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Comorbidity of alcohol abuse and depression: exploring the self-medication hypothesis

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Comorbidity of alcohol abuse and depression:
Exploring the self-medication hypothesis

by

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A dissertation submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

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ABSTRACT

Extensive evidence exists to indicate that the comorbidity of alcohol dependence disorders and major depression occurs at a rate far exceeding that which one would expect from base rates alone. Self-medication is one theory as to why this type of comorbid combination may be over-represented. Self-medication can be defined as the conscious or unconscious tendency to drink alcohol (or use other drugs) in response to the experience of depressive symptoms. The theory holds that substance use can temporarily attenuate the negative experience of depression, and for this reason can be seen as a means of escape. Unlike successful treatment with anti-depressant prescription medication, alcohol use is not an effective means of combating depression. In fact, it is predictably counter-productive. This project was undertaken with the goal of integrating many of the research findings from the last twenty years within a study of the extent to which self-medication occurs within a college student sample, a group whose drinking behavior has been notable for its potential to become problematic.

This was the first study to examine the self-medication hypothesis throughout the range of depressive symptomology and alcohol use, and its aim was to determine the point at which the self-medicative response becomes a serious risk as depression increases. The investigation also attempted to determine the amount of variance in alcohol use that can be explained by self-medication, specifically use motives, while controlling for the amount of self-reported depression. In general, it was expected that as depressive symptoms increase, the tendency to drink for self-medicative reasons will increase.

The results indicated strong support for the existence of self-medicative drinking even at sub-diagnosable levels of depression. A clear relation between level of depression and alcohol use was not found. However, this result was thought to be related to the collegiate sample used in this investigation and the impact of drinking in a collegiate subculture. Self-esteem was not found to have an effect on self-medication. However, changes in depression over a 4-week time period were

related to changes in the coping motives to drink over that same period in the predicted direction, a finding that is supportive of the self-medication hypothesis.

CHAPTER 1. INTRODUCTION

People drink alcohol for many different reasons. Some begin at an early age, seeking to experiment with forbidden activities or simply to fit in with friends. Others may abstain until they get to college or reach the legal drinking age. Some never drink at all. Regardless of the choice, it seems safe to assume that there are always driving forces behind the choice. One can choose to drink or, theoretically, choose not to drink. Further, one can choose to have a single glass of wine or a six-pack of beer. Some college students have even been known to go through a ritual called “Century Club,” during which they take 100 shots of beer in 100 minutes.

All choices carry some level of risk, from a relative absence of risk (like reading a book) to high levels of risk (like hang-gliding). The risks associated with alcohol use vary widely depending on the amount of alcohol one chooses to consume and the circumstances of the situation. A small woman, for example, might find herself quite intoxicated after only two glasses of wine, while a 300-pound linebacker might not even notice the effect of a second glass of beer. Neither is at much risk after one drink, but the risk changes considerably and predictably when they decide to drive home.

If one holds all other factors constant, one of the most salient factors in determining the level of risk associated with drinking is undoubtedly the amount consumed. Unfortunately, binge drinking is a popular past-time among college students, young people in general, and many other adults. Experts in the field define male “binge drinking” as the consumption of five or more drinks on one occasion. The number for females is understandably lower; any alcohol intake that meets or exceeds four drinks would constitute binge drinking. Because this level of intake is usually enough to cause intoxication, a state in which risk increases, binge drinking is by definition a risky behavior.

Binge drinking has been a popular activity on college campuses for some time, but risky collegiate drinking behavior may not be limited to binge drinking alone. There is no doubt that college students sometimes consume alcohol in a manner

that may not constitute a binge, yet there may be other consumption behaviors that can be cause for concern. If this possibility is held to be true, then ask what other types of drinking behavior are risky? Further, are there identifiable correlates which can and should raise concerns about an individual's drinking behavior?

One such risky consumption behavior may come in the form of a buzzword in pop culture, the so-called act of self-medicating. The idea of self-medication gained popular acceptance following the April 1994 suicide of popular musician Kurt Cobain, lead singer of the group *Nirvana*. After inflicting a lethal gun shot wound to the head, it was widely reported that Cobain had been a very unhappy person, and had battled severe depression for much of his life. It was also widely reported that Cobain (like many musicians before him who died young) was an avid drug user and alcoholic. With cultural acceptance of mental illness increasing in the early 90's, the media were ready to publicize the connection between severe mental illness and substance abuse long suspected by experts in the field. That connection was the notion of self-medication.

