

SOCIAL NETWORKS AND THEIR IMPACT DURING EMERGING ADULthood:
EXAMINING WHO MATTERS, WHY EMERGING ADULTS DRINK, AND HOW
RESEARCHERS STUDY THESE TOPICS

By

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Submitted in partial fulfillment of the requirements

for the degree of Doctor of Philosophy

at

Dalhousie University

Halifax, Nova Scotia

July, 2021

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DEDICATION

To my parents, who have filled my life with words of encouragement, given me literature that has inspired me to dream, modeled the joy that can accompany a robust vocabulary, and instilled in me a lifelong love of reading. Their words, spoken or given, led me to this moment. I am delighted to be able to give them something to read in return. Mom and Dad, I dedicate all 66,711 words to you.

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ABSTRACT

High rates of alcohol use and misuse are consistently documented among emerging adults (i.e., individuals aged 18-25 years). Numerous factors that may contribute to such high levels of alcohol use have been documented (e.g., genetics, personality, sociocultural norms). Among these factors, social network variables, such as the alcohol use and drinking motives of social contacts, have been highlighted as significant risk factors. These social network variables are thought to transmit influence through social influence and social selection principles. In the current dissertation, I aimed to better understand the impact of social network members on the alcohol use and drinking motives of emerging adults. In Study 1, I examined the influence of 882 different social network members' binge drinking (i.e., romantic partners, parents, peers, and siblings) on 321 emerging adults' binge drinking using a cross-sectional design and social network member recruitment. Romantic partner binge drinking was found to be a significant predictor of emerging adult binge drinking, while peer, parent, and sibling binge drinking were not. To study social network influence on drinking motives, I then created a brief alcohol motives measure (the BAMB) in Study 2, along with a brief cannabis motives measure (the BCAMB). Using expert opinion and a two-month longitudinal design with 176 emerging adults, I found both the BAMB and BCAMB to have satisfactory test-retest reliability, face validity, content validity, convergent validity, concurrent validity, and predictive validity. I then utilized the BAMB in Study 3 to investigate the influence of perceived social network member drinking motives on 177 emerging adults' own motives and binge drinking. Findings from this four-month longitudinal design indicated that perceived social network member drinking motives were a strong predictor of almost all emerging adults' drinking motives, and in some cases, were an indirect predictor of emerging adults' binge drinking through influences on own motives. As Study 3 was one of the first studies to study perceptions of social network members' drinking motives, I then sought to investigate the accuracy of such perceptions. Using a subsample of Study 3, Study 4 recruited 60 participants' social network members and used a Truth and Bias approach to examine accuracy in, and bias of, drinking motive perceptions. I found that most drinking motive perceptions were significantly or solely influenced by bias; all motives, with the exception of coping-with-anxiety, exhibited significant directional or assumed similarity bias. Despite this, the results also indicated that drinking motives perceptions for social, coping-with-anxiety, and coping-with-depression were influenced by accuracy. Taken together, my studies suggest that the social context of emerging adult drinking and drinking motives matter. Social network members appear to impact both how much and how often emerging adults drink, and why emerging adults choose to drink in the first place. Social network alcohol use and perceptions of social network drinking motives may represent important targets for intervention to reduce current and future risk of heavy and problematic drinking among emerging adults.

LIST OF ABBREVIATIONS AND SYMBOLS USED

α	Cronbach's Alpha
AMOS	Analysis of a Moment Structures
BAMM	Brief Alcohol Motives Measure
BCAMM	Brief Cannabis Motives Measure
BD	Binge drinking
BIC	Bayesian information criterion
CDN	Canadian
CFI	Comparative Fit Index
CI	Confidence Interval
CLPM	Cross-Lagged Panel Model
CWA	Coping-with-anxiety motives
CWD	Coping-with-depression motives
DFAQ-CU	Daily Sessions, Frequency, Age of Onset, and Quantity of Cannabis Use Inventory
DMQ-R	Drinking Motives Questionnaire-Revised
F-F	Female-female dyad
FIML	Full Information Maximum Likelihood
F-M	Female-male dyad
H1	Hypothesis 1
H2	Hypothesis 2
H3	Hypothesis 3
H4	Hypothesis 4

Intersex-M	Intersex-Male dyad
<i>M</i>	Mean
MDMQ-R	Modified Drinking Motives Questionnaire Revised
MDMQ-R+	Modified Drinking Motives Questionnaire Revised with additional items
MMM	Marijuana Motives Measure
MMM+	Marijuana Motives Measure with additional items
M-intersex	Male-intersex dyad
M-F	Male-female dyad
M-M	Male-male dyad
N	Sample size
NIAA	National Institute of Alcohol Abuse and Alcoholism
<i>p</i>	P-value
QxF	Quantity x Frequency
<i>r</i>	Correlation
RAPI	Rutgers Alcohol Problems Index
RMPI	Rutgers Marijuana Problems Index
RMSEA	Root mean square error of approximation
SD	Standard deviation
SE	Standard error
SPSS	Statistical Packages for the Social Sciences
Stand β	Standardized beta coefficient
T1	Time 1
T2	Time 2

TLI	Tucker Lewis Index
Unstand. B (B)	Unstandardized beta coefficient
VAS	Visual analog scale
WHO	World Health Organization

ACKNOWLEDGEMENTS

My dissertation is the product of the hard work and support of many individuals; some individuals dedicated their time and energy to the research process, while others dedicated their time and energy to listening to me, validating me, and making me laugh. Both types of contributions have been invaluable.

I first want to express gratitude and thanks to my supervisors, Dr. Sherry Stewart and Dr. Simon Sherry. Throughout my graduate education, they have managed to strike a fine balance between encouraging me to shoot for the stars and reigning in my overambitious nature (which as times, I imagine, was a difficult task). They have consistently valued my ideas, demonstrated confidence in my abilities, and provided unwavering support through journal rejections, project barriers, and a global pandemic. Dr. Stewart has been a remarkable female mentor, modelling how to be a formidable, productive, and astute researcher, all while being genuine and not losing sight of the people in front of her. I will forever be in awe of who she is. Dr. Sherry has been the grounding force of my graduate research, consistently advocating for statistical and methodological rigor. His advice (along with that of Dr. Stewart), has made me a better researcher. Dr. Sherry has also been an inspiring mentor on knowledge translation, teaching me of its importance and modeling the role of psychologists in the media. Together, Dr. Stewart and Dr. Sherry have delivered on the promise they made during my first visit to Halifax over five years ago – to teach me how to be a researcher and a clinician, to support me through the tumultuous journey of graduate school, and to guide me out the other side.

I would also like to thank the remaining members of my dissertation committee, Dr. Natalie Rosen and Dr. Sean MacKinnon. I am grateful for their respective knowledge and feedback throughout the development of my dissertation. As I have taken their courses, attended their research talks, and received their feedback on my work, I have been consistently impressed by Dr. Rosen's thoughtful and impactful research program, and by Dr. MacKinnon's seemingly infinite knowledge of statistics and remarkable amount of patience. I would also like to extend my thanks to Dr. Nancy Barnett, who served as my external examiner. I am humbled to have been examined by a committee composed of researchers who are all inspiring in their own individual ways.

In addition to the aforementioned individuals who supported my research, this dissertation was also made possible by the organizations and scholarships that supported me financially: the Canadian Institutes of Health Research, the Nova Scotia Graduate Scholarship fund, the Killam Trusts, and the Social Sciences and Humanities Research Council of Canada. I would also like to acknowledge the Dalhousie Psychiatry Research Fund, that provided me a grant as principal investigator that made the third and fourth studies of this dissertation possible.

Next, I would like to thank my parents, Debra Heinrichs and Stan Bartel. From a young age, they told me that I could achieve my dreams, even if I ran into obstacles and encountered failure along the way – for they would always be there to help me overcome and to catch me if I fell. They helped me cultivate the confidence to reach for the stars. As such, it is safe to say that so much of what I have accomplished, I owe to them. I could not wish for more loving and supportive parents. Their respective generosity,

thoughtfulness, work ethic, perseverance, and desire to make a difference inspires me on a daily basis. I hit the jackpot with you two.

Finally, I would like to thank my friends, my peers, my partner, and my extended family who have come together to form a remarkable circle of support. Their love, encouragement, and sarcastic comments have sustained me throughout my graduate education thus far. Sharing laughter, tears, conversations, study dates, workouts, and adventures with these individuals have made this time in my life wondrously rewarding and filled with joy.

I end with this: understandably, the vast majority of acknowledgements in this dissertation have focused on thanking the myriad of individuals who have supported me through graduate school. A similar focus within the acknowledgement section can also be found in most other dissertations. While these types of acknowledgements are important, one type of acknowledgement is often missing – an acknowledgement of the process of graduate school itself. Spending years continuously learning, managing stress, gaining autonomy, and achieving milestones is transformative. The version of myself that entered graduate school at 22 and the version of myself writing this dissertation at 26 are remarkably different. I count myself lucky to have spent a significant portion of my emerging adulthood and consequently, many important years of identity development, pursuing my Ph.D. Thanks to the process of graduate school, I am more flexible, more open, more astute, more introspective, and more determined than ever. So, in closing, cheers to the process of graduate school and to all who helped me thrive during it. I look forward to the day when I can check off the final thing on my to do list and characteristically scream “I did it!”

CHAPTER 1. INTRODUCTION

My dissertation examines the role of social influence on the drinking behaviors and drinking motives of emerging adults. It includes four publication-style manuscripts. The first examines whether the binge drinking of specific types of social network members (e.g., romantic partners, peers, siblings, parents) have an impact on the binge drinking of emerging adults using a cross-sectional design. The second involves the development of brief measures of alcohol and cannabis use motives, examining the reliability and validity of the measures through expert review and a longitudinal design. The third explores the impact of perceived social network member drinking motives on emerging adult's own drinking motives and drinking behaviors in the context of a longitudinal egocentric social network study. The fourth manuscript uses a collateral report arm of the previously mentioned longitudinal egocentric social network study to examine the accuracy of emerging adult's perceptions of their social network member's drinking motives. Prior to presenting the findings of each manuscript, I will introduce and discuss the following topics: the contemporaneous nature of emerging adulthood and alcohol misuse, theoretical perspectives on social influence and alcohol use that inform my dissertation, an overview of the current literature on social networks, alcohol use and drinking motives, and finally, the specific objectives of my research.

Contemporaneous Nature of Alcohol Use and Emerging Adulthood

Emerging adulthood is a developmental period proposed by Arnett (2000) that is theorized to occur between the late teens and mid-twenties, occurring roughly between the ages of 18 and 25 years (Arnett, 2000). It is distinguished from adolescence by the lack of dependency on others and distinguished from adulthood by the relative lack of

responsibilities (e.g., social roles, normative expectations; Arnett, 2000). Emerging adulthood is a time of life in which change and exploration of possibilities in areas such as work, love, education, and socializing, are thought to be greater than during any other time in the lifespan (Arnett, 2000). As such, this developmental period is thought to focus on identity exploration and be key in identity formation (Arnett, 2000).

While identity exploration can be thought of as an essential task preceding adulthood, it is also considered to function as a risk factor for behaviors such as substance misuse (Arnett, 2000). As part of identity exploration, emerging adults often seek out a wide range of experiences, many of which will no longer be acceptable once they enter adulthood (e.g., alcohol misuse; Arnett, 2005). As emerging adults seek out these experiences, they tend to exhibit significant instability in relational, work, and educational environments (Arnett, 2005). This environmental instability is thought to lessen social control (i.e., mechanisms that encourage individuals to follow the norms, rules, laws, and structures of society), as social networks and relationships that typically exert social control are more transient and evolving (Arnett, 2005). Moreover, while emerging adults are experiencing this instability, they are often simultaneously experiencing reduced social control over their alcohol use from parents and the state (i.e., less parental monitoring, alcohol use becomes legal; Arnett, 2005). This cumulative lessening of social control may increase the likelihood of emerging adults engaging in alcohol use behaviors that violate norms.

Notably, at any given time during the developmental stage of emerging adulthood, roughly 30% of Canadian emerging adults are attending college or university (Statistics Canada, 2019). Such attendance is thought to confer additional risk for alcohol

misuse by amplifying the characteristics of emerging adulthood (Reckdenwald et al., 2016). It has been said that college or university settings are “expressly designed for the identity explorations that are often part of emerging adulthood” (Arnett, 2016; pg. 219). In these contexts, emerging adults are free to explore different courses, experience a multitude of different ideas to aid them in the development of their worldview, meet many new people, and have a substantial amount of unstructured time (Arnett, 2016). Importantly, for many emerging adults, this freedom often comes without significant responsibility for themselves or others (Arnett, 2016). Reflecting this decreased responsibility, in comparison to non-college attending peers, emerging adults who attend college have been found to be less likely to occupy adult roles (e.g., being married, being parents, working full-time) and to have lower levels of social maturity (e.g., taking on responsibilities, being independent; Reckdenwald et al., 2016). As these factors have been linked to an increased risk of binge drinking, it has been theorized that college or university contexts may result in the social risk factors of emerging adulthood being more pronounced (i.e., less social control, lack of responsibilities; Reckdenwald et al., 2016).

In addition to the above-mentioned social factors that have been theorized to increase risk for alcohol misuse in emerging adulthood (Arnett, 2005), there are several biological factors that may also increase risk during this period of development. For example, the development of the prefrontal cortex, which is involved executive functioning (e.g., problem solving, planning, inhibition), lags behind the development of the limbic structures in the brain, which are involved in reward and affect (Lisdahl et al., 2013). As a result, the top-down control of the limbic system that occurs with the maturation of the prefrontal cortex, improving our ability to inhibit our impulses and

consider long-term negative consequences, is not as pronounced during emerging adulthood as it is in adulthood (Lisdahl et al., 2013). These biological developmental considerations are thought to place emerging adults at increased risk for substance misuse (Lisdahl et al., 2013).

Indeed, in line with the above theory regarding the social and biological risk factors of emerging adulthood, research suggests emerging adults have the highest rates of heavy drinking of any developmental period (Canadian Centre on Substance Use and Addiction, 2017; Substance Abuse and Mental Health Services Administration, 2013). Canadian statistics indicate that in comparison to other age groups, emerging adults exceed the lower risk drinking guidelines at higher rates than any other age group (Canadian Centre on Substance Use and Addiction, 2017). Similar statistics can be found in the United States, where emerging adults have the highest rate of alcohol use disorder (14.3%), in comparison to adolescents (3.4%) and adults (5.9%; Substance Abuse and Mental Health Services Administration, 2013).

These statistics are very concerning, as alcohol misuse often has negative impacts on occupational, social, physical health, and mental health functioning (World Health Organization (WHO), 2018). For example, alcohol misuse is associated with over 5% of all deaths worldwide, a rate that is higher than the deaths caused by either diabetes (2.8%), road injuries (2.5%), or hypertension (1.6%; World Health Organization, 2018). Alcohol misuse also accounts for 7% of disability-adjusted life years worldwide, indicating alcohol can result in a significant amount of time spent living in less than full health (World Health Organization, 2018). Among other significant consequences, alcohol misuse is also associated with increased risks of depression, suicidal ideation, and

unemployment (e.g., Fergusson et al., 2013), and is often reported to lead to interpersonal conflict (e.g., causing shame or embarrassment to others, getting into arguments, violence perpetration or victimization; Duke et al., 2018; Fergusson et al., 2013; White & Ray, 2014). Concerningly, in addition to the above-mentioned impacts of alcohol misuse that affect all age groups, emerging adults may also experience additional unique consequences. Research demonstrates that initiating alcohol misuse in emerging adulthood is associated with poorer cognitive functioning in comparison to those who initiate alcohol use in adulthood (Lisdahl et al., 2013). Moreover, heavy alcohol use or alcohol use disorder in emerging adulthood has been linked to gray and white matter abnormalities that are often associated with cognitive deficits (Lisdahl et al., 2013).

In summary, alcohol misuse is associated with significant negative consequences, many of which appear to be heightened for emerging adults. As a result, understanding risk factors for alcohol misuse in emerging adulthood is incredibly important. My dissertation seeks to add to the literature on this subject, focusing on emerging adults and their social networks.

Theoretical Influences of Social and Environmental Factors on Alcohol Use

In addition to Arnett's (2005) theory of the mechanisms behind alcohol use in emerging adulthood, there are several other well-known theories and ideas that inform my dissertation and describe potential influences on alcohol misuse. These include social learning theory (Bandura 1969, 1977, 1986) and the idea of homophily (Lazarsfeld & Merton, 1954), which I situate within the context of the social ecological model (Bronfenbrenner, 1979). These three theories and ideas will be explored and discussed in the context of emerging adulthood. The many pathways through which social

relationships influence alcohol use (e.g., social cohesion, bonding, norms, expectancies, socialization, selection) fit within these described theories.

Social Learning Theory

Social learning theory is a general theory of behavior that combines principles of learning with principles of cognitive psychology (Maisto et al., 1999). At its core, social learning theory suggests that humans learn from their environment in both direct and indirect ways (Lewis et al., 2010). While various social learning theories have been proposed (e.g., Bandura, 1969, 1977, 1986; Dollard & Miller, 1950; Mischel, 1973), Bandura's theory (1969, 1977, 1986) has arguably had the most influence on the alcohol literature and thus guides the current dissertation (Masito et al., 1999).

Bandura (1969, 1977, 1986) proposes that human behavior is influenced by four major principles: differential reinforcement, vicarious learning, cognitive processes, and reciprocal determinism. The principle of differential reinforcement suggests human behavior is impacted by the positive or negative reinforcement or punishment that follows a behavior (Bandura, 1969; Skinner, 1965). Notably, the rewards or punishments that occur after a given behavior are often different across settings, meaning that rewards or punishments are often setting-specific (Maisto et al., 1999; Skinner, 1965). Within social learning theory, the principle of differential reinforcement represents a direct source of influence (i.e., direct learning). Applied to alcohol, the concept of differential reinforcement suggests that if drinking behaviors are followed by rewards (e.g., increased social bonding, reduction in negative mood), they are more likely to occur again in future. In contrast, if drinking behaviors are followed by punishments (e.g., ostracism, physical illness), they may be less likely to occur again in future. It is possible for

drinking behaviors to have both rewarding and punishing consequences (e.g., enhancement of mood *and* later becoming sick). When this is the case, the ratio and immediacy of reinforcing and punishing consequences may contribute to the likelihood of an alcohol use behavior occurring again in future (Bandura, 1969; Bandura, 1977).

The principle of vicarious learning, which is also referred to as modelling, suggests individuals acquire new behaviors through observing the behaviors of others directly or through written or oral communication (Lewis et al., 2010; Maisto et al., 1999). Essentially, Bandura (1969, 1977, 1986) suggests that we observe the reinforcing and punishing consequences of other's behaviors and use this information to guide our own behavior. Vicarious learning is thought to be a more prominent way of learning than differential reinforcement, as it is more efficient than having to learn everything directly oneself through trial and error, and since vicarious learning can take place before one engages in a behavior oneself (Maisto et al., 1999). In the context of alcohol, an individual's own alcohol use may be impacted by observing another individual's drinking attitudes and behaviors, and the consequences that follow the model's drinking behavior (Lewis et al., 2010). For example, an individual may notice that a co-worker's binge drinking at an office party is met with judgement and social censure, which may result in the individual choosing to limit their own alcohol use in the same setting in the future.

The principle of cognitive processes suggests that cognitions mediate the relationship between environmental events (e.g., direct or indirect learning of consequences of behaviors) and an individual's own behavior (Bandura, 1969, 1977, 1986; Maisto et al., 1999; Lewis et al., 2010). In other words, through differential reinforcement and vicarious learning, individuals acquire expectancies about what

outcomes will occur from their behaviors, and then use these expectancies to guide their future behavior (Bandura, 1977). Applied to drinking, this suggests that an individual will engage in alcohol use if they expect that using alcohol will help them achieve desirable effects (or avoid undesirable events) in a specific situation. For example, an individual may choose to consume several alcoholic beverages during a party if they expect alcohol will facilitate social interactions or enhance their experience; however, another individual may choose not to consume several alcoholic beverages in the same setting if they expect such alcohol use will result in undesirable physical symptoms (e.g., dizziness).

Finally, the principle of reciprocal determinism suggests that influence does not only function in one direction, but rather can be bidirectional or cyclical (Bandura, 1986). For example, an individual's expectancies about a certain alcohol use pattern may impact their alcohol use, but their experiences while engaging in alcohol use may also impact their expectancies. Similarly, an individual's alcohol use may be impacted by the alcohol use of their social network members; however, at the same time, the individual may also choose who is in their social network (i.e., the individual impacts who is in their environment and therefore how much alcohol use is present; Reifman et al., 2006) and the individual's own alcohol use may also serve as a model for their social network members (i.e., the individual impacts the alcohol use of those in their social network; Reifman et al., 2006). Thus, the individual's behavior may be impacted by the environment, but the individual may also select and influence that same environment.

In summary, the four concepts of social learning theory all contribute to the process of social learning about alcohol. An individual may learn about the reinforcing (rewarding or relieving) or punishing effects of alcohol use directly through the

consequences of their own drinking behaviors, or indirectly by observing the drinking behaviors and consequences of significant others in their environment (Maisto et al., 1999). The individual then cognitively processes these observations, forming expectancies, and using them to determine whether to engage in a particular drinking behavior (Maisto et al., 1999). The drinking behavior they choose to engage in then goes on to impact their environment and those within it, contributing to a feedback loop of reciprocal influence (Maisto et al., 1999). This process of social influence can be applied to any type of drinking behavior (i.e., anywhere on the continuum from abstinence to heavy drinking) or drinking-related belief/cognition (e.g., specific alcohol outcome expectancies, drinking motives). Taken together, social learning suggests that alcohol use patterns and cognitions are primarily learned behaviors that are greatly influenced by the social environment.

Homophily: The Combined Effect of Social Selection and Socialization

It is a well-established that people tend to interact more frequently with similar than with dissimilar people (McPherson et al., 2001). This concept, colloquially summarized by the phrase “birds of a feather flock together”, is known as homophily (Lazarsfeld & Merton, 1954). Homophily can be broken down into two subtypes: status homophily and value homophily (Lazarsfeld & Merton, 1954). Status homophily refers to homophily based on sociodemographic dimensions such as sex, race, age, religion, occupation, while value homophily refers to homophily based on attitudes, beliefs, abilities, and aspirations (e.g., political beliefs; Lazarsfeld & Merton, 1954). In the context of alcohol use, it would follow that homophily could exist at the level of value homophily (e.g., affiliation with others who have similar beliefs about alcohol). Notably,

as particular alcohol use patterns are associated with different sociodemographic dimensions (e.g., age, sex, religion; Canadian Centre on Substance Use and Addiction, 2017; Tuck et al., 2017), similarity in alcohol use could occur as a by-product of status homophily.

While there are many factors that contribute to homophily (e.g., geography, organizational foci; McPherson et al., 2001), the two main causes of homophily are thought to be selection and socialization. Socialization refers to the process of social group members becoming more similar to one another over time. This socialization may occur through various processes (e.g., social learning as outlined by Bandura [1969], relationship maintenance processes as outlined by Roberts and Leonard [1998]).

Selection refers to the process of choosing and acquiring social network members based on similarities to oneself, at the level of status and/or values. In other words, selection involves carefully selecting those who are similar to oneself to be part of one's social network, increasing the overall similarity of those with whom one interacts. This may also include carefully deselecting those who are dissimilar to oneself and dropping them from one's social network. In the context of alcohol use, individuals may select social network members who engage in similar alcohol use patterns to themselves or who have similar alcohol use attitudes to themselves and choose to sever ties or distance themselves from social network members with discordant alcohol use behaviors and attitudes (Reifman et al., 2006).

Importantly, consistent with Bandura's (1986) concept of reciprocal determinism, both selection and socialization are not entirely independent or asynchronous, but rather are thought to operate in a contemporaneous and reciprocal fashion. For example, one

may slowly select new social network members who are similar to oneself in status or values, while simultaneously also being influenced by existing (and new) social network members (e.g., Reifman et al., 2006). Ultimately, the combined processes of socialization and selection function to increase homophily. Homophily seems to convey many benefits, including higher levels of interpersonal attraction (Montaya et al., 2008) and a greater sense of feeling understood (Murray et al., 2002). Thus, homophily itself may be impacted by processes of differential reinforcement, as it may be innately rewarding. In summary, homophily suggests that individuals both surround themselves with others who are similar and become more similar to others around them over time. Applied to the context of alcohol use, homophily may result in networks of individuals with similar alcohol-related behaviors and attitudes.

Social Ecological Model

The social ecological model, proposed by Bronfenbrenner (1979), recognizes that individuals are embedded within a series of larger social systems that interact with and influence each other in a reciprocal fashion. Bronfenbrenner outlines a variety of interacting systems within the model, including: 1) microsystems - patterns of relationships, roles, and activities in a given setting such as family, work, social settings; 2) mesosystems - interactions between two or more microsystems such as family and work; 3) exosystems - settings in which the individual is not an active participant, but in which events occur that impact or are impacted by the microsystem containing the individual (e.g., things that happen in a romantic partner's work place could impact the individual); 4) macrosystems - micro, meso-, and exo-systems that exist at the level of the

community or culture. Both social learning theory and homophily fit within this model, accounting for the influence and presence of individuals within and between systems.

Applied to alcohol use, this model suggests there are several sources of influence that may impact drinking. At the lowest level, an individual's alcohol use may be impacted by their unique characteristics (e.g., alcohol expectancies, cognitive processes, personality; Bandura, 1969; Sudhinaraset et al., 2016). Moving up a level, an individual's alcohol use may also be impacted by one of their microsystems (e.g., family, peers, work, or school environments) through mechanisms of socialization and selection (Bandura, 1969; McPherson et al., 2001; Sudhinaraset et al., 2016). These various microsystems may also interact with each other to impact alcohol use through the same mechanisms (e.g., a family member attending a peer event in which alcohol is served, may alter one's own pattern of alcohol consumption), thereby forming mesosystems (Sudhinaraset et al., 2016). An individual's alcohol use may also be impacted by exosystems, such that events that occur within another microsystem impact the individual's own microsystem (e.g., the alcohol use of an individual's romantic partner may be impacted by the alcohol use of the partner's co-workers, which then may indirectly impact the individual's own alcohol use through social learning; Brofenbrenner, 1979). Importantly, overarching these micro-, meso-, and exo-systems, are macro-level factors that impact alcohol use through vicarious learning (e.g., community norms and attitudes regarding alcohol use, exposure to alcohol advertising, societal policies related to alcohol use; Sudhinaraset et al., 2016). See Figure 1.1 for a depiction of the Social Ecological Model applied to alcohol use.

Within this social ecological model, each higher-level system has trickle-down effects, such that macro-level factors influence exosystems, mesosystems, and

microsystems, which go on to impact individual attitudes and behaviors (Sudhinaraset et al., 2016). At the same time, bottom-up effects are also present (i.e., reciprocal determinism), in that individuals impact microsystems, which interact to impact mesosystems and exosystems, and ultimately go on to impact macro-level factors. For the current dissertation, Bronfenbrenner's (1979) social ecological model is key as it positions both social learning theory and homophily within proximal and distal environmental contexts.

Situating Theoretical Concepts Within Emerging Adulthood

It is important to situate the theoretical concepts that inform this dissertation in the context of emerging adulthood. While social learning theory, the concept of homophily, and the social ecological model theorize that those around us influence our alcohol use, certain sources of influence are more impactful and relevant than others during different developmental stages. During childhood and early adolescence, the family microsystem is considered a main source of social influence (Wood et al., 2004). During this time of life, parents exert significant control over an individual's alcohol use behaviors and may be a primary model for alcohol use (Wood et al., 2004). Similarly, siblings (especially older siblings), may begin to experiment with alcohol prior to an individual's own peers, serving as a proximal model of alcohol use (Altonji, et al., 2010; Whiteman et al., 2013; Wood et al., 2004).

As individuals transition further into adolescence, they often begin to assert independence from the family environment, spending less time with parents and siblings and spending more time with peers and romantic partners (Borsari & Carey, 2001; Larson & Richards, 1991; Wood et al., 2004). As this occurs, adolescents shift from relying on

family members for support and intimacy to relying on peers and romantic partners (Borsari & Carey, 2001; Larson & Richards, 1991). This shift does not occur without impact—it has been suggested that as the importance and amount of time spent with certain network members increases, so does the likelihood that individuals will conform to the behaviors of those individuals (i.e., the principles of social learning may have a greater effect; Latané, 1981). Thus, this developmental shift toward peers and romantic partners results in a reorganization of the hierarchy of social influence: peers and romantic partners take over as the most important source of social influence, while parents and siblings are relegated to a lower position (Derrick & Leonard, 2016; Wood et al., 2004). During emerging adulthood, this pattern continues, with both peers and romantic partners at the top of the social influence hierarchy (Derrick & Leonard, 2016). Thus, the microsystems serving as the most importance arenas for social learning and selection shift throughout development.

Research Evidence on the Influences of Social Network Members on Alcohol Use

Research investigating the influence of socialization and selection on alcohol use has examined the influence of broad social networks, as well as the impact of specific network members (e.g., romantic partners, friends). In the sections below, the salient research on romantic partners, friends, family members, and broad social networks is detailed and summarized. This review of the literature centers on the influence of others' alcohol use, as the current dissertation has a particular focus on this topic.

Romantic Partners

Theories of selection suggest that individuals may select romantic partners who have alcohol use patterns and attitudes similar to one's own (i.e., assortative mating). In

line with this, previous research has found partner drinking behaviors prior to marriage to be similar (e.g., during adolescence; Ask et al., 2012; Leonard & Das Eiden, 1999; Yamaguchi & Kandel, 1993) and emerging adult alcohol use to predict partners' alcohol use six or seven years later (Labouvie, 1996; Wiersma et al., 2010). While the complex design needed to study selection effects in romantic partners prospectively is rarely found in the literature, one study has found adolescents begin selecting partners with similar alcohol use patterns as early as eighth grade (Aikins et al., 2010). Together, these results support assertions that individuals may be selecting romantic partners with similar alcohol use behaviors.

Numerous studies have also found evidence of socialization within couples (see Muingo et al. 2020, for review). Research indicates baseline partner drinking predicts an individual's future drinking, even after accounting for their own baseline drinking (e.g., Bartel et al., 2017; Leonard & Mudar, 2004; Leonard & Homish, 2008; Mushquash et al., 2013; Windle & Windle, 2014). This pattern has been demonstrated over the short (e.g., 1 month; Mushquash et al., 2013) and long term (e.g., ten years; Windle & Windle, 2014). Notably, one study even suggests that the alcohol use of romantic partners predicts individuals' future alcohol use one to eight years later regardless of whether the relationship has continued (Gudonis-Miller et al, 2012). This result speaks to the strength of partner influence, aligning with developmental assertions that romantic partners serve as one of the most important sources of influence in emerging adulthood (Derrick & Leonard, 2016; Wood et al., 2004).

The combined effects of socialization and selection may result in couples forming a drinking partnership, whereby they develop drinking rituals and reciprocally influence

each other's drinking patterns (Roberts & Leonard, 1998). This reciprocal influence (i.e., reciprocal determinism) may come from several sources. For example, individuals often spend significant time with their partners, and they may frequently drink together as part of shared activities (Muyingo et al., 2020); as such, opportunities for partners to model drinking patterns and engage in social learning are plentiful. The observation of partners' drinking may lead individuals to emulate the drinking patterns they observe to be associated with rewarding outcomes. Moreover, while observing the drinking patterns of their partners, individuals may notice a discrepancy between their alcohol use and that of their partners (Roberts & Leonard, 1998). In response, individuals may shift their behaviors to align with their partners' (Roberts & Leonard, 1998). This shift may be done to avoid negative consequences of not conforming to their partner's behavior (Latané, 1981), or may be done in hopes of being rewarded with increased acceptance (Baumeister & Leary, 1995). In addition, this shift may also occur to promote the relationship, as similarity of drinking behaviors has been found to affect relationship quality, satisfaction, and maintenance; congruent drinking patterns between couples have been found to predict relationship quality or satisfaction (e.g., Meiklejohn et al., 2012; Wiersma & Fischer, 2009; see Fischer & Wiersma, 2012), while discrepant drinking patterns between couples have been found to predict lower relationship quality, marital disruptions, and relationship dissolution (Leonard et al., 2014; Mudar et al., 2001; Ostermann et al., 2005; Torvik et al., 2013). Finally, individuals may also shift their drinking patterns as they develop increasingly positive attitudes towards the alcohol use patterns of their partners due to the 'mere exposure' effect - a documented phenomenon wherein individuals develop a preference for something simply due to increased familiarity and exposure

(Moreland & Zajonc, 1982). Taken together, the above-mentioned mechanisms may result in, and account for, the significant homophily that has been documented in the drinking behaviors of romantic partners.

Peer Influence

Similar to research on romantic partners, research on peers also aligns with the assertions that peers become more important during adolescence and early adulthood (e.g., Borsari & Carey, 2001; Larson & Richards, 1991). Findings consistently suggest that peers are one of the most important sources of influence for emerging adults (Durkin et al., 2005). For example, alcohol use of peers is significantly associated with individuals' own binge drinking and weekly alcohol consumption both cross-sectionally and longitudinally (e.g., Andrews et al., 2002; Barnett et al., 2014; Lorant & Nicaise, 2015). These associations are thought to be the result of both selection and socialization processes. Emerging adults appear to choose friends with similar alcohol use patterns when transitioning from high school to college (Abar & Maggs, 2010), suggesting the presence of selection. At the same time, the incorporation of heavy drinking peers into social networks is associated with increased alcohol consumption (Demartini et al., 2013), suggesting the impact of socialization. Moreover, additional research into socialization effects suggests that the more individuals perceive friends to be drinking, the more they drink themselves (Abar & Maggs, 2010).

Of note, certain peers known as “drinking buddies” (i.e., peers one chooses to drink with; Leonard & Mudar, 2003) are thought to have a particularly strong influence on an individual's own alcohol use. For example, drinking buddies have been found to predict alcohol use one year later, even after controlling for the alcohol use of other peers

(Reifman et al., 2006). Drinking buddies have also been found to predict drinking during single drinking occasions; when drinking together, the alcohol consumption of individuals' drinking buddies predicts their own drinking, even after accounting for the drinking of other people who are present (Nogueira-Arjona et al., 2019).

There are several factors that may contribute to the impact of peers on alcohol use. For example, most emerging adults consume alcohol in the context of social gatherings, which are often peer-based (Keough et al., 2018; Schulenberg & Maggs, 2002). As such, consuming alcohol with peers in a social context is widely considered to be normative for emerging adults, and venues designed for the social consumption of alcohol (e.g., bars, clubs) cater towards this developmental period (Goldman et al., 2011). As a result of these normative expectations and frequent chances for social alcohol consumption, emerging adults experience ubiquitous opportunities for peer modeling of drinking behaviors and for differential reinforcement of their own drinking behaviors within the peer context. Consequently, emerging adults may engage in alcohol use to gain the benefits previously modelled by peers or experienced within the peer context. Importantly, some of these benefits may be social in nature, as the use of alcohol within social contexts is thought to facilitate bonding and improve social relationships (Schulenberg & Maggs, 2002). The facilitation of social bonding may be especially important to emerging adults, given they are being exposed to new contexts in which they must form new relationships (e.g., school, work, peer group of new romantic partner; Arnett, 2000). Thus, emerging adults may imitate the alcohol use of peers to assist with relationship formation and gain social benefit (e.g., increased acceptance, Baumeister & Leary 1995; Cooper, 1994). Importantly, individuals may also accrue additional drinking

peers over time into their networks, resulting in increasing opportunities for the above-mentioned mechanisms of influence to take place (Reifman et al., 2006). Finally, similar to what may occur with romantic partners, emerging adults may be influenced by the mere exposure effect and develop increasingly positive attitudes towards drinking over time (Moreland & Zajonc, 1982). Given all these sources of influence, it has been suggested that “alcohol use is inextricably linked to social relationships with peers” (Schulenberg & Maggs, 2002, p. 62).

Family Members

As one cannot choose the family in which they are born, the concept of selection is not relevant when considering the impact of family member alcohol use on an individual. Instead, in addition to the concept of socialization, the concept of genetics becomes relevant. Twin studies demonstrate that roughly 50% of the variance in alcohol consumption in emerging adults is accounted for by genetics, indicating a moderate heritability rate (Dick et al., 2009; Van Beek et al., 2012; Verhulst et al., 2015). Notably, twin studies also suggest that genetic influences become stronger over time, such that in the context of alcohol use initiation in adolescence, genetics appear to be less impactful than the environment (i.e., reflecting early experimentation); however, as individuals enter emerging adulthood, genetics become more important (i.e., reflecting more regular patterns of use and the genetically-influenced selection of social networks with similar alcohol use patterns; see Dick, 2011 for a review). This suggests the impact of familial alcohol use on an individual is not only due to socialization, but also due to genetic contributions. Unfortunately, many studies do not have the capacity to tease apart these influences, as large sample sizes are required (Dick, 2011). As a result, much of the

following literature represents the combination of these influences. Given theory that the influence of family members lessens with age, the following literature discusses adolescent and emerging adult influences separately.

Parental Influence.

While many parental factors (e.g., parental monitoring and support) have been linked with offspring alcohol use, research suggests parental alcohol consumption is the most important parental factor in the process of alcohol socialization (Pederson & von Soest, 2013). In line with this finding, research consistently indicates that parental drinking predicts adolescent alcohol initiation, alcohol use, and alcohol misuse (e.g., Ellickson et al., 2001; Vermeulen-Smith et al., 2012; Yap et al., 2017). Parental drinking also appears to confer risk of belonging to a higher risk drinking trajectory during later adolescence (Alati et al., 2014; Walden et al., 2007). Moving beyond adolescence, research demonstrates parental drinking is associated with binge drinking, drinking frequency, drunkenness, and negative alcohol-related consequences in emerging adulthood and early adulthood (Abar, et al., 2011; Pederson & von Soest, 2013). Similar findings also suggest that emerging adults whose parents engage in moderate- or high-risk alcohol consumption are more likely to consume alcohol in comparison to emerging adults whose parents engage in low-risk alcohol consumption (Mahedy et al., 2018).

While the observational designs used in the parental studies described above are inherently confounded by the heritable contributions to drinking, the portion of parental influence that is attributable to socialization effects, rather than genetic effects, is likely due to principles of social learning. Parents model alcohol use in a variety of settings (e.g., home, restaurants, social gatherings) and may serve as one of the most consistent

sources of in-vivo alcohol modeling during childhood and adolescence (e.g., Wood et al., 2004). As mentioned previously, the impact of parental influence is theorized to decrease in emerging adulthood (Wood et al., 2004). This may occur for many reasons. For example, a large proportion of Canadians move out of their family homes in emerging adulthood, resulting in the proximal influence of parents lessening (Statistics Canada, 2018). Moreover, as individuals begin to form their own identities, they tend to become closer with individuals outside of the family system (Arnett, 2005; Larson & Richards, 1991). In line with this, as an individual transitions from adolescence to emerging adulthood, they are less likely to list their parents in the top five people who are important to them (Meisel & Barnett, 2017). Importantly, parental influence on alcohol use has consistently been shown to decrease from adolescence to emerging adulthood (e.g., Scholte et al., 2008). Thus, while parent alcohol use appears to have an impact on the drinking of emerging adults, it is likely not one of the strongest sources of influence for emerging adult drinking.

Sibling Influence

Like parental alcohol use, sibling alcohol use also appears to have a significant impact on adolescent and emerging adult alcohol use. Adolescent research indicates sibling alcohol use is often associated with an individual's own alcohol use and serves as a predictor of frequent alcohol consumption (Jones & Magee, 2014; Windle, 2000). Notably, older sibling alcohol use appears to have an especially potent effect, consistently predicting younger sibling alcohol use in adolescents (e.g., Altonji, et al., 2010; Whiteman et al., 2013). Moving into emerging adulthood, investigations of sibling alcohol use are less common. Existing reports suggest siblings continue to influence each

other's alcohol use during this stage of development; however, the impact of co-twin and older sibling alcohol use declines between adolescence and emerging adulthood (Poelen et al., 2007; Samek, et al., 2018; Whiteman et al., 2017).

There are several significant reasons why sibling alcohol use may impact an individual's own alcohol use. Whiteman and colleagues (2017) note that like romantic partners and peers, siblings may engage in drinking partnerships, such that they drink together as a shared activity, or as part of social events. Such drinking partnerships provide ample opportunities for social learning, allowing for drinking-related rewards to be observed and expectancies of what drinking behaviors are popular or desirable to be shaped (Whiteman et al., 2017). Moreover, in adolescence, older siblings may introduce younger siblings to settings, activities, and social network members that may encourage alcohol use (Samek et al., 2015; Whiteman et al., 2017). In emerging adulthood, siblings often move out of the family home (Statistics Canada, 2018), resulting in less contact with their siblings and families, and fewer shared activities (Poelen et al., 2007; Whiteman et al., 2017). This lessening contact may partially account for the dissipating influence of siblings after adolescence. In line with this speculation, genetic research on twins suggests the shared environmental influences that impact sibling alcohol use in late adolescence decrease in emerging adulthood (57% vs 18%), while unique environmental influences increase (15% vs 48%; van Beek et al., 2012). As such, research aligns with theory suggesting siblings, like parents, may become less relevant sources of influence in emerging adulthood.

Overall Networks

Given the above-mentioned research highlighting the impact of various types of network members, studies have begun to take a broader approach to studying social networks (e.g., Meisel et al., 2013; Meisel & Barnett, 2017; Russell et al., 2021). Rather than study specific types of network members, researchers have begun to study the overall impact of social networks made up of diverse network members (e.g., partners, friends, family, roommates, neighbours; Meisel et al., 2013; Meisel & Barnett, 2017; Russell et al., 2021). Unsurprisingly, findings from this work echo those from more narrow network studies; research demonstrates that as the number of drinkers in an individual's social network increases, the individual's own alcohol use also tends to increase (e.g., Neighbors et al., 2019, Rosenquist et al., 2010). For example, at a broad level, the likelihood of an individual drinking heavily increases by 18% with each additional heavy drinker they add to their network (Rosenquist et al., 2010). Conversely, the likelihood of an individual drinking heavily reduces by 10% with each additional person they add to their network who does not drink alcohol (Rosenquist et al., 2010). This also appears to hold true for emerging adults, as adding heavier drinking members to college social networks is associated with higher risks of drinking (Meisel & Barnett, 2017). This same effect appears to occur within daily interactions of emerging adults, such that interacting with social network members who drink or social network members who are drinking buddies is associated with a greater likelihood of engaging in alcohol use on a given day, in comparison to the likelihood of engaging in alcohol use when interacting with social network members who do not consume alcohol (Neighbors et al., 2019). Like research on specific social network members, overall network research suggests selection and socialization are occurring simultaneously, such that individuals

are influenced by their network, while also forming new relationships with similar others (Bullers et al., 2001).

Moving Beyond the Alcohol Use of Social Networks: Examining Motives

In addition to the alcohol use of social network members, other characteristics or beliefs of social network members may also influence the alcohol use of emerging adults (e.g., injunctive norms, alcohol expectancies; Lau-Barraco & Collins, 2011). One such characteristic that has yet to be thoroughly investigated in the context of social influence is drinking motives, a variable that has been linked both directly and indirectly to alcohol use and related consequences (Cooper et al., 2016). Drinking motives are broadly conceptualized as reasons for drinking and represent the “why” of alcohol use.

Early models of drinking motives suggested that while various factors influence the decision to consume alcohol (e.g., personality characteristics, reinforcement of drinking behaviors, vicarious learning sociocultural environment), these factors combine and lead to a final decision-making point to drink or not to drink, based on whether individuals anticipate drinking will result in more positive emotional consequences than could be achieved by not drinking (Cox & Klinger, 1988). In other words, while various factors are thought to contribute to drinking, the final decision to drink is thought to be driven by anticipated affective changes (Cox & Klinger, 1988). This model aligns with social learning theory, suggesting cognitive processes mediate the impact of various factors on alcohol consumption (Bandura, 1969); however, this model also differentiates between alcohol expectancies (as included in social learning theory) and drinking motives.

While drinking motives and alcohol expectancies may be similar in nature, drinking motives are the reasons an individual decides to drink, while alcohol expectancies are the individual's beliefs about what may happen as a result of consuming alcohol (Cox & Klinger, 2004). While an individual may expect alcohol use to result in many possible outcomes (e.g., tension reduction, social bonding, increased romantic, increased positive emotion), an individual may only drink to achieve certain valued effects (i.e., choosing to drink to increase positive emotion). As such, alcohol expectancies are thought to activate drinking motives, which then lead to alcohol consumption (Cox & Klinger, 1988). In line with this, drinking motives have been found to mediate the effect of alcohol expectancies on alcohol use (e.g., Cooper et al., 1995; Kunstche, Wiers, et al., 2010).

Current models of drinking motives have expanded upon Cox and Klinger's (1988) model and propose drinking motives have two dimensions: reinforcement (positive or negative) and source (internal or external; Cooper, 1994). These dimensions are used to classify desired drinking outcomes, indicating whether outcomes are positively or negatively reinforcing and whether desired outcomes occur within the individual or within the social environment (Cooper, 1994). Using this model, several drinking motives have been established and well-studied: social motives (drinking to enhance social relationships or social gatherings; positive reinforcement and external context), enhancement motives (drinking to increase positive emotions; positive reinforcement and internal context), conformity motives (drinking to avoid social ostracism; negative reinforcement and external context), and coping motives (drinking to reduce anxiety or depression; negative reinforcement and internal context; Cooper, 1994;

Grant et al., 2007). In an analysis of over 13,000 participants, Cooper and colleagues (2016) report that social motives are the most highly endorsed, followed by enhancement, coping, and conformity motives. This pattern of endorsement appears to generally occur across samples of different age groups, including emerging adults (Cooper et al., 2016).

Each type of drinking motive has been associated with a unique context and pattern of alcohol use. For example, social motives have been shown to occur almost exclusively in social settings, as social rewards are most readily available in social contexts (Cooper, 1994). As drinking in social settings is associated with more benign consequences than drinking alone (Christiansen et al., 2002; Gonzalez et al., 2009), social motives tend to be associated with lower-risk patterns of alcohol consumption (Cooper et al., 2016). While previous studies documenting a positive relationship between social motives and binge drinking and/or alcohol-related problems do exist (e.g., Aurora & Klanecky, 2016; Van Damme et al., 2013), the meta-analysis completed by Cooper and colleagues (2016), suggests that after controlling for other drinking motives, social motives are unrelated to binge drinking (mean beta weight = .05) and alcohol-related problems (mean beta weight = .03).

Like social motives, conformity motives are also thought to occur primarily in social settings, as peer pressure and avoidance of social rejection is most relevant in social contexts (Cooper, 1994). Despite the demonstrated protective effect of drinking in social settings, conformity motives may be risky, as they operate using negative reinforcement and are driven by avoidance (Cooper et al., 2016). Drinking motivated by avoidance goals, rather than approach goals, is thought to be less adaptive for several reasons. First, it can result in negative attentional biases that may lead to ineffective

behaviors while drinking (e.g., interpreting a neutral remark as an insult and reacting; Cooper et al., 2016)). Second, it is associated with stronger emotional and behavioral responses which may make it more likely that an individual prioritizes short- over long-term goals (Cooper et al., 2016). Third, it creates a feedback loop wherein an individual is more likely to drink in response to aversive experiences in the future (Cooper et al., 2016). Given these conflicting protective (i.e., social context) and risky (i.e., avoidance) aspects of conformity motives, such motives tend to be less benign than social motives. Research suggests conformity motives demonstrate a weak positive association with alcohol-related problems (Cooper et al., 2016; Kuntsche, Wiers, et al. 2010; Young et al., 2015) or specific alcohol-related problem domains (e.g., impaired control, diminished self-perception, poor self-care; Merrill & Read, 2010), and are weakly and negatively associated with heavier alcohol use (Cooper et al., 2016; Grant et al., 2009). When examining specific age groups, conformity motives appear to most often be discussed and linked to alcohol-related problems in adolescent samples (e.g., Kuntsche, Stewart, et al., 2008; Kuntsche, Wiers et al., 2010), although they have also been linked to alcohol-related problems in emerging adults (e.g., Doumas & Midgett, 2015; Merrill & Read, 2010; Young et al., 2015).

In contrast to social and conformity motives, enhancement motives do not have as strong a relationship with one specific drinking context (Cooper et al., 2016). It has been suggested that enhancement motives may also lead to drinking in social contexts, as social interaction is often a significant source of human reward (Reis et al., 2000); however, pleasurable experiences are not inextricably linked to social contexts. As a result, enhancement motives have been found to occur in a range of settings, depending

on what is more pleasurable to the individual (Cooper et al., 2016). As would be expected with a motive based on enhancing one's experience, enhancement motives have demonstrated a stronger association with usual and heavy consumption than any other drinking motive (Cooper et al., 2016). Despite this association with heavy consumption, enhancement motives are not always found to have a strong relationship with alcohol-related problems. It appears the relationship between enhancement motives and drinking problems is often dependent on level of alcohol consumption (e.g., Molnar et al., 2010).

In contrast to the other motives, coping motives are often associated with drinking in solitary environments (Kuntsche, Knibbe, et al., 2010). This is theorized to be a result of the presence of negative emotions, which often result in withdrawal from social interactions. This effect appears to be particularly potent for depressive emotions (see Cooper et al., 2016). Moreover, drinking to cope does not necessitate the presence of others for it to be rewarding, and may be more effective if drinking occurs in a solitary context (Cooper et al., 2016). Given that both avoidance and solitary drinking are thought to be associated with risky drinking, it is not surprising that research suggests general coping motives are directly linked to alcohol-related problems (e.g., Cooper et al., 2008; Holahan et al., 2001). Notably, research has also expanded upon Cooper's original conception of coping motives to include two separate types of coping motives: coping with depression and coping with anxiety (Grant et al., 2007). It appears that these coping motives sub-types have different relationships with alcohol outcomes. For example, coping-with-depression has been found to be predict alcohol-related problems more strongly than coping-with-anxiety (Goldstein et al., 2010; Mezquita et al., 2014; Vernig & Orsillo, 2015). This may be due to the particular association of coping-with-depression

and solitary contexts and the particularly negative bias that may come from avoidant coping in the context of depressive mood (e.g., difficulty disengaging from mood-congruent stimuli; Cooper et al., 2016; Hallion & Ruscio, 2011).

When compared individually, drinking motives appear to exist on a continuum from benign to harmful (Cooper et al., 2016). Anchoring the benign end are social motives. As one moves down the continuum, conformity motives are found, followed by enhancement motives. Coping motives belong at the far side, anchoring the harmful end of the continuum. Importantly, while most research examines the relationship between drinking motives and alcohol outcomes in this individual fashion, motives actually exist simultaneously to create a drinking motives profile. Limited existing research on such profiles indicate that risk associated with individual motives may be additive for certain alcohol outcomes (Cadigan et al., 2015). For example, individuals high on both positively reinforcing motives (i.e., social and enhancement) and coping motives, have been found to have more alcohol-related problems than those with high coping motives and low positive reinforcement motives, and those with high positive reinforcement motives and moderate coping motives (Cadigan et al., 2015). Notably, research also suggests that regardless of what type of motives are endorsed, endorsing higher levels of drinking motives, either individually or in the context of a motives profile, is associated with higher levels of alcohol consumption (Cadigan et al., 2015; Kuntsche et al., 2005). Thus, it appears that motives for drinking represent an important risk factor for alcohol use and misuse, whether examined individually or as a profile.

Like other risk factors for alcohol use (e.g., alcohol expectancies, impulsivity, social norm perceptions), drinking motives also appear to be susceptible to the far-

reaching effects of social learning and homophily (Gilman et al., 2014; Martino et al., 2006; Lewis et al., 2015). For example, emerging adult research indicates that the drinking motive profiles of romantic partners are more similar than would be expected by chance (Kehayes et al., 2017). Similarly, perceived parental and peer drinking motives are often found to be associated with an individual's own drinking motives (Cloutier et al., 2021). Adding to this, certain motives of one romantic partner (i.e., enhancement and social motives) have been found to predict the corresponding motives of the other partner, and, in turn, that partner's subsequent drinking (Kehayes et al., 2019). Similar results have been demonstrated in drinking buddies, where the social motives of one drinking buddy predict the social motives of the other, which then go on to predict the other buddy's alcohol use (Kehayes et al., 2021). Broader investigations of social influence in peer settings have been conducted with adolescent samples. This research tells a similar story – the motives of peers influence adolescents' own motives both cross-sectionally and longitudinally, and the motives of these adolescents then go on to predict their own alcohol use (Kuntsche & Stewart, 2009; Stewart et al., 2014).

It is likely that the same mechanisms of social influence at play with alcohol use are relevant to the context of drinking motives. For the same reasons as are theorized to occur in alcohol use (e.g., social acceptance, feeling understood; Montaya et al., 2008; Murray et al., 2002), individuals may seek out those who drink for similar reasons. Individuals may also observe whether their drinking motives are associated with reinforcing or punishing consequences and adjust their motivations for drinking accordingly (i.e., differential reinforcement). Moreover, as the alcohol expectancies and beliefs of others can be perceived by social network members (i.e., when asked,

individuals are able to report on the alcohol expectancies and beliefs of others; e.g., Mooney & Corcoran, 1991), it is likely that drinking motives of others can also be perceived. In fact, a recent study examining perceptions of drinking motives demonstrates evidence of this (Cloutier et al., 2021). As such, individuals may observe the consequences of the drinking motives of others and choose to adjust their own drinking motives accordingly. Taken together, theory and research on drinking motives suggests these motives are not only risk factors for alcohol use behaviors and related problems, but also may be subject to social influence themselves.

Sociocultural Context of Alcohol Use and Drinking Motives

As outlined within the social ecological model (Bronfenbrenner, 1979), alcohol-related behaviors and beliefs of individuals, social network members, and broad networks (i.e., micro- and meso-systems) do not exist in a vacuum – rather they exist within, and are impacted by, the context of societal and cultural factors (i.e., macro-level factors). While the included literature review has focused on the impact of others' alcohol use or drinking motives on one's own alcohol use and drinking motives, it is important to note that these factors are themselves impacted by sociocultural context (i.e., macro-level factors; Sudhinaraset et al., 2016). Indeed, research from the past 75 years consistently indicates that cultural context has an important impact on alcohol use behaviors (see Castro et al., 2014 for a review). Different drinking levels have reliably been shown to exist in different countries and within different subcultures (Castro et al., 2014; Gordon et al., 2012; Schmid et al., 2003). A small, but similar, effect has also been found for drinking motives, as the frequency of endorsing certain drinking motives has been shown

to vary across different countries and cultures (Kuntsche et al., 2015; Mackinnon et al., 2017).

There are several mechanisms that may account for the differences between cultures. For example, alcohol holds different positions in different cultures; in some cultures, alcohol is religiously or legally forbidden, while in other cultures moderate drinking is woven into everyday life (i.e., banal or Mediterranean drinking), or occurs intermittently (e.g., weekends, festivals; Room & Mäkelä, 2000; Room, 2013). Even within a particular culture, certain patterns of alcohol consumption are reserved for, or associated with, particular social categories or subcultures (e.g., binge drinking in emerging adults; Room, 2013). Thus, the social acceptability of different alcohol use patterns and motives differs across cultures or subcultures (e.g., developmental stages, neighborhoods; Ahern et al., 2008).

These differing cultural contexts impact the number and types of opportunities for differential reinforcement, vicarious learning, and cognitive processes within various contexts (e.g., Castro et al., 2014). For example, cultural context has been shown to impact alcohol expectancies, with greater expectations of positive effects of alcohol in some cultures than others (Schmidt et al., 1999; Lindman et al., 2000). Given these results, authors have concluded that mechanisms of social influence are broadly impacted by contextual variables and cultural alcohol traditions (i.e., macro-level factors; Lindman et al., 2000). Note that while sociocultural context is clearly important, the current dissertation does not focus on sociocultural factors, but rather nestles findings within sociocultural context in the discussion.

Summary

Emerging adulthood is a unique developmental period that serves as a risk factor for substance misuse generally and alcohol misuse specifically. Within emerging adulthood, both broad social networks and specific types of social network members (e.g., peers, romantic partners) have been found to influence the alcohol use of individuals. While there are many characteristics and behaviors of social network members that influence the alcohol use of individuals, social network member alcohol use and drinking motives appear to be important. Both theory and research suggest that the alcohol use and motives of others likely exhibit effects through social learning, selection, and sociocultural influences.

Dissertation Aims

My dissertation's primary goal was to investigate the impact of social network member alcohol use and drinking motives on the alcohol use and drinking motives of emerging adults. As emerging adulthood represents the developmental stage with the highest proportion of heavy drinking and alcohol-related problems, I chose to focus on this age group.

Study 1

Entitled "*Social influences on binge drinking in emerging adults: Which social network members matter most?*", Study 1 (Bartel et al., 2020) investigated which type of social network members have the greatest impact on emerging adult's binge drinking when considered within a single model. Previous research has focused on specific social network member types (e.g., romantic partners), or undifferentiated social networks (i.e., impact of entire network full of various types of network members) but has not examined the differential contributions of multiple types of network members. Study 1 fills this gap

in the literature. Using a cross-sectional design, I sampled emerging adults and between one and five of their social network members. As highlighted in the Introduction, research and theory suggest that the alcohol use of those around emerging adults, particularly peers and romantic partners, influences their alcohol use. As such, I hypothesized that the binge drinking of peers and romantic partners, but not the binge drinking of parents and siblings, would predict target binge drinking. Study 1 utilized structural equation modelling and had a particular focus on binge drinking, as it is a pattern of alcohol consumption that is consistently associated with negative consequences (Patrick et al., 2020). While these hypotheses were derived from the literature, they were also based on social learning theory (Bandura, 1969) and Arnett's (2000) theory of emerging adulthood.

Study 2

Entitled "*Development of brief alcohol and cannabis motives measures: Psychometric evaluation using expert feedback and longitudinal methods*", Study 2 involved the creation of shortened alcohol and cannabis motives measures. Because I wanted to study the social influence of drinking motives within an egocentric social network design (i.e., where participants report on 15 members of their social networks) in Study 3, I first needed to develop psychometrically sound drinking motive measures with low participant burden. Similar barriers have been encountered by other researchers attempting to study motives using ecological momentary assessment or daily diary designs (e.g., Joyce et al., 2021; O'Donnell et al., 2019). As shared alcohol and cannabis motives are thought to exist (Simons et al., 1998), I chose to develop a brief cannabis-use motives measure at the same time. This two-part study first involved expert feedback on

my developed items, followed by a two-wave longitudinal design. I used correlation, multiple linear regression, and generalized linear modelling in the context of multiple imputation to investigate the reliability and validity of my scales and compare them to the original, validated full-length versions. I hypothesized: 1) brief and full-length measures would have similar test-retest reliability; 2) brief and full-length subscales would be at least moderately concurrently correlated; 3) brief and full-length subscales would remain significantly concurrently correlated after removing shared items; 4) enhancement, coping-with-anxiety, and coping-with-depression would predict concurrent substance use quantity x frequency for brief and full-length scales; and 5) baseline quantity, conformity motives, and coping-with-depression motives would prospectively predict follow-up substance-related problems for brief and full-length scales. These hypotheses were derived from the test construction literature and from the drinking motives literature.

Study 3

Entitled “*Social influences on why we drink: Perceived drinking motives in social networks impact individuals’ own drinking motives and alcohol use*”, Study 3 investigated the influence of perceived social network motives on the motives and alcohol use of emerging adults. While the literature indicates that individuals’ drinking motives and alcohol use are impacted by classmates and schoolmates in adolescence (Kuntsche & Stewart, 2009; Stewart et al., 2014), and romantic partners and drinking buddies in emerging adulthood (Kehayes et al., 2019; Kehayes et al., 2021), it was unclear what impact broad social networks have on the motives and binge drinking of emerging adults. Moreover, it was also unclear whether the documented similarity of motives with social network members were the product of social selection and/or social

influence. I filled these gaps using an egocentric social network design which sampled emerging adults at two time points, four months apart. I used path analysis with multiple imputation to test for the presence of selection and socialization, as well as to examine whether perceived social network drinking motives predicted participant drinking indirectly through participants' own motives. I hypothesized baseline perceived network motives would predict participant's own motives at follow-up, after accounting for stability over time, supporting socialization. I also tested whether baseline participant motives would predict perceived network motives at follow-up, after accounting for stability over time; however, as selection had not been studied previously, I did not make specific hypotheses here. I also hypothesized perceived enhancement, social, coping, and conformity motives of the social network would indirectly influence participants' own binge drinking frequency via participants' own motives. These hypotheses came from the limited literature on drinking motives and social influence (e.g., Kehayes et al., 2019; Kehayes et al., 2021; Kutsche and Stewart, 2009; Stewart et al., 2014) and were informed by social learning theory (Bandura, 1969) and homophily (Lazarsfeld & Merton, 1954).

Study 4

Entitled "*Accuracy and bias in perceptions of why social network members drink: A truth and bias approach to drinking motive (mis)perception*", Study 4 investigated the accuracy of the perceived drinking motives of social network members. As Study 3 utilized perceived drinking motives, I sought to investigate whether these perceptions aligned with "reality". This information did not yet exist and was key for helping to interpret the results of Study 3. In addition, this information also provides guidance about which types of designs are most effective for studying and understanding social influence

of drinking motives. As a branch of the design described in Study 3, I recruited the participants' social network members to report on their own behavior. I then compared participant and social network member reports using multiple regression analyses informed by the Truth and Bias model (West & Kenney, 2011) to determine accuracy and bias. I hypothesized all drinking motives perceptions would demonstrate evidence of accuracy, aligning with self-reported behavior of network members. At the same time, I also hypothesized that participants would assume they have similar drinking motives to their social network members (i.e., assumed similarity); however, I expected that these effects would be smaller than the accuracy effects. With respect to a systematic under- or over-estimation of drinking motives, I hypothesized participants would overestimate social and enhancement motives, as they are the most frequently endorsed and socially accepted, and would underestimate conformity and coping drinking motives, as they are the least-commonly endorsed and may be associated with negative connotations (e.g., Grazioli et al., 2018; Kenney et al., 2013). In addition to the above-mentioned hypotheses, I also sought to investigate the potential moderating role of sex in an exploratory capacity. These hypotheses were derived from the alcohol perceptions literature and from the drinking motives literature.

Dissertation Outline

Each of the above-mentioned four studies are presented in turn in the upcoming chapters. Study 1 can be found in Chapter 2, Study 2 in Chapter 4, Study 3 in Chapter 6, and Study 4 in Chapter 8. Transitions between studies can be found in Chapters 3, 5, and 7, respectively. An integrative discussion of my dissertation's findings, including theoretical and clinical implications, can be found in Chapter 9.

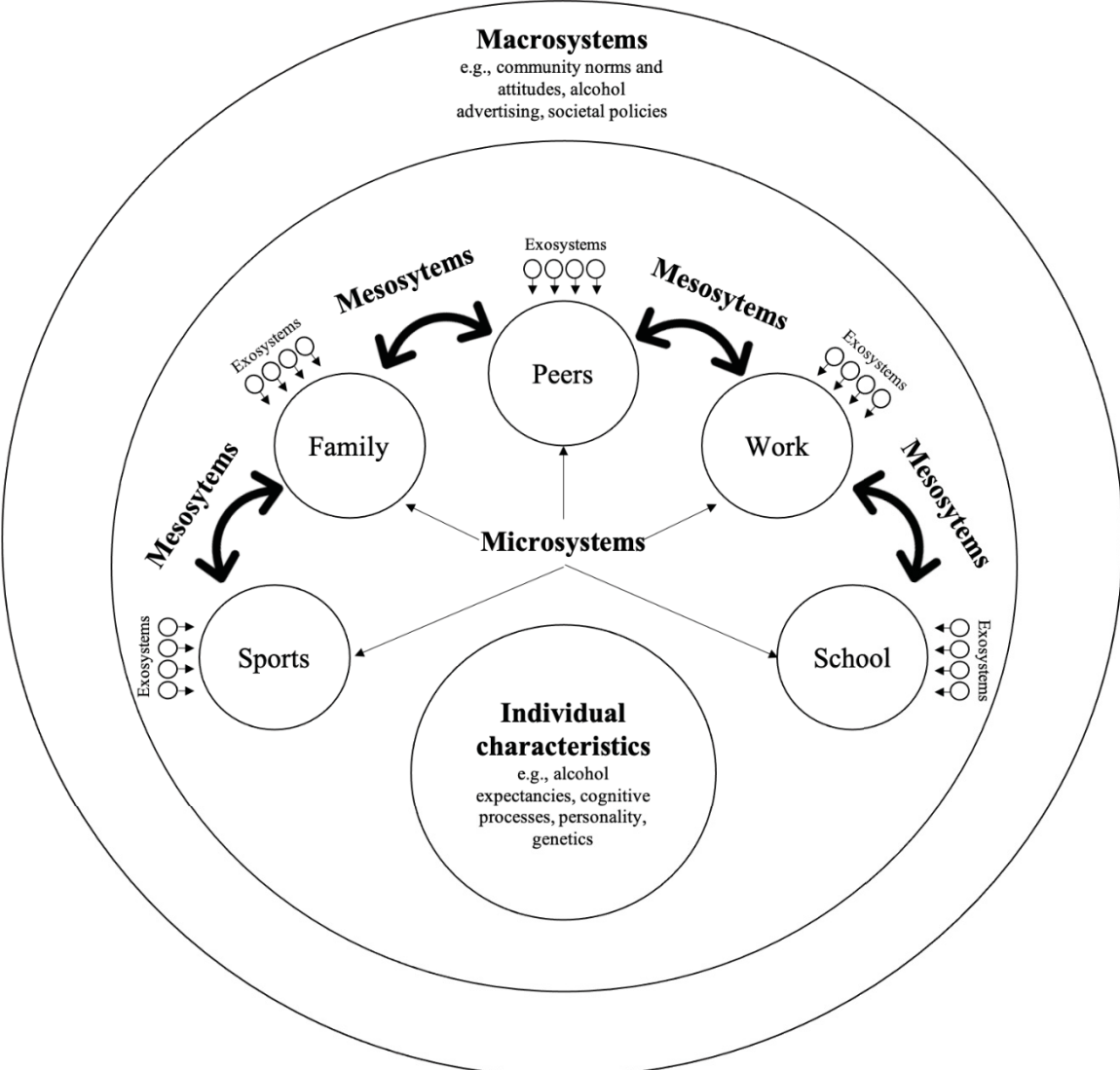


Figure 1.1. Brofenbrenner's (1979) Social Ecological Model applied to alcohol. Figure based on the work of Sudhinaraset et al. (2016).

CHAPTER 2. STUDY 1 – SOCIAL INFLUENCES ON BINGE DRINKING IN EMERGING ADULTS: WHICH SOCIAL NETWORK MEMBERS MATTER MOST

The manuscript prepared for this study is presented below. Readers are advised that Sara Bartel, under the supervision of Dr. Sherry Stewart and Dr. Simon Sherry, was responsible for developing the research hypotheses, preparing the data set for analyses, conducting the analyses, and interpreting the study results. Sara wrote the initial draft of the manuscript and received and incorporated feedback from her co-authors. The manuscript then underwent peer-review. Sara responded to reviewers and led each round of revisions. The Manuscript was accepted to be published in the journal *Substance Abuse* on December 16th, 2019 and published January 17, 2020. See Appendix A for copyright permission from the publisher (Taylor & Francis) to include this paper in the thesis. The full reference is as follows: Bartel, S. J., Sherry, S. B., Smith, M. M., Glowacka, M., Speth, T. A., & Stewart, S. H. (2020). Social influences on binge drinking in emerging adults: Which social network members matter most? *Substance Abuse*, 1-5.

Abstract

Background: Binge drinking peaks in emerging adulthood and is associated with a myriad of negative consequences. Research indicates that social network members have a significant influence on binge drinking. In particular, theory suggests that drinking habits of romantic partners and peers have a stronger influence on emerging adult binge drinking than do drinking habits of siblings and parents. I investigated the relative influences of siblings, parents, romantic partners, and peers on emerging adults' binge drinking using a multisource design and a robust measure of binge drinking. I hypothesized peer and romantic partner binge drinking would more strongly predict emerging adult (egos) binge drinking than would parent and sibling binge drinking.

Methods: I recruited 321 participants (egos) aged 17–25 years, alongside 882 members of their social network (alters). Egos and alters completed self-report measures of binge drinking (frequency, quantity, and self-perception). *Results:* Structural equation modeling revealed that the direct positive effect from romantic partner binge drinking to ego binge drinking was significant. In contrast, the direct effects from peer, parent, and sibling binge drinking to ego binge drinking were nonsignificant. *Conclusion:* In emerging adulthood, romantic partners appear to have the strongest association with ego binge drinking.

Keywords: binge drinking, alcohol, social network

Introduction

Binge drinking – the consumption of 5+ drinks in two-hours (4+ for women; National Institute of Alcohol Abuse and Alcoholism [NIAAA], 2004) – peaks in early adulthood and is associated with risks such as accidents, lost productivity, and relationship problems (Patrick et al., 2019; Thavorncharoensap et al., 2009). As these negative consequences are especially prevalent in emerging adulthood (18-25 years; Arnett, 2005), identifying factors, such as social influences, that contribute to binge drinking in emerging adulthood is vital.

Emerging adults are embedded within social networks where members influence one another's alcohol use via active (e.g., explicit offers of alcohol) and passive (e.g., modeling, perceived norms) mechanisms (Bandura & Walters, 1977). Developmental theorists suggest peers and romantic partners are the most important sources of social influence for emerging adults (Borsari & Carey, 2001; Larson & Richards, 1991). During emerging adulthood, young people shift from spending most of their time with parents and siblings to spending more time with peers and romantic partners (Arnett, 2005). As such, emerging adults rely more on peers and partners than family for support and intimacy, representing a change from adolescence (Arnett, 2005).

Among emerging adults, peer use of alcohol is a robust predictor of regular and hazardous drinking (Mason et al., 2014), and active and passive influences from peers independently predict binge drinking (Read et al., 2005). Similarly, the alcohol use of partners influences individual binge drinking over the short- and the long-term and predicts changes in alcohol consumption between adolescence and emerging adulthood (Bartel et al., 2017; Musquash et al., 2013; Wiersma et al., 2009).

In contrast, the impact of parent and sibling alcohol use on the alcohol use of emerging adults is unclear. Studies on sibling influence in emerging adulthood suggest the influence of siblings is modest, and tends to occur from older siblings, especially if siblings are close in age and the same sex (Boyle et al., 2001). Research also suggests parental alcohol use increases the likelihood emerging adults will also drink alcohol; however, relative to the influence of peer drinking, parental drinking might have a smaller impact on emerging adults' drinking (Scholte et al., 2008).

Advancing Literature on Binge Drinking and Social Influence in Emerging Adults

Research has focused primarily on specific social network members or undifferentiated social networks rather than contributions of multiple types of network members on emerging adult alcohol use. My aim was to address this by determining the most important types of social network members. Moreover, research has typically included participant perceptions of network members' alcohol use instead of having network members directly report on their alcohol use (Mason et al., 2014). As perceptions of others' alcohol use can be biased, it is unclear if the actual alcohol use of network members is an important influence (Henry et al., 2011). Therefore, I collected self-reported alcohol use directly from network members. My study is the first to compare the influence of multiple types of network members using direct reports. Finally, I advanced the literature by measuring binge drinking as a latent variable composed of frequency, intensity, and perceptions of binge drinking. Building on theory and research (Arnett, 2005; Bartel et al., 2017), I hypothesized the binge drinking of peers and romantic partners, but not the binge drinking of parents and siblings, would be associated with participant (i.e., ego) binge drinking.

Methods

Participants

A total of 321 undergraduate emerging adult egos (M age = 19.5; range 17-25; 72.9% female; 80.4% Caucasian) from Dalhousie University were recruited as part of a larger study (Smith et al., 2019). 1,680 social network members (alters) of egos were contacted; 962 alters responded. Alters were comprised of 166 mothers, 99 fathers, 65 sisters, 37 brothers, 3 spouses, 80 dating partners, 373 friends, 52 roommates, 4 classmates, 3 co-workers, 42 other relatives (e.g., grandparent), and 32 “others.” Alters categorized as “other” and “other relatives” were excluded, as were alters who did not specify their relationship to the ego ($n = 6$). There was subsequently 882 alters grouped into categories of parents, siblings, peers (friends, roommates, classmates, and coworkers) and romantic partners ($M = 2.99$ alters/ego; range = 0-5 alters/ego). Alter characteristics are in Table 2.1.

Measures

Binge Drinking Frequency

Consistent with the National Institute on Alcohol Abuse and Alcoholism (NIAAA, 2003), egos and alters were asked, “During the past 7 days, how often did you have 5 (4 for women) or more drinks containing any kind of alcohol within a 2-hour period?” Egos and alters responded on a 12-point scale from “0 times” to “10+ times”. This item correlates strongly with NIAAA’s measure of binge drinking frequency ($r = .68-.83$; Musquash et al., 2013).

Intensity

Egos and alters were asked, “What is the greatest number of drinks you consumed in a 2-hour period during the past 7 days?”, as a measure of binge drinking intensity (Musquash et al., 2014).

Binge Drinking Self-Perceptions

Egos and alters were asked three items assessing perceptions of their binge drinking (e.g., “The average person would be amazed if s/he knew how much alcohol I consumed within a 2-hour period (during the past 7 days)”); Mushquash et al., 2013). Items were rated on a 5-point scale from 1 (*strongly disagree*) to 5 (*strongly agree*). Research demonstrates this scale has adequate reliability ($\alpha = .77-.87$; Mushquash et al., 2013).

Procedure

Ethics approval was given by an Institutional Review Board. Participants were given a detailed consent form and written consent was obtained. Egos completed paper-and-pencil versions of measures and provided email address of five alters whom they had known for at least three months and had contact with at least twice a week. Eligible alters completed measures online. Egos were compensated with one credit towards a psychology course. Alters were entered into 1-of-20 \$50 draws.

Data Analysis Approach

I examined descriptive statistics and correlations (see Table 2.2). Structural equation modeling tested the loadings of the binge drinking variables onto a latent factor using a measurement model. Hypotheses were tested by estimating a structural model using structural equation modelling.

Results

Descriptive Statistics

Means, standard deviations, bivariate correlations, and Cronbach's alphas appear in Table 2.2. Following Cohen's (1992) guidelines for small, moderate, and large effects ($r = .10, .30, .50$), ego binge drinking had a moderate positive relationship with peer binge drinking and a large positive relationship with partner binge drinking. The relationships between ego binge drinking with parent and sibling binge drinking were small and non-significant ($p > .05$).

Structural Equation Modeling

I tested if parent, sibling, peer, and/or partner binge drinking were predictors of ego binge drinking using structural equation modeling with FIML estimation in AMOS (Arbuckle, 2011). I evaluated fit using CFI, TLI, and RMSEA. CFI and TLI $\geq .95$, and RMSEA $\leq .06$ indicate good fit (Kline, 2011)¹.

Measurement Model

The measurement model (Figure 2.1) fit well: $\chi^2(80) = 128.12$, CFI = .968; TLI = .952; RMSEA = .043, 90% CI [.029-.057]. Factor loadings were significant ($p < .001$) and $> .40$.

Structural Model

The structural model (Figure 2.2) had the identical fit indices as listed above for the measurement model. Only romantic partner binge drinking predicted ego binge

¹There were six alters classified as "peers" who were over the age of 30. Given that these individuals may not be "peers" due to the age gap, analyses were also run without these six individuals. The pattern of results and statistical significance did not change in this analysis.

drinking ($\beta = .69, p < .001$). A total of 50% of the variance in ego binge drinking was accounted for by all four predictors.

Discussion

I tested the association of the binge drinking patterns of social network members with the binge drinking patterns of emerging adults using a multi-source design and a psychometrically-robust binge drinking measure. I investigated the relative influence of different social network member groups by examining various social network members in a single model. As most research relies on egos' perceptions of alters' drinking – perceptions which can be biased (Henry et al., 2011) – a major strength of my study was my use of direct reports of drinking from alters themselves. Results may have been quite different if the same model had been run using egos' perceptions of alters' drinking.

As hypothesized, parent and sibling binge drinking was not associated with ego binge drinking. My results align with theory and research suggesting the relative influence of parents and siblings decreases with age (Scholte et al., 2008; Smith et al., 2019; Reifman et al., 2006); however, my results do not preclude siblings and parents influencing alcohol use of egos at an earlier time point. Moreover, as parents and siblings may live in another city and may not be geographically close to the undergraduates in my study, their social influence may not be as salient as the social influence of more proximal alters with whom egos may have more exposure (i.e., partners and peers). Consistent with Bartel and colleagues (2017) and Mushquash and colleagues (2013), and as hypothesized, romantic partners' binge drinking was associated with ego binge drinking. The large size of this effect probably reflects the important influence of romantic partners during emerging adulthood and the cross-sectional nature of my study,

which did not allow us to separate selection and socialization effects.

People select romantic partners based on similarity of characteristics, values, and behaviors, which may lead people to choose partners with similar alcohol use (Roberts & Leonard, 1998). This similarity-based selection of partners may be especially important given findings that the degree of similarity in alcohol use between partners impacts relationship quality (Roberts & Leonard, 1998). As such, the similarity of binge drinking between partners in my sample may partially reflect this selection process. Once in a relationship, partners may further reduce discrepancies between their alcohol use patterns and that of their partners to improve relationship quality and meet needs for approval and acceptance (Baumeister & Leary, 1995). This socialization effect may be stronger in romantic partner contexts, given individuals may spend significant time with partners (i.e., more so than with individual friends), given social learning theory suggests the behavior of those who are highly valued is most likely to be emulated (Bandura & Walters, 1977), and given developmental theory suggests romantic partners are important in emerging adulthood (Larson & Richards, 1991). Thus, partners might influence how much individuals consume alcohol (Kehayes et al., 2019).

Partners might also influence why individuals drink alcohol; individuals may observe their partners' motivations for drinking (e.g., drinking to cope with anxiety) and adopt those reasons for drinking themselves, resulting in an escalation of drinking behavior (Baumeister & Leary, 1995). Ultimately, the combined effects of selection and socialization might result in a "drinking partnership" (Roberts & Leonard, 1988) and explain my strong direct effects of partners on ego binge drinking. Research suggests this "drinking partnership" may result in an increase or decrease in binge drinking depending

on the individuals and the context (Rodriguez et al., 2016).

Contrary to hypotheses, peer binge drinking was not associated with ego binge drinking. Broad peer networks have an impact on binge drinking while, in general, single peers, except for “drinking buddies,” might not (Nogueira-Arjona et al., 2019; Reifman et al., 2006). Thus, I might not have included enough peers to capture the influence of a peer network or might not have included the “right” single peers. Secondly, peer influence might be the result of descriptive or injunctive norms (how much peers are perceived to drink; what is perceived to be accepted by the peer group) rather than the actual drinking habits of specific individuals. Third, as romantic partners are likely present in many peer-based interactions, some of the variance from peers may have been captured and accounted for by partners in the model. Nonetheless, my results accord with developmental theory suggesting during the transition from adolescence to emerging adulthood, the importance of peers declines, while the importance of romantic partners increases (Erikson, 1963).

Limitations and Future Directions

My results are limited by the predominately female, White, and university-educated sample and may not be generalizable to more diverse groups. Future research should adopt a longitudinal design. Additionally, a broader peer network was not captured by my study, nor was the influence of different types of peers (e.g., drinking buddies vs. casual acquaintances). The impact of these distinct sources of peer influence should be investigated and compared to romantic partners. Furthermore, though my results suggest parental binge drinking is not a significant influence, parents might influence emerging adults via mechanisms other than personal alcohol use (e.g., rules

about drinking; Wetherill & Fromme, 2007). Finally, while my design is notable because it used direct reports from alters rather than egos' perceptions of alters drinking, the same model run using such ego perceptions may provide different results.