In the strictest sense, self-medication would be defined as the use of alcohol or another drug by an individual who is experiencing psychological distress and/or pain due to a mental disorder which would likely benefit from a pharmaceutical intervention. However, in the absence of that medication, the individual takes into his/her own hands the task of chemically coping with his/her psychological distress by abusing alcohol or other substances. Notice the key factors in the definition: the presence of a mental disorder which would benefit from medication, absence of medication, and the substitution of that medication with an alternative, self-administered chemical.

As broad as that definition is, it is perhaps still too narrow, considering that the individual may not acknowledge the substance as a substitution for a legitimate pharmacotherapeutic approach. In other words, the self-medicator may not realize that he/she is self-medicating through his/her use of alcohol or other drugs. The scope of the original definition of self-medication may also be debatable in that it requires the self-medicator to be suffering from a diagnosable disorder. If an

individual were to drink or use drugs expressly to escape the pain of depressive symptoms that together would not be sufficient to warrant a diagnosis of major depression, should such drinking or drug use be considered self-medication as well? More specifically, is the experience of such symptoms enough to propagate the self-medication response?

In an effort to address these questions of the scope and generalizability of self-medication, the present study can expand the definition to its most basic elements of behavior, circumstance and choice. A broader definition might identify self-medication as any substance use that is engaged primarily in response to feelings of pain or distress, whether consciously or unconsciously. Thus, self-medication is a reaction to a stressor, in this case psychological pain or distress. Further, many theorists would characterize this type of substance use as a purposive coping behavior.

Having identified both a strict and a broad definition of self-medication, one moves logically to the question: what is known about self-medication? The ensuing literature review constitutes an effort to integrate scholarly work that has either directly or indirectly addressed the issue of self-medication. This review should lead us directly to questions that remain unanswered, and thus the basis for the study proposed herein. If successful, this project will serve to integrate knowledge regarding self-medication as well as to add empirical data to this growing field of research. Perhaps as importantly, the conclusions that may be drawn from the results obtained could have implications for the screening, assessment, and treatment of depression and alcohol use and abuse in the clinical setting.

CHAPTER 2. LITERATURE REVIEW

Comorbidity

Definition and Rates

Comorbidity can be defined as a situation in which an individual simultaneously expresses symptoms of more than one psychological disorder. While any two disorders might manifest themselves at the same time in a person, some combinations are far more prevalent than others.

The incidence of comorbid depression and substance abuse is higher than would be predicted. Samples of individuals suffering from major depressive disorders show much higher rates of substance abuse than would be seen in a non-clinical sample. Alternatively, samples of substance abusers show much higher rates of depression than would be predicted in a normal sample (Myers et al., 1984). Depression was found in 54% of opioid addicts, 38% of alcoholics, and 32% of cocaine users. While these estimates are notable, they are made even more striking when one considers the 7% rate at which major depression occurs in a normal population. In a study focusing on alcoholics, Schuckit (1985) found that as many as 80% of alcoholics report depressive symptoms, with a third of those meeting the criteria for a diagnosis of major depression. While these are individuals whose alcoholism is severe enough to cause them to seek treatment (which may, in turn, be a correlate of comorbidity with affective disorder), the size of the relation between major depression and alcoholism is striking.

One of the primary sources of information in the area of comorbidity research is the National Comorbidity Study (NCS) conducted by Kessler and colleagues and published in 1994 and in 1997. These studies provide detailed information as to the prevalence of individual disorders in the general population. They also provide some specific information about comorbidity. Kessler et al. (1994) found that 48% of the population had at least one psychiatric disorder, and about 60% of those had a combination of a substance abuse disorder and an affective disorder. This report also found that 24.3% of men and 48.5% of women with a lifetime alcohol disorder

also reported a lifetime major depressive disorder. These prevalence estimates grow even higher when one refers to alcohol treatment samples. Some studies of individuals who are seeking alcohol treatment report comorbid depression rates as high as 70% (Kessler et al., 1994).

In a study of the comorbidity of alcohol-related and depressive disorders among college-age adolescents, males who meet criteria for alcohol abuse/dependence are almost four times more likely to be diagnosed with major depressive disorder than those who do not drink pathologically (Deykin, Levy, & Wells, 1987). Females who meet these criteria are six times more likely. Another study found that young adults with depressive or anxious disorders are twice as likely as those without them to develop a substance abuse disorder (Christie et al., 1988).