Concluding Remarks

When investigating the social networks of emerging adults, partners are a particularly influential type of network member when it comes to binge drinking. The strength of romantic partner influence has implications for alcohol misuse interventions, which should not underestimate the impact of partners on emerging adult binge drinking.

Table 2.1. Study 1 Alter characteristics

Type	Number included	Percentage of total alters	Mean number per ego (range)	Mean age in years	Relationship length in years
Parents	265	30.05%	.88 (0-2)	51.16 (37-68)	19.57 (.08-26)
Siblings	102	11.56%	.35 (0-3)	21.14 (14-34)	19.71 (3.25-23.58)
Romantic	83	9.41%	.25 (0-1)	21.40 (17-36)	2.59 (.17-13.16)
Peers	432	48.98%	1.44 (0-5)	20.20 (11-63)	5.07 (.08-25.92.)

Note: As parents were not required to be biological parents, the value of .08 may represent a step-parent. As one peer indicated they had known the target for more years than the target reported being alive, this report of relationship length was not included in the table above.

Table 2.2. Study 1 Bivariate Correlations, Means, standard Deviations, Possible Range, Actual Range, and Alpha Reliability

Variable	1	2	3	4	5
1. Target BD total	—				
2. Parent BD total	.12	—			
3. Sibling BD Total	.17	.10	—		
4. Peer BD total	.27**	-.04	-.05	—	
5. Partner BD total	.60**	.04	.55**	.17	—
<i>M</i> (before standardization)	7.86	5.67	6.46	8.75	9.37
<i>SD</i> (before standardization)	6.17	3.61	5.14	5.94	6.82
Possible range of scores	3+	3+	3+	3+	3+
Actual range of scores	3-35	3-26	3-23	3-34	3-19
Cronbach's alpha (α)	.91	.77	.89	.88	.81

Note: Missing data handled with pairwise deletion. **BD** = binge drinking. Binge drinking total was calculated by summing each measure of binge drinking (i.e., frequency, intensity, and perception). For correlations, binge drinking total was calculated by first standardizing each measure of binge drinking, summing these three standardized measures, and then standardizing this total. When more than one alter of a certain type was present (e.g., two parents) the mean frequency, intensity and perception were calculated and summed. ($N = 20$ [partner/sibling] to 221 [target/peer]). Cronbach's alpha calculated using

summation of standardized frequency, standardized severity, and standardized total perception scale. See measures section for previous research on the alpha of the three-item perception scale.

* $p < .05$ ** $p < .01$.

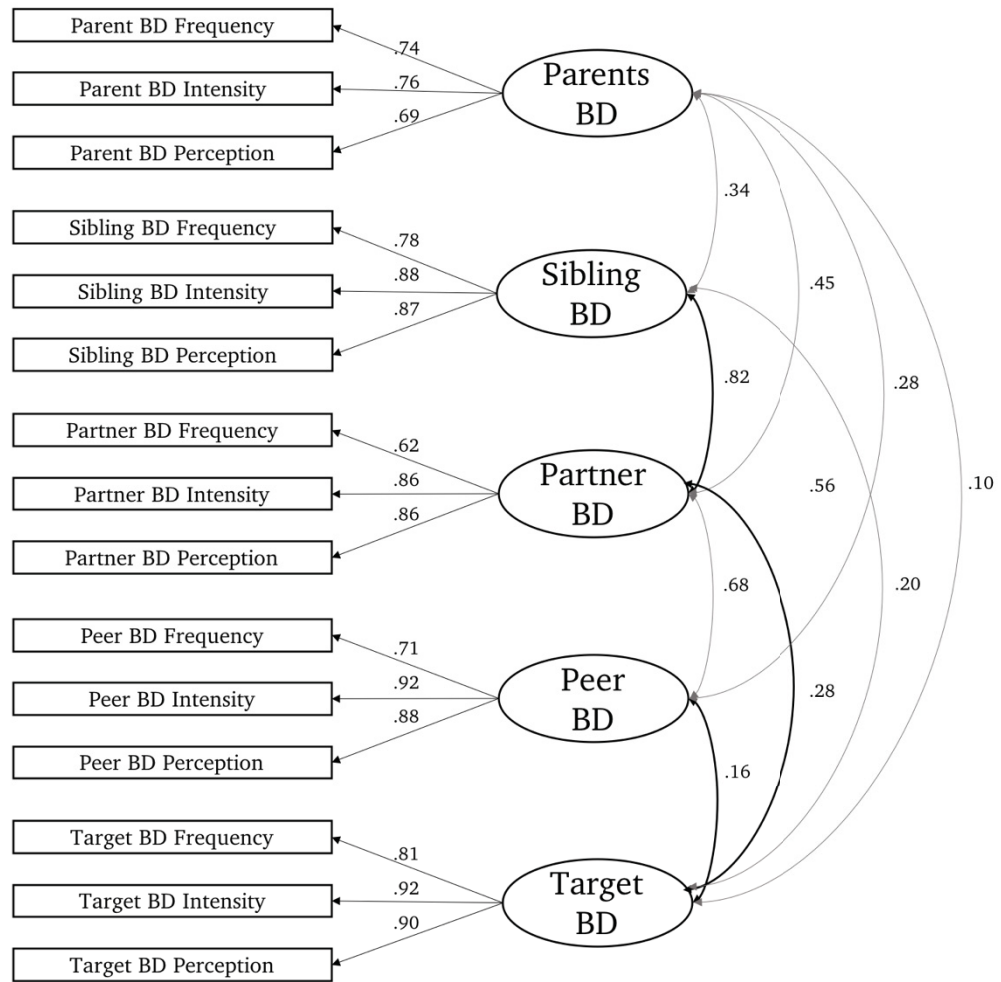


Figure 2.1. Measurement Model. Ovals represent latent variables. Rectangles represent observed indicators. Double-headed black arrows represent significant correlations ($p < .05$). Double headed grey arrows represent non-significant correlations ($p > .05$). Single headed black arrows represent significant loadings ($p < .05$). Pairwise deletion was utilized. BD = binge drinking.

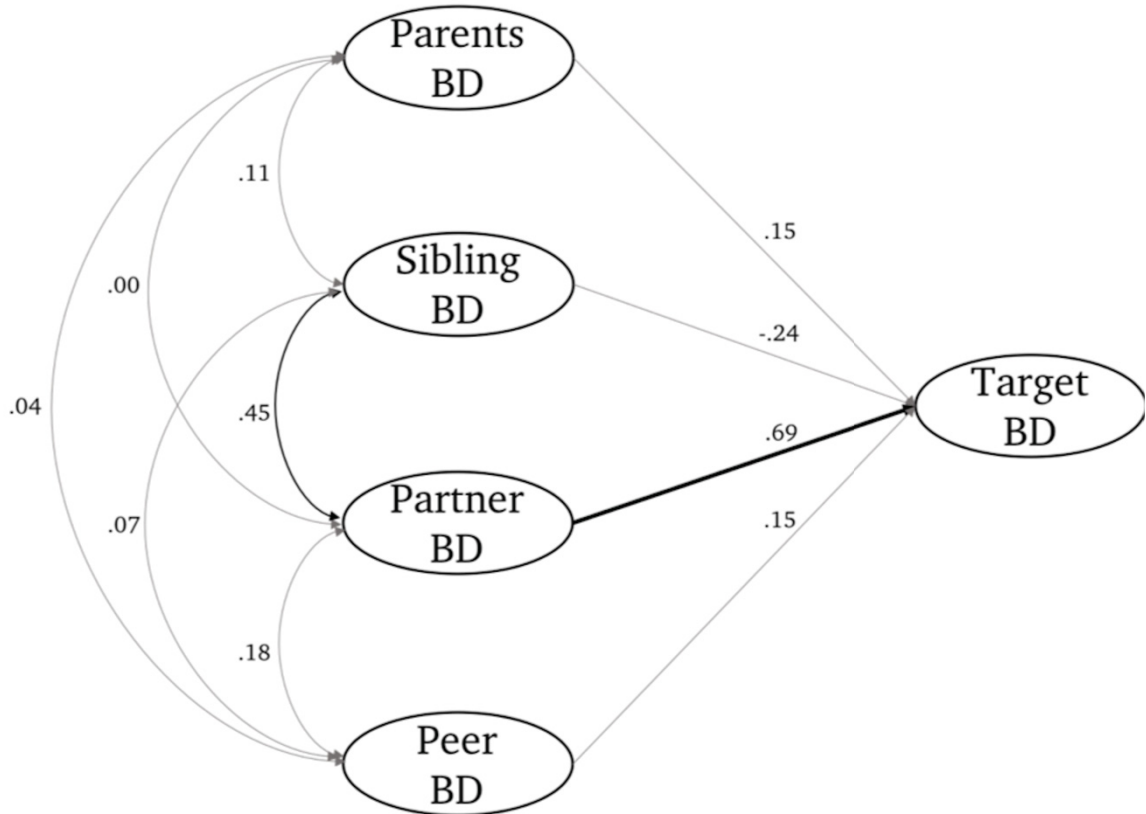


Figure 2.2. Structural Model. Significant direct effects ($p < .05$) are represented by single-headed black arrows. Non-significant direct effects ($p > .05$) are represented by single-headed grey arrows. Double headed arrows signify covariances. Estimates are standardized.

CHAPTER 3: TRANSITION FROM STUDY 1 TO STUDY 2

The results of Study 1 align with the literature suggesting that the alcohol use of those around us is not insignificant – rather, it has a notable impact on our own alcohol use (e.g., Rosenquist et al., 2010). Following the completion of Study 1, I began to wonder why this is. Specifically, I was curious about the mechanisms through which the alcohol use of others impacts an individual’s own alcohol use. Returning to theory, Bandura (1969) suggests the influence of social network member’s behavior on our own behavior is largely the result of differential reinforcement and vicarious learning; however, Bandura emphasizes that such social learning does not result in behavior change on its own. Instead, cognitive processes must occur that translate the learning into behavior. Consistent with this, cognitive processes such as drinking motives and alcohol expectancies have been found to mediate the link between social network members alcohol use and an individual’s own alcohol use (Lau-Barraco et al., 2012; Müller & Kuntsche, 2011). Thus, research supports the importance of cognitive processes in mediating social influences on alcohol use.

Research has also begun to explore whether an individual’s alcohol-related cognitive processes are influenced by social network factors other than social network members’ alcohol use. For example, research has begun to ask whether an individual’s drinking motives are influenced by the drinking motives of others in their social network (e.g., Kehayes et al., 2019). As outlined in the introduction of the current dissertation (Chapter 1), preliminary research suggests they may be. It appears that individuals’ drinking motives are impacted by the drinking motives of those around them (e.g., Kehayes et al. 2019; Kuntsche & Stewart, 2009). This field of work represents a critical

advancement in the literature, as it has the potential to substantially increase our understanding of the etiology of individuals' drinking motives and their fluctuations over time. Given drinking motives are consistently linked to alcohol misuse and related problems (Cooper et al., 2016) and mediate the effect of other risk factors such as alcohol expectancies (e.g., Cooper et al., 1995; Kunstche, Wiers, et al., 2010) and personality (e.g., Chinneck et al., 2018; Stewart et al., 2001), gaining further knowledge about factors that affect the development and fluctuations in drinking motives is important for prevention and treatment of alcohol misuse.

As the research on social influence on drinking motives is in its relative infancy, I sought to advance it in several ways as part of the current dissertation. While I will reserve a thorough discussion of these advancements for Chapter 4, I will touch on one major advancement here. The existing literature on social influence and drinking motives focuses on dyads (e.g., Hussong 2003; Kehayes et al., 2019; Kehayes et al. 2021) or specific network member types (i.e., classmates, schoolmates; Kuntsche & Stewart, 2009; Stewart et al., 2014). While this work is an important starting point, the knowledge generated from these handful of studies is restricted to specific social network members (i.e., one person or type of network member). Because individuals are influenced by more than one type of social network member (Rosenquist et al., 2010), the current literature does not reflect the reality of the diverse nature of social networks, and likely does not fully capture the social influences within an individual's network. As such, one of the main goals of the current dissertation is to extend the previous research on social influence on drinking motives to diverse social networks.

One of the most effective ways to study such diverse social networks is using an egocentric social network design (i.e., participants report on the behavior of those who are close to them; Carrington et al., 2005). This design does not require an entire enclosed network (e.g., classroom, residence hall) like sociocentric designs, and thus does not limit the types of social network members that are reported on (i.e., if capturing a sociocentric network within a residence hall, the design assumes friends and peers with whom one lives are the most influential and misses out on other network members who may not be represented within the residence hall, such as other friends, romantic partners, siblings, parents, co-workers; Carrington et al., 2005; Chung et al., 2005). As a result, egocentric methodology allows for the collection of large networks that may be more likely to capture the distinct sources of social influence in an individual's life. As I sought to capture the influence of multiple types of social network members (parents, peers, romantic partners, etc.) on drinking motives, I chose to use an egocentric design to advance the literature. While egocentric studies can enquire about any number of social network members, I chose to include 15 network members for each participant, as this number has been suggested to be sufficient to capture the diverse sources of influence in an individual's life (e.g., Zywiak et al., 2009).

Unfortunately, when planning this study design, I came upon a roadblock experienced by many researchers before: the existing gold-standard measures for alcohol use motives, the Drinking Motives Questionnaire Revised (DMQ-R, Cooper; 1994) and the Modified Drinking Motives Questionnaire Revised (MDMQ-R; Grant et al., 2007), include 20 and 28 questions, respectively. As such, requiring participants to fill out these measures on behalf of each social network member would result in participants filling out

300-420 questions on the drinking motives of social network members alone. In the context of other study variables, the high participant burden would make such a study unfeasible. Notably, while researchers previously attempted to overcome this barrier by creating a short form of the DMQ-R (Drinking Motives Questionnaire Revised Short Form; Kuntsche & Kuntsche, 2009), the short form contains 12 items, thus remaining too burdensome for use in social network and daily diary designs given its multi-item nature.

Previous studies have also encountered the aforementioned feasibility issue and dealt with it in two main ways. For example, one study asked individuals to report on the average drinking motives across a specific type of network member (i.e., “to what extent do your peers drink because...”; Cloutier et al., 2021), rather than to report on each network member individually. While this reduces participant burden, it cannot capture the differences between network members (i.e., it forces participants to provide one value to represent all network members, many of whom likely have varying levels of drinking motives) and has been shown to have less predictive value than asking about each individual separately (Russel et al., 2020). Moreover, it is well established that individuals often systematically overestimate alcohol variables at the group level (e.g., peer alcohol use; Carey et al., 2006), rather than the individual level (e.g., Reid et al., 2020). Thus, assessing variables across network members is considered to increase inaccuracy (Barnett et al., 2014; Reid et al., 2020). As such, I did not want to take this methodological approach in the current dissertation. The second approach has occurred in daily diary studies, in which context asking participants to fill out an entire drinking motives questionnaire on a daily (or several times daily) basis is often unfeasible. Researchers have dealt with this problem by selecting a few items from motives measures

to include in daily surveys, rather than including the entire measures (e.g., Joyce et al., 2021; O'Donnell et al., 2019). This approach is also limited, because it cannot be assumed that the items chosen from the full measures represent each motive in a valid and reliable way. Thus, both previously attempted solutions were not viewed to be ideal for the current dissertation.

Rather than follow the approaches taken by other researchers, I decided to instead develop and evaluate brief measures of drinking motives (Study 2) that could be used when the full-length motive measures present too much participant burden (e.g., Studies 3-4). Given the frequency of this problem encountered within the research labs in which I am a member and the broader field, and the consistent link between drinking motives and alcohol use, the development of such measures represents a critical methodological advancement. Importantly, as issues of participant burden and feasibility are not only limited to alcohol motives, I decided to simultaneously create a brief measure of cannabis use motives as well. Chapter 4 outlines the process of developing and testing the reliability and validity of the above-mentioned brief motives measures.

CHAPTER 4. DEVELOPMENT AND PSYCHOMETRIC EVALUATION OF BRIEF ALCOHOL AND CANNABIS MOTIVES MEASURES

The manuscript prepared for this study is presented below. Readers are advised that Sara Bartel, under the supervision of Dr. Sherry Stewart and Dr. Simon Sherry, was responsible for designing the study, developing the research hypotheses, gaining ethical approval, collecting the data, preparing the data set for analyses, conducting the analyses, and interpreting the study results. Sara wrote the initial draft of the manuscript and received and incorporated feedback from her co-authors. Sara submitted a paper based on the included manuscript to *Cannabis* on April 29, 2021. The current reference is as follows: Bartel, S. J., Sherry, S. B., Mahu, I. T., & Stewart, S. H. Development and psychometric evaluation of brief alcohol and cannabis motives measures. Submitted to *Cannabis*.

Abstract

Objective: Alcohol and cannabis use motives are often studied as contributors to risky substance use patterns. While various measures for capturing alcohol and cannabis use motives exist, most contain 20+ items, which render their inclusion in certain research designs (e.g., daily diary) or with certain populations (e.g., polysubstance users) unfeasible. I sought to generate and validate six-item measures of alcohol and cannabis motives from existing gold-standard measures, the Modified Drinking Motives Questionnaire-Revised (MDMQ-R) and the Marijuana Motives Measure (MMM).

Methods: In Study 2a items were generated, feedback from 33 content-domain experts was obtained, and item revisions were made. In Study 2b, the finalized brief alcohol and cannabis motives measures, along with the MDMQ-R, MMM, and substance-related measures, were administered to 176 emerging adult university students who reported using both alcohol and cannabis (71.6% female; mean age = 20.15 years) at two timepoints, two months apart. Participants were recruited through a participant pool.

Results: In Study 2a, experts indicated satisfactory ratings of face and content validity. Expert feedback was used to revise three items. Study 2b results suggest test-retest reliabilities for the single-item forms ($r = .34-.60$) were similar to those obtained with the full motives measures ($r = .39-.67$). Convergent validity was acceptable-to-excellent in that the brief and full-length measures were significantly intercorrelated ($r = .40-.83$). The brief and full-length measures had predominantly similar concurrent and predictive relationships for alcohol and cannabis quantity x frequency and problems, respectively.

Conclusions: The brief measures represent psychometrically-sound measures of alcohol

and cannabis use motives with substantially less participant burden than the MDMQ-R and MMM.

Keywords: alcohol motives, cannabis motives, test development, psychometrics

Introduction

Individuals are motivated to engage in alcohol and cannabis use to achieve a variety of effects (i.e., substance use motives). Theory suggests motivations for alcohol and cannabis use exist on positive vs negative reinforcement and internal vs external dimensions (Cooper et al., 2016). These two dimensions interact to create four categories of motives for alcohol and cannabis use (Cooper et al., 2016): 1) internal positive reinforcement motives, involving the use of substances to increase positive emotions (i.e., enhancement motives); 2) internal negative reinforcement motives, involving the use of substances to reduce or avoid negative emotions (i.e., coping motives); 3) external positive reinforcement motives, involving the use of substances to enhance or improve social events or relationships (i.e., social motives); and 4) external negative reinforcement motives, involving the use of substances to reduce or avoid ostracism (i.e., conformity motives).

Research supports the validity of the above model for both alcohol and cannabis (see Cooper et al., 2016 for review) and substance use motives have been shown to be important mediators within motivational models for substance use (e.g., mediating the effect of alcohol expectancies on alcohol use; Kuntsche et al., 2010). As a result, various measures of alcohol and cannabis use motives were based on this theory, beginning with Cooper's foundational measures (Cooper, 1992; Cooper, 1994). In recent years, iterations of Cooper's scales were developed and expanded upon. Currently, two commonly used and well-validated iterations are the Marijuana Motives Measure (MMM; Simons et al. 1998) and the Modified Drinking Motives Questionnaire-Revised (MDMQ-R; Grant, et al. 2007). Both include Cooper's items assessing enhancement, social, coping, and

conformity motives. Each also adds items either allowing for the separation of the internal, negative reinforcement motive into separate coping-with-anxiety and coping-with-depression scales (MDMQ-R) or the separation of the internal, positive reinforcement motive into separate enhancement and expansion motives scales (expansion motives include using to enhance experience and creativity; MMM).

In line with motivational theory, the motives measured by the MDMQ-R and the MMM are linked to alcohol- and cannabis-related outcomes. Coping, enhancement, and expansion motives have been shown to predict frequency and/or quantity of alcohol and cannabis use (Bonar et al., 2017; Cooper et al., 2016). Coping motives have also been found to predict alcohol- and cannabis-related problems both cross sectionally and longitudinally (Cooper et al., 2016; Patrick et al., 2016). With respect to coping motive subtypes, coping-with-depression appears to be particularly predictive of problems (e.g., Loose & Acier, 2017). Other motives such as conformity and enhancement motives have also demonstrated weak positive (conformity) or indirect (enhancement – via consumption) relationships with alcohol- and cannabis-related problems (Cooper et al., 2016; Simons et al., 1998). Notably, social motives appear to be more normative and less of a risk factor, as they are related to typical patterns of consumption, but not consistently related to problematic use (Cooper et al., 2016; Kuntsche et al., 2005).

Limitations of Current Measures

While both the MDMQ-R and the MMM have strong psychometric properties (e.g., Grant et al., 2007; Simons et al., 1998), their use in certain study designs is not feasible due to their length (25+ items each). For example, when conducting ecological momentary assessment studies, asking participants to complete 25+ item measures one or

more times per day places too high a burden on participants when other measures are also included. The length of the MDMQ-R and the MMM can also pose a problem for polysubstance use studies or egocentric social network studies, as asking participants to complete these scales for multiple substances or multiple social network members is burdensome. Given research suggests questionnaire length and participant burden may be associated with careless participant responding, the length of the existing motives questionnaires may also impact the validity of data collected (e.g., Gibson & Bowling, 2019). While a 12-item short form of Cooper's measure (1994) has been developed and validated (Kuntsche & Kuntsche, 2009), this measure remains too long for research using the designs outlined above. Moreover, the 12-item short form does not separate the coping motive into coping-with-depression and coping-with-anxiety, distinguishable motives which are associated with different outcomes (Grant et al., 2007; Loose & Acier, 2017). A short form of the MMM has yet to be developed. My goal was to develop and validate brief and comparable versions of the MDMQ-R and the MMM to reduce existing barriers for studying alcohol and cannabis use motives in the above situations.

Method

To develop and validate my measures, I conducted two studies. Study 2a was a measure development study, consisting of item generation, expert feedback, and item revision. Study 2b was a validation study where the psychometric properties of the revised versions of the new measures were tested in a longitudinal design.

Study 2a: Item Development

Item Generation

I followed the short-form test development methods employed by Breslin et al. (2000) and Smith et al. (2011). For both alcohol and cannabis, I created one item for each of the following six motives: enhancement, expansion, social, coping-with-anxiety, coping-with-depression, and conformity. Each item consisted of a general statement representing the general concept of the motive, followed by two examples from MDMQ-R or MMM items in brackets (e.g., “In the past 30 days, I’ve used alcohol because it’s a good way to socialize with others [e.g., because it makes social gatherings more enjoyable, or to be sociable].”). Items were generated using the following guidelines: the general statement must be face-valid and reflect the main aspects of the motive, and the two examples which follow must, if possible: 1) have high factor loadings onto the construct; 2) be face valid; and 3) cover the core aspects of the motive, as well as the breadth of content included in the motive items. When developing the preliminary versions of these measures, I aimed to balance all these guidelines; however, because I wanted to make the alcohol and cannabis scales the same to enable cross-substance comparisons, this was not always possible. For example, while the expansion motive items on the MMM have been studied in relation to alcohol, factor loadings for these items are not published, and expansion motives are not included in the MDMQ-R. As such, the expansion item I developed for both cannabis and alcohol relied upon the factor loadings of the expansion motive questions included in the MMM. Of note, despite not being commonly mentioned in relation to alcohol, alcohol expansion motives have been shown to be endorsed more highly than alcohol conformity motives (Simons, Correia & Carey, 2000). Thus, the expansion motive is likely relevant to alcohol and warranted inclusion within my alcohol measure.

As I sought to measure each motive with one item, capturing variation in participant response was essential. As such, I chose to use a visual analog scale (VAS) response format, which offers more nuanced response options than traditional Likert-type scales (Kuhlmann et al., 2017). VAS response formats also have several advantages, including being quick, avoiding systematic bias from limited scale responses (i.e., scale coarseness), and providing interval-scaled data (Aguinis et al., 2009; Klimek et al., 2017). Item responses range from “never” (0) to “always” (100). Each item is scored individually and is stand-alone (i.e., there is no scale score).

Expert Opinion

I identified 72 experts from whom I sought feedback on my developed items, consistent with best-practice recommendations for test development (Boateng et al., 2018). While typically 5-7 experts are used, I wanted to receive as much expert feedback as possible (Boateng et al., 2018). An expert was defined as first or senior authors of at least one publication about alcohol or cannabis motives in the past 15 years and was identified through a PsychInfo search on “alcohol motives” or “cannabis motives”. The 72 experts were e-mailed a letter, a copy of my developed measures, and an online questionnaire which asked them to provide feedback on my approach to test construction, and on the validity and wording of my draft items (See Supplemental Materials B for copy of this questionnaire). Emails were sent in August 2018 and experts were asked to respond within a 2-week period (with extra time if requested). Responses were anonymous. Prior to reviewing expert feedback, I decided to change an item for both substances (see above) if $\geq 10\%$ of experts disagreed on one of the questions related to that item or if $\geq 10\%$ raised the same criticism regarding an item.

Expert responses

I received 33 responses to my survey (45.8% response rate). 92.3% and 95.2% of experts reported they would use the brief alcohol and cannabis motives questionnaires, respectively; and 87.5% agreed I had taken an acceptable approach to brief-form test development (remaining 12.5% did not agree/disagree). The vast majority agreed the items had face- and content-validity (i.e., were fully representative; see Table 4.1). Given my $\geq 10\%$ rule mentioned above, the enhancement, coping-with-depression, and conformity items were altered for both alcohol and cannabis. In terms of the enhancement item, the general statement (“I’ve used alcohol because it enhances my pleasure”) and second item example (“because it’s fun”) were altered; 21% of experts thought that the word “pleasure” had sexual connotations and 21% thought that “because it’s fun” overlapped with the social motive and/or did not reflect an *increase* in fun (i.e., enhancement of experience). Thus, the general statement was changed (i.e., “I’ve used alcohol because it enhances positive feelings) and a different enhancement item that loads well onto both the MDMQ-R and the MMM enhancement scales was selected (i.e., “to get high”). In terms of the coping-depression item, the second item example (“to forget my worries”) was altered; 52% of experts disagreed that it was very relevant to the motive, and reported the item was too similar in content to the coping-with-anxiety motive. Thus, the second item example was changed to “stop me from dwelling on things”, as it also loads strongly onto the coping-depression motive, appears to tap into the same part of the construct, and is less overtly associated with anxiety. In terms of the conformity item, the first item example (“because my friends pressure me to use”) was altered; 10% disagreed that this item example was very relevant to the motive, and 15%

indicated people often do not identify with active pressure, teens would not endorse the item, or that the item does not translate well to other cultures. Thus, the first item example was changed to “to be liked”, as this item loads well onto the conformity motive construct. See Supplemental Materials A for the final versions of the Brief Alcohol Motives Measure (BAMM) and the Brief Cannabis Motives Measure (BCAMM) following implementation of the expert feedback.

Study 2b: Measure Evaluation

I then sought to evaluate the reliability and further evaluate the validity of the BAMM and BCAMM. I hypothesized: 1) brief and full-length measures would have similar reliability, as indicated by relative consistency (i.e., correlations over time); 2) brief and full-length subscales would be at least moderately concurrently correlated; 3) brief and full-length subscales would remain significantly concurrently correlated after removing shared items between the brief and full-length measures; 4) given theoretical links of internal motives with substance use quantity/frequency (Cooper et al., 2016), for both substances, enhancement, coping-with-anxiety, and coping-with-depression (plus expansion in the case of cannabis) would predict substance use quantity x frequency (QxF) concurrently for brief and full-length scales; 5) given theoretical links of direct relations of negative reinforcement motives with problems (Cooper et al., 2016), for both substances, baseline quantity, coping-with-anxiety motives, and coping-with-depression motives would prospectively predict follow-up substance-related problems for the brief and full-length scales.²

²While developing the MDMQ-R and the MMM, the authors included all motives in regression analyses for exploratory purposes. As established relationships between the MDMQ-R and the MMM with substance use outcomes now exist that are consistent with theory (Cooper et al., 2016), we only included specific theoretically-derived motives in our hypotheses/analyses.

Participants

One-hundred-and-seventy-six individuals between 17-30 years³ ($M=20.15$, $SD = 3.15$) were recruited (Male = 50, Female =126) through a psychology participant pool at an Eastern Canadian university. Eighteen participants were lost to attrition at wave two (89.8% retention). To ensure participants could be considered “users”, participants had to have used alcohol \geq four times, and cannabis recreationally \geq two times, in the past month at baseline (see Cogle et al., 2015). This study received Research Ethics Board approval from Dalhousie University.

Measures

BAMM and BCAMM. As outlined above, each measure included an item to assess enhancement, expansion, social, coping-with-anxiety, coping-with-depression, and conformity motives. Each item was answered using a VAS from never (0) to always (100). Items are scored individually (i.e., there is no total BAMM or BCAMM score).

Marijuana Motives Measure + (MMM+). The MMM (Simons, et al., 1998) is a 25-item measure assessing enhancement, expansion, social, coping, and conformity motives. The measure has good internal consistency (subscale α 's=.86-.92), concurrent, and predictive validity (e.g., cannabis-related problems; Simons et al., 1998). To compare the coping-with-anxiety and coping-with-depression items on the BCAMM to full length subscales, the coping-with-anxiety and coping-with-depression items from the MDMQ-R were added to the MMM substituting “cannabis” for “alcohol”. The items replaced the original four coping items of the MMM.

³Note that one additional individual aged 52 participated; however, as we sought to study emerging adults, this participant was excluded from the analysis.

Modified Drinking Motives Questionnaire – Revised + (MDMQ-R+). The MDMQ-R (Grant et al., 2007) is a 28-item measure assessing enhancement, social, coping-with-anxiety, coping-with-depression, and conformity motives. This measure has good test-retest reliability ($ICC=.65-78$), concurrent validity for drinking quantity, and predictive validity for alcohol-related problems (Grant et al., 2007). As previously done by Simons et al. (1998), I added the expansion items from the MMM, substituting “alcohol” for “marijuana” to compare the expansion item on the BMM to a full-length subscale.

Substance Use Questionnaire. This measure assessed alcohol and cannabis quantity and frequency using the quantity and frequency items recommended by the National Institute of Health for assessing alcohol use (National Institute of Health, 2003), and items from the Daily Sessions, Frequency, Age of Onset, and Quantity of Cannabis Use Inventory (DFAQ-CU; Cuttler & Spradlin, 2017), respectively. Each question referred to the past 30 days. Alcohol questions include a visual depiction and textual description of a typical drink. Alcohol quantity was assessed by the question, “During the last 30 days, how many alcoholic beverages did you have on a typical day when you drank alcohol?” Ten response options were given, ranging from 1-25+ drinks. Alcohol frequency was assessed by the question, “During the last 30 days, how often did you usually have any kind of drink containing alcohol”, with seven response options ranging from “once” to “every day”. Cannabis frequency was assessed by the question “Which of the following best captures how often you used cannabis for recreational reasons in the last 30 days?”, with 16 response options ranging from “I did not use cannabis” to “15+ times a day”. Cannabis quantity included an image with a Canadian 5-dollar bill and various amounts

of cannabis (1/8th -1 gram), adapted from the DFAQ-CU and was assessed with the following question “In a typical session of use over the last 30 days, how much cannabis did you typically use?”. Responses were entered into a textbox and could include up to 3 decimal places. A QxF variable was created for both alcohol and cannabis by multiplying participant responses to quantity and frequency items (Grant et al., 2007).

Rutgers Alcohol Problem Index. The RAPI (White & Labouvie, 1989) is a 23-item measure assessing alcohol-related problems. The time frame was 30 days and items were scored dichotomously. This method of scoring has been shown to have adequate convergent validity (e.g., $r = .44$ with drinking frequency; Martens et al., 2007) and had excellent internal consistency in the current sample [$\alpha = .91$ (baseline)-.94 (follow-up)].

Rutgers Marijuana Problem Index (RMPI). The RMPI (Simons et al., 2000) is a 23-item measure assessing common cannabis-related problems. The RMPI modifies RAPI items to assess cannabis. The time frame was 30 days and items were scored dichotomously for consistency with the RAPI scoring. The RMPI has demonstrated the expected relationships with cannabis use (see Simons et al., 2005) and had good-to-excellent internal consistency in the current sample [$\alpha = .87$ (baseline)-.95 (follow-up)].

Procedure

At baseline, participants gave informed consent and completed measures online in the lab. Two months later, participants completed the measures online at home. Participants were compensated with psychology credits or a \$10 CDN Amazon gift card after each wave. Data collection began in October, 2018 and was completed by March, 2020.

Results

Descriptive Statistics

Eighteen participants demonstrated monotone missing data. There was no statistically significant difference in those who dropped out from those who were retained on baseline alcohol ($t = -.45, p = .66$) or cannabis quantity ($t = .185, p = .85$), or alcohol ($t = -.18, p = .86$) or cannabis frequency ($t = .98, p = .33$). Little's MCAR test was non-significant ($X^2 = 1121.96; df = 1072; p = .14$). Multiple imputation in SPSS was used to handle missing data (40 imputations to prevent fall off of statistical power as recommended by Graham et al., 2007). All variables in the analyses were used as potential predictors and imputed variables. No auxiliary variables were added. Results were pooled using the default settings in SPSS.

Means, standard deviations and bivariate correlations for the complete BMM, BCMM, MDMQ-R+, and the MMM+ appear in Supplementary Tables 4.2 and 4.3. As normality assumption for Pearson's bivariate correlations were violated for both brief measures, Spearman's rank-order correlations were conducted. At time 1 (T1), the mean number of drinks per occasion was 3.60 ($SD = 1.4$) and frequency of use was 3.59 ($SD = 1.02$; which corresponds to "once per week"). The mean grams of cannabis used per occasion of use was .59 ($SD = .75$)⁴ and frequency of cannabis use was 4.01 ($SD = 1.02$; which corresponds to "twice per week"). At time 2 (T2), the mean RAPI score of dichotomized items was 6.60 ($SD = 5.80$) and mean dichotomized RMPI score was 4.89 ($SD = 4.30$), meaning the participants experienced an average of about seven alcohol-related problems and about five cannabis-related problems in the last 30 days.

⁴An examination of the cannabis quantity variable indicated some participants had entered unrealistic values in answer to the question, "In a typical session of use (i.e., one sitting) over the last 30 days, how many grams of cannabis did you personally use?" (e.g., 100 grams). As such, 8 participants who entered >5 grams were removed from the analyses.

Test-retest Reliability

Test-retest reliability was examined using Spearman's rank order correlations as a measure of relative consistency (Lexell & Downham, 2005). As shown in Tables 4.2, the brief measures were significantly correlated at T1 to T2 (for alcohol, $r=.34-.59$; for cannabis, $r=.33-.60$). The MDMQ-R+ ($r=.39-.63$) and MMM+ ($r=.46-.67$) were also significantly correlated at T1 to T2. Software developed by Lee and Preacher (2013) was used to compare the strength of test-retest correlations between each item of the brief measures and the corresponding full motives subscale (e.g., BAMB social item vs. MDMQ-R+ social subscale). The test-retest reliabilities of the BAMB items were not significantly different from those for the MDMQ-R+ subscales ($p \geq .05$). Similarly, the test-retest reliabilities of the BCAMB items were not significantly different from those for the MMM+ subscales ($p \geq .05$).

Convergent Validity

Convergent validity correlations were interpreted as moderate ($r=.40-.59$), strong ($r=.60-.79$), and very strong ($r=.80-1.00$; Evans, 1996). Convergent validity between the BAMB and MDMQ-R+ subscales at T1 and T2 ranged from moderate ($r=.40$) to strong ($r=.73$) at T1, with enhancement, coping-with-anxiety, coping-with-depression, and conformity demonstrated strong convergent validity, while social and expansion demonstrated moderate convergent validity. At T2, enhancement, coping-with-depression, and conformity demonstrated strong convergent validity, while social, coping-with-depression, and expansion demonstrated moderate convergent validity. Convergent validity between the BCAMB and MMM+ subscales at T1 and T2 ranged from moderate ($r=.56$) to very strong ($r=.83$). At T1, coping-with-anxiety and coping-

with-depression demonstrated very strong convergent validity, enhancement, social, and expansion demonstrated strong convergent validity, and conformity demonstrated moderate convergent validity. At T2, enhancement, social, coping-with-anxiety, coping-with-depression, and expansion demonstrated strong convergent validity, while conformity demonstrated moderate convergent validity. See Table 4.3 for convergent validity results.

To examine whether the correlations between the brief and full measures were primarily due to the two shared items between the brief and full-length measures (i.e., two example items within brackets in the BAMB and BCAMB), the subscale scores of the MDMQ-R+ and the MMM+ were re-calculated without the shared items (see Table 4.4). Convergent validity remained moderate to very strong for all motives, except social motives for alcohol. Further examination indicated the BAMB social item was significantly correlated with the MDMQ-R+ social motive items that have high face validity (e.g., “to be sociable”), but not with items with lower face validity for social motives (i.e., “as a way to celebrate”, “because it is customary on special occasions”). This pattern also existed for the BCAMB and the MMM+, although correlations were stronger. See Supplemental Materials D Tables 4.4-4.15 for correlations between the BAMB and BCAMB and individual subscale items from the MDMQ-R+ and the MMM+. Across the remaining 28 items from the other MDMQ-R+ subscales (not social), 21 had moderate or strong correlations with the corresponding BAMB items, while 7 had weak correlations ($r = .20-37$) with the corresponding BAMB items. Across all remaining 28 items from the other MMM+ subscales (not social), 26 had moderate,

strong, or very strong correlations with the corresponding BCAMM items, while 2 had weak correlations (.33-.35) with the corresponding BCAMM items.

Concurrent and Predictive Validity

The first set of concurrent validity analyses included alcohol QxF at T1 as predicted by T1 BAMB or MDMQ-R+ coping-with-anxiety, coping-with-depression, and enhancement motives (see Table 4.5). Partially consistent with H4, there was a significant effect of T1 BAMB and MDMQ-R+ enhancement. An increase of one standard deviation of the BAMB or MDMQ-R+ enhancement motive corresponded to an increase of 1.20 or 1.77 in alcohol QxF, respectively. There were no significant effects of BAMB or MDMQ-R+ coping-with-anxiety or coping-with-depression.

The linear regression assumption of multivariate normality was violated for the planned regressions to test H4 with cannabis variables and H5 with both alcohol and cannabis variables. As recommended (e.g., Neal & Simons, 2007), generalized linear modelling (Glim) was chosen. Assumptions for Glim were met. Robust estimates of standard errors were used to handle heterogenous variance. For each analysis, I ran models with various distributions and links, comparing averaged BIC across all 40 imputations to determine the best fit. See Supplementary Materials D for model comparisons. I calculated McFadden's pseudo- R^2 (McFadden, 1973) to compare the predictive ability of brief and full motive measures.

The second set of concurrent validity analyses included T1 cannabis QxF predicted by T1 BCAMM or MMM+ enhancement, coping-with-anxiety, coping-with-depression, and expansion motive (see Table 4.6). A Gamma distribution with log-link was the best fit for the data. Partially consistent with H4, there was a significant effect of

BCAMM coping-with-anxiety and MMM+ coping-with-anxiety, coping-with-depression, and expansion motives. No significant effects of BCAMM or MMM+ enhancement motives were found. McFadden's pseudo R^2 was .14 for the BCAMM and .14 for the MMM+.

Interpreting the effect sizes for this model requires some extrapolation; as this model used a log-link, for every one unit increase in a predictor, the mean of the outcome (cannabis QxF) is multiplied by the exponentiated slope of the predictor. For example, BCAMM coping-with-anxiety has an exponentiated slope of 1.03. Thus, every 1 unit increase in BCAMM coping-with-anxiety corresponds to a 3% increase in cannabis QxF. As the units between the brief- full- measures are different, it may be more useful to examine standard deviations, rather than increases in single units. The standard deviation of BCAMM coping-with-anxiety is 35.95; thus, one standard deviation increase in BCAMM coping-with-anxiety is associated with a 107.85% increase in cannabis QxF (3×35.95). Given the exponentiated 95% confidence interval ranges from 1.01-1.04, one standard deviation could be associated with an 35.95-143.80% increase in cannabis QxF. Applying the same mathematical principles, a 1 unit increase in the MMM+ coping-with-anxiety motive corresponds to a 15% increase in cannabis QxF. One standard deviation increase in MMM coping-with-anxiety is associated with a 56.1% increase in cannabis QxF (exponentiated 95% CI = 3.74-112.20% increase).

The first set of predictive validity analyses included alcohol-related problems at T2 as predicted by T1 alcohol quantity, and BAMM or MDMQ-R+ conformity and coping-with-depression motives (see Table 4.7). A negative binomial distribution with log link was the best fit for the data. Partially consistent with H5, there were significant

effects of T1 BAMB and MDMQ-R+ coping-with-depression motives. Exponentiated, one standard deviation increase in BAMB coping-with-depression corresponds to a 27.39% increase in alcohol-related problems (exponentiated 95% CI = 0.08%-27.39% increase). Similarly, one standard deviation increase in MDMQ-R+ coping-with-depression corresponds to a 26.96% increase in alcohol-related problems (exponentiated 95% CI = 13.48-40.44%) There was no significant effect of T1 alcohol quantity or T1 BAMB or MDMQ-R conformity. McFadden's pseudo R^2 was .02 for the BAMB and .03 for the MDMQ-R+.

I then ran the same predictive validity models, substituting cannabis variables for alcohol variables and adding in sex as a covariate (as it was significant correlated with the dependent variable). A negative binomial distribution with log link was the best fit for the data. Partially consistent with H5, there was a significant effect of T1 cannabis quantity and T1 BCAMB and MMM+ coping-with-depression motives in predicting T2 cannabis-related problems. Exponentiated, one standard deviation increase in BCAMB coping-with-depression corresponded to a 35.95% increase in cannabis-related problems (exponentiated 95% CI = .10-35.95%). Similarly, one standard deviation increase in the MMM+ coping-with-depression corresponded to a 26.32% increase in cannabis-related problems (exponentiated 95% CI = 18.16-54.58%). There was a significant effect of sex for the BCAMB, with the sex effects of the MMM+ marginally significant at $p = .05$. There were no significant effects of T1 BCAMB or MMM+ conformity items (see Table 4.8). McFadden's pseudo R^2 was .02 for the BCAMB and .03 for the MMM+.

Discussion

I developed and examined the psychometrics of the BAMB and the BCAMB, brief alcohol and cannabis use motive measures based on the MDMQ-R and the MMM, respectively. I created two six-item measures that incorporated feedback from 33 experts in alcohol and cannabis use motives. Expert responses in Study 2a suggest the BAMB and the BCAMB have excellent face- and content-validity. My use of experts is a strength of this work, as expert input is widely recommended in scale development (Boateng, 2018), but is rarely used.

Results from Study 2b suggest both the brief and full-length measures have similar test-retest reliability, as indicated by participants remaining in a moderately similar ranked position within the data set over time for each motive. Thus, hypothesis 1 was supported. Note that the reliability ranged from $r = .34-.67$. This likely does not reflect poor psychometric properties, but rather the nature of motives, which are thought to be trait-states (Windle & Windle, 2018). While further research examining the use of the BAMB and BCAMB scales in daily diary contexts is needed, the test-retest reliability results suggest the brief measures, like the full measures, may capture sufficient change for such a design.

In terms of convergent validity, most of the concurrent correlations between the brief and full-length measures were strong, supporting hypothesis 2 and suggesting good convergent validity between the BAMB and the MDMQ-R+, and between the BCAMB and the MMM+. After removing shared items from the MDMQ-R+ and the MMM+, the revised correlations remained similar, with the single exception of the social motive for alcohol. This may be explained by the facts that two of the three unshared items of the MDMQ-R+ and the MMM+ social subscales do not include the word “social” and the

social subscale of the MDMQ-R+ has lower internal consistency than other motives ($\alpha = .58$; Grant et al., 2007). Given this, the BAMB social item appears to capture the core components of the social motive well and may represent a more face valid measure of the social motive construct than that of the MDMQ-R given the BAMB's focus on sample items that include the term "social". Of note, an examination of the relationship between BAMB and BCAMB items and corresponding MDMQ-R+ and MMM+ subscales (see Supplementary Materials D), respectively, suggests the BAMB and BCAMB appear to capture the breadth and depth of all other motives. Thus, the concurrent correlational analyses suggest the good convergent validity between brief and full-length measures is not simply due to shared items and largely support hypothesis 3.

Study 2b also suggests the brief measures predict substance use outcomes in a similar fashion to the MDMQ-R+ and MMM+. In line with my hypotheses, enhancement motives on both brief and full-length measures predicted concurrent alcohol QxF, and were associated with similar increases in alcohol QxF per standard deviation increase in the BAMB and MDMQ-R (1.2 vs 1.77). Similarly, coping-with-depression motives on both brief and full-length measures prospectively predicted both alcohol- and cannabis-related problems, after controlling T1 quantity. Again, both the brief and full measures were associated with similar increase in alcohol- and cannabis-related problems per standard deviation increase with the brief and full measures (alcohol: brief = 27.39%, full = 26.96%; cannabis: brief = 35.95%, full = 26.32%) Thus, brief measures generally demonstrated the same concurrent and predictive relationships as the full measures. There were two notable exceptions to this, however. First, while MMM+ coping-with-anxiety, coping-with-depression, and expansion motives were significant predictors of cannabis

QxF, only BCAMM coping-with-anxiety was significant. This difference may be a result of power. In models containing both brief and full measures, coping-with-anxiety had the strongest effect, while the effects of coping-with-depression and expansion were weaker; it is possible the BCAMM model did not have enough power to detect these weaker effects with the increased error associated with single item measures. Second, as indicated in Supplementary Materials C, BIC comparisons often suggested models including full measures were a better fit. Given the full scales have higher content validity simply by virtue of having more items (Baumgartner & Homburg, 1996), this was to be expected regardless of the quality of the brief items. Despite this, R^2 and McFadden's R^2 values for brief and full measures were similar, suggesting only a slight loss of predictive power when using the brief scales. In situations where the full-length measures cannot be used without significant participant burden, this slightly lower predictive power is likely worth the trade-off in increased feasibility.

It is worth noting that Study 2b results deviated from aspects of hypotheses 4 and 5. First, despite hypothesizing enhancement, coping-with-anxiety, and coping-with-depression motives would predict alcohol QxF, only enhancement was a significant predictor for both the BAMM and the MDMQ-R+. This aligns with research indicating enhancement is a notably stronger predictor of both alcohol quantity and frequency than coping motives (e.g., Cooper et al., 2016). Additionally, with respect to coping motives, this result may be expected given the non-clinical emerging adult sample; coping motives tend to be more prevalent among clinical populations (Molnar et al., 2010) and were not endorsed highly by the participants. Second, conformity motives were not a significant predictor of alcohol- or cannabis-related problems for the brief or full measures. Given

extant research that the conformity motives-substance problems relation is relatively weak, the lack of significance may be related to power (Cooper et al., 2016).

Additionally, research suggests the relationship between conformity motives and alcohol-related problems is not always present ($\beta = -.02-.12$; Cooper et al.), and the relationship between conformity motives and cannabis-related problems is inconsistent (e.g., Fox et al., 2011), only present in certain samples (e.g., Buckner et al., 2016), or not significant (e.g., Buckner et al., 2007). Thus, my lack of findings between conformity motives and substance-related problems may also reflect this complicated relationship.

Limitations

My results are limited by my sample; as I validated the BAMB and the BCAMB in a predominantly female, highly educated, emerging adult, dual alcohol-cannabis user sample, it is not clear whether these measures are appropriate for samples with other characteristics. My results are also limited by my methodological decisions; as I sought to create brief versions of the established MDMQ-R and the MMM, I did not add any additional motives that may be relevant for cannabis (e.g., sleep promotion). While this allowed for comparison between the BCAMB and the MMM, the BCAMB may be limited by the exclusion of other such motives. In addition, to minimize participant burden and capture as much nuance as possible, I chose to use a VAS scale, rather than categorical answers as included in the MDMQ-R and the MMM. While this made the most sense given the reasoning behind creating the BAMB and BCAMB, it does alter the nature of comparison between the brief and full-length measures. Furthermore, I did not have a second round of feedback with experts after changing the wording of 3 items. While my changes were carefully considered, an additional round of expert feedback

would have provided further confirmation of face and content validity. Finally, I chose to study the reliability and validity of the BAMB and the BCAMB in a longitudinal design. The validity of these measures in a daily diary/ecological momentary assessment context should be ascertained in future.

Conclusions

My findings support the reliability and validity of the BAMB and the BCAMB. In situations where the MMM or the MDMQ-R cannot be feasibly used due to participant burden, the BAMB and the BCAMB offer a psychometrically sound alternative. These measures open the door for motives to be included in various research designs that were previously rendered impractical, thereby solving a problem in the motives research field.

Table 4.1. Study 2 Results from Experts Regarding Face and Content Validity

Motive	Substance	Face Validity	Core Aspects	All Aspects
Enhancement	Alcohol	90.62% (6.25)	96.67% (3.33)	80.64% (6.45)
	Cannabis	95.24% (4.76)	95.24% (4.76)	90.47% (9.52)
Social	Alcohol	96.55% (3.45)	100.00% (0.00)	82.73% (10.34)
	Cannabis	100.00% (0.00)	100.00% (0.00)	85.71% (9.52)
Coping-with-anxiety	Alcohol	100.00% (0.00)	96.55% (3.45)	86.21% (3.45)
	Cannabis	100.00% (0.00)	100.00% (0.00)	90.48% (4.76)
Coping-with-depression	Alcohol	83.71% (3.57)	92.85% (3.57)	81.12% (3.57)
	Cannabis	95.00% (5.00)	100.00% (0.00)	80.95% (14.29)
Conformity	Alcohol	92.00% (0.00)	96.00% (0.00)	82.61% (17.39)
	Cannabis	95.00% (5.00)	90.00% (10.00)	82.61% (17.39)
Expansion	Alcohol	83.34% (16.67)	80.00% (20.00)	72.00% (20.00)
	Cannabis	100.00% (0.00)	100.00% (0.00)	95.24% (4.76)

Note: The percentage before the brackets indicates the percentage of experts that agreed or strongly agreed that the item either was face-valid, represented all aspects of the motive, and reflected the core aspects of the motive, respectively. The number within brackets represents the percentage of experts that neither agreed nor disagreed.

Table 4.2 Test-Retest Correlations Between T1 and T2

Motive	BAMM	MDMQ-R+	BCAMM	MMM+
Enhancement	.53**	.63**	.49**	.61**
Social	.43**	.49**	.47**	.57**
Coping with Anxiety	.54**	.54**	.60**	.67**
Coping with Depression	.52**	.59**	.60**	.64**
Conformity	.55**	.48**	.33**	.46**
Expansion	.34**	.39**	.50**	.56**

* $p < .05$; ** $p < .01$

Note: Correlations represent pooled Spearman's Rank Order Correlations. Correlations reflect items/subscales at T1 correlated with same items/subscales at T2. BAMM = Brief Alcohol Motives Measure; MDMQ-R+ = Modified Drinking Motives Questionnaire Revised +; BCAMM = Brief Cannabis Motives Measure; MMM+ = Marijuana Motives Measure.

Table 4.3 Convergent Validity Between the BAMB and the MDMQ-R, and the BCAMM and the MMM+ at T1 and T2

Motive	T1 Alcohol	T2 Alcohol	T1 Cannabis	T2 Cannabis
Enhancement	.63**	.60**	.62**	.62**
Social	.47**	.40**	.65**	.62**
Coping with Anxiety	.70**	.58**	.81**	.75**
Coping with Depression	.73**	.62**	.83**	.74**
Conformity	.61**	.60**	.59**	.56**
Expansion	.49**	.57**	.79**	.73**

* $p < .05$; ** $p < .01$

Note: Correlations represent pooled Spearman's Rank Order Correlations. T1 Alcohol = correlations between T1 Brief Alcohol Motives Measure item and corresponding T1 Modified Drinking Motives Questionnaire Revised + subscale; T2 Alcohol = correlations between T2 Brief Alcohol Motives Measure item and corresponding T2 Modified Drinking Motives Questionnaire Revised + subscale; T1 Cannabis = correlations between T1 Brief Cannabis Motives Measures item and corresponding T1 Marijuana Motives Measure + subscale; T2 Cannabis = correlations between T2 Brief Cannabis Motives Measure item and corresponding T2 Marijuana Motives Measure + subscale.

Table 4.4. Study 2 T1 Concurrent Correlation Between the BAMB and the MDMQ-R+ and the BCAMB and the MMM+ Excluding Shared Items.

Motive	Alcohol	Cannabis
Enhancement	.61**	.63**
Social	.19**	.45**
Coping-with-anxiety	.51**	.70**
Coping-with-depression	.70**	.83**
Conformity	.56**	.61**
Expansion	.45**	.76**

** $p < .01$

Note: Correlations represent Spearman's Rank Order Correlations. Due to shared items between the BAMB and BCAMB items and the MDMQ-R+ and the MMM+ subscales, the subscale scores of the MDMQ-R+ and the MMM+ were re-calculated without the shared items and correlated with the relevant BAMB and BCAMB items.

Table 4.5. Study 2 Regression Coefficients in Multiple Regressions for Alcohol QxF Predicted by the BAMM and the MDMQ-R+ Coping-with-Anxiety, Coping-with-Depression, and Enhancement Motives

T1 Alcohol QxF										
Measure	BAMM					MDMQ-R+				
Variables	Unstand.B	SE	t	p	R ²	Unstand.B	SE	t	p	R ²
	<i>B</i>					<i>B</i>				
Intercept	10.64	1.08	9.84	.00		6.46	1.87	3.47	.00	
Coping-with-anxiety T1	.01	.02	.27	.79		.09	.22	.42	.68	
Coping-with-depression T1	.00	.03	-.08	.94	.04	.0	.10	.03	.97	.08
Enhancement T1	.04	.02	2.38	.02		.39	.12	3.26	.00	

Note: BAMM = Brief Alcohol Motive Measures; MDMQ-R+ = Modified Drinking Motives

Questionnaire Revised +. R² represents average of R² values across 40 imputations.

Table 4.6. Study 2 Generalized Linear Model for Cannabis QxF Predicted by BCAMM and MMM+ Coping-with-Anxiety, Coping-with-Depression, Enhancement and Expansion Motives.

T1 Cannabis QxF										
Measure	BCAMM					MMM+				
Variable	<i>B</i>	<i>SE</i>	Wald	Wald	<i>p</i>	<i>B</i>	<i>SE</i>	Wald	Wald	<i>p</i>
			χ^2	χ^2				χ^2	χ^2	
			95%	95%				95%	95%	
			CI	CI				CI	CI	
			lower	higher				lower	higher	
Intercept	.80	.28	.24	1.35	.01	1.01	.71	-.38	2.40	.15
Coping-with-anxiety T1	.03	.01	.01	.04	.00	.14	.07	.01	.27	.04
Coping-with-depression T1	.01	.01	-.01	.03	.40	.08	.03	.02	.14	.01
Enhancement T1	.00	.01	-.01	.01	.93	-.05	.05	-.14	.05	.35
Expansion T1	.00	.01	-.02	.01	.57	-.08	.03	-.15	-.01	.02

Note: Statistics represent pooled effects. Generalized linear models utilized the gamma distribution with log link. BCAMM = Brief Cannabis Motives Measure; MMM+ = Marijuana Motives Measure +

Table 4.7. Study 2 Generalized Linear Model for Time 2 Alcohol-Related Problems Predicted by Time 1 Alcohol Quantity and Brief Conformity and Coping-with-Depression Motives.

T2 Alcohol-related problems										
Measure	BAMM					MDMQ-R+				
Variables	<i>B</i>	<i>SE</i>	Wald χ^2 95% CI lower	Wald χ^2 95% CI higher	<i>p</i>	<i>B</i>	<i>SE</i>	Wald χ^2 95% CI lower	Wald χ^2 95% CI higher	<i>p</i>
Intercept	1.02	.29	.46	1.58	.00	.42	.28	-.33	1.16	.27
Alcohol quantity T1	.12	.06	-.00	2.48	.05	.11	.06	-.01	.24	.08
Conformity T1	.01	.00	-.00	.01	.10	.05	.03	-.01	.11	.09
Coping-with-depression T1	.01	.00	.00	.01	.00	.04	.01	.02	.06	.00

Note: Statistics represent pooled effects. Generalized linear models utilized the negative binomial distribution with log link. BAMM = Brief Alcohol Motive Measures; MDMQ-R+ = Modified Drinking Motives Questionnaire Revised +.

Table 4.8. Study 2 Generalized Linear Model for Time 2 Cannabis-Related Problems Predicted by Time 1 Cannabis Quantity and Enhancement and Coping-with-Depression Motives.

T2 Cannabis-related problems										
Measure	BCAMM					MMM+				
Variables	<i>B</i>	<i>SE</i>	Wald	Wald	<i>p</i>	<i>B</i>	<i>SE</i>	Wald	Wald	<i>p</i>
			χ^2	χ^2				χ^2	χ^2	
			95%	95%				95%	95%	
			CI	CI				CI	CI	
			lower	higher				lower	higher	
Intercept	1.85	.19	1.48	2.22	.00	1.26	.38	.53	2.00	.00
Sex	-.42	.19	-.78	.06	.02	-.38	.19	-.76	-.01	.05
Cannabis quantity T1	.01	.00	.00	.02	.00	.01	.00	.00	.02	.01
Conformity T1	-.01	.00	-.01	.00	.27	.00	.40	-.08	.08	1.00
Coping-with- depression T1	.01	.00	.00	.01	.00	.04	.01	.02	.06	.00

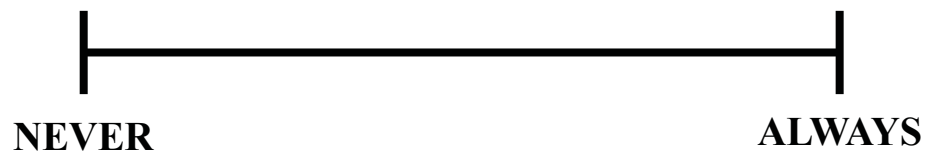
Note: Statistics represent pooled effects. Generalized linear models utilized the negative binomial distribution with log link. BCAMM = Brief Cannabis Motives Measure; MMM+ = Marijuana Motives Measure +.

Supplementary Materials A: BAMB and BCAMB

Brief Alcohol Motives Measure (BAMB)

Listed below are 6 reasons people might be inclined to drink alcohol beverages. Please decide how frequently your own drinking is motivated by each of the reasons listed and click on the place on the scale that best represents this frequency.

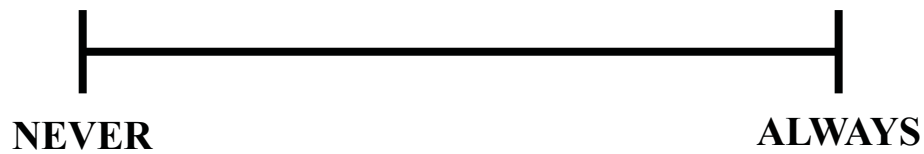
In the past 30 days, **I've used alcohol because it enhances positive feelings** (*e.g., because I like the feeling, or to get a high*).



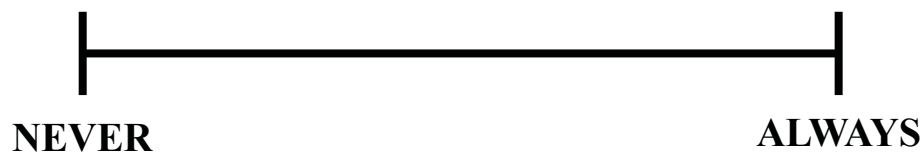
1. In the past 30 days, **I've used alcohol because it's a good way to socialize with others** (*e.g., because it makes social gatherings more enjoyable or to be sociable*).



2. In the past 30 days, I've used alcohol because it helps me cope when I'm feeling nervous, anxious or tense (e.g., to reduce my anxiety or to relax).



3. In the past 30 days, I've used alcohol because it helps me cope when I'm feeling sad, down or blue (e.g., because it helps me when I'm feeling depressed or to stop me from dwelling on things).



4. In the past 30 days, I've used alcohol because I didn't want to feel left out (e.g., to be liked or to fit in with a group I like).



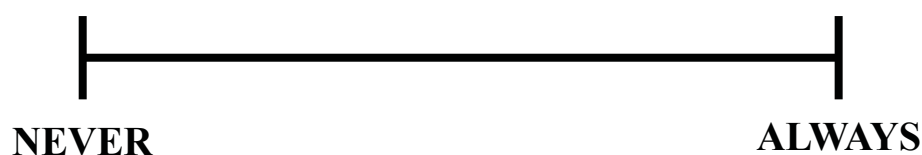
5. In the past 30 days, I've used alcohol because it expands my awareness (*e.g., allows me to be more creative and original or to understand things differently*).



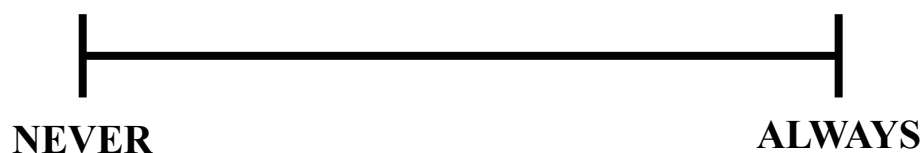
Brief Cannabis Motives Measure (BCAMM)

Listed below are 6 reasons people might be inclined to use cannabis. Please decide how frequently your own cannabis use is motivated by each of the reasons listed and click on the place on the scale that best represents this frequency.

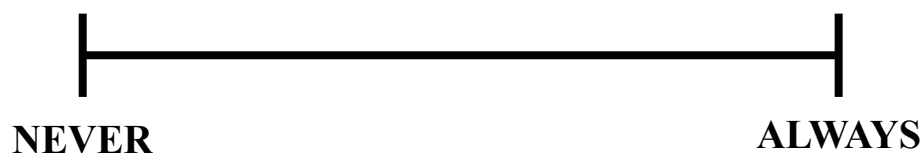
1. In the past 30 days, **I've used cannabis because it enhances positive feelings** (*e.g., because I like the feeling, or to get a high*).



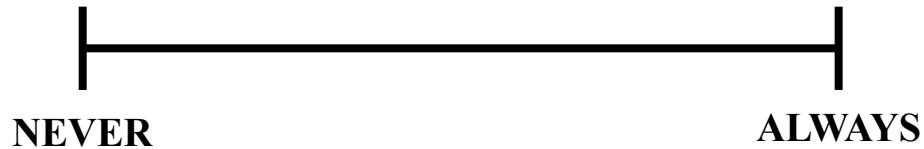
2. In the past 30 days, **I've used cannabis because it's a good way to socialize with others** (*e.g., because it makes social gatherings more enjoyable or to be sociable*).



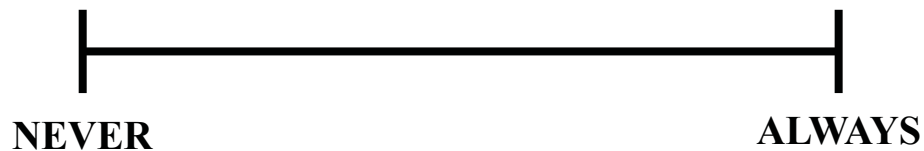
3. In the past 30 days, **I've used cannabis because it helps me cope when I'm feeling nervous, anxious or tense** (*e.g., to reduce my anxiety or to relax*).



4. In the past 30 days, I've used cannabis because it helps me cope when I'm feeling sad, down or blue (e.g., because it helps me when I'm feeling depressed or to stop me from dwelling on things).



5. In the past 30 days, I've used cannabis because I didn't want to feel left out (e.g., to be liked or to fit in with a group I like).



6. In the past 30 days, I've used cannabis because it expands my awareness (e.g., allows me to be more creative and original or to understand things differently).



Supplementary Material B: Feedback on the BAMB and BCAMB

Please complete questions 1-3 about the following shortened drinking motives item: “In the past 30 days, **I’ve used alcohol because it enhances my pleasure** (*e.g., because I like the feeling, because it’s fun*).”

1. This item reflects the enhancement motive clearly (i.e., it is face valid)

Strongly disagree
 Disagree
 Neither agree nor disagree
 Agree
 Strongly agree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

2. This item reflects all aspects of the enhancement motive construct.

Strongly disagree
 Disagree
 Neither agree nor disagree
 Agree
 Strongly agree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

3. This item reflects the core aspects of the enhancement motive construct.

Strongly disagree
 Disagree
 Neither agree nor disagree
 Agree
 Strongly agree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

Please complete questions 4-6 about the following shortened drinking motives item: “In the past 30 days, **I’ve used alcohol because it’s a good way to socialize with others** (*e.g., because it makes social gatherings more enjoyable or because it is what most my friends do when we get together*).”

4. This item reflects the social motive clearly (i.e., it is face valid).

[] [] [] [] []
 Strongly Disagree Neither agree Agree Strongly agree
 disagree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

5. This item reflects all aspects of the social motive construct.

[] [] [] [] []
 Strongly Disagree Neither agree Agree Strongly agree
 disagree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

6. This item reflects the core aspects of the social motive construct.

[] [] [] [] []
 Strongly Disagree Neither agree Agree Strongly agree
 disagree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

Please complete questions 7-9 about the following shortened drinking motives item: “In the past 30 days, **I’ve used alcohol because it helps me cope when I’m feeling nervous, anxious or tense** (e.g., to reduce my anxiety or because I feel more self-confident or sure of myself).”

7. This item reflects the coping-anxiety motive clearly (i.e., it is face valid).

[] [] [] [] []
 Strongly Disagree Neither agree Agree Strongly agree
 disagree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

8. This item reflects all aspects of the coping-anxiety motive construct.

Strongly disagree
 Disagree
 Neither agree nor disagree
 Agree
 Strongly agree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

9. This item reflects the core aspects of the coping-anxiety motive construct.

Strongly disagree
 Disagree
 Neither agree nor disagree
 Agree
 Strongly agree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

Please complete questions 10-12 about the following shortened drinking motives item:
 “In the past 30 days, **I’ve used alcohol because it helps me cope when I’m feeling sad, down or blue** (e.g., *because it helps me when I’m feeling depressed or to stop me from dwelling on things*).”

10. This item reflects the coping-depression motive clearly (i.e., it is face valid).

Strongly disagree
 Disagree
 Neither agree nor disagree
 Agree
 Strongly agree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

11. This item reflects all aspects of the coping-depression motive construct.

Strongly disagree
 Disagree
 Neither agree nor disagree
 Agree
 Strongly agree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

12. This item reflects the core aspects of the coping-depression motive construct.

Strongly disagree
 Disagree
 Neither agree nor disagree
 Agree
 Strongly agree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

Please complete questions 13-16 about the following shortened drinking motives item: “In the past 30 days, I’ve used this drug because I didn’t want to feel left out (e.g., because my friends pressure me to use marijuana or to fit in with the group I like).”

13. This item reflects the conformity motive clearly (i.e., it is face valid).

Strongly disagree
 Disagree
 Neither agree nor disagree
 Agree
 Strongly agree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

14. This item reflects all aspects of the conformity motive construct.

[]	[]	[]	[]	[]
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

15. This item reflects the core aspects of the conformity motive construct.

[]	[]	[]	[]	[]
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

16. I would use the Shortened Modified Drinking Motives Questionnaire Revised after it has been validated.

[]	[]	[]	[]	[]
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

If you disagree, please describe why you would not use this measure in the box below.

If you have any additional comments about our shortened marijuana motives measure, please leave them in in the box below.

Feedback on the Shortened Marijuana Motives Measure

Please complete questions 1-3 about the following shortened marijuana motives item:
 “In the past 30 days, **I’ve used marijuana because it enhances my pleasure** (e.g.,
because I like the feeling or to get high).”

1. This item reflects the enhancement motive clearly (i.e., it is face valid)

Strongly disagree
 Disagree
 Neither agree nor disagree
 Agree
 Strongly agree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

2. This item reflects all aspects of the enhancement motive construct.

Strongly disagree
 Disagree
 Neither agree nor disagree
 Agree
 Strongly agree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

3. This item reflects the core aspects of the enhancement motive construct.

Strongly disagree
 Disagree
 Neither agree nor disagree
 Agree
 Strongly agree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

Please complete questions 4-6 about the following shortened marijuana motives item:
 “In the past 30 days, **I’ve used marijuana because it’s a good way to socialize with others** (e.g., *to be sociable or because it makes social gatherings more fun*).”

4. This item reflects the social motive clearly (i.e., it is face valid).

[] [] [] [] []
 Strongly Disagree Neither agree Agree Strongly agree
 disagree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

5. This item reflects all aspects of the social motive construct.

[] [] [] [] []
 Strongly Disagree Neither agree Agree Strongly agree
 disagree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

6. This item reflects the core aspects of the social motive construct.

[] [] [] [] []
 Strongly Disagree Neither agree Agree Strongly agree
 disagree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

Please complete questions 7-9 about the following shortened marijuana motives item:
 “In the past 30 days, **I’ve used marijuana because it expands my awareness** (e.g., *allows me to be more creative and original or to understand things differently*).”

7. This item reflects the expansion motive clearly (i.e., it is face valid).

[] [] [] [] []
 Strongly Disagree Neither agree Agree Strongly agree
 disagree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

8. This item reflects all aspects of the expansion motive construct.

Strongly disagree
 Disagree
 Neither agree nor disagree
 Agree
 Strongly agree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

9. This item reflects the core aspects of the expansion motive construct.

Strongly disagree
 Disagree
 Neither agree nor disagree
 Agree
 Strongly agree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

Please complete questions 10-12 about the following shortened marijuana motives item: **“In the past 30 days, I’ve used marijuana because it helps me cope when I’m feeling nervous, anxious, depressed, or sad (e.g., to forget about my problems or it helps when I feel depressed or nervous).”**

10. This item reflects the coping motive clearly (i.e., it is face valid)

Strongly disagree
 Disagree
 Neither agree nor disagree
 Agree
 Strongly agree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

11. This item reflects all aspects of the coping motive construct.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

12. This item reflects the core aspects of the coping motive construct.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

Please complete questions 13-16 about the following shortened marijuana motives item: “In the past 30 days, **I’ve used marijuana because I didn’t want to feel left out** (e.g., *because my friends pressure me to use marijuana or to fit in with the group I like*).”

13. This item reflects the conformity motive clearly (i.e., it is face valid).

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

14. This item reflects all aspects of the conformity motive construct.

[]	[]	[]	[]	[]
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

15. This item reflects the core aspects of the conformity motive construct.

[]	[]	[]	[]	[]
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

If you disagree, please comment in the box below on your reasoning and how the item could be improved.

16. I would use the Shortened Marijuana Motives Measure after it has been validated.

[]	[]	[]	[]	[]
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

If you disagree, please describe why you would not use this measure in the box below.

If you have any additional comments about our shortened marijuana motives measure, please leave them in in the box below.

Feedback on the Approach to Test Construction

1. Using a visual analog response scale is a good idea.

Strongly
disagree

Disagree

Neither agree
nor disagree

Agree

Strongly agree

If you disagree, please comment in the box below on your reasoning.

2. This is an acceptable approach to short-form test development.

Strongly
disagree

Disagree

Neither agree
nor disagree

Agree

Strongly agree

If you disagree, please comment in the box below on your reasoning.

Supplementary Material C: Statistical Model Decision Making

For each analysis, I considered the following distributions and links if suitable for the data (e.g., accepted non-integers, accepted zeros): gamma with log link, tweedie with log link, negative binomial with log link, and poisson with log link. I used Raftery's (1995) criteria for comparing models using BIC values; a BIC differences between models could be weak (0-2), positive (2-6), strong (6-10) or very strong (>10).

Concurrent Validity

As seen in Supplementary Table 4.1 below, the Gamma distribution with log link was the best fit for T1 QxF analyses for both the BCAAM and the MMM+ models (BCAAM log likelihood = -582.70, BIC = 1191.20; MMM+ log likelihood = -582.66, BIC = 1190.79) and was a significant improvement over the intercept-only models (BCAAM: $\chi^2(4) = 182.79, p < .001$; MMM+: $\chi^2(4) = 182.57, p < .001$). A BIC comparison suggested the difference between models was weak.

Predictive Validity

The first set of predictive validity analyses included alcohol-related problems at T2. As seen in Table 1 below, the negative binomial distribution with log link was the best fit for both the BAMB and the MDMQ-R+ models (BAMB log likelihood = -582.70, BIC = 1005.97; MDMQ-R+ log likelihood = -491.29, BIC = 1003.24) and was a significant improvement over the intercept-only models (BAMB: $\chi^2(3) = 17.75, p < .01$; MDMQ-R+: $\chi^2(3) = 20.45, p < .01$). A BIC comparison suggested positive evidence of difference between models.

The second set of predictive validity analyses included cannabis-related problems at T2. As seen in the table below, negative binomial distribution with log link was the

best fit for both the BCAMM and the MMM+ models (BCAMM: log likelihood = -504.19, BIC = 1035.59; MMM+: log likelihood = -99.92, BIC = 988.96) and was a significant improvement over the intercept-only models (BCAMM: $\chi^2(3) = 20.76, p < .05$; MMM+: $\chi^2(3) = 29.79, p < .001$). A BIC comparison suggested the difference between models was very strong.

Supplementary Table 4.1. Study 2 Model Comparisons for Generalized Linear Models

Dependent variable	Independent variables	Measure	Gamma BIC	Negative binomial BIC	Poisson BIC	Tweedie BIC
T1	Enhancement,	BCAMM	1191.20	N/A	N/A	2385.15
Cannabis	coping-with-	MMM+	1190.79	N/A	N/A	2336.08
QxF	anxiety, coping- with-depression, and expansion motives					
T2	Alcohol quantity, and coping-with-	BAMM	N/A	1005.97	1518.03	1181.82
Alcohol- related problems	anxiety and coping- with-depression motives	MDMQ- R+	N/A	1003.24	1507.85	1175.84
T2	Cannabis quantity, sex, and coping-	BCAMM	N/A	1035.59	1639.00	1246.08
Cannabis- related problems	with anxiety and coping-with- depression motives	MMM+	N/A	988.96	1576.19	1219.78

N/A = distributions inappropriate due to variables including data that is not whole numbers or includes zero.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	
20. T2 MDMQ-	.09	.34	.08	.05	.24	.19	.08	.40	.01	.03	.27	.09	.14	.49	<u>.17</u>	.13	.30	.26	.29	-					
R+ Social																									
21. T2 MDMQ-	.27	.23	.53	.44	.21	.11	.35	.14	.58	.49	.23	.21	.30	.26	.54	.49	.21	.23	.32	.22	-				
R+ CWA																									
22. T2 MDMQ-	.28	.28	.50	.54	.20	<u>.18</u>	.29	.01	.58	.62	.28	.37	.25	<u>.15</u>	.46	.59	.22	.26	.32	.27	.66	-			
R+ CWD																									
23. T2 MDMQ-	.06	.25	<u>.18</u>	.14	.36	.15	<u>.15</u>	.07	.25	.31	.60	.34	.10	.31	<u>.18</u>	<u>.17</u>	.48	.25	.22	.32	.31	.49	-		
R+ Conform																									
24. T2 MDMQ-	<u>.19</u>	<u>.19</u>	.24	.30	.21	.26	.27	.10	.04	.36	.37	.57	.26	<u>.19</u>	.32	.27	.26	.39	.42	.13	.40	.47	.38	-	
R+ Expand																									
Mean	53.	65.	29.	20.	17.	11.	52.	61	28.	22.	21.	15.	14.	15.	8.6	14.	6.7	7.6	14.	15.	8.3	14.	7.4	7.9	
	63	39	08	08	46	36	05	84	58	91	83	45	83	45	2	50	3	8	06	20	1	76	1	1	
SD	30.	27.	31.	27.	23.	16.	31.	25.	29.	27.	24.	20.	4.5	3.7	3.3	6.7	2.4	2.8	4.7	4.1	3.2	7.1	3.5	3.7	
	04	35	07	39	20	75	44	88	38	68	75	76	5	3	8	4	8	5	6	9	2	6	9	8	

Note: Bold = $p < .01$; Underlined = $p < .05$. Correlations represent pooled Spearman's Rank Order Correlations. T1 = time one; T2 = time two; B Enhance A = brief alcohol motives measure enhancement item; B Social A = brief alcohol motives measure social item; B CWA A = brief alcohol motives measure coping-with-anxiety item; B CWD A = brief alcohol motives measure coping-with-depression item; B Conform A = brief alcohol motives measure conformity item; MDMQ-R+ Enhance = Modified Drinking Motives Questionnaire Revised + enhancement subscale; MDMQ-R+ Social = Modified Drinking Motives Questionnaire Revised + social subscale; MDMQ-R+ CWA = Modified Drinking Motives Questionnaire Revised + coping-with-anxiety subscale; MDMQ-R+ CWD = Modified Drinking Motives Questionnaire Revised + coping-with-depression subscale; MDMQ-R+ Conform = Modified Drinking Motives Questionnaire Revised + conformity subscale; MDMQ-R+ Expand = Modified Drinking Motives Questionnaire Revised + expansion subscale.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.
Mean	68.	40.	51.	38.	13.	36.	60.	37.	46.	35.	15.	29.	17.	10.	10.	18.	6.3	10.	16.	10.	10.	18	<u>.67</u>	10.
	09	45	88	36	94	31	60	36	14	44	85	32	08	67	79	61	6	91	14	71	56	17	/	14
SD	30.	31.	35.	35.	22.	33.	31.	28.	34.	33.	20.	28.	5.0	4.1	3.7	9.0	2.3	5.5	5.5	4.5	4.0	9.4	3.0	5.2
	36	69	06	95	75	44	12	69	59	21	43	83	3	4	4	8	4	0	2	5	9	0	7	7

Note: Bold = $p < .01$; Underlined = $p < .05$. Correlations represent pooled Spearman's Rank Order Correlations. T1 = time one; T2 = time two; B Enhance C = brief cannabis motives measure enhancement item; B Social C = brief cannabis motives measure social item; B CWA C = brief cannabis motives measure coping-with-anxiety item; B CWD C = brief cannabis motives measure coping-with-depression item; B Conform C = brief cannabis motives measure conformity item; MMM+ Enhance = Marijuana Motives Measure + enhancement subscale; MMM+ Social = Marijuana Motives Measure + social subscale; MMM+ CWA = Marijuana Motives Measure + coping-with-anxiety subscale; MMM+ CWD = Marijuana Motives Measure + coping-with-depression subscale; MMM+ Conform = Marijuana Motives Measure + conformity subscale; MMM+ Expand = Marijuana Motives Measure + expansion subscale.

Supplementary Table 4.4. Study 2 Correlations Between T1 BAMB Social Item and Individual MDMQ-R+ Social Subscale Items

	1.	2.	3.	4.	5.	6.
1. BAMB Social	-					
2. MDMQ-R+ item 1	.00	-				
3. MDMQ-R+ item 4	.33**	.14**	-			
4. MDMQ-R+ item 7	.61**	.13**	.45**	-		
5. MDMQ-R+ item 10	.10	.24**	.31**	.24**	-	
6. MDMQ-R+ item 13	.53**	.29**	.35**	.42**	.22**	-

** $p < .01$; * $p < .05$

Note: Correlations are Spearman's Rank Order. Statistics represent pooled effects.

MDMQ-R+ item 1 = "As a way to celebrate."; MDMQ-R+ item 4 = "Because it is what most of my friends do when we get together."; MDMQ-R+ item 7 "To be sociable."; MDMQ-R+ item 10 = "Because it is customary on special occasions."; MDMQ-R+ item 13 = "Because it makes a social gathering more enjoyable."

Supplementary Table 4.5. Study 2 Correlations Between T1 BCAMM Social Item and Individual MMM+ Social Subscale Items

	1.	2.	3.	4.	5.	6.
1. BCAMM Social	-					
2. MMM+ item 1	.35**	-				
3. MMM+ item 4	.47**	.39**	-			
4. MMM+ item 7	.59**	.37**	.45**	-		
5. MMM+ item 10	.19*	.48**	.41**	.32**	-	
6. MMM+ item 13	.65**	.42**	.49**	.52**	.34**	-

** $p < .01$; * $p < .05$

Note: Correlations are Spearman's Rank Order. Statistics represent pooled effects.

MMM+ item 1 = "As a way to celebrate."; MMM+ item 4 = "Because it is what most of my friends do when we get together."; MMM+ item 7 "To be sociable."; MMM+ item 10 = "Because it is customary on social occasions."; MMM+ item 13 = "Because it makes a social gathering more enjoyable."

Supplementary Table 4.6. Study 2 Correlations Between T1 BMM Coping-with-Anxiety Item and Individual MDMQ-R+ Coping-with-Anxiety Subscale Items

	1.	2.	3.	4.	5.
1. BMM Coping-with-anxiety	-				
2. MDMQ-R+ item 2	.48**	-			
3. MDMQ-R+ item 8	.33**	.12	-		
4. MDMQ-R+ item 11	.62**	.36**	.47**	-	
5. MDMQ-R+ item 19	.70**	.44**	.30**	.64**	-

** $p < .01$; * $p < .05$

Note: Correlations are Spearman's Rank Order. Statistics represent pooled effects.

MDMQ-R+ item 2 = "To relax."; MDMQ-R+ item 9 = "Because I feel more self-confident or sure of myself."; MDMQ-R+ item 11 "Because it helps me when I am feeling nervous."; MDMQ-R+ item 19 = "To reduce my anxiety."

Supplementary Table 4.7. Study 2 Correlations Between T1 BCAMM Coping-with-Anxiety Item and Individual MMM+ Coping-with-Anxiety Subscale Items

	1.	2.	3.	4.	5.
1. BCAMM Coping-with-anxiety	-				
2. MMM+ item 2	.53**	-			
3. MMM++ item 8	.33**	.14	-		
4. MMM++ item 11	.73**	.48**	.36**	-	
5. MMM+ item 19	.80**	.56**	.24**	.74**	-

** $p < .01$; * $p < .05$

Note: Correlations are Spearman's Rank Order. Statistics represent pooled effects.

MMM+ item 2 = "To relax."; MMM+ item 9 = "Because I feel more self-confident or sure of myself."; MMM+ item 11 "Because it helps me when I am feeling nervous."; MMM+ item 19 = "To reduce my anxiety."

Supplementary Table 4.8. Study 2 Correlations Between T1 BAMB Coping-with-Depression Item and Individual MDMQ-R+ Coping-with-Depression Subscale Items

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. BAMB CWD	-									
2. MDMQ-R+ item 5	.55**	-								
3. MDMQ-R+ item 14	.64**	.53**	-							
4. MDMQ-R+ item 16	.53**	.57**	.55**	-						
5. MDMQ-R+ item 17	.60**	.53**	.52**	.67**	-					
6. MDMQ-R+ item 20	.52**	.51**	.50**	.53**	.48**	-				
7. MDMQ-R+ item 21	.52**	.48**	.42**	.47**	.50**	.54**	-			
8. MDMQ-R+ item 22	.53**	.46**	.54**	.46**	.44**	.44**	.66**	-		
9. MDMQ-R+ item 23	.50**	.45**	.40**	.46**	.57**	.50**	.64**	.55**	-	
10. MDMQ-R+ item 27	.49**	.39**	.48**	.57**	.55**	.43**	.47**	.42**	.58**	-

** $p < .01$; * $p < .05$

Note: Correlations are Spearman's Rank Order. Statistics represent pooled effects.

BAMB CWD = BAMB coping -with-depression; MDMQ-R+ item 5 = "To forget my worries."; MDMQ-R+ item 14 = "To cheer me up when I'm in a bad mood."; MDMQ-R+ item 16 = "To numb my pain"; MDMQ-R+ item 17 = "Because it helps me when I am feeling depressed."; MDMQ-R+ item 20 = "To stop me from dwelling on things."; MDMQ-R+ item 21 = "To turn off negative thoughts about myself."; MDMQ-R+ item 22 = "To help me feel more positive about things in my life."; MDMQ-R+ item 23 = "To

stop me from feeling so hopeless about the future.”; MDMQ-R+ item 27 = “To forget painful memories.”

Supplementary Table 4.9. Study 2 Correlations Between T1 BCAMM Coping-with-Depression Item and Individual MMM+ Coping-with-Depression Subscale Items

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. BCAMM CWD	-									
2. MMM+ item 5	.73**	-								
3. MMM+ item 14	.71**	.66**	-							
4. MMM+ item 16	.68**	.71**	.56**	-						
5. MMM+ item 17	.78**	.66**	.68**	.72**	-					
6. MMM+ item 20	.64**	.65*	.61**	.63**	.65**	-				
7. MMM+ item 21	.72**	.67**	.56**	.72**	.70**	.71**	-			
8. MMM+ item 22	.56**	.50**	.57**	.51**	.57**	.60**	.63**	-		
9. MMM+ item 23	.64**	.58**	.54**	.68**	.68**	.59**	.76**	.59**	-	
10. MMM+ item 27	.63**	.58**	.52**	.70**	.62**	.50**	.65**	.43**	.63**	-

** $p < .01$; * $p < .05$

Note: Correlations are Spearman's Rank Order. Statistics represent pooled effects.

BCAMM CWD = BCAMM coping-with-depression; MMM+ item 5 = "To forget my worries."; MMM+ item 14 = "To cheer me up when I'm in a bad mood."; MMM+ item 16 = "To numb my pain>"; MMM+ item 17 = "Because it helps me when I am feeling depressed."; MMM+ item 20 = "To stop me from dwelling on things."; MMM+ item 21 = "To turn off negative thoughts about myself."; MMM+ item 22 = "To help me feel

more positive about things in my life.”; MMM+ item 23 = “To stop me from feeling so
hopeless about the future.”; MMM+ item 27 = “To forget painful memories.”

Supplementary Table 4.10. Study 2 Correlations Between T1 BAMB Enhancement Item and Individual MDMQ-R+ Enhancement Subscale Items

	1.	2.	3.	4.	5.	6.
1. BAMB Enhancement	-					
2. MDMQ-R+ item 3	.55**	-				
3. MDMQ-R+ item 6	.37**	.46**	-			
4. MDMQ-R+ item 9	.40**	.39**	.35**	-		
5. MDMQ-R+ item 12	.40**	.55**	.47**	.26**	-	
6. MDMQ-R+ item 26	.65**	.66**	.33**	.43**	.50**	-

** $p < .01$; * $p < .05$

Note: Correlations are Spearman's Rank Order. Statistics represent pooled effects.

MDMQ-R+ item 3 = "Because I like the feeling."; MDMQ-R+ item 6 = "Because it is exciting."; MDMQ-R+ item 9 = "To get a high."; MDMQ-R+ item 12 = "Because it's fun."; MDMQ-R+ item 26 = "Because it makes me feel good."

Supplementary Table 4.11. Study 2 Correlations Between T1 BCAMM Enhancement Item and Individual MMM+ Enhancement Subscale Items

	1.	2.	3.	4.	5.	6.
1. BCAMM Enhancement	-					
2. MMM+ item 3	.53**	-				
3. MMM+ item 6	.42**	.56**	-			
4. MMM+ item 9	.46**	.57**	.43**	-		
5. MMM+ item 12	.52**	.67**	.58**	.58**	-	
6. MMM+ item 26	.64**	.64**	.38**	.49**	.64**	-

** $p < .01$; * $p < .05$

Note: Correlations are Spearman's Rank Order. Statistics represent pooled effects.

MMM+ item 3 = "Because I like the feeling."; MMM+ item 6 = "Because it is exciting.";

MMM+ item 9 = "To get a high."; MMM+ item 12 = "Because it's fun."; MMM+ item

26 = "Because it makes me feel good."

Supplementary Table 4.12. Study 2 Correlations Between T1 BAMB Conformity Item and Individual MDMQ-R+ Conformity Subscale Items

	1.	2.	3.	4.	5.	6.
1. BAMB Conformity	-					
2. MDMQ-R+ item 15	.41**	-				
3. MDMQ-R+ item 18	.34**	.34**	-			
4. MDMQ-R+ item 24	.35**	.30**	.57**	-		
5. MDMQ-R+ item 25	.47**	.31**	.48**	.41**	-	
6. MDMQ-R+ item 28	.56**	.36**	.48**	.47**	.50**	-

** $p < .01$; * $p < .05$

Note: Correlations are Spearman's Rank Order. Statistics represent pooled effects.

MDMQ-R+ item 15 = "To be liked."; MDMQ-R+ item 18 = "So that others won't kid me about not using."; MDMQ-R+ item 24 = "Because my friends pressure me to use."; MDMQ-R+ item 25 = "To fit in with a group I like."; MDMQ-R+ item 28 = "So I won't feel left out."

Supplementary Table 4.13. Study 2 Correlations Between T1 BCAMM Conformity Item and Individual MMM+ Conformity Subscale Items

	1.	2.	3.	4.	5.	6.
1. BCAMM Conformity	-					
2. MMM+ item 15	.35**	-				
3. MMM+ item 18	.40**	.55**	-			
4. MMM+ item 24	.48**	.27**	.39**	-		
5. MMM+ item 25	.40**	.35**	.44**	.42**	-	
6. MMM+ item 28	.54**	.43**	.47**	.50**	.61**	-

** $p < .01$; * $p < .05$

Note: Correlations are Spearman's Rank Order. Statistics represent pooled effects.

MMM+ item 15 = "To be liked."; MMM+ item 18 = "So that others won't kid me about not using."; MMM+ item 24 = "Because my friends pressure me to use."; MMM+ item 25 = "To fit in with a group I like."; MMM+ item 28 = "So I won't feel left out."

Supplementary Table 4.14. Study 2 Correlations Between T1 BAMB Expansion Item and Individual MDMQ-R+ Expansion Subscale Items

	1.	2.	3.	4.	5.	6.
1. BAMB Expansion	-					
2. MDMQ-R+ item 29	.20**	-				
3. MDMQ-R+ item 30	.42**	.33**	-			
4. MDMQ-R+ item 31	.30**	.53**	.46**	-		
5. MDMQ-R+ item 32	.36**	.43**	.52**	.63**	-	
6. MDMQ-R+ item 33	.41**	.38**	.36**	.45**	.42**	-

** $p < .01$; * $p < .05$

Note: Correlations are Spearman's Rank Order. Statistics represent pooled effects.

MDMQ-R+ item 29 = "To know myself better."; MDMQ-R+ item 30 = "Because it helps me be more creative and original."; MDMQ-R+ item 31 = "To understand things differently."; MDMQ-R+ item 32 = "To expand my awareness."; MDMQ-R+ item 33 = "To be more open to experiences."

Supplementary Table 4.15. Study 2 Correlations Between T1 BCAMM Expansion Item and Individual MMM+ Expansion Subscale Items

	1.	2.	3.	4.	5.	6.
1. BCAMM Expand	-					
2. MMM+ item 29	.48**	-				
3. MMM+ item 30	.75**	.61**	-			
4. MMM+ item 31	.77**	.61**	.80**	-		
5. MMM+ item 32	.78**	.64**	.76**	.85**	-	
6. MMM+ item 33	.54**	.54**	.61**	.64**	.65**	-

** $p < .01$; * $p < .05$

Note: Correlations are Spearman's Rank Order. Statistics represent pooled effects.

MMM+ item 29 = "To know myself better."; MMM+ item 30 = "Because it helps me be more creative and original."; MMM+ item 31 = "To understand things differently.";

MMM+ item 32 = "To expand my awareness."; MMM+ item 33 = "To be more open to experiences."

CHAPTER 5: TRANSITION FROM STUDY 2 TO STUDY 3

The creation of the BMM made it possible to examine the social influence of alcohol motives in an egocentric social network design (i.e., Study 3). My goals in conducting such an examination were four-fold. First, as previously discussed, I aimed to examine the social influence of alcohol motives in a diverse, representative network. Second, I wished to study the social influence of alcohol motives in such networks using a longitudinal design and an emerging adult sample. Previous research on the social influence of drinking motives has typically examined the impact of others' motives cross-sectionally or by collapsing over time (e.g., Hussong, 2003; Kehayes et al., 2019; Kehayes et al., 2020; Kuntsche & Stewart, 2009). The one longitudinal study that does exist occurred in an adolescent sample, again with a restricted network (i.e., schoolmates; Stewart et al., 2014). Thus, a study of emerging adults in a diverse social network context that utilizes multiple time points within data analysis does not exist. This is a notable gap, as it means the impact of diverse social networks on the drinking motives of emerging adults and how this relationship functions over time remains unknown. Given emerging adulthood is associated with high levels of risky drinking (Canadian Centre on Substance Use and Addiction, 2017), and that motives have been inextricably linked to such drinking, filling this gap is crucial.

Third, I wanted to study emerging adults' perceptions of the drinking motives of others in their social network, rather than the actual motives. Except for one limited recent study which examined the correlations between adolescents' own motives and perceptions of parent or friend motives (Cloutier et al., 2021), the existing literature is built entirely on direct reports from social network members (i.e., network members

report on their own motives). While this focus on direct reports is not necessarily problematic, emerging research in the alcohol use field suggests that in comparison to actual alcohol use, perceptions of alcohol use are equal or stronger predictors of participant's own alcohol use over time (Deutsch et al., 2015). Moreover, the authors suggest that perceived and actual alcohol use variables may represent different sources of social influence (Deutsch et al., 2015). As such, not only is it likely that perceptions of drinking motives are an important avenue of study, but it is also conceivable that perceptions of social network member motives may be more important for social learning than actual motives of social network members. For example, if an individual perceives someone to be consuming alcohol for enhancement reasons, when they really are consuming alcohol for social reasons, the rewards and punishments they observe in their network member will be applied to social learning about enhancement motives, not social motives. Thus, previous studies which have relied on direct reports provided by network members (Cloutier et al., 2021; Deustch et al., 2015) may not have tapped into all the sources of social influence that are occurring.

Fourth, I aimed to extend the current findings by examining both socialization and selection. While theory suggests that individuals likely seek out those who consume alcohol for similar reasons (Lazarsfeld & Merton, 1954), previous research has not been able to differentiate selection and socialization forces or has chosen to focus exclusively on socialization processes. This differentiation between selection and socialization provides important information in the conceptualization of social influence processes. Thus, in Study 3 I sought to examine whether perceived social network motives at baseline predict an individual's own motives at a later time point, *and* whether an

individual's motives at baseline predict perceived social network motives at a later time point in the context of a fluctuating social network.

Taken together, my goal for Study 3 was to examine the social influence and selection of drinking motives within a diverse social network of emerging adults using a longitudinal design. I specifically sought to investigate whether the perceived drinking motives of the social network would influence participants' own motives, and if so, whether these motives would go on to predict participants' alcohol use (i.e., socialization). In Study 3, I also sought to investigate whether the drinking motives of participants would influence the perceived drinking motives of the overall network (i.e., selection), and if so, whether they would then go on to predict perceived network alcohol use. Like in Study 1, I was specifically interested in examining binge drinking as the alcohol outcome, as it is a variable associated with significant harms (WHO, 2018).

CHAPTER 6. SOCIAL INFLUENCES ON WHY WE DRINK: PERCEIVED DRINKING MOTIVES IN SOCIAL NETWORKS IMPACT INDIVIDUALS' OWN DRINKING MOTIVES AND ALCOHOL USE

The manuscript prepared for this study is presented below. Readers are advised that Sara Bartel, under the supervision of Dr. Sherry Stewart and Dr. Simon Sherry, was responsible for designing the study, developing the research hypotheses, gaining ethical approval, collecting the data, preparing the data set for analyses, conducting the analyses, and interpreting the study results. Sara wrote the initial draft of the manuscript and received and incorporated feedback from her co-authors. Sara submitted the manuscript to *Drug and Alcohol Review* for peer review on March 15, 2021. The current reference is as follows: Bartel, S. J., Sherry, S. B., & Stewart, S. H. (2021). Social influences on why we drink: Perceived drinking motives in social networks impact individuals' own drinking motives and alcohol use. Submitted to *Drug and Alcohol Review*.

Abstract

Introduction: A significant body of research has investigated the impacts of social influence and social selection on binge drinking and risk factors for binge drinking in emerging adults; however, one risk factor for binge drinking that has yet to be thoroughly investigated in this regard is drinking motives. Preliminary research suggests the motives of others may impact our own alcohol use indirectly through our own motives (i.e., social influence). While these are important findings, research to date has been only conducted with adolescents or dyads and has not examined selection. I filled these gaps with a longitudinal egocentric social network design. *Methods:* Emerging adults ($N = 177$) completed measures on their alcohol use, drinking motives, and social networks at baseline (T1) and four-month follow-up (T2). *Results:* A cross-lagged panel model indicated T1 perceived network drinking motives predicted T2 participant drinking motives (for all motives but social), but T1 participant drinking motives did not predict T2 perceived network drinking motives. Path analysis indicated T1 perceived network drinking motives predicted T2 participant binge drinking frequency indirectly through T2 participant drinking motives for enhancement, coping-with-anxiety, and conformity, but not social or coping-with-depression, motives. *Discussion:* Results suggests drinking motives of those around us impact our own drinking motives, and indirectly, our own alcohol use. I found evidence of social influence, but not social selection. *Conclusion:* It appears that those around us have the capacity to influence our drinking behaviors through our drinking motives.

Keywords: social influence, social selection, drinking motives, social network

Introduction

Between 30-45% of emerging adults engage in binge drinking, the consumption of 4+ (5+ for men) drinks in a 2-hour period or less (National Institute of Health, 2003; Substance Abuse and Mental Health Services, 2012). This is significant, as binge drinking is associated with negative consequences to relationships, employment, and physical and mental health (WHO, 2018). Given these consequences, investigating factors that increase binge drinking during emerging adulthood is essential.

Alongside other factors (e.g., genetics, personality; Edenberg et al., 2013; Shin et al., 2012), processes such as social learning and social selection are theorized to have a strong impact on emerging adults' binge drinking. Social learning, the process of learning through observing others' behavior being rewarded or punished, leads individuals to engage in alcohol use behaviors perceived to be immediately rewarded (Bandura, 1969). In contrast, social selection leads individuals to surround themselves with others who are similar to them in characteristics or behaviors (e.g., alcohol use), resulting in the formation of social networks with high similarity (Verbugge, 1977). Notably, both social selection and social learning are thought to have a strong impact on alcohol use during emerging adulthood, as sources of social influence frequently change, social networks expand (Wrzus, et al., 2013), and external controls on alcohol use decrease (e.g., less parental supervision; Arnett, 2005).

Both selection and social learning impact binge drinking in emerging adults. Individuals contribute to the level of binge drinking in their networks (i.e., selection), while at the same time their own binge drinking is influenced by the drinking of others in their network (i.e., social influence, e.g., Reifman et al., 2006). Social factors also appear

to impact risk factors for binge drinking. For example, social influence can result in more impulsive choices and alter alcohol expectancies (Gilman et al., 2014; Martino et al., 2006). Thus, social processes can impact binge drinking directly, as well as indirectly by influencing risk factors for binge drinking.

One risk factor for binge drinking that has yet to be thoroughly investigated in terms of social processes is drinking motives, a variable consistently linked to alcohol misuse (Cooper et al., 2016). As drinking motives may be observable to others, they may be a prime candidate for selection and/or social influence. For example, an individual may notice someone drinking to facilitate social interaction (social motives), to fit in (conformity motives), to experience positive feelings (enhancement motives), or to manage negative emotions (coping motives). Then, depending on whether the observer shares the drinking motive observed in the other person, they may be more or less likely to form a relationship with this individual (i.e., selection). In addition, individuals may observe motive-specific drinking-related rewards of others (e.g., social rewards like affiliation with social motives). Others' drinking motives may thus go on to impact an individual's alcohol use via social influence. This social influence likely occurs indirectly through a mediator. For example, motives of others may impact our own motives, which may then impact our own alcohol use.

Indeed, emerging research indicates drinking motives of friends, drinking buddies, and romantic partners can impact one's own alcohol use. In a dyadic study, Hussong (2003) examined the direct effect of others' motives on individuals' alcohol use, finding best friends' social, enhancement, and coping motives directly predicted participants' own concurrent drinking. Similarly, in dyadic studies of drinking buddies

and romantic partners, Kehayes and colleagues (2019; 2021) found social, enhancement, and coping-with-anxiety motives of drinking buddies and romantic partners predicted participant's own future drinking. Notably, when averaged across time, Kehayes and colleagues found the effect of dyadic partners' motives on individuals' alcohol use was mediated, rather than direct. The impact of romantic partners' enhancement and social motives on participants' alcohol use was mediated through participants' own corresponding motives (Kehayes et al., 2019), while the impact of drinking buddies' social motives on participants' alcohol use was mediated by participants' own social motives (Kehayes et al., 2021).

Two studies to date have extended beyond dyads and begun to examine social influences within social networks. In a cross-sectional study of classmates, Kuntsche and Stewart (2009) found an indirect effect of classmates' drinking motives on adolescents' alcohol use via the adolescents' own drinking motives. The coping, conformity, social, and enhancement drinking motives of classmates predicted the adolescents' own matching drinking motives, which then went on to influence their own alcohol use. The indirect findings regarding enhancement and coping motives were then replicated in a longitudinal study of self-identified schoolmates among adolescents (Stewart et al., 2014; note other motives were not examined). Coping and enhancement motives of five nominated peers indirectly influenced participant binge drinking through individual coping and enhancement motives, respectively, again supporting social learning predictions.

Advancing the Literature

Research suggests social influence not only impacts the “what” (i.e., what alcohol and how much is consumed; Rinker et al., 2016), and “when” (i.e., frequency and location of drinking; Mustonen et al., 2016) of drinking, but also impacts the “why” (i.e., motives for drinking). This literature represents a critical advancement in knowledge; however, several key areas remain unexplored. To date, a study examining the impact of social network motives on individuals has not been completed with emerging adults, or in a representative social network (i.e., containing a mix of friends, family, and romantic partners) at any developmental stage. Given risky alcohol use is highly prevalent in emerging adulthood (Substance Abuse and Mental Health Services, 2012), it is important to confirm whether knowledge gained from previous investigations of social influence and alcohol motives can be applied to this important developmental stage. Moreover, studying representative social networks is essential, as they are likely are a better approximation of the real-world than the previously examined restricted social networks (e.g., classmates). Furthermore, all existing studies have had social network members report on their own motives, rather than asking participants why they believe network members engage in alcohol use (i.e., perceptions). As preliminary research suggests perceptions of the motives of others are not completely accurate (Shannon et al., 2018), perceptions of network motives may have a greater impact than actual network motives on participant motives/behavior. Finally, the existing motives literature has exclusively investigated social influence; however, it is equally possible selection is occurring (i.e., own motives could predict future network motives through selection of network members with motives similar to one’s own). An examination of selection is critical, as its presence may represent an additional point of intervention (i.e., preventing networks of risky

motives from forming). As such, I sought to examine whether perceived network motives and participants' own motives reciprocally predicted each other over time.

Objectives and Hypotheses

I filled the above-mentioned gaps in the literature using a longitudinal egocentric social network design in emerging adults. H1: Consistent with social influence, I hypothesized T1 perceived network motives would predict T2 participant motives, after accounting for stability in perceived network motives over time (See Figure 1). H2: Consistent with social learning theory, I hypothesized perceived enhancement, social, coping-with-anxiety, coping-with-depression, and conformity motives of the social network would indirectly influence participants' own binge drinking frequency via participants' own corresponding motives (see Figure 2). Consistent with social selection, I also tested whether T1 participant motives would predict T2 perceived network motives after accounting for stability in participant motives over time; however, as selection had not previously been studied in relation to drinking motives, I did not make specific hypotheses and this analysis remained exploratory.

Materials and Methods

Participants

One-hundred-and-seventy-seven emerging adults (mean [SD] age = 21.85 [2.02]; range 18-25); males = 54; females = 122; other = 1) who reported using alcohol 4+ times and cannabis recreationally 2+ times in the past month participated. For reasons related to another study, the sample included drinkers who also regularly use cannabis (Bartel et al., 2020). Seventy-seven percent of participants self-identified as White, 2.8% as Asian;

2.2% as Hispanic/South American/Latina/o; 2.2% as Middle Eastern; 1.7 % as Black; 1.1% as First Nations/Inuit/Metis; 0.5% as Asian Indian; 2.2% as “other”, and 10.3% as multiracial. Forty-nine participants were lost to follow-up (27.6% attrition). Participants retained and lost did not significantly differ on study variables at baseline.

Measures

Binge Drinking

I assessed frequency of binge drinking as recommended by the National Institute of Health (2003). Binge drinking was defined as 5+ (males) or 4+ (females) drinks containing alcohol within a two-hour period. A definition (“One alcohol beverage equals one 12-oz [355ml] bottle/can of beer, or one 4-oz [118 ml] glass of wine, or one 1-oz [29.6 ml] shot of hard liquor, either straight or with a mixer) and image of a standard drink (glass of wine, can/bottle of beer, shot of hard liquor, cooler) were provided. Eight response options were given, ranging from “never” (0) to “every day” (7), with a reference period of the last 30 days.

Brief Alcohol Motives Measure

Based on the Modified Drinking Motives Questionnaire – Revised (MDMQ-R; Grant et al., 2007), the Brief Alcohol Motives Measure (BAMM; Study 2) is a 6-item measure of enhancement, social, coping-with-depression, coping-with-anxiety, conformity, and expansion motives. Each item includes a general statement reflecting an alcohol motive, as well as two specific examples of the motive within parentheses [e.g., “In the past 30 days, I’ve used alcohol because it helps me cope when I’m feeling sad, down, or blue (*e.g., because it helps me when I’m feeling depressed or to stop me from dwelling on things*)”]. Response option is a visual analog scale scored from 0-100

(“Never” – “Always”). Each item is scored individually. According to a panel of experts, the BMM has excellent face and content validity (Study 2). The BMM has good convergent validity with the MDMQ-R (moderate-to-strong correlations) and comparable test-retest reliability in the range expected for a trait-state measure ($r = .35-.67$; Study 2). The BMM has satisfactory concurrent and predictive validity (e.g., concurrently associated with drinking levels; prospectively predicts alcohol-related problems; Study 2).

Social Network Member Perceptions Questionnaire

This measure asked participants to list 15 members of their social network with whom they were closest, and answer questions about each member. Participants could list different network members at each time point. Questions included reformatted BMM items asking about each network member’s drinking motives. Network motives were averaged across network members to create a network score for each motive.

Procedure

Participants were recruited through posters, online advertisements, and a psychology pool at an Eastern Canadian University. Consenting participants completed the measures online in the lab at time 1 (T1) and again online at home four months later (T2). Participants were compensated with psychology credits, a \$20CDN Amazon gift card, or a combination after each wave. This study received institutional Research Ethics Board approval and followed Tri-council Ethical Standards (Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, & Social Sciences and Humanities Research Council of Canada, 2018).

Results

Descriptive Statistics

At T1, item-level missing data was minimal (0-1.1% depending on the item). At T2, item-level missing data was more substantial (27.6-31.5% depending on the item), with 27.6% representing a pattern of monotone missing data due to attrition. Data was missing completely at random as indicated by a nonsignificant Little's MCAR test, $\chi^2 = 265.99, p = .19$. Missing data were handled through multiple imputation using the R package "mice." Predictive mean matching was chosen due to skewed variables. Motives measures often have skewed distributions, as some motives are more commonly endorsed than others (see Cooper et al., 2016). Forty imputations were used to prevent falloff of statistical power (Graham et al., 2007). All independent, dependent, and mediating variables were included as the basis for imputation. Results were pooled according to Rubin's (1987) rules.

All statistics and analyses represent the imputed dataset. Univariate outliers were detected for perceived network enhancement motives ($n = 3$) and perceived network social motives ($n = 2$). Analyses were run with and without outliers, with no significant differences between models. As such, outliers were retained. Variables were examined for skewness. All motives variables were in the relatively symmetrical range (skewness 0-.5) with the exception of participant coping-with-depression variables; at T1 and T2 coping-with-depression indicated moderate to high skew (T1 = .76; T2 = 1.03). As such, coping-with-depression was \log_{10} transformed to correct for non-normality in all analyses. See Table 6.1 for descriptive statistics and Spearman's rank correlations. T1 perceived network conformity motives were significantly correlated with T2 binge drinking, while other T1 perceived network motives were not. T2 participant

enhancement, social, and conformity motives were significantly correlated with T2 binge drinking, while T2 participant coping-with-anxiety and coping-with-depression motives were not. T1 perceived network motives were significantly correlated with T2 participant motives. On average, 57% of each participant's network remained stable from T1 to T2 ($SD = 18\%$; range = 13%-100%).

Path Analysis

Using path analysis, I tested a cross-lagged panel model (CLPM) in which T1 perceived network motives predicted T2 participant motives after controlling for stability in participant motives over time, and in which T1 participant motives predicted T2 perceived network motives after controlling for stability in perceived network motives over time (see Figure 1). A separate model was run for each motive. Robust estimators of standard error were used. CLPM models indicated T1 perceived network motives predicted T2 perceived network motives for all motives and T1 participant motives predicted T2 participant motives for all motives. Partially consistent with H1, T1 perceived network motives predicted T2 participant motives for all motives but social. Notably, the effect of perceived network motives on participant motives for conformity motives was more than double that of the effect for enhancement, coping-with-depression and coping-with anxiety (regression coefficients .43 vs..19-.20). In contrast, T1 participant motives did not predict T2 perceived network motives for any motives (see Table 6.2).

As there was evidence for social influence, a second path analysis examined whether T1 perceived network motives impacted participants' T2 binge drinking frequency through participants' own T2 drinking motives, after controlling for

participant's own binge drinking frequency and motives at T1 (see Figure 2). Robust estimators of standard error were used. Robust CFI and TLI $>.95$, and robust RSMEA $<.08$, were used to indicate good fit (Kline, 2011). Aligning with sample size recommendations (Koopman et al., 2015; Özdil & Kutlu, 2019), and replicating Kuntsche and Stewart (2009), the Sobel Test was used to test indirect effects (i.e., product of T1 network motives predicting T2 participant motives, and T2 participant motives predicting T2 binge drinking). Note that bootstrapping indirect effects was not compatible with the multiple imputation component of models. Results indicated T1 perceived network motives predicted T2 participant binge drinking frequency indirectly through participants' own T2 motives in the case of enhancement, coping-with-anxiety, and conformity motives, but not social or coping-with-depression motives. For social motives, network motives at T1 were unrelated to own motives at T2. For coping-with-depression motives, T2 own motives were unrelated to own T2 binge drinking. None of the direct effects from T1 network motives to T2 binge drinking were significant (see Table 6.3).

Post-Hoc Analyses

Cross-sectional Examination of Social Motives

While I found T1 perceived network social motives did not indirectly predict T2 binge drinking through participant's own social motives at T2, previous cross-sectional research had found network social motives to predict participant's alcohol use through their own social motives (Kuntsche & Stewart, 2009). To ascertain whether my discrepant findings were due to my longitudinal model, which controls for prior levels of social motives and binge drinking, I conducted a cross-sectional mediation analysis (See

Figure 6.3). T1 perceived network social motives predicted T1 participant social motives (path a in Figure 6.3; Stand. $\beta = .34$, $p < .001$). T1 participant social motives predicted T1 participant binge drinking (path b in Figure 6.3; Stand. $\beta = .21$, $p < .01$). The Sobel test indicated the indirect effect of T1 perceived network motives on T1 binge drinking through participant's own social motives was significant (path $a*b = .07$, $p < .05$). T1 perceived network motives did not significantly predict T1 participant binge drinking (path c in Figure 6.3; Stand. $\beta = -.01$, $p > .05$). T1 participant social motives $R^2 = .11$. T1 binge drinking $R^2 = .04$. As the model was fully saturated, model fit was excellent (CFI = 1.00, TLI = 1.12, RMSEA = 0.00).

Self-Other Discrepancies

As descriptive statistics suggested participants may perceive their social network members to have higher levels of drinking motives than they themselves endorse (i.e., motive perception scores were higher than own reported motives scores), post-hoc self-other discrepancy scores were calculated to investigate this possibility. These calculations are included here, as they may help to interpret the path analysis findings. Participant's own motives were subtracted from perceived social network motives for each separate drinking motive at both T1 and T2. Self-other discrepancies were all positive (suggesting on average, participants perceived social network members to more highly endorse all motives than participant's themselves endorsed). Conformity motives demonstrated the largest self-other discrepancies, while social motives demonstrated the smallest. See Table 6.4 for self-other discrepancy calculations. See Figure 6.4 for a density graph illustrating the distribution of self-other discrepancies. For each motive, the majority of participants demonstrated a positive self-other discrepancy (between 52.5-79.5%).

Discussion

I investigated the impact of social network drinking motives on the motives and drinking behaviors of emerging adults. While research suggested social network motives may impact an individual's drinking through the individual's own motives (e.g., Kuntsche & Stewart, 2009), previous studies did not examine selection, did not allow participants to identify their own social network members, did not examine participant perceptions, were conducted in restricted social networks or dyads, and/or focused on adolescents. My study significantly advanced the literature in this area by filling the above-mentioned gaps.

My results align with research suggesting the motives of those around us predict our own future motives. The CLPM analyses indicated perceived enhancement, conformity, coping-with-anxiety, and coping-with-depression motives of social network members positively predicted participants' future motives, such that the stronger those motives are perceived to be within the network at baseline, the higher participant's own corresponding motives are at a subsequent time. Notably, social motives were the exception to this pattern: perceived social motives within the social network did not predict participant's own future social motives. An examination of the self-other discrepancy calculations suggests it may be that social motives of others did not predict participants own motives at a later time point because they were perceived to be similar to one's own social motives. In other words, because there was only a very small perceived discrepancy between participant's own motives and the motives of those of their social network members, participants did not need to adjust their behavior to match those in their social network (e.g., Borsari & Carey, 2001).

It is important to note that my longitudinal social motives findings contradict those of Kuntsche and Stewart (2009), who found classmates' social motives predicted participant's own social motives cross-sectionally. Post-hoc cross-sectional mediation analyses suggest my conflicting results may be due to my longitudinal design, which controls for participants' baseline social motives (i.e., a strong predictor of social motives); when I did not control for baseline social motives, network social motives indeed predict participant's own social motives cross-sectionally. These differing cross-sectional and longitudinal results highlight the importance of conducting mediation with longitudinal data.

Interestingly, I found that the effect of perceived network conformity motives on participant's own motives was twice as large as the effects of the social network on enhancement, coping-with-anxiety, and coping-with depression, motives (regression coefficient .44 vs .18-.22). Self-other discrepancies may explain this finding. As seen in Table 6.2, the discrepancy between self and other motives was greatest for conformity motives ($M = 20.41-24.57$ vs. range of 4.08-18.14 for all other motives across time points). As a result, individuals may have perceived a large discrepancy between own and network conformity motives and substantially shifted their own conformity motives to reduce this discrepancy. Such matching phenomena have been consistently documented in the alcohol use literature (e.g., Borsari & Carey, 2001). Additionally, it is also possible conformity motives may have a large effect due to developmental stage. Given emerging adults are frequently exposed to new social groups (Wrutz et al. 2013), the rewards of conformity motives (i.e., social acceptance) may be more strongly desired by emerging adults than the rewards of other motives (e.g., enhancing positive feelings).

Importantly, despite substantial change in social networks from T1 to T2 (an average of 43% change in network membership), I did not find that T1 participant motives predicted T2 perceived network motives after accounting for stability in participant motives over time. While not a perfect test of selection, these analyses suggest that selection, as conceptualized in the current study, is not occurring. It may be that selection is more likely to occur for alcohol use behaviors (e.g., Reifman et al., 2006) than for motives. To feel accepted and to have shared experiences with alcohol, individuals may be more concerned about whether they and their network members engage in similar patterns of alcohol use, than whether they engage in alcohol use for similar reasons. Moreover, selection may also happen over a longer period, may not have been captured due to the moderate stability within networks, or may be based on other characteristics (e.g., personality).

Of note, the effects of network motives on participant motives in the current sample were stronger than those reported in previous studies (i.e., regression coefficients of .19-.43 in the current study vs. .08-.14 [Kuntsche & Stewart, 2009] and .07-.15 [Stewart et al., 2014]). There are several possible explanations for this. First, the strength of this association may be the result of the study design, which used participant perceptions rather than actual motives of network members. It is possible a false consensus effect is occurring (Ross et al., 1977), wherein individuals are viewing others to have more similar drinking motives to their own than they actually do. This perceived similarity would likely translate into larger effects. Second, there may be greater amounts of homophily (i.e., selection) occurring in the current sample. Network members in both Kuntsche and Stewart (2009), and Stewart et al. (2014) were limited to

classmates/schoolmates. In contrast, participants in the current study were able to choose from anyone who was close to them. Thus, one possibility is that the stronger effects reflect participants purposefully forming relationships with others who drink for similar reasons. While the CLPM model did not suggest selection effects occurred between T1 and T2, the design of the current study may not have captured such effects. Regardless of the explanation, my results indicate perceived motives in the social network are strong predictors of one's own drinking motives. Thus, emerging adults' perceptions of "why" others in their network drink, appear to be impacting "why" they are drinking themselves.

The second set of analyses extended the CLPM results and indicate social network motives indirectly impact participants' binge drinking frequency through participants' own drinking motives, lending support to predictions emerging from social learning theory about how others influence our own behavior (i.e., by way of influencing our motivations; Bandura, 1969). I found the higher the enhancement, conformity, or coping-with-anxiety motives were perceived to be present in the network, the higher participant's own enhancement, conformity, or coping-with-anxiety motives, respectively, and in turn, the more frequent participants' binge drinking.

In contrast to my second hypothesis, both perceived coping-with-depression and social motives did not indirectly impact participant binge drinking. Given perceived network social motives did not predict increases in participants' own social motives between T1 and T2, it is not surprising that they did not indirectly predict participant binge drinking. For coping-with-depression, perceived coping-with-depression motives of network members predicted participants' own coping-with-depression motives; however, these motives did not go on to predict participant binge drinking. In contrast,

perceived coping-with-anxiety motives of network members predicted participants' own coping-with-anxiety motives, which in turn went on to predict binge drinking. It is possible these differing relationships may reflect my chosen outcome of binge drinking. Coping-with-depression is theorized to have a strong relationship with alcohol-problems, rather than drinking behavior (e.g., Loose & Acier, 2017), while coping-with-anxiety motives have been linked to drinking behavior (e.g., Mezquita et al., 2011).

My results have notable implications. With respect to understanding drinking motives, the perceived motives of others appear to be a significant predictor of one's own drinking motives over time. While there are clearly other predictors of drinking motives (e.g., personality; Chinneck et al., 2018), the impact of perceived motives is an important finding. With respect to potential clinical implications, as perceived drinking motives of others are an important predictor of our own drinking motives, and in turn our own drinking behavior, there may be utility in incorporating perceptions of other's drinking motives into social network interventions for alcohol misuse. When determining if one needs to end risky relationships or avoid certain drinking scenarios to reduce alcohol misuse (e.g., Daley & Douaihy, 2019), it may be helpful to ask about the perceived motives of individuals in those relationships or scenarios. Additionally, these results may lend additional insight into case conceptualization of a client's alcohol misuse (i.e., when trying to understand the "why" of the drinking behavior).

Limitations and Future Directions

My study has several limitations. First, I only had two waves of data. While this is an improvement on a largely cross-sectional literature, a longitudinal design with at least three waves would better control for the role of time within the mediational analysis (e.g.,

help to more accurately capture the cause and effect of a process that is developing over time; Reichardt, 2011). Second, while I did not find evidence of selection, it is possible four months between waves was not the ideal timeframe for capturing selection effects. Moreover, I did not provide an optimal test of selection, which is best investigated by examining new network members; on average over half of the network was stable in members. Third, I chose to study participant perceptions, rather than actual motives of network members, as I believe perceptions likely have a greater impact on participant behaviors; however, perceptions may be inaccurate. Indeed, in the current study, participants perceived the majority of motives to be more highly endorsed by social network members, than by themselves. If this inaccuracy is confirmed via more statistically advanced techniques (e.g., Truth and Bias Analyses; West & Kenney, 2011), interventions targeting normative misperceptions (e.g., Dotson et al., 2015) may be useful for alcohol motives. Future research should investigate the accuracy of perceived network motives to determine if an adapted social norms intervention may be relevant. Fourth, my dataset involved an alcohol-cannabis co-using sample, which may be different than an alcohol-only sample (e.g., co-use samples have been found to demonstrate higher levels of alcohol-related problems and different patterns of use than alcohol-only samples; see Yurasek et al., 2017 for a review). Finally, my sample was also predominantly White. As such, my results may not generalize to other more diverse samples

Conclusion

My study examined the influence of perceived drinking motives in the social network on the drinking motives and, in turn, drinking behaviors of emerging adults. Results support the presence of social influence, but not selection. Notably, perceived

network motives for enhancement, conformity, and coping-with-anxiety indirectly predicted participant's binge drinking frequency over time through participants' own motives. Thus, it is not only perceptions of how much or how often network members drink that influences one's binge drinking (e.g., Reifman et al., 2006), but also perceptions of why our network members drink.

Table 6.1. Study 3 Correlations Between Study Variables

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	
1. BD T1	-																						
2. BD T2	.54	-																					
3. Net enhance T1	.09	.04	-																				
4. Net social T1	.07	.09	.63	-																			
5. Net con T1	<u>.18</u>	<u>.19</u>	.28	.40	-																		
6. Net CWA T1	.14	.02	.33	.23	.46	-																	
7. Net CWD T1	.09	-.06	.27	<u>.17</u>	.42	.88	-																
8. Net enhance T2	.05	.10	.52	.35	.08	<u>.16</u>	.13	-															
9. Net social T2	-.05	.06	.37	.54	.24	.13	.07	.52	-														
10. Net con T2	.13	.24	.27	.34	.62	.42	.36	.31	.41	-													
11. Net CWA T2	-.03	.07	.14	.12	.33	.66	.61	.25	.25	.59	-												
12. Net CWD T2	.04	.04	<u>.16</u>	.14	.33	.63	.71	.21	.19	.57	.87	-											
13. Enhance T1	.23	.14	.64	.32	<u>.17</u>	<u>.18</u>	<u>.17</u>	.35	.22	.23	-.03	.00	-										
14. Social T1	.21	.23	.22	.39	<u>.16</u>	.13	.06	.13	.30	.26	.10	.08	.30	-									
15. Con T1	.03	.12	.04	.09	.42	.19	<u>.16</u>	.00	.18	.30	.10	<u>.16</u>	.09	.09	-								
16. CWA T1	.13	.12	<u>.15</u>	.08	<u>.18</u>	.53	.49	.10	.12	.25	.32	.35	.21	.10	.27	-							
17. CWD T1	<u>.16</u>	.15	.11	.01	.23	.51	.53	.04	-.03	<u>.17</u>	.25	.34	.22	.07	.24	.68	-						
18. Enhance T2	.15	.25	.44	.14	.07	<u>.18</u>	<u>.16</u>	.42	.16	<u>.17</u>	.14	.13	.52	.12	.04	.27	.23	-					
19. Social T2	.11	<u>.23</u>	.22	.31	.09	.07	.03	<u>.19</u>	.38	.14	.14	.09	<u>.17</u>	.44	.13	.06	.01	.32	-				
20. Conf T2	<u>.22</u>	.33	.12	.21	.53	.35	.32	.08	<u>.19</u>	.55	.36	.37	.13	<u>.21</u>	.42	.31	.27	.06	<u>.19</u>	-			
21. CWA T2	.04	.14	.09	.04	.15	.39	.38	.04	-.04	.20	.37	.39	.08	.05	.09	.45	.47	.27	.00	<u>.17</u>	-		
22. CWDT2	.10	.04	-.01	-.04	.16	.40	.41	-.06	-.13	.15	.29	.42	.06	-.09	.14	.36	.49	.15	-.12	.23	.57	-	
Mean	2.64	2.44	75.2	83.0	53.2	50.2	44.6	71.1	76.9	48.9	49.4	44.4	66.5	78.6	28.5	38.1	26.4	62.9	72.8	30.2	35.3	29.8	
SD	1.16	1.16	14.5	10.7	22.2	21.2	23.0	18.5	18.5	23.1	22.1	22.8	29.4	22.2	32.0	30.2	31.1	25.5	18.5	29.7	32.9	30.1	

Underline = $p < .05$; Bold = $p < .01$ ** Note. Correlations represent Spearman's rank correlations in the imputed data set. BD T1 = binge drinking frequency at T1; BD T2 = binge drinking frequency at T2; Net enhance T1 = perceived enhancement motives for social network members at T1; Net social T1 = perceived social motives for social network members at T1; Net con T1 = perceived conformity motives for social network members at T; Net CWA T1 = perceived coping-with-anxiety motives for social network members at T1; Net CWD T1 = perceived coping-with-depression motives for social network members at T1; Enhance T2 = participants' own enhancement motives at T2; Social T2 = participants' own social motives at T2; Con T2 = participants' own conformity motives at T2; CWA T2 = participants' own coping-with-anxiety motives at T2; CWD T2 = participants' own coping-with-depression motives at T2. The range in possible scores for each motives measure is 0-100. The mean score on the

binge drinking measure of 2.44 (T1) and 2.64 (T2) on the 0-7 scale indicates binge drinking between three and four times per month. CWD T1 and CWD T2 means and SDs are presented before \log_{10} transformations for ease of interpretation.

Table 6.2. Study 3 Model fit and Regression Coefficients for Cross-Lagged Panel Model

Motive	T1 perceived network motives predicting T2 network motives (a)	T1 participant motives predicting T2 participant motives (b)	T1 perceived network motives predicting T2 participant motives (c)	T1 participant motive predictive T2 perceived network motives (d)	Covariance between T1perceive d network and participant motives	Covariance between T2 perceived network and participant motives	T2 perceived network motives R ²	T2 participant motives R ²
Enhancement β	0.50	0.43	<u>0.20</u>	0.03	0.64	0.24	0.33	0.27
Social β	0.48	0.35	0.11	0.09	0.34	0.30	0.27	0.16
Conformity β	0.58	0.27	0.43	0.03	0.37	0.31	0.36	0.34
CWD β	.71	0.34	<u>0.20</u>	-0.08	0.53	<u>0.19</u>	0.45	0.23
CWA β	0.62	0.35	<u>0.19</u>	-0.04	0.53	0.19	0.36	0.23

Underline = $p < .05$; Bold = $p < .01$ Note: Regression coefficients are standardized. (a) – (d) correspond to paths in Figure 6.1. Enhancement = BAMB enhancement motive item; Social = BAMB social motive item; Conformity = BAMB conformity motive item; CWD = BAMB coping-with-depression item; CWA = BAMB coping-with-anxiety motive. As the CLPM model was fully saturated, fit statistics are not displayed or interpreted.

Table 6.3. Study 3 Model fit and Regression Coefficients for Indirect Effect of T1 Perceived Network motives on T2 Binge Drinking.

Motive	Robust CFI	Robust TLI	Robust RMSEA	T1 perceived network motives predicting T2 participant motives (a)	T2 participant motives predicting T2 binge drinking (b)	Mediated effect (T1 network motive to T2 binge drinking through participant motives (a*b))	T1 perceived network motives predicting T2 binge drinking (c)	T1 participant motives predicting T2 participant motives (d)	T1 binge drinking predicting T2 binge drinking (e)	Covariance between T1 binge drinking frequency and T1 network motives	Covariance between T1 binge drinking frequency and T1 participant motives	Covariance between T1 perceived network motives and T1 participant motives	T2 participant motive R ²	T2 binge drinking R ²
Enhance	1.00	1.01	0.00	0.20	0.22	.04	-.08	0.43	.50	0.02	0.20	0.64	0.33	0.30
Social	1.00	1.05	0.00	0.11	0.23	.03	-0.01	0.35	0.50	0.06	0.21	0.45	0.16	0.31
Conform	1.00	1.00	0.02	0.43	0.27	.12	-0.06	0.27	0.47	<u>0.19</u>	0.03	0.37	0.35	0.33
CWD	0.99	0.96	0.05	0.20	0.05	.01	-0.12	0.34	0.52	0.08	0.15	0.53	0.23	0.28
CWA	1.00	1.06	0.00	<u>0.19</u>	<u>0.16</u>	.03	-0.10	0.35	0.52	0.11	0.53	0.12	0.23	0.30

Underline = $p < .05$; Bold = $p < .01$ Regression coefficients are standardized. (a) – (e) correspond to paths in Figure 6.2. CFI = comparative fit index; TLI = Tucker-Lewis index; Enhance = BAMB enhancement motive item; Social = BAMB social motive item; Conform = BAMB conformity motive item; CWD = BAMB coping-with-depression item; CWA = BAMB coping-with-anxiety motive.

Table 6.4. Study 3 Self-other Discrepancy Calculations

Motive	T1 Self-Other Discrepancy (<i>SD</i>)	T2 Self-Other Discrepancy (<i>SD</i>)
Enhancement	8.55 (19.99)	8.56 (25.03)
Social	4.20 (17.73)	4.08 (22.87)
Conformity	24.57 (29.88)	20.41 (26.10)
Coping-with-anxiety	11.89 (28.16)	15.65 (29.99)
Coping-with-depression	18.15 (26.85)	17.86 (29.42)

Note: Positive values indicate that perceived network motives were greater than own motives; negative values indicate that own motives were greater than perceived network motives. Difference scores can range from 0-100.

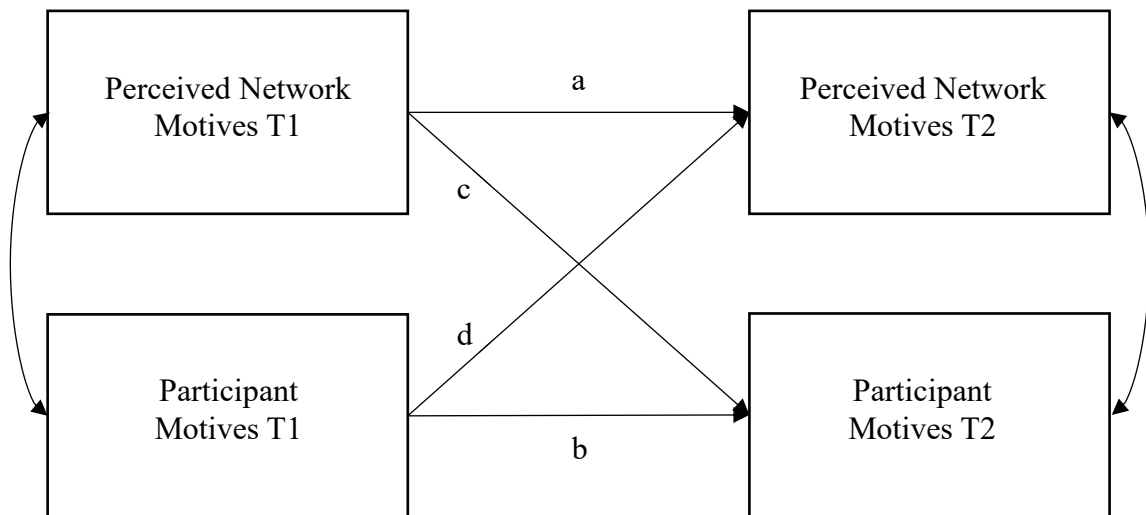


Figure 6.1. Cross-lagged panel model of perceived network motives and participant motives at T1 and T2.

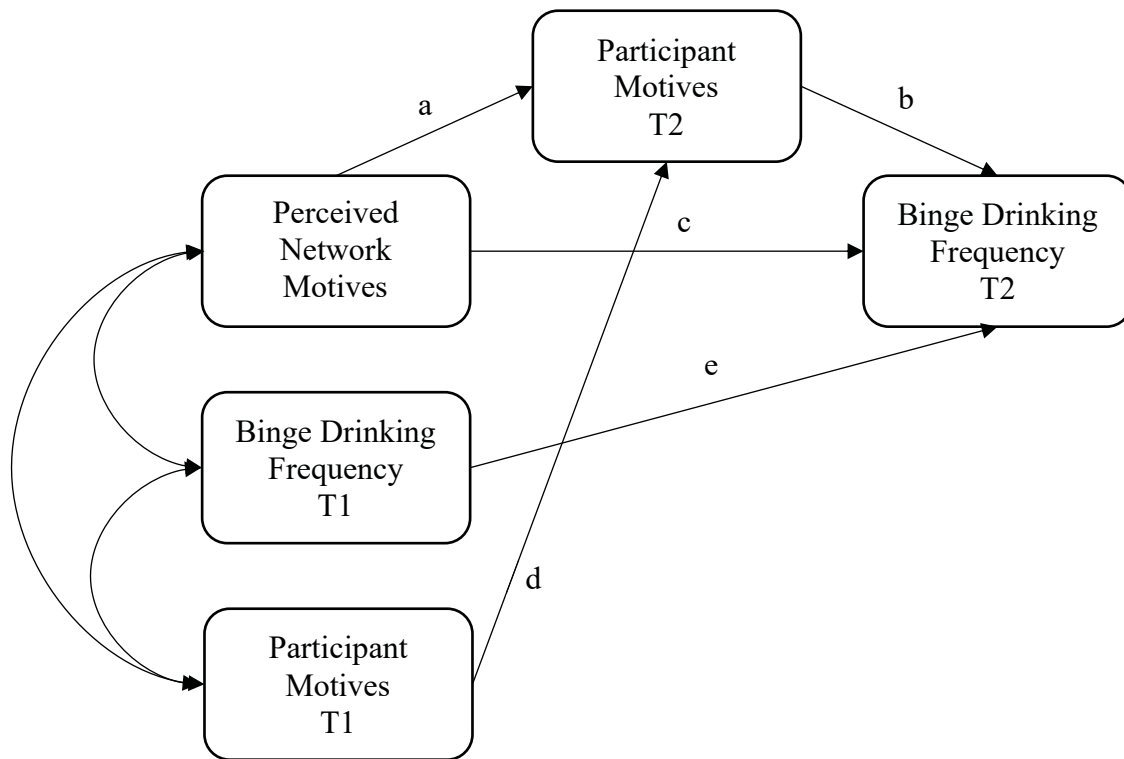


Figure 6.2. Model predicting indirect effects of perceived network motives on participant binge drinking frequency via participant motives.

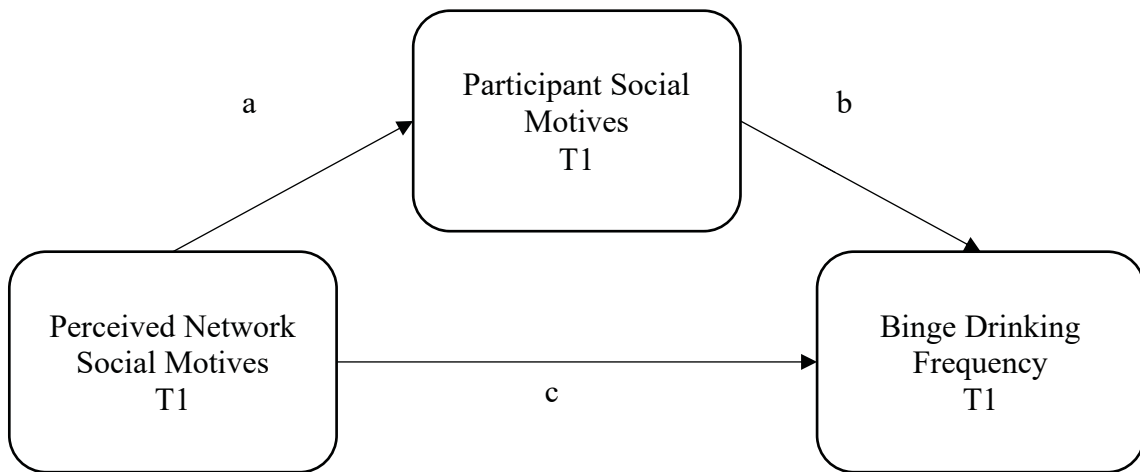


Figure 6.3. Post-hoc cross-sectional social motives mediation.

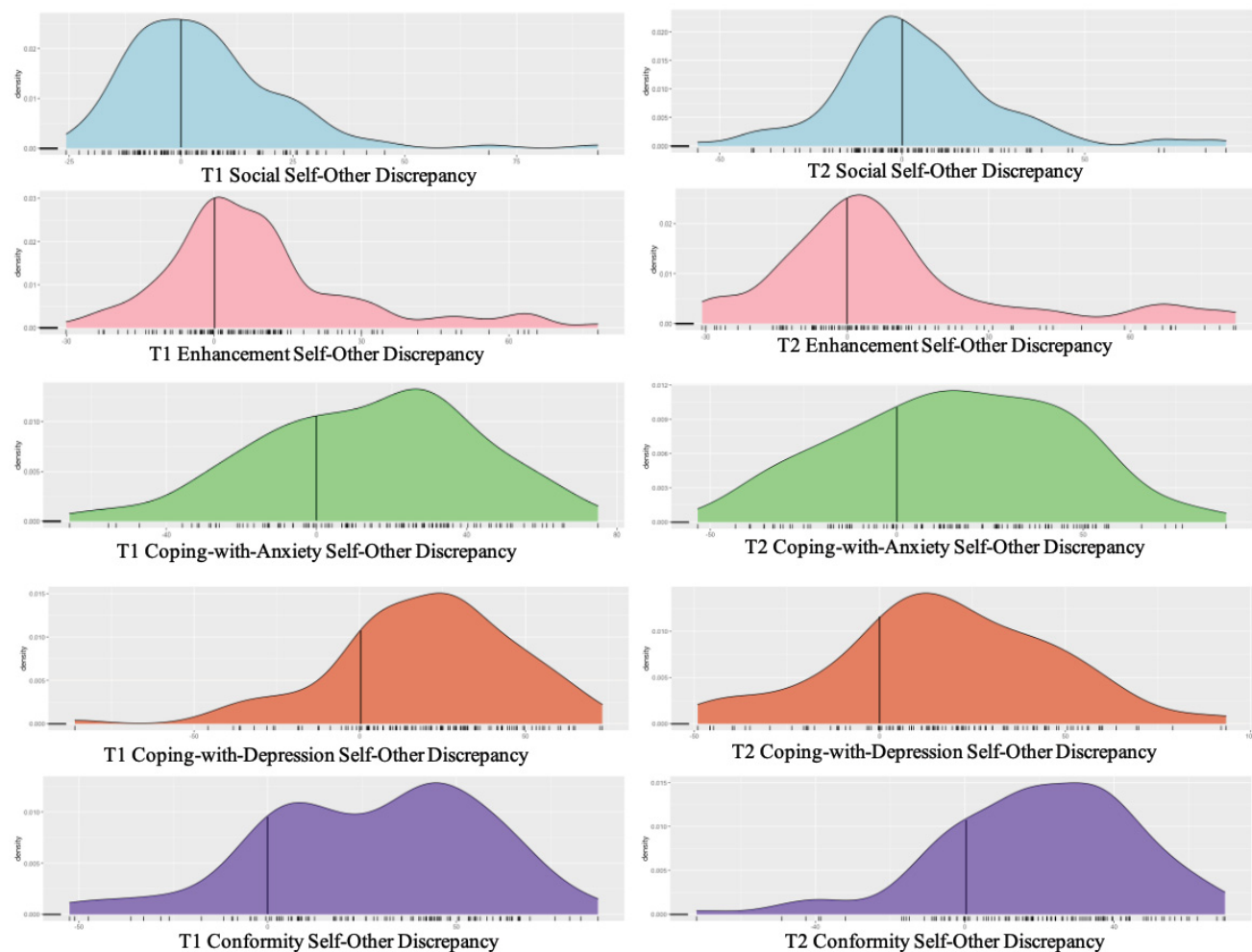


Figure 6.4. Graph illustrating distribution of self-other discrepancies. Values of zero indicated perfect accuracy. Values below zero suggest a negative self-other discrepancy (i.e., underestimation of network motives), while values greater than zero suggest a positive self-other discrepancy (i.e. overestimation of network motives). The vertical line marks 0.

CHAPTER 7. TRANSITION FROM STUDY 3 TO STUDY 4

The results of Study 3 align with findings from the broader egocentric social network literature suggesting the perceptions of alcohol-related variables in one's social network are important (e.g., Kenney et al., 2018; Massengale et al., 2016; Russell et al., 2020). Given this documented association between perceptions of social network members and alcohol use, researchers have investigated whether perceptions of alcohol use align with social network members' reports. Studies suggest emerging adults are generally accurate in their perception of close peers' drinking quantity (Kenney et al., 2017), drinking frequency (Mason et al., 2019), binge drinking frequency (Cox et al., 2019), drinking status (Reid et al., 2020), and maximum drinks per day (Reid et al., 2020).

Notably, despite this overall accuracy, several studies indicate perceptions of peer use are not immune to perceiver bias. Mason et al., Kenney et al., Reid et al., and Henry et al. (2011) found perceivers' own alcohol use biased their perceptions of peers' alcohol quantity, frequency, drinking status (i.e., abstainer or drinker), and maximum drinks per day (i.e., perceptions of peer use are pulled towards the perceiver's own alcohol use). This suggests the presence of the false consensus effect where individuals believe others are more similar to themselves than they really are and project their own behaviors onto others (Ross et al., 1997); however, it appears the false consensus effect does not overpower accuracy effects, which are often considerably larger (Reid et al., 2020). In the minority of studies that find the false-consensus effect to be larger, studies often have significant methodological flaws (e.g., Scalco et al., 2016⁵). Importantly, the presence of the false consensus effect is not universal:

⁵ In Scalco et al. (2016), participants were asked whether any of their closest three friends had ever previously used alcohol (yes/no). Following this, one of their *four* closest friends was recruited to report on whether they had ever used alcohol. This recruited friend's

two studies have not found evidence of such bias in perceptions of others' drinking status (Reid et al., 2020) or alcohol frequency (Mason et al., 2019). Thus, whether the false consensus effect is found to be present or not, most studies support the supposition that emerging adults are generally accurate in their perceptions of close friends' alcohol use behaviors.

It is important to note that the above-mentioned accuracy literature stands in contrast to literature examining the accuracy of perceptions of alcohol use among distal peer groups. A significant number of studies demonstrate emerging adults consistently overestimate alcohol use of distal peer groups such as fellow university or college students (e.g., Dumas et al., 2019; Franca et al., 2010). These discrepant accuracy findings likely reflect the reference group about which perceptions are being reported. In the case of distal peer groups (e.g., all students on campus), perceivers do not know or spend time with all members of the peer group, and thus must base their perceptions on norms and broad observations of group members. This is likely to be less accurate than perceptions of specific close peers, which can be based on many observations of each individual peer.

Taken together, the literature on the accuracy of alcohol use perceptions is vast and varies depending on the reference group. It appears that the accuracy of alcohol use perceptions increase as one moves from distal social groups to individual close peers. Notably, this research has not yet been extended to examine the accuracy of perceptions of drinking motives in one's social network. While it is possible such perceptions follow the

response was then used to determine whether participant perceptions were accurate. It is clear that this is not an ideal way to measure accuracy. For example, if 2/3 of an adolescent's close friends have used alcohol, the adolescent may answer "yes" to the question asking if any of their close friends have used alcohol. If the one friend recruited is one of the 2 friends who have used alcohol, the participant will be categorized as accurate; however, if the one friend recruited is the friend who has not used alcohol, the participant will be categorized as inaccurate, when this is not the case. Moreover, if the recruited member is the fourth friend listed, and thus was not included within the question asking adolescents to report on their *three* closest friends, the use of the recruited friend would not have been considered in the participant's perceptions.

same accuracy pattern (i.e., perceptions of the drinking motives of individual close peers are more accurate than perceptions of the drinking motives of distal social groups), drinking motives differ from alcohol use in an important way – while alcohol consumption can be directly observed (i.e., people can be seen consuming a drink), drinking motives are not always directly observed since they are internal, cognitive processes, that may not be outwardly communicated. Thus, drinking motives are likely not as observable in nature as alcohol consumption, and must therefore be inferred. As such, perceptions of the drinking motives of others may be less accurate than perceptions of general alcohol use.

Investigating the accuracy of drinking motive perceptions is important for three main reasons. First, understanding the accuracy of drinking motives perceptions would help to clarify the results of Study 3; I found the strength of the relationship between network motives and participant motives to be notably stronger than previous studies (i.e., Kuntsche & Stewart, 2009; Stewart et al., 2014). Currently, it is not clear if the strength of the current results reflects my use of participant perceptions (which may be biased by the false consensus effect; Ross, 1977), and/or if it reflects the developmental stage of the participants (emerging adulthood vs. adolescence). Additionally, as motives are thought to mediate the impact of social influence on alcohol use, future social network research incorporating motives into models of social influence on alcohol use is warranted. As such, in addition to providing context for the results of Study 3, understanding the accuracy of motive perceptions will provide context for the interpretation of future social network studies.

Second, given Study 3 suggests drinking motive perceptions have a significant impact on individuals' own drinking motives, understanding whether these perceptions reflect reality allows for intervention targeting. For example, should participants be overestimating the

presence of risky drinking motives in their networks, normative interventions or psychoeducation may be relevant (see Dempsey et al, 2018). Such interventions have been shown to be effective with alcohol use social norm misperceptions, which like motives perceptions, often predict participants' alcohol use (Arbour-Nicitopoulos et al., 2010). For example, normative feedback has been found to effectively alter alcohol use social norms misperceptions, as well as subsequent alcohol consumption (e.g., Neighbors et al., 2004). Notably, emerging research suggests such normative feedback may also be effective for drinking motives (Blevins & Stephens, 2016). In contrast, should participants be accurately perceiving the drinking motives of others, interventions aimed at reducing the risky drinking motives of individuals and networks may be more relevant (e.g., public health messaging, therapeutic suggestions to develop alternative social networks with individuals who have exhibited less risky motives for drinking).

Third, an examination of motive accuracy will help researchers determine which type of research design is most appropriate to answer their research questions in future. For example, if motives perceptions are found to be accurate, researchers can more comfortably utilize egocentric designs, which are more feasible and cost effective. If motives perceptions are found to be inaccurate, researchers will be faced with the choice of recruiting actual network members to report on their motives directly or relying on (inaccurate but predictive) participant perceptions. Either approach would likely have different results and the choice to use an egocentric design or sociocentric design would have to be defended and its limitations acknowledged.

Study 4 seeks to investigate the accuracy of emerging adults' perceptions of the drinking motives in their social networks. Using a collateral report arm attached to the

methodology of Study 3, network members were recruited to directly report on their own drinking motives. These motives were then compared to participant perceptions of network members' motives using a Truth and Bias Model to account for the false consensus effect (West & Kenny, 2011). Study 4 examines whether individuals are accurate or biased, allowing for a commentary on the utility of participant perceptions of social network drinking motives.

CHAPTER 8: ACCURACY AND BIAS IN PERCEPTIONS OF WHY SOCIAL
NETWORK MEMBERS DRINK: A TRUTH AND BIAS APPROACH TO DRINKING
MOTIVE (MIS)PERCEPTION

The manuscript prepared for this study is presented below. Readers are advised that Sara Bartel, under the supervision of Dr. Sherry Stewart and Dr. Simon Sherry, was responsible for designing the study, developing the research hypotheses, gaining ethical approval, collecting the data, preparing the data set for analyses, conducting the analyses, and interpreting the study results. Sara wrote the initial draft of the manuscript and received and incorporated feedback from her co-authors. Sara submitted the manuscript to *Emerging Adulthood* for peer review on April 21, 2021. Bartel, S. J., Sherry, S. B., Rodriguez, L. M., & Stewart, S. H. Accuracy and bias in perceptions of why social network members drink: A truth and bias approach to drinking motive (mis)perception. Submitted to *Emerging Adulthood*.

Abstract

Objectives: Research suggests perceived drinking motives of network members influence emerging adults' own alcohol use indirectly through their own drinking motives; however, it is unclear whether these perceptions are accurate. Ascertaining the accuracy of motives perceptions will help determine the relevance of social norms interventions for drinking motives and shed light on the utility of egocentric versus direct reporting designs. **Methods:** Sixty emerging adults reported on their drinking motives and the drinking motives of a network member. Network members were recruited and reported on their drinking motives, resulting in 60 dyads. **Results:** Truth and Bias models indicated participants overestimated network members' social, enhancement, and conformity motives. Coping-with-depression and enhancement motives exhibited assumed similarity. Participants were pulled toward the truth for social, coping-with-anxiety, and coping-with-depression motives. **Discussion:** Most motive perceptions were heavily or singularly influenced by bias. Whether to include actual and/or perceived motives in research designs should be carefully considered.

Keywords: drinking motives; Truth and Bias analysis; social network; perceptions

Introduction

Drinking motives, the reasons that one chooses to consume alcohol, are consistently linked to alcohol use and misuse (Cooper et al., 2016). Research suggests drinking motives directly predict alcohol use, as well as serve as important mediators for the effects of other predictors of alcohol use. For example, enhancement motives (drinking to experience positive feelings) and coping motives (drinking to manage negative affect) directly predict heavy drinking and alcohol-related problems, respectively (Cooper et al., 2016). At the same time, research indicates enhancement and coping motives mediate the relationship of personality variables, such as extraversion or impulsivity, with alcohol-related outcomes (e.g., alcohol use, alcohol-related problems; Kuntsche, von Fischer, et al., 2008; Littlefield et al., 2010). Similar examples of direct and mediated influences also exist for social motives (drinking to facilitate social affiliation) and conformity motives (drinking to reduce social censure; Bruce et al., 2011; Cooper et al., 2016; Lewis et al., 2008). Taken together, drinking motives have a clear and well-established impact on alcohol use.

Research has begun to suggest that it is not only our own drinking motives that impact our own alcohol use, but also the drinking motives of other people. At a dyadic level, Kehayes and colleagues (2019; 2021) demonstrated that the motives of both romantic partners and drinking buddies predicted participants' own drinking motives, which then went on to predict participants' own alcohol use. Similarly, at a broader level, Kuntsche and Stewart (2009) and Stewart et al. (2014) found that the drinking motives of classmates/school friends predicted participants' own drinking motives, which then went on to predict participants' own alcohol use. This emerging field of research suggests that one may adopt

others' reasons for drinking, and that this helps explain social influences on one's own alcohol use.

Recently, the study of social influence and drinking motives expanded to examine participant perceptions of the drinking motives of social network members (i.e., why participants believe others are drinking), rather than asking social network members to report on their own drinking motives (Study 3; Cloutier et al., 2021). This research indicates that like social network members' direct reports, perceptions of social network members' drinking motives are significantly correlated with participants' own drinking motives (Study 3; Cloutier et al., 2021). Notably, Study 3 replicated previous findings (Kuntsche & Stewart, 2009; Stewart et al., 2014) in a longitudinal egocentric social network design with emerging adults, finding even stronger effect sizes between perceived social network motives and one's own motives than previous work using direct reports from network members. This is an exciting methodological advancement, as it allows for the study of broader self-selected social networks and suggests the possibility that perceptions of motives may have a stronger effect on alcohol use than actual motives within the social network.

One question that remains is "How accurate are individuals' perceptions of the drinking motives of others in their social network?" Research regarding the accuracy of perceptions of other alcohol-related behaviors in the social network suggests adults are fairly accurate in their perceptions of close social network members. For example, Cox et al. (2019), Kenney et al. (2017), and Mason et al. (2019) found perceptions of close friends' and peers' drinking behaviors to be relatively accurate. Similarly, even after using a statistically advanced approach (i.e., Truth and Bias analyses; West & Kenny, 2011) to account for the false consensus effect (i.e., assuming others are similar to oneself; Ross et al., 1977), Reid et

al. (2020) found perceptions of friends' drinking status (i.e., abstainer, light drinker, etc.) and maximum drinks per day were fairly accurate (i.e., significant accuracy effect within the Truth and Bias model).

Despite these results, some research suggests perceptions of peers' alcohol use are inaccurate (e.g., Dumas et al., 2019; Scalco et al., 2016). These studies tend to have methodological differences that may account for discrepancies between perceptions of peers' drinking and peers' actual drinking. For example, one study found adolescents' perceptions of close friends' alcohol use are biased in the directions of individuals' own alcohol use (e.g., Scalco et al., 2016); however, this study did not ask participants to report on the alcohol use of specific friends. Instead, this study required participants to report on general close friend use (e.g., "Tell whether or not any of your three close friends have ever used alcohol"), and this report was then compared to the use of one close friend from the list (Scalco et al., 2016). The resulting findings of inaccuracy may reflect the fact that participants provided one report across friends, which would not be accurate for individual friends if friends have discrepant patterns of use. Other studies show individuals overestimate the drinking of their peers (e.g., Dumas et al., 2019); however, these studies ask about more distal peer groups (e.g., other students on a college campus, rather than close friends or specific individuals), which again are likely to be associated with less accurate perceptions. Together, these findings suggest alcohol use perceptions may become less accurate as they become more distal and if social network members are not asked about individually.

Overall, research in emerging adults suggests perceptions of others' alcohol use can be accurate, sufficing that perceptions are made in relation to close social network members and perceptions are separately made for each social network member. No published work to

date has examined whether this is also true of drinking motives perceptions. One important difference between perceptions of drinking motives and perceptions of alcohol use is that whereas others' patterns of alcohol use can be directly observed in social situations (e.g., the number of drinks consumed), drinking motives must be either inferred or transmitted verbally.

Filling this gap in the literature by ascertaining the accuracy of motives perceptions is important. Given that the perceived motives of others have been found to impact emerging adults' own motives, and in turn their own drinking behavior (Study 3), if emerging adults are largely overestimating the risky motives of others (e.g., enhancement motives, coping motives; Cooper et al., 2016), interventions targeting these misperceptions may reduce the presence of own risky drinking motives and in turn impact own drinking behavior. For example, if an individual believes their social network members are drinking for enhancement reasons (a motive associated with risky alcohol misuse; Cooper et al., 2016), when they are truly drinking for social reasons (a motive associated with the most benign alcohol use outcomes; Cooper et al. 2016), providing corrective information about social network members' motives may reduce a participant's own enhancement motives and thereby their risky binge drinking. If, on the other hand, motives perceptions are found to be accurate, a broader intervention addressing motives at a social network or societal level may be more appropriate (e.g., changes to the social network to choose network members with less risky motives). Similar assertions have been made and justified regarding the importance of investigating alcohol consumption perceptions in social networks (e.g., Reid et al., 2020). Given rates of harmful alcohol use are particularly high in emerging adulthood, research that may aid in understanding and intervening in such alcohol use is essential (Canadian Centre

on Substance Use and Addiction, 2017; Substance Abuse and Mental Health Services Administration, 2013).

I sought to fill the aforementioned gaps in the literature by examining the accuracy of perceptions of drinking motives in one's social network in a sample of emerging adults using an advanced statistical approach – namely Truth and Bias analysis (West & Kenny, 2011). I was specifically interested in examining accuracy of perception (truth), assumed similarity (i.e., projecting one's own drinking motives onto others; bias), and systematic over- or under-estimation of the drinking motives in one's social network (i.e., drinking motives social norms misperceptions; bias). Given the literature suggests adults are relatively accurate in their perceptions of social network members' alcohol use, I hypothesized [H1] that all drinking motives perceptions would be demonstrate a significant accuracy effect, suggesting they align with network members' self-reported behavior. I also hypothesized [H2] that assumed similarity would be present, whereby participants would assume social network members have similar drinking motives to themselves; however, I expected that the assumed similarity effects would not be as strong as the accuracy effects. With respect to a systematic under- or over-estimation of drinking motives, I hypothesized [H3] that participants would overestimate social and enhancement motives, as they are the most frequently endorsed and socially accepted drinking motives (Cooper et al., 2016). I also hypothesized [H4] participants would underestimate conformity and coping drinking motives as they are the least-commonly endorsed (Cooper et al., 2016), may be associated with negative connotations (e.g., poor coping, mental health difficulties; Grazioli et al., 2018; Kenney et al., 2013) that participants may not want to connect to their close relationships (i.e., may not want to report on “negative characteristics” of social network members), and may not be

openly discussed. I also sought to investigate the moderating role of relationship closeness, as increased levels of relationship closeness may improve accuracy (i.e., because participant's may know their social network members more intimately). As relationship closeness has not previously been explored in the motives perception literature, I did not make hypotheses regarding the nature of this potential moderation and our examination of relationship closeness as a moderator should be considered exploratory.

Methods

Participants

Sixty emerging adults (mean age = 21.57; range = 19-25; $SD = 1.90$; male = 17; female = 42; intersex = 1; 68% university students) and sixty of their social network members (mean age: 23.83; range = 18-50; 76% emerging adults; male = 25; female = 34; intersex = 1⁶) participated in the current study (i.e., one social network member per participant). According to the 60 emerging adult participants, on average, dyads had known each other 6.92 years ($SD = 6.74$; range = .25-23 years) and had contact with each other either in person, by phone, or via social media 5.40 days of a typical week ($SD = 2.12$). Twenty-seven participants indicated the type of relationship they had with the member of their dyad (friends = 13, romantic partner = 6, roommate = 4, siblings = 3; co-worker = 1)⁷. Half of all dyads were same-sex (50.00%; 24 F-F; 6 M-M), while the other half were mixed-sex (50.00%; 18 F-M; 1 M-intersex; 1 intersex-M; 10 M-F). In terms of racial identity, 78.4% of the 60 emerging adult participants identified as White, 16.8% identified as biracial

⁶ Note that due to an uneven sex distribution, we were unable to examine sex as a moderator. Recent close network research has found a similar variable (gender) not to impact accuracy or bias of alcohol-related perceptions (Reid et al., 2020).

⁷This information was initially not collected; however, once it was recognized it may provide additional context for the results, a question assessing relationship type was added to the study.

or multiracial, and 4.8% identified as Black, Middle Eastern, or Other. To be included in the study, the emerging adult participants had to report using alcohol \geq four times, and using cannabis recreationally \geq two times, in the past month. Note that the cannabis use criterion was for another arm of the research study (Bartel et al., 2020). Beyond knowing the referring participant, there were no inclusionary or exclusionary criteria for social network members; however, 100% of recruited social network members reported using alcohol (i.e., were not abstainers) and 76.3% reported using cannabis.

Measures

Brief Alcohol Motives Measure

All participants and social network members completed the Brief Alcohol Motives Measure (BAMM; Study 2), a 6-item measure of alcohol motives based on the Modified Drinking Motives Questionnaire – Revised (MDMQ-R; Grant et al., 2007). This measure was included instead of the MDMQ-R to reduce participant burden caused by the egocentric nature of the data set. The BAMM assesses own enhancement, social, coping-with-depression, coping-with-anxiety, conformity, and expansion drinking motives. Each of the six items includes a brief general statement describing an alcohol use motive, as well as two specific examples of the motive within parentheses [e.g., “In the past 30 days, I’ve used alcohol because it’s a good way to socialize with others (*e.g., because it makes social gatherings more enjoyable or to be sociable*)”]. Response options are in the form of a sliding visual analog scale with anchors of “Never” and “Always”. Each item is scored individually from 0-100. As indicated by a sample of experts, the BAMM has excellent face validity and content validity (Study 2). The BAMM has moderate to strong correlations with the MDMQ-R, indicating good convergent validity. The BAMM also has comparable test-retest

reliability with the MDMQ-R ($r = .35-.67$; a level that would be expected for a trait-state variable; Windle & Windle, 2018). Furthermore, the BAMB has adequate concurrent validity (e.g., concurrently predicts drinking levels) and predictive validity (e.g., prospectively predicts alcohol-related problems; Study 2).

Social Network Member Perceptions Questionnaire.

This measure asked participants to report on their social network member and their relationship with that individual. Questions assessed 1) relationship closeness using the Inclusion of Other in Self Scale (Aron et al., 1992), a pictorial single-item measure in which individuals are asked to rate the extent to which they are connected to another person using a Venn diagram approach; 2) social network member drinking using recommended questions from the National Institute of Health (National Institute of Health, 2003); 3) social network member drinking motives using reformatted BAMB items. For the reformatted BAMB items, participants were given the following instructions: “Listed below are 6 reasons people might be inclined to drink alcohol beverages. Please decide how frequently [X’s] drinking is motivated by each of the reasons listed.” A reformatted version of each BAMB question was then given [e.g., “In the past 30 days, [X] has used alcohol because it enhances positive feelings (*e.g., because they like the feeling, or to get a high*)”]. The reformatted BAMB items were answered on the same visual analog scale and scored from 0-100.

Procedure

Participants were part of a larger study on social networks and substance use ($N = 177$; Study 3), which recruited emerging adults from university and community settings. In addition to the measures listed above, they were also asked to list 15 members of their social networks and answer questions about those individuals. Participants were compensated with

psychology credits, a \$20 CDN Amazon gift card, or a combination as remuneration. Following the completion of these measures online in the lab, participants were then given the option to provide the contact information for as many of the 15 network members they listed as possible. If contact information was given ($n = 106$ participants; 353 network members), the study team attempted to contact these social network members via phone or email. A total of 101 social network members, belonging to 60 participants, were recruited (1-4 network members per participant). Each social network member completed an online survey and was provided a \$5.00 CDN Amazon gift card as compensation for their participation. The current sample includes the 60 participants with recruited social network members and 60 of their social network members. Given my chosen data analysis approach (i.e., Truth and Bias analyses) cannot address the dependence created by having a different number of social network members for each participant, one social network member for each of the 60 participants was selected for analyses using a random number generator. The selection of one network member out of several has been done previously (Fillo et al., 2017; Reid et al., 2020). This study received institutional Research Ethics Board approval and followed Tri-council Ethical Standards (Canadian Institute of Health Research, 2018).

Data Analysis Approach

To test if participants tended to be accurate or biased in their perceptions of the drinking motives of their social network members, I conducted regression analyses using the Truth and Bias model of judgement (West & Kenny, 2011). As my sample included participants reporting on themselves and their network members, as well as network members reporting on themselves (but not on the participants), a multilevel modeling approach within the Truth and Bias framework was not appropriate.

My model tested three distinct influences on participant perceptions of network members' drinking motives: the directional bias, the truth force, and the bias force. The directional bias assesses how attracted perceivers are to a particular end of the judgement scale and represents the difference between the mean of the truth and the mean of the judgement (West & Kenny, 2011). In the current study, the directional bias represents the difference between the mean of social network members' actual motives scores and the mean of participant judgements of social network members' motives scores (i.e., systematic over- or under-estimation). The truth force assesses the extent to which judgements are being pulled towards the truth (West & Kenny, 2011). In the current study, the truth force assesses how strongly participant judgements of network members' motives are pulled towards the actual motives scores of network members. [Note that truth and bias analyses assume that social network members' reports of their own behavior are the truth (i.e., social network members' self-reports reflect their 'true' motives).] The bias force (also referred to as "assumed similarity") assesses the extent to which judgements are being pulled towards one's own scores on the same variable (West & Kenny, 2011). In the current study, the bias force represents the extent to which participants' judgements of social network members' motives are being driven by participants' own motives scores.

In my regression models, the truth value (social network members' reports of their own motives) and the bias value (participants' own motives) are independent variables predicting participant judgements of their network members' motives. To ascertain whether truth or bias effects were moderated, the models were also run to include relationship closeness as a moderator. A main effect of relationship closeness represents a moderation of the directional bias, while the interaction between relationship closeness and the truth value,

or relationship closeness and the bias value represent relationship closeness moderating the truth and bias forces, respectively. I ran models for social, enhancement, conformity, coping-with-anxiety, and coping-with-depression motives separately. In accordance with recommendations for Truth and Bias analyses (West & Kenny, 2011), I grand mean centered participants' judgements of their social network members' motives (the outcome), as well as participants' own motives (bias value) on the sample mean of social network members' actual motives (truth value). I grand mean centered relationship closeness on the sample mean for the moderator variable.

The intercept of my model represents a directional bias, with a positive value (>0) indicating participants tended to report social network members had higher scores on a particular drinking motive than the network members actually reported about themselves (i.e., overestimation), and a negative value (<0) indicating participants tended to report social network members had lower scores on a particular drinking motive than the network members' actually reported about themselves (i.e., underestimation). The directional bias is reported in units (0-100) on the BAMM. The slope of the relationship between participants' perceptions of the motives of social network members and social network members' reports on their own motives (i.e., truth value) represents the extent of accuracy in their perceptions of the motives of social network members. A significant positive slope indicates agreement between participants' judgements of social network members' motives and social network members' reports on their own motives. Finally, the slope of the relationship between participants' perceptions of the motives of social network members and participants' own motives (i.e., bias value) represents whether participants assume their social network members have similar motives to themselves. A significant positive slope suggests

participant judgements tend to be skewed towards their own motive scores (i.e., assumed similarity), while a significant negative slope suggests participant judgements tend to be skewed away from their own motives scores (i.e., assumed dissimilarity).

It is important to note that perceptions can simultaneously have significant accuracy and bias effects; participants may accurately track whether social network members have low, moderate, or high levels of a drinking motive, while at the same time, also being biased towards their own motives or systematically over- or under-estimating the network members' motive. Let us use enhancement motives as an example: a significant accuracy effect for enhancement motives would represent that when social network members highly endorse drinking for enhancement reasons, they are perceived to drink for enhancement reasons at a high level. A positive directional bias would mean that social network members are perceived to generally drink for enhancement reasons to a greater extent than they actually report themselves. A significant positive effect of assumed similarity bias would mean that the individual projected their own level of enhancement motives onto their social network member (i.e., if the individual has high enhancement motives, the social network member is also perceived to have high enhancement motives). All three of these effects could occur simultaneously – in this context it would indicate that while social network members who highly endorse drinking for enhancement reasons are being perceived to drink for enhancement reasons at a high level, there is also a mean-level bias, such that network members are perceived to endorse enhancement motives to greater extent than the social network members report. Moreover, while generally correlating with network members actual motives, judgements are also skewed towards the individual's own motives. Ultimately, the Truth and Bias Model predicts participant perceptions using actual social

network members' motive scores and participants' own motive scores, each of which may predict significant variance, and/or may result in an intercept that is higher or lower than zero.

Results

I conducted the Truth and Bias informed regression analyses in SPSS Version 26.0. A total of 0-2 data points were missing from bias, perception, and truth variables for each motive (i.e., participants did not answer a question). These missing data were handled via list-wise deletion resulting in N 's = 58-60 per analysis. All assumptions of linear regression were met, and no univariate or multivariate outliers were detected. All residuals were screened and appeared normal. Average relationship closeness was 5.42 ($SD = 1.5$; range 1-7), indicating more than 50% overlap in self and other, suggesting a moderate to high level of perceived closeness⁸. There were no main effects of relationship closeness ($p > .05$) for any motives. Relationship closeness did not interact with any significant truth or bias effects for any motives ($p > .05$). See Table 1 for descriptive statistics and Table 2 for regression results⁹. As this is the first examination of its kind in the drinking motives literature, an a priori power analysis was not conducted; however, previous published Truth and Bias studies have had similar or smaller sample sizes (Dutra et al., 2014; Kouros & Papp, 2018; Overall et al., 2012; Wiesel et al., 2020).

⁸ Note that while this variable also existed from the perspective of social network members, I choose to use participants' perceptions of closeness, as I was interested in whether participants' own perceptions of closeness moderated the effect of truth and bias on their own motive perceptions. Descriptive statistics for closeness reported by social network members was very similar ($M = 5.31$; $SD = 1.59$; range = 1-7).

⁹ Note that standardized and unstandardized regression coefficients in my regression analyses are quite similar. This is to be expected, as all independent and dependent variables are in the same units. Other Truth and Bias models also demonstrate this. Moreover, in the current study, standard deviations of variables included in my regression analyses are reasonably similar, which means an increase in one standard deviation in one variable will predict a similar increase in standard deviation in other variables.

Social Motives

For social motives, there was a significant positive slope of the truth force suggesting judgements were biased towards the truth. There was also a significant positive directional bias, suggesting participants were overestimating the social motives of their social network members by approximately 12 points out of 100 on average. There was not a significant bias force.

Enhancement Motives

Participants were not accurate in their estimation of the enhancement motives of their social network member, as indicated by a non-significant slope of the truth force. A directional bias was present, suggesting participants were overestimating the enhancement motives of their social network member by approximately 13 points out of 100, on average. Participants also exhibited assumed similarity, as indicated by a significant positive slope of the bias force.

Conformity Motives

Participants were not accurate in their estimation of the conformity motives of their network members as indicated by a non-significant slope of the truth force. Participants did not display a significant bias towards their own conformity motives, as indicated by a non-significant bias slope. Despite this, participants exhibited a positive directional bias, suggesting participants were overestimating the conformity motives of their social network members by approximately 20 points out of 100, on average.

Coping Motives

For both coping-with-anxiety and coping-with-depression motives, there was a significant positive slope of the truth force, suggesting that participants were accurate in their

perceptions of their network members' coping motives. There was no significant intercept, suggesting participants were not systematically underestimating or overestimating the coping-with-anxiety and coping-with-depression motives of their social network members. Of note, coping-with-anxiety and coping-with-depression motives differed with respect to the bias force; there was no evidence of the bias force for coping-with-anxiety motives; however, the bias force for coping-with-depression exhibited a significant positive slope. This latter result suggests participants' judgements were positively biased towards their own coping-with-depression motives. Thus, in the case of coping-with-depression, participants were simultaneously biased (i.e., assumed similarity) and pulled towards the truth. A difference test comparing the strength of these effects indicated that judgements were not pulled more strongly towards either assumed similarity or accuracy, $t(144) = .45, p > .05$ (Robinson et al, 2013).

Discussion

My study is the first to examine the accuracy and bias of drinking motives perceptions, representing a significant advancement of the literature. Results indicated partial support for all hypotheses. Regarding H1, emerging adult participants were generally accurate in their perceptions of social network members' social, coping-with-anxiety, and coping-with-depression motives, as indicated by significant slopes for the truth bias estimates. This result is particularly notable for coping-with-anxiety and coping-with-depression motives, as coping motives are conceptualized as internal motives (Cox & Klinger, 1988). It appears that individuals are able to perceive such motives, even though they may be less observable and are often associated with drinking in solitary contexts (Skryznski & Creswell, 2020). Given this finding, it is possible that individuals may

communicate directly about drinking to cope, as is often modelled in popular culture (Atkinson et al., 2011). Thus, for social, coping-with-anxiety, and coping-with-depression motives, participants' perceptions are reasonably associated with social network members' actual motives.

In contrast, participants were not accurate in perceiving enhancement or conformity motives and also exhibited a systematic overestimation of these motives. With regard to conformity motives, this overestimation may represent the developmental stage of participants and social network members, as all participants and 76% of network members were emerging adults. Given emerging adulthood is a time of expanding social networks and identity formation (Arnett, 2005; Wrzus et al., 2013), participants may be experiencing higher pressures to fit in during this developmental stage. This context may prime participants to view drinking in new environments or with new social circles as being prompted by conformity motives for other emerging adults, more so than it is in reality. In terms of the overestimation of enhancement motives, the systematic bias may reflect the high prevalence of enhancement motives (Cooper et al., 2016). Participants may be more likely to perceive other individuals as drinking for enhancement reasons by virtue of this motive being relatively normative. This same explanation may apply to social motives as well, which participants also systematically overestimated. Notably, many media portrayals of emerging adult drinking include positive reinforcement motives such as social and enhancement motives (e.g., Atkinson et al., 2013), which may also contribute to this overestimation. Thus, H3 (participants would overestimate social and enhancement motives) was supported, while H4 (participants would underestimate conformity and coping motives) was not, and in fact there was evidence of *overestimation* in the case of conformity.

In addition, partially in support of H2, there was evidence of assumed similarity for coping-with-depression; however, this effect was not significantly smaller than the effect of the truth force. This finding suggests the false consensus effect was occurring for coping-with-depression, whereby individuals project their own drinking motives onto others and assume others have more similar drinking motives to their own than they really do (Ross et al., 1977). Moreover, this finding suggests that perceptions were biased towards assumed similarity just as much as they were pulled towards the truth in the case of coping-with-depression motives. It is notable that assumed similarity was present for coping-with-depression, but not coping-with-anxiety, motives. This may be a result of the lower base-rate of coping-with-depression motives (Study 2; Grant et al., 2007), which may skew participant perceptions. Drinking to cope with depression is often associated with negative connotations (e.g., alcohol-related problems; Cooper et al., 2016) and may not be observed as frequently due to the lower base-rate. As a result, individuals who do not drink to cope with their depression may assume those they like do not consume alcohol for that reason, as doing so would be associated with negative judgments. Moreover, as depression in particular is associated with solitary drinking (Keough et al., 2015), emerging adults may have fewer opportunities to observe individuals drinking to cope with depression. Individuals who do not drink to cope with depression may thus need to rely on their own behavior to estimate the motives of network members. In contrast, participants who do drink to cope with depression may assume that if they are drinking for this reason, others must also be – even if it is not commonly talked about or observed. Thus, regardless of their endorsement of drinking to cope with depression, participants could be biased by their own motives. This may not be

true for coping-with-anxiety, as coping-with-anxiety has a relatively higher base-rate (Study 2; Grant et al., 2007).

Also, partially in support of H2, there was evidence of assumed similarity for enhancement motives. Like the overestimation of enhancement motives, this assumed similarity may also reflect the frequent media portrayal of enhancement drinking (Atkinson et al., 2013). Individuals who are high in enhancement motives may assume others are high in enhancement motives as well, given the normative portrayal of such motives. In contrast, those with low levels of enhancement motives may notice that their motives are discrepant with such portrayals and assume that if they have discrepant enhancement motives that break the norm, others also likely do as well (i.e., others likely also have low enhancement motives).

Finally, my results suggest that accuracy and bias of drinking motives perceptions may not depend on relationship closeness. This is notable, as one would imagine that as relationships become more intimate, perceptions of internal processes such as drinking motives would become more accurate. There are several possible interpretations of my findings regarding relationship closeness. It is possible that accuracy of drinking motive perceptions do not improve with intimacy and closeness. Alternatively, as on average, the relationships within the current sample were reported to be quite close, the effects of relationship closeness may have been attenuated in the current sample. Additionally, the current study design may not have been ideally suited to capture an existing impact of relationship closeness; I had a small sample size, as well as utilized a single item measure of relationship closeness (which may not be the ideal quantification of this variable).

Implications

The current results have important implications both for clinical practice and for future research. It appears that perceptions of coping-with-anxiety motives are mostly accurate, rather than biased; however, perceptions of social, coping-with-depression, conformity, and enhancement motives are all significantly impacted by bias. My results suggest perceptions of drinking motives are not as accurately perceived as perceptions of alcohol use behavior, indicating the literature on normative perceptions and alcohol use (e.g., Cox et al., 2019; Kenney et al., 2017; Mason et al., 2019; Reid et al., 2020) likely does not apply to perceptions about drinking motives. Moreover, given that perceptions that others drink for enhancement or conformity reasons have been linked to increased binge drinking frequency indirectly through one's own motives (Study 3), an overestimation of these motives may represent a significant vulnerability factor for risky drinking behavior. This aligns with and extends research demonstrating that overestimating the drinking behavior of distal and close peers is a significant risk factor for frequent heavy drinking (Cox et al., 2019). Given research suggests such alcohol overestimations can be corrected using personalized normative feedback interventions (Miller et al., 2013), it is possible an individualized intervention highlighting normative misperceptions with drinking motives may also help to reduce alcohol use. Such an intervention has previously been developed for distal peers, and shows promise (Blevins & Stephens, 2016). This existing intervention could be adapted for close peers, where, in addition to comparing an individual's motives to existing norms, receiving psychoeducation about motives, and learning non-alcohol-related ways to reach desired effects (e.g., alternative coping strategies, alternative ways to enhance experience), individuals are also informed of a general tendency of emerging adults to overestimate certain drinking motives of close others. Given perceptions of close peers' drinking motives

have been found to impact one's own drinking motives (Study 3), informing emerging adults of the inaccuracy and overestimation of motive perceptions may function to indirectly reduce participant's drinking. Future research should investigate this idea.

Importantly, as my research suggests perceptions of motives are not always an accurate approximation of social network members' "actual" motives, whether participant perceptions or network members' actual motives should be studied is an important question. It is possible the study of perceptions may be a better approximation of social influence; indeed, social psychological research often suggests that perceptions of others are more important than the actual reports in several domains (Fiske et al., 2010), including alcohol use and interpersonal relationships (e.g., Rodriguez et al., 2013; Rodriguez & Neighbors, 2015). For example, if a network member is perceived to be drinking for enhancement reasons, when they are actually drinking for social reasons, it will likely be the perceived enhancement reasons that exert social influence on the perceiver's own drinking behavior. The influence of these perceived enhancement motives would not be captured if network members' actual motives were studied exclusively, meaning a significant source of influence would be lost. Future research should compare the influence of perceived vs. actual motives of network members on the individual's drinking to provide further guidance on study design selection for future social network research.

Limitations

My results are limited by several factors, many of which open doors to future avenues of research. First, my sample was predominantly female, White, and used both alcohol and cannabis; it is not clear if my results generalize to samples with other characteristics. Second, my social network members represent a variety of different types of network members, rather

than one type (e.g., friends) and varied in same vs. mixed-sex dyads. I chose to use this design because research suggests the motives of diverse network members influence use (e.g., Kehayes et al., 2019; Kehayes et al., 2021); however, it is not clear if the results are different for perceptions of certain social network member types (e.g., friends vs. romantic partners). Future research may be able to address this question. Third, I did not assess whether participants and their social network members consumed alcohol together, which may moderate accuracy or bias effects. Future research should examine this possibility. Fourth, Truth and Bias analysis is based on the assumption that self-reported motives of network members represent the “truth”; however, self-reports of own motives are influenced by factors such as social desirability, which were not controlled for in the current study (Davis et al., 2009; Moeller et al., 2009; van de Mortel, 2008). It is possible that participants may not be as biased as my analyses suggest but are rather accurately reporting on their network members’ motives.

Conclusions

My study examined the accuracy and bias of perceived drinking motives in close social networks. Results indicated that while some motives are perceived accurately, the majority of motives perceptions were partly or exclusively influenced by own motives (i.e., bias) and/or overestimation. As perceived motives of social network members are strong predictors of one’s own motives and indirectly predict own risky alcohol use (Study 3), over-estimation or misperception (e.g., assumed similarity) of social network motives may have significant consequences. Given perceptions of others’ drinking motives are generally inaccurate, researchers must carefully consider whether to study actual motives and/or perceptions of motives when examining social network influences in the drinking motives area.

Table 8.1 Study 4 Descriptive Statistics

Motive	Participant's own motives			Participant perceptions of social network motives			Social network motives		
	<i>M</i>	<i>SD</i>	Range	<i>M</i>	<i>SD</i>	Range	<i>M</i>	<i>SD</i>	Range
Social	80.90	16.72	17-100	80.83	22.47	0-100	68.55	29.31	0-100
Enhancement	67.22	25.79	0-100	71.20	28.05	0-100	57.33	29.41	0-100
Conformity	26.17	29.54	0-100	44.02	35.24	0-100	24.60	31.03	0-100
Coping-with-Anxiety	36.37	32.71	0-100	34.86	32.48	0-100	31.28	30.91	0-100
Coping-with-Depression	21.98	29.31	0-90	24.57	27.77	0-100	23.76	29.31	0-100

Note: These values represent the variables prior to centering.

Table 8.2. Study 4 Truth and Bias Analyses Regression Coefficients

Motive	Variable	Unstand.	<i>SE(B)</i>	Stand.	95% CI		Sig. (<i>p</i>)	<i>R</i> ²
		<i>B</i>		β	lower	upper		
Social	Intercept	12.16	3.14		5.86	18.45	.00	.23
	Truth	.31	.08	.45	.14	.47	.00	
	Bias	.23	.14	.20	-.05	.51	.11	
Enhancement	Intercept	12.73	3.10		6.52	18.96	.00	.34
	Truth	.16	.10	.18	-.04	.37	.11	
	Bias	.55	.11	.53	.32	.77	.00	
Conformity	Intercept	19.96	4.59		10.75	29.17	.00	.11
	Truth	.29	.15	.25	-.19	.59	.07	
	Bias	.24	.16	.20	-.07	.55	.13	
Coping-with- Anxiety	Intercept	3.39	3.83		-4.23	11.08	.38	.27
	Truth	.52	.13	.51	.27	.77	.00	
	Bias	.03	.12	.03	.21	.28	.78	
Coping-with- Depression	Intercept	2.69	3.44		04.22	9.59	.44	.18
	Truth	.28	.12	.30	.05	.52	.02	
	Bias	.26	.12	.27	.02	.49	.04	

Note: Truth = network member's report on their own drinking motive score; Bias = participant's own drinking motives scores.

CHAPTER 9. GENERAL DISCUSSION

My dissertation sought to improve our understanding of how the drinking behaviors and drinking motives of social network members impact emerging adults. As part of this goal, I sought to provide psychometric and methodological advancements through the creation of brief motives measures and through the examination of motive perception accuracy. To achieve these aims, I conducted four studies. In the follow sections, I summarize and integrate the findings of my studies, as well as integrate my findings with the extant literature. I then discuss the theoretical and clinical implications of my dissertation. I conclude with an overview of the strengths and limitations of my work, and with suggestions for future research.

Summary and Integration of Findings

Summary

Study 1 examined the impact of social network member binge drinking on the binge drinking of emerging adults. Specifically, Study 1 separated the impact of peers, romantic partners, parents, and siblings, investigating which type of social network member binge drinking was associated with emerging adult binge drinking. Results suggested that while peer and romantic partner binge drinking were each associated with emerging adult binge drinking in bivariate analyses, romantic partners had the greatest impact, and the sole impact, in multivariate analyses.

Following Study 1, I became interested in the cognitive mechanisms (i.e., alcohol expectancies, alcohol motives) outlined in social learning theory that may mediate the impact of network members' alcohol use on participants' alcohol use (Bandura, 1969). I began to wonder whether these cognitive mechanisms could themselves be impacted by social

learning. I was specifically eager to learn more about the social learning of drinking motives; however, a drinking motives measure that would allow me to study the social influence of drinking motives in a large egocentric network did not exist. In response to this barrier, I chose to develop and validate brief measures of substance use motives in Study 2 (i.e., the BMM and BCMM). Results suggested the BMM and BCMM represent psychometrically sound measures.

Now that I had my brief measures, I was able to complete Study 3 and examine the social influence of perceived drinking motives in an egocentric design. Study 3 results indicated that, with the exception of social drinking motives, all network drinking motives predicted participants' own drinking motives at a later time point, even after controlling for stability in participants' own drinking motives. Moreover, in the case of enhancement, conformity, and coping-with-anxiety motives, perceived network drinking motives went on to predict participant binge drinking frequency through participant drinking motives. Notably, while there was substantial network change between baseline and follow up, participants did not demonstrate selection effects (i.e., participant drinking motives did not predict network drinking motives after accounting for stability). Study 3 represented the first examination of social network drinking motive influence in a more diverse network of emerging adults.

Given Study 3 results were based on perceptions, Study 4 investigated the accuracy of these motives perceptions. Using Truth and Bias Analysis (West and Kenney, 2011), I found emerging adults' perceptions of social network member drinking motives tended to be greatly or entirely influenced by bias. The only exception to this occurred for the coping-with-anxiety motive, which was found to be solely influenced by the truth force. Conformity,

enhancement, and social motives were systematically over-estimated, and coping-with-depression and enhancement motives exhibited assumed similarity (i.e., own motives were projected on to social network members). Study 4 significantly advanced the literature, representing the first statistically rigorous examination of motive perception accuracy.

Integration of Study Findings

The findings of the current dissertation speak to the importance of social networks in influencing alcohol and related cognitions in emerging adults. Study 1 and Study 3 add to the literature suggesting that the presence of actual and perceived social network member drinking behaviors and motives impact emerging adults' binge drinking. The results also showcase that both certain individuals within a network, and the entire network, can and do exert influence. As a result, the findings of Study 1 suggest that when studying social influence in emerging adults, it is critical to move beyond the typical focus on peers, as was done in Study 3. Notably, while the mechanisms through which social network members impacted participants in Study 1 is not clear, Study 3 provides a hypothesis about how this impact may occur (i.e., mediation through drinking motives). Thus, together, the results of Study 1 and Study 3 provide two examples of the types of social network factors that are sources of influence and how this influence may happen.

In addition, the current dissertation's research methodology and findings related to drinking motives are particularly notable. Study 2 provided the methodological tool to study drinking motives in an egocentric social network design, and Studies 3 and 4 then provided evidence of the feasibility of this tool within such a design. Regarding the broader drinking motives findings of this dissertation, the integration of Study 3 and Study 4 results provides

an interesting commentary¹⁰. For example, BAMM descriptive statistics in Study 3 suggested individuals perceived their social network members to have higher levels of drinking motives than they themselves endorsed. This aligned with the only other existing study of motive perceptions to date, which also found evidence of positive self-other discrepancies (Cloutier et al., 2021). These self-other discrepancies suggest that the overestimation of others' drinking behavior often seen in the broader peer norms literature (e.g., Franca et al., 2020; Kenney et al., 2017) may be occurring in drinking motives as well. Sure enough, the results of Study 4, while only representing a small snapshot of the social network members from Study 3, nonetheless suggested social network member enhancement, social, and conformity motives were all systematically overestimated by participants.

While this overestimation and the broader inaccuracy of motives perceptions captured in Study 4 aligns with the literature on the inaccuracy of broad peer estimations (e.g., all students on a campus; Franca et al., 2020; Kenney et al., 2017), it does stand in contrast to the literature suggesting close friend alcohol use perceptions are accurate (e.g., Reid et al., 2020). This contrast may be due to the increased amount of extrapolation that is necessary for perceiving close friend drinking motives, in comparison to close friend alcohol use. For example, perceptions of the alcohol use of a close friend can be informed by directly observing how often and how many drinks an individual consumes. In contrast, drinking motives are an internal process and cannot be observed as easily. While individuals may directly express why they drink some of the time (e.g., "I need a drink to help me deal with this"), drinking motives are not explicitly verbalized all the time. Moreover, different

¹⁰ As mentioned in the limitation section, please note that the social network members included in Study 4 likely do not full represent all social network members reported on in Study 3. The integration of Study 3 and Study 4 results should be read keeping the aforementioned caveat in mind.

drinking motives can present with similar outward behaviors and be easily misperceived (e.g., individuals drinking in a new social setting may appear to be drinking to fit in, when they are actually drinking to enhance social affiliation). Thus, significant extrapolation must occur when reporting on the drinking motives of others, even in the case of close social network members.

Notably, despite perceptions of other's drinking motives largely being biased or overestimated in Study 4 and demonstrating positive self-other discrepancies in Study 3, perceptions of other's motives in Study 3 still generally followed the pattern of relative endorsement that is documented in the extant literature, with one exception – conformity motives. While studies, including Study 2, typically report social motives are the most highly endorsed, followed by enhancement motives, coping motives, and conformity motives (Cooper et al., 2016; Grant et al., 2007), social network members were perceived to drink for conformity reasons more often than for coping reasons. In addition, the discrepancy between self and other motives in Study 3 was the greatest for conformity motives, suggesting conformity motives are particularly viewed to be much more common in others than in oneself. Indeed, the results of Study 4 indicated that within the subsample, conformity motives are not only overestimated, but also overestimated to the greatest degree.

Notably, conformity motives were not the only motives in Studies 3 and 4 to exhibit a pattern worthy of comment. In contrast with all other motives in Study 3, perceived network social motives did not significantly predicting own social motives. Moreover, social motives demonstrated the smallest self-other discrepancy. Aligning with this latter result, Study 4 suggested that participants' judgements of social motives in their network members, while not solely influenced by accuracy, did fall in accordance with the true social motives of their

network members. Together, these findings suggest that unlike other drinking motives, the impact of perceived social network social motives may be benign, despite some misperception. This suggests that it may not be fruitful to invest resources aimed at correcting (mis)perceptions of social motives within the social network, or aimed at intervening to reduce the presence of social motives within the network.

Additionally, the Study 3 findings regarding coping motives are also notable, especially when interpreted in the context of Study 4 findings. Study 3 demonstrated that perceived social network coping-with-anxiety and coping-with-depression motives were strong predictors of emerging adults' own coping-with-anxiety and coping-with-depression motives. Study 4 demonstrated that both perceived social network coping-with-depression motives and coping-with-anxiety motives were predicted by social network members' actual coping motives; however, coping-with-depression motives were also influenced by one's own coping-with-depression motives (i.e., assumed similarity), while coping-with-anxiety motives were not. Together, the results of Study 3 and Study 4 suggest that the actual coping motives of individuals in one's social network may serve as a risk factor (or, when lower, a protective factor) for one's own motives and, in the case of coping-with-anxiety, one's own binge drinking. If others in one's social network frequently drink to cope with anxiety or depression, it may increase the extent one drinks to cope oneself and, in turn, potentially increase one's own alcohol use. In contrast, if others in one's social network do not drink to cope with depression or anxiety, or do so infrequently, it may decrease the extent one drinks to cope and, in turn, potentially reduce one's own alcohol use. Thus, the presence of coping motives in the social network may greatly impact one's own coping motives over time. Notably, as Study 4 suggests the perceptions of social network member coping-with-

depression motives are strongly impacted by one's own coping motives, it appears part of the influence of the social network on coping-with-depression motives (as captured in Study 3) could be one's own coping-with-depression motives. In other words, it is possible individuals influence their own coping-with-depression motives over time by projecting their own motives onto others and then those perceptions come back to influence (i.e., maintain or exacerbate) the individual's own coping-with-depression motives. Thus, it may be that for coping-with-depression motives, the actual coping-with-depression motives of others in the network matter, but one's own coping motives are equally important in accounting for social influence.

A similar story can be told about enhancement motives. Study 2 and Study 3 highlight the association between enhancement motives and alcohol use, particularly weekly alcohol use and binge drinking frequency (i.e., both heavy consumption variables), again aligning with existing literature (Cooper et al., 2016). Study 3 suggests the perceived enhancement motives in one's social network are a strong predictor of one's own enhancement motives, and indirectly, one's binge drinking frequency. When combined with the results of Study 4 suggesting perceived enhancement motives are a product of overestimation and assumed similarity (rather than actual enhancement motives of network members), this suggests that one's own enhancement motives and assumed norms for enhancement motives (i.e., overestimation) may be largely responsible for the social influence of perceived enhancement motives in the social network. Thus, it is possible that the actual presence of enhancement motives in the network may be relatively unimportant or, at the very least, less important than one's projected enhancement motives or normative

assumptions about the prevalence of enhancement motives. Future research should investigate this possibility.

Finally, it is important to mention that since previous work has found the drinking motives of romantic partners and drinking buddies to influence an individual's own motives, researchers have speculated individuals may be able to correctly perceive other's drinking motives despite their internal nature (Kehayes et al., 2019; Kehayes et al., 2021). Study 4 suggests that this is not the full story – while individuals are accurate to a certain extent for some motives, they are simultaneously biased in their perceptions of almost all drinking motives. These results raise questions about how previous researchers (i.e., Kehayes et al., 2019; Kehayes et al., 2021; Kuntsche & Stewart, 2009; Stewart et al., 2014) could find that direct reports of social network member motives impacted participant's own drinking motives, and subsequently, their alcohol use. After all, how would such motives influence an individual if they are not perceived correctly? In the case of motives that are influenced by accuracy to some extent (i.e., social, coping-with-anxiety, coping-with-depression), it is possible these accuracy effects were driving the relationships between direct reports and participant's motives and alcohol use in previous research; however, this would not explain the findings for enhancement and conformity motives, which were not found to be impacted by accuracy in Study 4. An alternative explanation may be that individuals are more accurate perceivers of romantic partners' (Kehayes et al., 2021) and schoolmates' (Kuntsche & Kuntsche, 2009; Stewart et al., 2014) drinking motives than the diverse network members included in Study 4. It is also possible that the information individuals may pick up on the drinking motives of others are not either encoded or retrieved easily or are picked up unconsciously. As a result, an individual's report on their social network member's approval

may not fully represent all the information they have gathered about a network member's drinking motives, despite this information impacting their behavior.

Theoretical Implications

Emerging Adulthood

As outlined in Chapter 1, the theory of emerging adulthood suggests that individuals between 18 and 25 years of age exist within a unique developmental period (Arnett, 2000). It has been theorized that during this stage of development, peers and romantic partners usurp parents and siblings as the most prominent sources of social influence (Borsari & Carey, 2001). Study 1 results support this theory, suggesting that in the context of alcohol use, romantic partners may be the most important social network members, surpassing both peers and family members. This is notable, as peer use is often focused on and touted as being the most important in emerging adult drinking (e.g., Borsari & Carey, 2006; Smith et al., 2019). In addition, it has also been theorized that characteristics of emerging adulthood place individuals at risk for substance misuse, which is prevalent in this population (Arnett, 2005). The current dissertation supports this idea, finding that 38.8% of participants in Study 1 endorsed engaging in binge drinking at least once in the past week, and 82.5% and 84.0% of participants endorsed binge drinking at least once in the past month in Study 2, and Study 3, respectively. Finally, the current dissertation supports the contention that emerging adulthood is a time of shifting social relationships (Arnett, 2000). Study 3 found that, on average, 43% of participants' 15 closest relationships changed within a four-month period. Clearly, it is not only peripheral relationships (e.g., acquaintances) that frequently change during this life stage, but also close relationships.

Social Learning Theory

The current dissertation is consistent with social learning theory predictions. For example, Study 1 demonstrated the drinking of social network members impacts the drinking of individual emerging adults, particularly in the case of social network members who are romantic partners. While Study 1 was unable to tease apart whether the impact of romantic partners was due to selection or socialization, previous research consistently demonstrates socialization of binge drinking occurs in romantic partners (e.g., Bartel et al., 2020; Mushquash et al., 2013; see also review by Musingo et al., 2020). Study 3 demonstrated that the perceived drinking motives of social network members impact individuals' own drinking motives at a subsequent timepoint, which then go on to predict alcohol misuse in many cases. This suggests that individuals are observing the drinking motives of others, and then adjusting their own drinking motives accordingly to obtain the same rewards or avoid the same punishments from alcohol use. Such rewards may include changes to internal states (e.g., reduction in negative emotions) or to the external social environment (e.g., social acceptance, relationship satisfaction). For example, individuals may observe that drinking to cope with anxiety appears to be socially acceptable and an effective way to lessen anxiety in the short-term, resulting in an individual choosing to drink to cope with their own anxiety. Taken together, the results of the current dissertation support the idea that social learning impacts alcohol-related cognitive processes and behaviors.

Critically, the current dissertation also provides commentary regarding the nature of vicarious learning related to drinking motives. Despite the bias found to be present in most motive perceptions in Study 4, Study 3 found these perceptions to have significant influence. This suggests that vicarious learning may occur regardless of the accuracy of observations. In fact, because observations may not always be based in fact (i.e., perceiving rewards of

conformity motives in others, when really witnessing rewards of social motives), using perceptions may be more suitable for capturing social learning than using direct reports.

In addition, Study 3 and 4 also support the presence of reciprocal determinism. It appears that vicarious learning impacts both the motives (i.e., cognitive processes) and behaviors (i.e., opportunities for differential reinforcement) of emerging adults, suggesting socialization is occurring. While motives do not appear to reciprocally impact the environment in a direct fashion (i.e., individuals do not appear to be systematically selecting social network members with similar drinking motives), motives do impact what is perceived to occur in the environment. In other words, participants' own biased perceptions (i.e., cognitive processes) appear to reciprocally influence the vicarious learning that takes place. For example, Study 4 suggests that in the case of enhancement and coping-with-depression motives, one's own motives impact which drinking motives are perceived in others (i.e., others' motives are assumed to be similar to one's own). Coupled with the Study 3 finding that perceptions of enhancement and coping-with-depression motives in one's social network impact one's own motives, it follows that one's own biases in motive perceptions may influence one's motives over time. Thus, while individuals may not impact what types of motives are present in their own network via selection, their own cognitive processes determine which motives are perceived to be present, which then impacts the vicarious learning that takes place where own motives are maintained or exacerbated.

Taken together, the results of the current dissertation largely support predictions emerging from social learning theory. It appears drinking behaviors and drinking motives of others confer social influence on one's own drinking behaviors and drinking motives.

Drinking Motives Theory

Studies 2, 3, and 4 all significantly advance the literature on drinking motives. By developing a brief measure of alcohol motives, Study 2 paves the way for drinking motives to be studied using a variety of designs that were previously infeasible. In fact, in addition to Study 3 and Study 4, studies have already begun utilizing the BAMB to do just that (Deacon et al., 2021). Studies 2 and 3 also add further evidence of the relationship between drinking motives and specific alcohol outcomes; in line with previous literature, enhancement motives were found to predict total alcohol use and binge drinking frequency (Cooper et al., 2016). Similarly, social motives were also found to be associated with binge drinking frequency; however, this relationship was weaker than that of other motives (i.e., enhancement and conformity). While this result suggests social motives are less risky than other motives, aligning with the broader literature (Cooper et al., 2016), it also suggests that social motives are not completely benign. Similar relationships between social motives and binge drinking have been documented in other emerging adult samples (Van Damme et al., 2013), suggesting this relationship may reflect the normative nature of binge drinking in this developmental period. Alternatively, the relationship between social motives and binge drinking frequency found in Study 3 may also be due to the fact that the analyses did not control for the overlap between motives (e.g., enhancement).

Notably, the results of Study 2 and Study 3 indicate that while conformity motives are not strong predictors of alcohol-related problems, they are strong predictors of binge drinking frequency. This result contrasts with other literature suggesting conformity motives are weakly associated with binge drinking (Cooper et al., 2016). It is possible the strength of the relationship between conformity and binge drinking may be explained by developmental stage. Conformity motives are thought to cause individuals to mimic the drinking patterns of

those around them to fit in (Cooper, 1994). In the case of emerging adults, the mimicked drinking pattern is likely to be binge drinking simply due to its high prevalence in this population (Substance Abuse and Mental Health Services, 2012). Of course, it is also possible this large effect is due to differences in measurement instruments, as I used the BMM, rather than the MDMQ-R. While three of five items on the conformity subscale of the MDMQ-R are directly included within the BMM conformity item, the BMM conformity item does not directly include the concepts of being pressured to drink or of being made fun of for abstaining from alcohol use. It is possible that these latter two items are not typically associated with binge drinking and their inclusion in the MDMQ-R weakens the association between the conformity motives and binge drinking.

With respect to coping motives, neither coping-with-anxiety nor coping-with-depression motives were found to predict QxF of alcohol use in Study 2. Similarly, in Study 3, coping-with-depression motives were not found to predict binge drinking frequency; however, coping-with-anxiety motives were predictive of binge drinking frequency (albeit less strongly than some other motives). These results add to the general literature that specific coping motives have an inconsistent relationship with alcohol outcomes (Cooper et al., 2016). They also align with literature suggesting coping-with-anxiety may have a stronger relationship with more risky alcohol consumption variables (e.g., quantity vs. frequency) than coping-with-depression (Kehayes et al., 2019). Consistent with past research, Study 2 demonstrated coping-with-depression motives predicted alcohol-related problems (Goldstein et al., 2010; Mezquita et al., 2014; Vernig & Orsillo, 2015). Taken together, both coping-with-depression and coping-with-anxiety motives seem to be associated with risk, but

different types of risk, underlining the importance of separating these two aspects of coping motives (Grant et al., 2007).

This dissertation also extends the current literature, which has begun to examine social influence on drinking motives (e.g., Kehayes et al., 2019; Kehayes et al., 2021; Kuntsche & Stewart, 2009; Stewart et al., 2014). My work represents the first emerging adult study to move beyond dyads and the first work to study the indirect effect all motives longitudinally in any sample (i.e., without collapsing over time). My results indicate that despite often being neglected in drinking motives research, the impact of social relationships on drinking motives is an important area of study.

Critically, my work suggests that the documented similarity in perceived and actual drinking motives of social network members and participants (Cloutier et al., 2021; Kehayes et al., 2017; Kehayes, 2020) may be due to socialization, rather than selection. It appears that individuals may not choose social network members based on perceived drinking motives. Instead, as suggested by previous literature, individuals may choose social network members based on drinking behavior (e.g., Bullers et al., 2001). Selection based on alcohol consumption may be done in hopes of increasing relationship satisfaction and facilitating social bonding - outcomes that are associated with engaging in similar alcohol use to others (Homish & Leonard, 2008; Sayette et al., 2012). Moreover, given similar drinking behavior can be motivated by a variety of different reasons (e.g., Study 3 results suggest binge drinking frequency is related to enhancement, conformity, social, and coping-with-anxiety motives), individuals may concentrate on sharing drinking behaviors with their social network, rather than sharing drinking motives. Importantly, it appears that once social network members are present, their drinking motives do matter. So, while perceived drinking

motives may not be considered heavily when forming relationships, these motives go on to significantly impact an individual's substance use, accounting for similarity in motives.

My work is also the first to suggest that individuals are not so accurate in their perceptions of the drinking motives of others around them. This is notable – while perceived motives have a strong influence on one's own motives, and in some cases, one's own drinking behaviors, these perceptions often do not reflect reality. As such, the results of previous studies based on actual drinking motives of social network members may fail to be replicated with motive perceptions. Alternatively, the results of previous studies based on actual drinking motives of network members may be stronger or wider reaching when replicated with motive perceptions, as drinking motives perceptions may be capturing a previously untapped source of social influence (see Future Directions).

In summary, my dissertation significantly advances motives theory and the motives literature. It suggests that social relationships are important when considering changes in drinking motives over time, and the impact of drinking motives on alcohol outcomes. Moreover, it indicates that the way researchers measure drinking motives is important – it is likely that predictions using actual drinking motives and drinking motives perceptions may result in different results. Finally, this dissertation provides two new measures of substance use motives that will allow for drinking (and cannabis use) motives to be studied more widely, thereby leaving a mark on the drinking motives field.

Social Ecological Model and Sociocultural Influence

The findings of my dissertation likely align with the Social Ecological Model (Bronfenbrenner, 1979) and discussions of sociocultural influence. While Study 1 and Study 3 captured a significant impact of the social network on an individual's own binge drinking

or drinking motives, there was still significant variance left unaccounted for. In Study 1, the binge drinking of social network members accounted for ~50% of the variance in target's own binge drinking. In Study 3, baseline perceived motives of social network members and baseline participant motives together accounted for 17-41% of the variance in participant motives at follow-up. These results demonstrate microsystems (e.g., family, peers) have an influence, thereby aligning with the Social Ecological Model; however, there are clearly other predictors of binge drinking and drinking motives besides the actual or perceived presence of these variables in the individual's measured social network.

The Social Ecological Model (Bronfenbrenner, 1979) suggests that some of the unaccounted variance may be explained by other network members or systems that were not captured in Study 1 and Study 3. For example, while my studies tried to capture a broad range of people in microsystems (e.g., family, school, work), they did not capture all members of such microsystems. Given that individuals as diverse as co-workers, roommates, siblings, friends, romantic partners, and parents have been found to exert influence on an individual's alcohol use (e.g., Bennett et al., 1999; Rosenquist et al., 2010; Smith et al., 2019), there are likely other individuals than the 1-15 social network members included in Study 1 and Study 3 who exerted influence. Moreover, the Social Ecological Model also suggests unique influence occurs when two microsystems cross-over (i.e., mesosystems). It is likely that drinking behaviors and drinking motives are influenced by these mesosystems (e.g., drinking motives and behaviors may differ when at an event with one's partner *and* one's parent, then when at an event with either one's partner *or* one's parent). Such mesosystems may exert a distinctive influence that cannot be captured by focusing on the influences of individual network members.

In addition, some of the unaccounted variance may be related to macrosystems (i.e., community or culture level), otherwise known as sociocultural variables. Canada has been classified as a “high-binge drinking” country/culture (Hogan et al., 2014). In such cultures, binge drinking in emerging adults is thought to provide high status with peers, resulting in affiliation with social groups and thus social benefits (Hogan et al., 2014). Moreover, within high binge drinking environments, binge drinking is often considered to be socially acceptable for emerging adults (i.e., liberal injunctive norms), creating increased opportunities for heavy alcohol use, and fewer negative social consequences (i.e., social censure) of such use (Hogan et al., 2014). This view may be especially prevalent in Nova Scotia (the population of study), where a subculture that “normalizes and glamorizes drinking, intoxication, and alcohol-related consequences” for young adults has been documented (Addiction Services Alcohol Task Group, 2007, pg. 17). Such a culture of high binge drinking likely encourages emerging adults in Nova Scotia to engage in binge drinking, as well as impacts the prevalence of certain drinking motives among such individuals (e.g., in a culture where drinking is thought to confer social benefits, individuals may be more motivated to drink for social reasons).

Drinking cultures are thought to be partially created and communicated through the media. Studies broadly demonstrate that greater alcohol-related engagement with social media or media sources is associated with greater self-reported drinking and alcohol-related problems (Carrotte et al. 2016; Curtis et al., 2018). Through the lens of social learning theory, media is thought to define what drinking behaviors are normative and rewarding through modeling (i.e., vicarious reinforcement) of alcohol use and drinking motives. For example, research demonstrates that the media (e.g., social media, television, magazines)

tends to showcase alcohol use in emerging adults as an activity that leads to positive outcomes (e.g., bonding, celebrating), and often neglects to depict negative alcohol-related consequences (Atkinson et al., 2011). Moreover, when negative consequences of alcohol use are shown, such consequences are often extreme (e.g., violence or dependence), rather than milder negative consequences (e.g., sickness, hangover, slurring; Atkinson et al., 2011) that may be more common. Thus, highlighting rewarding consequences and ignoring common punishing consequences of alcohol use in the media may result in individuals developing positive alcohol expectancies, and may increase perceived descriptive and injunctive norms.

With respect to the portrayal of drinking motives, the media often depicts alcohol use as occurring for social reasons (Atkinson et al., 2011). In fact, in television programs, 74.7% of drinking occasions are depicted as occurring for social reasons (i.e., general socializing, to celebrate, bonding; Atkinson et al., 2011). In addition, television also shows drinking as occurring for reasons such as managing personal crises (2.9%) and relaxation (1.1%; Atkinson et al., 2011). Investigations of social media advertisements tell a similar story, with 46% of alcohol advertisements being associated with positive emotional experiences, and 17% being associated with close social relationships (Barry et al., 2018). Taken together, the media appears to model social, enhancement, and coping motives for alcohol consumption, which may lead emerging adults to believe that certain drinking motives are normative and accepted.

Through the above-mentioned media depictions of drinking or drinking motives, individuals may come to believe drinking is a natural and normative part of life for emerging adults. These beliefs may make emerging adults more likely to enter in to drinking scenarios wherein their media-informed beliefs are reinforced through vicarious learning and/or

differential reinforcement. For example, media depictions of drinking may increase the likelihood an individual goes to a bar, a place in which they may witness others engaging in various patterns of alcohol consumption, for a variety of reasons. Observing others drinking may normalize and reinforce the depictions of alcohol in the media, leading individuals to engage in certain drinking behaviors or motives themselves and to learn of the rewarding and punishing consequences firsthand. This media-influenced pattern may be particularly likely for emerging adults who are students or romantic partners, as alcohol use is often portrayed as an inherent part of these social roles (Atkinson et al., 2011). This portrayal by the media may contribute to the documented heavy drinking of students (e.g., Quinn & Fromme, 2011) and the formation of drinking partnerships (Roberts & Leonard, 1998) as found in Study 1.

Importantly, as theorized in the Social Ecological Model (Bronfenbrenner, 1979), the above-mentioned sociocultural factors likely trickle down and influence the microsystems captured in Study 1 and Study 3. Sociocultural context may directly influence the drinking behaviors and motives of those in an individual's microsystem, and those drinking behaviors and motives then go on to impact the individual as found in Study 1 and Study 3. Moreover, sociocultural context may also directly impact the individual's own drinking behaviors and motives, resulting in social influence occurring simultaneously from multiple levels. Viewed within this lens, my dissertation suggests social network members impact the drinking behaviors and drinking motives of other social network members; however, all members are simultaneously influenced by sociocultural factors such as media and norms both directly and indirectly (i.e., through their impact on others).

Clinical Implications

The results of my dissertation have several important clinical implications. Overall, my work aligns with literature suggesting that targeting drinking motives in both treatment-seeking and non-treatment seeking populations may help to prevent the escalation of alcohol use over time (e.g., Anthenian et al., 2017; Kuntsche et al., 2008; Woud et al., 2015). Within treatment contexts, it may be helpful to discuss perceptions of social network drinking motives and provide normative feedback. Similarly, it may be helpful to discuss social network drinking behaviors (particularly of romantic partners) and strategies for coping with, and limiting the influence of, other's alcohol use. Psychoeducation about these topics may also be useful at a broader level (e.g., campus-wide, public health). The following section outlines the rationale for these ideas, the related literature, and potential ways to include them within existing evidence-based treatments and prevention strategies. While a significant literature exists about the clinical implications of social network alcohol use, a much less substantial literature exists for the clinical implications of social network drinking motives. As such, the following section has a particular emphasis on drinking motives in a clinical context.

Research consistently demonstrates that drinking motives mediate the impact of risk factors (e.g., personality; Littlefield et al., 2010) on alcohol use, and represent a proximal factor through which more distal factors influence alcohol use (Kuntsche, von Fischer, et al., 2008). Consistent with this, treatment studies have found drinking motives to mediate the effect of interventions on reductions in alcohol use. For example, Conrod et al. (2011) found the effects of a personality-targeted intervention for alcohol use on drinking behaviors were mediated by changes in drinking motives. Similarly, an intervention for anxiety sensitivity found evidence of chained mediation, such that reductions in anxiety sensitivity due to the

intervention, led to reductions in drinking to cope with anxiety, which in turn resulted in reduced alcohol-related problems (Olthuis et al., 2015). Similar effects have also been demonstrated in other substances; cannabis motives have been found to mediate the effect of Cognitive Behavioral Therapy (CBT) for cannabis use on cannabis outcomes (Blevins et al., 2016). In addition to the above-mentioned literature, some researchers have reported moderation where their alcohol interventions only reduce alcohol consumption for those with high levels of coping, social, or enhancement motives (Gilmore & Bountress, 2016; Labrie et al., 2008). While these latter studies did not test mediation, they add to the literature suggesting drinking motives matter as a moderator in the success of alcohol interventions.

Given drinking motives appear to be key in reducing and maintaining alcohol use, researchers have suggested drinking motives should be explicitly targeted in substance use interventions (e.g., Blevins et al., 2016; Gilmore & Bountress, 2016). The results of Study 2 and Study 3 lead me to echo these claims. Previously, one study has attempted to target drinking motives through stand-alone intervention; using a normative feedback design, Blevin and Stephens (2016) compared a Motives Feedback Condition (i.e., psychoeducation about coping motives, teaching of alternative coping strategies, and feedback on coping motives, alcohol use, and consequences) to a Standard Feedback Condition (i.e., feedback about alcohol use and consequences only). The authors report that while the two conditions did not differ in effectiveness, the Motives Feedback Condition reduced coping-with-depression motives more than the Standard Feedback Condition. Notably, within the Motives Feedback Condition, reductions in coping-with-depression motives predicted a reduction in alcohol quantity and problems two months later (Blevins & Stephens, 2016). Thus, it appears

that drinking motives can be explicitly targeted, and when they are, both drinking motives and alcohol use are reduced over time.

More typically, drinking motives interventions take place within evidence-based alcohol use treatments, such as CBT (National Institute for Health and Care Excellence, 2011). Assessment of drinking motives often occurs as part of case conceptualizations and functional analyses during the early phases of CBT for alcohol use (McHugh et al., 2010). In fact, assessing drinking motives using the DMQ-R (Cooper et al., 1994) has been recommended as part of this assessment process (McHugh et al., 2010). As CBT progresses, cognitive restructuring and psychoeducation may be used to address cognitive distortions and misinformation about drinking motives (e.g., psychoeducation that drinking can actually worsen or maintain anxiety rather than help cope with it; Kushner et al., 2018). Moreover, alternative coping strategies for negative affect and ways to meet needs associated with drinking motives (e.g., feeling good, celebrating, fitting in) are often included as part of treatment (McHugh et al., 2010).

Given drinking motives are assessed and targeted in alcohol use interventions and drinking motives have been shown to mediate the effects of some interventions, regularly assessment of drinking motives during alcohol misuse treatment may aid in progress monitoring and understanding drinking behaviors. As research suggests objective measures are a better metric of therapy progress than clinicians' own judgements, using a questionnaire to assess drinking motives may be a more valid metric of progress than verbally checking in with clients each week (Lambert & Shimokawa, 2011). The BAMM may serve as an excellent option for such progress monitoring in alcohol use treatment, as it provides several advantages over existing measures. First, requiring clients to fill out other measures of

drinking motives (20+ items) each week, along with measures of alcohol consumption, may result in significant burden. As a six-item measure, the BMM does not have such drawbacks. Second, requiring clinicians to calculate scale scores of the DMQ-R or the MDMQ-R may also place too high a burden on clinicians. As the BMM uses a VAS scale, scale scores do not need to be summed. Moreover, given progress monitoring is increasingly being done online, scoring a VAS scale is easily done electronically without the need of a ruler. Importantly, literature on progress monitoring suggests shorter measures and easy scoring reduce client and clinician barriers to progress monitoring (e.g., Ionita et al., 2020; Persons et al., 2015). This suggests the BMM may be used as a tool to help clinicians engage in progress monitoring, thereby adhering to best practice. Future research should explicitly investigate the utility of a 7-day BMM in the context of alcohol use treatment (see Future Directions).

Significantly, while assessing and monitoring individual characteristics such as drinking motives is an essential part of existing evidence-based substance use treatments, discussing social network characteristics is also critical. Alcohol treatments commonly include conversations about whom within the client's network may place the client at risk of alcohol misuse (i.e., who uses alcohol heavily or problematically, and who encourages or enables alcohol misuse within the network; Daley & Douaihy, 2019; Epstein & McCrady, 2009). The results of my dissertation support the importance of such conversations. Moreover, Study 1, as well as the broader literature, suggests that it is important to explicitly ask about romantic partners' alcohol use and provide psychoeducation about drinking partnerships and the impact of alcohol on relationships. While covering this information is part of Behavioral Couples Therapy (O'Farrell & Fals-Stewart, 2012), it is not always

explicitly part of other evidence-based treatments. In addition, my dissertation also suggests it is important to inquire about the perceived alcohol motives of clients' social network members. Skipping such a discussion may undermine treatment, as perceived motives of others clearly have an impact on clients' own motives, which function as the last decision point prior to alcohol use (Cox & Klinger, 1988).

Following discussions about the impact of social networks on alcohol use, evidence-based treatments often include strategies for resisting the alcohol urges triggered by social network members (e.g., proactively identifying direct and indirect social network pressures to use and creating a plan for how to cope with such pressures when they occur through use of skills such as assertiveness, reminding of goals, identifying thinking traps, visualization of coping effectively, avoidance of triggers; Daley & Douaihy, 2019). The results of Study 1 indicate it may be warranted to focus such strategies on romantic partners (and possibly peers) in particular. Moreover, Study 3 suggests it is possible that individuals may not only be triggered to drink by others' alcohol use, but also their perceived reasons for use. For example, a client may perceive motives of social network members and want to drink for the same reasons to achieve desirable observed effects or to gain acceptance (e.g., "That person is drinking to enhancing pleasurable emotions – I want to experience that"). Learning specific strategies for coping with urges triggered by another's perceived drinking motives may be useful. Clinicians could likely apply existing evidence-based strategies for coping with urges, rather than developing new skills specific to urges triggered by others drinking motives.

Moreover, substance use treatments often recommend that individuals create a recovery support system of social network members with whom they can engage in non-

substance related activities (Daley & Douaihy, 2019). Study 1 suggests this may be particularly important for romantic partners who have formed a drinking partnership. If romantic partners do not join this recovery support system, reducing alcohol use may be particularly difficult. Study 3 raises the possibility that it is not only the degree to which alcohol use is present in the recovery support system that may matter, but also the perceived drinking motives of those individuals. If clients plan to be around others who are drinking, it may be useful to only include others who are perceived to predominantly drink for social reasons in the recovery support system, as such motives do not appear to be transferable over time or to go on impact alcohol use in emerging adults.

In addition, clinicians may also want to consider providing psychoeducation and normative feedback about drinking *and* drinking motives norms (i.e., alcohol use and drinking motive norms can be provided for emerging adults and compared to client's perceived norms and own alcohol use and motives). Such techniques already exist within the context of CBT for alcohol use (e.g., Epstein & McCrady, 2009; Pedrelli et al., 2013) and may be valuable if extended to drinking motives. For example, research suggests individuals who seek treatment for alcohol misuse often have elevated coping motives (Hammarberg, et al., 2017). As Study 4 results indicate emerging adults typically assume others have similar coping-with-depression motives to themselves, providing normative feedback that most people do not drink to cope with negative affect may have utility. Given such strategies have been found to reduce motives in a standalone intervention (Blevins & Stephens, 2016), they may be a useful adjunct to existing interventions.

Additionally, psychoeducation explaining that drinking motive perceptions are often biased, and these perceptions go on to impact one's own drinking, could be included. Such

information may cause clients to reconsider their drinking motive observations in real time, thereby interrupting the process of social learning (i.e., “I’m assuming my partner is drinking for enhancement, but I don’t actually know. Best not to make assumptions.”). In the case of treatments that involve social network members, such as Behavioral Couples Therapy or Network Therapy (Galanter, 1993; O’Farrell & Fals-Stewart, 2012), correcting specific network member perceptions directly may also be possible (i.e., network members could self-report on their own motives, and these reports could be compared to client perceptions). Moreover, in the context of Behavioral Couples Therapy or Network Therapy, psychoeducation could also be delivered to social network members directly. Participating network members could be informed about the impact of their drinking motives on the client and could then be given a list of non-substance-related activities or strategies that provide the same rewards garnered by drinking motives (e.g., doing yoga to cope with anxiety). Clinicians could encourage network members to engage in such activities with the client in place of drinking together.

Finally, psychoeducation about the relationship between motives and substance-related outcomes could also be provided to help clients identify risk factors for alcohol misuse and gain motivation to alter their motives. Such psychoeducation and normative feedback could be conducted on a small scale within individual or group therapy (as described above) or carried out on a larger scale as part of campus interventions, as done by Blevins and Stephens (2016). As discussed in the Future Directions section, research should investigate the utility of such interventions in both contexts.

The opportunity for large scale interventions also exists in the form of advertisements about alcohol use and drinking motives. Research on normative advertisements on university

campuses has found some notable results. Several studies have found such advertisements to significantly reduce normative misperceptions (DeJong et al., 2006; Perkins & Craig, 2006; Su et al., 2018). Moreover, a number of studies have found advertisements to also significantly reduce alcohol use. For example, one study reported campus advertisements displaying norms for drinking behaviors, consequences, and a specific drinking motive (i.e., drinking to relieve academic pressure) reduced alcohol use by 30-50% in student athletes (Perkins & Craig, 2006). Similarly, another study found normative alcohol messages communicated via social media marketing reduced binge drinking rates by 29.2% on a university campus (Glaser et al., 2001). Finally, a randomized control trial of 18 campuses, found campuses that received normative marketing had significant less alcohol consumption three years later (DeJong et al., 2006).

Given research suggesting alcohol norm marketing can be effective (especially when widely disseminated over the long term), it is possible a campus wide normative marketing intervention for drinking motives may also effectively lower drinking motives and potential misperceptions, ultimately leading to reduced alcohol use. Such an intervention could include education about normative rates of motive endorsement, consequences of motives endorsements, and suggest alternative activities to meet drinking outcomes (e.g., “X% of students drink to cope with depression. Did you know drinking to cope with depression leads to alcohol-related problems and can worsen mental health? Other strategies are available to help you cope. For example...”). Moreover, given Study 3 results about the impact of close social networks on drinking motives, campaigns could educate emerging adults about the impact of social networks on their motives and their drinking over time (e.g., “Did you know who you choose as a romantic partner has a large impact on your alcohol use and reasons for

use? Partners can place you at risk for negative alcohol-related consequences”). As outlined in the future research section, if evidence suggests drinking motives are overestimated or misperceived at the campus level, such an intervention may especially be useful; however, significant further research is necessary before launching a motives marketing campaign. Additionally, while the idea of a motives marketing campaign is appealing and the overall research on alcohol marketing campaigns on university campuses is promising, some social norms marketing interventions have not successfully reduced normative perceptions or alcohol use (e.g., DeJong et al., 2009). Thus, marketing it is not always an effective intervention. It is not clear whether these mixed results would transfer to the context of drinking motives.

In addition to campus-wide marketing campaigns aimed at reducing alcohol use, campaigns have also been attempted at the broader societal level. While public health advertisements communicating the long-term harms of alcohol use and providing drinking guidelines have been found to strengthen intentions to drink less (Brennan et al., 2021; Wakefield et al., 2017), there is unfortunately little evidence that mass media campaigns at the societal level actually result in change in alcohol consumption (Young et al., 2018). Despite this, mass media campaigns have been shown to significantly impact cognitive variables like knowledge, attitudes, and beliefs about alcohol use (Young et al., 2018), which suggests mass media campaigns may be able to impact drinking motives. Campaigns that outline the long-term harms of certain drinking motives, provide normative information, and educate about the influence of social network members may be useful (See Future Directions).

Strengths and Limitations

While I have discussed the strengths and limitations of each study in the corresponding manuscripts, there are broader strengths and limitations of my research. These broad strengths and limitations are outlined below.

Sample

A strength of my samples was that they solely included emerging adult participants. Given the prevalence and significant impact of alcohol misuse in this age group (e.g., Lisdahl et al., 2013; Substance Abuse and Mental Services, 2012), studying factors that contribute to alcohol use in emerging adulthood is essential. At the same time, the focus on emerging adulthood is also limiting; as emerging adulthood is a unique developmental stage (Arnett, 2000), the results of Studies 1-4 may not be generalizable to other developmental stages.

An additional limitation of the included samples lies in the types of emerging adults that are represented within my dissertation studies. Study 1 targets and Study 2 participants were exclusively undergraduate students sampled using an undergraduate participant pool. Moreover, while Study 3 included community recruitment, 69% of participants indicated they were undergraduate or graduate students. Reflecting this, 68% of the subsample of participants from Study 3 that were included in Study 4 were also university students. Taken together, my core samples were exclusively or largely composed of students attending higher education. While statistics indicate that 30% of emerging adults in Canada are attending university at any given time, not all emerging adults attend university (Statistics Canada, 2019). Moreover, research suggests that emerging adults who attend university and those who do not have both similarities and differences in life trajectory and characteristics (Mitchell & Syed, 2015). As such, my results may not generalize to emerging adults who are not currently attending university.

Similar sample limitations also exist with respect to other sample characteristics. For example, Studies 2, 3, and 4 included participants who, at baseline, reported using both alcohol and cannabis in the past month. While cannabis is the most commonly-used drug among alcohol users (Subbaraman & Kerr, 2015), these results may not generalize to alcohol-only samples, which have documented differences from co-use samples. For example, alcohol and cannabis co-use samples have been found to have greater levels of substance related problems than alcohol-only samples (Subbaraman & Kerr, 2015; Thompson et al., 2021). Additionally, users of alcohol and cannabis report a larger number of social network members who use cannabis in comparison to alcohol-only users (Meisel et al., 2021). Furthermore, my dissertation studies were composed of predominately female participants. While research suggests the social influence of alcohol use generally does not differ between males and females (e.g., Barnett et al., 2014; Pederson & Von Soest, 2013; Whiteman et al., 2013), males and females are often found to have different alcohol use patterns (i.e., males typically being more likely to consume alcohol and being more likely to consume larger quantities of alcohol in comparison to females; Canadian Centre on Substance Use and Addiction [CCSA], 2019). As such, the sex distribution within my samples may have influenced the level of alcohol use present. Moreover, my samples were also predominantly composed of White participants. It is not clear whether my results will hold across samples that are more ethnically/racially diverse. Future research may consider utilizing strategies to recruit a more diverse sample in terms of sex or race (e.g., targeted advertisements).

It is also worth noting that my dissertation studies used biological sex, rather than gender, and defined sex in a predominantly binary manner (i.e., either male or female, or male,

female, or intersex). Thus, results may not generalize to other sex and gender identities (e.g., transgender, gender fluid, non-binary). Relatedly, while a strength of Study 1 is that I included same-sex couples, such couples only comprised 9% of romantic partners. Thus, Study 1 results should be replicated in couples or individuals who identify as LGBTQ2SIA+, a population that has historically been excluded from couples research and is often underrepresented in research in general (Andersen & Zou, 2015).

Design

Waves of Data Collection.

A significant strength of the current dissertation is the use of longitudinal designs in both Study 2 and Study 3. The longitudinal design in Study 2 provided the opportunity to assess test-retest reliability and predictive validity, allowing us to follow best practice for testing the psychometrics of the BAMB and BCAMB (Boateng et al., 2018). In Study 3, the longitudinal design allowed us to control for motive stability, representing a significant improvement over previous cross-sectional research (e.g., Hussong, 2003; Kuntsche & Stewart, 2009).

Despite these strengths, both Study 3 and Study 1 are limited by the number of waves of data collection. Study 3 only included two waves of data collection. As additional waves have been found to increase the accuracy of mediation analyses, the design of Study 3 was not perfect (Reichardt, 2011). One or more additional waves would have allowed for me to better account for the role of time and represented an improved model of cause and effect (Reichardt, 2011). Relatedly, Study 1 was cross-sectional and could not demonstrate temporal precedence. As such, it is not clear whether the association between binge drinking

in romantic partners and binge drinking in participants found in Study 1 holds over time, or whether this association is due to social influence or social selection.

Types of Network Members

There are significant strengths related to the social network members that were recruited or perceived in the included studies. Study 1 involved the recruitment of 962 social network members and Study 4 involved the recruitment of 101 social network members (N = 59 included in Study 4 analyses). This reflects a significant strength, as the recruitment of social network members in addition to participants allows for multiple sources of information and is a labor-intensive design. An additional strength of the current dissertation comes from Study 3's focus on larger and more diverse social networks. In comparison to much of the previous literature on social influence, the design of Study 3 allowed participants to list a larger number of social network members (i.e., not limited to 5 social network members; Zywiak et al., 2009) and did not restrict social network member types (e.g., Kehayes et al., 2019; Kehayes et al., 2021; Kuntsche & Stewart, 2009; Stewart et al., 2014).

Despite these strengths, my use of network members is not without limitations. First, as research suggests multiple types of network members are source of social influence (e.g., Bennett et al., 1999; Rosenquist et al., 2010; Smith et al., 2019), the goal of Study 3 was to evaluate the influence of the overall network rather than the influence of specific individuals. Given this goal, information about the types of network members listed by participants was not initially collected; however, approximately halfway through the first wave of data collection, I realized this would be important for sample description and thus information about types of social network members listed was added to my social network member questionnaire. As such, I am not able to comment on the types of network members included

at baseline for just over half of the participants ($n = 90$) in Study 3 and half of the participants in Study 4 ($n = 32$). While testing for differing influence or differing accuracy based on types of network members was not included in my study goals, this limitation prevented the completion of such supplementary analyses in Study 3 and Study 4. Second, while social network members were recruited for collateral reports in Study 4, not all my participants from Study 3 had participating network members. Of those that did, I was only able to use 60% of participants due to limitations of my chosen analysis which required participant-network member dyads. While the integration section of the current discussion interprets Study 3 results in the context of Study 4 findings, it cannot be guaranteed that the results of Study 4 participants apply to all of Study 3 participants. In fact, t-tests suggest that while social network members who were recruited for Study 4 did not differ significantly from social network members who were reported on in Study 3 on age or relationship length, they did significantly differ on relationship closeness ($p < .05$) and frequency of contact ($p < .05$). Specifically, recruited social network members had more frequent contact and were perceived to have closer relationships with participants. Third, none of the studies included in this dissertation assessed whether social network members were drinking buddies. Given drinking buddies have been found to be exert significant social influence beyond general peers (Nogueira-Arjona et al., 2019; Reifman et al., 2006), it may be that certain network members are driving the associations between social network members and participant alcohol use found in Study 1 and Study 3. Unfortunately, the current dissertation cannot test such possibilities.

Reliance on Self-Report Measures

The studies in the current dissertation predominantly relied on self-report data. While self-report data are frequently used in psychological studies and are very efficient, self-reports do not come without limitations – especially in the context of substance use. One particular concern regarding the use of self-report data in alcohol use studies is the influence of social desirability; findings suggest social desirability and impression management result in the underreporting of alcohol use, alcohol-related harms, and certain drinking motives in self-report contexts (e.g., Davis et al., 2009; Moeller & Crocker, 2009). While social desirability scales can be included to detect and control for bias introduced by social desirability (van de Mortel, 2008), the current dissertation unfortunately did not include such scales. Despite this, Studies 2 and 3 did include response options reflecting extreme alcohol quantities (e.g., consumption of 25+ drinks on one occasion), which are recommended to limit impression management (i.e., as middle response options are viewed to represent what is normative, extreme response options shift the idea of normal upwards, resulting in those trying to manage their impression being more willing to admit greater levels of consumption; Davis et al., 2009).

An additional concern regarding self-report data is the assumption that individuals can correctly remember the details of their alcohol use patterns (e.g., how many drinks, how often) and motivations. Research suggests that there is a stark disconnect between retrospective and in-the-moment reporting of alcohol consumption and substance-use motives (e.g., Piasecki et al., 2007; Searles et al., 2000). Daily diary and ecological momentary assessment studies can be used to increase the accuracy of alcohol reporting and motives (e.g., Searles et al., 2000). As such methods were not used in the current dissertation,

the accuracy of reported motives is unclear. Replicating the current studies using daily diary or ecological momentary designs would be beneficial.

Additionally, in the case of drinking motives, self-report data comes with an assumption that individuals have the insight necessary to correctly perceive their own drinking motives. It is not clear whether all individuals have this ability, as a mismatch between motives and behavior has been demonstrated. For example, in a study of motives for cigarette smoking, social motives were found to be unrelated to observed smoking in social settings (Otsuki et al., 2008). This limitation likely plagues the entire substance use motives literature and may not be avoidable.

Future Directions

In addition to the future directions outlined in each manuscript and within the current chapter, there are several ways future research could expand on my dissertation findings. First, as previously mentioned, both Study 1 and Study 3 could be replicated with more waves to provide further clarity on the effects of social network alcohol use and alcohol motives. Replicating Study 1 with additional waves of data collection would provide the opportunity to disentangle socialization and selection effects, while replicating Study 3 with additional waves of data collection would also allow for an ideal test of social influence through mediation and allow for the use of more advanced statistical techniques (e.g., RI-CLPM; Hamaker et al., 2015). Future research aiming to study *both* socialization and selection of alcohol and drinking motives could also recruit students out of high school, similar to Meisel and Barnett (2017), and follow them as they transition into a different life stage (e.g., college) where new relationships are likely to form. By using a longitudinal egocentric design that allows for fluctuating networks in this context, researchers could better

determine if selection and/or socialization is occurring for both alcohol use and alcohol motives.

Second, it would be fruitful to investigate the relative impact of different types of social network members on alcohol outcomes in comparison to the impact of the broader undifferentiated network on alcohol outcomes. Such an investigation would provide the opportunity to determine if social network influence is driven by certain individuals, who can thus be focused upon in research and intervention, or if the cumulative effect of the larger network is equally or more important than the influence of certain types of individuals. These findings would help guide researchers in selecting which network members to study. Additionally, these findings would inform potential interventions, providing insight into whether treatment should focus on the influence of particular types of network members (e.g., romantic partners) or the broader network. Such analyses could be carried out for both alcohol use and alcohol motives. Moreover, researchers may consider conducting Truth and Bias Analyses for drinking motives by network member type, in order to determine if individuals are more accurate or biased when perceiving certain types of people (e.g., romantic partners vs. friends).

Third, as variables included in Study 3 accounted for 17-41% of the variance in drinking motive change over time, future research could investigate the relative impact of other variables. Researchers may consider including previously documented predictors of drinking motives (e.g., personality, emotional states; see Cooper et al. 2016), as well as measures of cultural norms (e.g., societal norms, campus norms) and social desirability, in one model to paint a clearer picture of the predictors of drinking motives and their relative importance.

Fourth, future research on social network drinking motives should carefully consider whether to utilize direct reports from social network members, and/or perceptions of network members by the target. At a basic level, utilizing perceptions makes for a simpler and more economical research design that allows for participants to report on broad social networks. In comparison, utilizing direct reports from network members is more time consuming, and often does not allow for the collection of broad networks due to financial barriers (i.e., the number of participants grows from only compensating targets, to also compensating network members) or feasibility concerns (i.e., not all social network members want to participate). The results of Study 4 add to these considerations, suggesting that studies utilizing perceptions of drinking motives must acknowledge that these perceptions are likely not entirely accurate, and thus findings may not represent actual network member behavior or beliefs. In contrast, studies relying on direct reports of drinking motives must acknowledge that they are likely not capturing all the influence that comes from each social network member, as the motives social network members endorse may be very different from the motives perceived to be present for these same individuals. Researchers should thoughtfully consider the pros and cons of each approach and interpret their findings within the context and limitations of their chosen research design. To provide further clarity on the use of perceptions or direct reports, future research could collect both perceived social network member motives and actual social network motives using a sample size that allows for the comparison of the relative predictive power and alcohol outcomes of perceptions and direct reports. Such information will indicate if perceptions and direct reports account for unique variance in participant outcomes and whether they are both useful sources of information.

Fifth, examining the utility of my findings in clinical contexts is an important next step. Researchers may consider further examining whether drinking motives mediate outcomes in popular substance use treatment protocols. If this is the case, research could investigate the clinical utility of the BMM, particularly a 7-day version, as a way to monitor weekly treatment progress. Moreover, research may want to investigate the utility of a normative intervention for drinking motives included as an adjunct to existing evidence-based treatments, or as a stand-alone intervention. With respect to an adjunct intervention, researchers may consider adding in an explicit session on drinking motives (i.e., psychoeducation about risks, normative rates, and alternative coping strategies) to CBT for alcohol use and comparing outcomes to standard CBT. With respect to a stand-alone intervention, the only existing model is the coping motives intervention created by Blevins and Stephens (2016). While this intervention was found to reduce coping-with-depression motives, adding content about coping-with-depression motives to a typical normative intervention did not improve alcohol outcomes. As such, future research may consider expanding on the existing intervention by Blevins and Stephens to more effectively target coping motives, as well as expanding the intervention to target other motives that may be associated with risky alcohol use (e.g., enhancement motives). Finally, the usefulness of public health campaigns including drinking motives should be examined. Experimental studies could show participants advertisements/public health messages about normative rates of drinking motives and about the relationship between specific drinking motives and alcohol outcomes. Participants could then indicate their intention to drink for the reasons discussed in the advertisements, and this could be compared to participants randomized to be exposed to an advertisement about a different (control) topic. Similar work has been conducted in the

past to develop effective public health messaging campaigns (Wakefield et al., 2017). If motive-related public health messages are found to result in lower intentions to drink for particular reasons, such campaigns could be piloted on university campuses or other areas with high populations of emerging adults.

Finally, each of my models could be replicated in other developmental contexts. With respect to Study 1, research and theory suggest romantic partners are important sources of influence for both emerging adults and adults (e.g., Bartel et al., 2017; Windle & Windle, 2014; see also review by Muyingo et al., 2020). While this suggests the results of Study 1 may be found across different age groups, it is also likely that romantic partners become more or less important in different developmental periods relative to other network members. As such, future research may consider replicating Study 1 in different developmental contexts. Similarly, the results of Study 2b could also be replicated in a different age group. As other previously validated motives measures have been found to be reliable and valid in age groups other than those in which they were originally tested (e.g., Gilson et al., 2013; Martin et al., 2016; Stewart et al., 1996), the psychometric properties of the BAMB and BCAMB may transfer to other age groups; however, this should be examined prior to the using the BAMB and BCAMB in other developmental periods. Likewise, the results of Study 3 would also benefit from replication in other developmental periods. As emerging adults exist within a culture of heavy alcohol use and are in a period of identity formation in which they are exploring alcohol use, trying to fit in, and working to form new social bonds (Arnett, 2005), the influence of others' perceived motives may be especially strong. It is not clear whether the level of influence captured in Study 3 continues as individuals move into life stages that are often accompanied by lower levels of alcohol use and more stable social networks than in

emerging adulthood (Substance Abuse and Mental Health Services, 2012; Wruz et al., 2013). Given it may be valuable to target motive perceptions to reduce alcohol use, determining if they should be targeted across age groups is important. Finally, as there is a documented shift in the endorsement of drinking motives over the life course (i.e., social, enhancement, and coping motives being endorsed less frequently in older adults than in adolescents and emerging adults; Cooper, 1994; Gilson et al., 2013; Grant et al., 2007), Study 4 results could also be examined in other developmental periods. If the accuracy of motive perceptions is to be used to guide research design choices and potential psychoeducational interventions in other age groups, the accuracy question within these age groups should be investigated.

Conclusions

In conclusion, my dissertation sought to better understand the influence of social network members on the alcohol use and drinking motives of emerging adults. To accomplish this goal, I conducted both cross-sectional and longitudinal studies, recruiting participants, as well as their social network members. My studies all produced notable novel findings. Study 1 demonstrated that binge drinking of romantic partners predicts emerging adult binge drinking more strongly than peer, sibling, and parent binge drinking. This result advances the literature on who is the most important source of influence within the social network in the emerging adult developmental stage. Study 2 established the BMM (and the BCMM) as psychometrically sound measures that can be used when the MDMQ-R (or the MMM) are not feasible. The creation of these brief measures expands what is possible in the field of substance use motives research. Study 3 indicated that emerging adults' perceptions of their social network members' drinking motives matter; overall, their perceptions of other's drinking motives strongly influence their own future drinking motives and, in some

cases, their own future alcohol use. This study propels the literature forward, filling gaps and representing one of the first studies to examine drinking motives perceptions. Finally, Study 4 showed that perceptions of social network drinking motives are predominantly biased. Thus, the social learning that occurs from viewing others drinking motives likely does not fully reflect what is happening within the social network. These results highlight the importance of carefully choosing whether to study motive perceptions and/or direct social network member reports. Taken together, the results of my dissertation add to the growing evidence suggesting the social context of drinking and drinking motives cannot be ignored. The social network appears to impact not only how much or how often emerging adults drink, but also why emerging adults drink in the first place. Thus, social network drinking behaviors and perceptions of these behaviors may represent critical targets for intervention.

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APPENDIX A. COPYRIGHT PERMISSION TO INCLUDE STUDY 1



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Home



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Email Support



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Create Account



Social influences on binge drinking in emerging adults: Which social network members matter most?

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 Publication: Substance Abuse
 Publisher: Taylor & Francis
 Date: Oct 1, 2020

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