One of the most common ways to numerically conceptualize comorbidity is the use of the odds ratio (OR; Swendsen and Merikangas, 2000). This method compares the prevalence of co-occurrence of two disorders with the statistically expected co-occurrence given their individual prevalence in the population. Thus, a ratio of 1.0 would indicate that there is virtually no relationship between the two disorders in terms of their tendency to appear together versus individually. However, a ratio significantly higher than 1.0 would indicate that the two disorders co-occur more often than would be predicted, and thus appear to be related. For example, if the odds ratio for the comorbidity of alcohol dependence and major depressive disorder is 2.0, that means that an individual diagnosed with alcohol dependence is twice as likely to be depressed as an individual without a diagnosis. Kessler et al. (1997) reported depression with alcohol abuse ORs as low as .9, while Grant (1995) found ORs as high as 3.8 for depression with alcohol dependence. Another study found that alcohol diagnoses were twice as likely among those with anxiety disorders as in those who were not suffering from anxiety problems (Kushner & Sher, 1993).

While some combinations of comorbidity may have higher ORs, they may not demand the attention of the combinations that are the focus of this exposition. For

example, Kessler et al. (1997) also found that the comorbidity rates of alcohol use disorders with schizophrenia and bipolar disorder are higher than those of alcohol disorders with depression; however, the prevalence of depression results in a larger number of people suffering from this combination of disorders.

Approach Differences

National Surveys

There are a number of possible approaches to the study of comorbidity. One of the most prominent has already been mentioned in the NCS (Kessler et al., 1994, 1997). This approach is important to mention not only due to its scope (N = 8098), but also because these researchers sampled the general population to find the prevalence of disorders. This method is relatively free from selection biases and thus provides perhaps the most generalizable statistics for the population as a whole.

Another example of this type of approach is the Epidemiologic Catchment Area Study (ECA; Robins & Reiger, 1991). Like the NCS, the ECA sampled the population and conducted structured interviews to assess the prevalence of psychiatric disorders in the sample and inferentially in the general population. The National Longitudinal Alcohol Epidemiologic Survey (NLAES; Grant, 1995; Grant & Hartford, 1995) provides another example of this approach, also focusing on the comorbidity of alcohol use disorders and depression.

Clinical Investigations

While national surveys provide accurate and unbiased data, they are extremely expensive to conduct, and due to the time constraints respective of the participants, only so much information can be collected. While the sample sizes may not be as impressive, it could be argued that clinical investigation is even more prominent in the research of comorbidity. Essentially, these are studies in which researchers collect data in treatment facilities with disorder-focused programs. In doing so, they are instantly selecting samples with one of the two disorders in which

they are interested. They can then measure the incidence of the second disorder to assess the comorbidity.

Thus, two sub-approaches become possible within clinical investigations. One is to examine comorbidity among affective disorders and substance use disorders by selecting for the affective disorder first. Two primary examples of this approach can be seen in later sections of this document. The first is a study of substance use among patients in treatment for agoraphobia (Bibb & Chambless, 1986). Though agoraphobia is an affective disorder, it is not depression. However, this article is exemplary of the “disorder-first approach,” contrasting the “substance-first approach” to be discussed in a moment. Another example of the “disorder-first approach” can be seen in Breslau, Andreski, and Kilbey’s (1991) study of nicotine dependence among depressives and in Test, Wallisch, and Allness’ (1989) study of substance use among schizophrenic patients. Finally, from the approach of examining depression first, those who have a history of major depressive disorder are significantly more likely to have a diagnosis of nicotine dependence (Breslau, Andreski, & Kilbey, 1991).

However, the “substance-first approach” (observing affective disorders among substance-treatment populations) may be the most prevalent of all, given the preponderance of individuals seeking treatment for substance use-related issues. Examples of this approach can be seen in studies by Brown and Schuckit (1988), Brown et al. (1995), Castaneda, Galanter, and Franco (1989), Hughes (1993), Keeler, Taylor, and Miller (1979), Khantzian (1985, 1989), Kinnunen, Doherty, Militello, and Garvey (1996), Lerman, Caporaso, Main, Audrain, and Boyd (1998), Martin (1980), Pomerleau, Collins, Shiffman, and Pomerleau (1993), Rounsaville et al. (1991), Rounsaville, Dolinsky, Babor, and Meyer (1987), Rounsaville, Weissman, and Crits-Cristoph (1982), Rounsaville, Weissman, Kleber, Wilber (1982), Schuckit (1985), and Woody, O’Brien, and Rickels (1975).

While the importance of these research findings cannot be underestimated, the utility of clinical investigation data must be taken in context. Swendsen and Merikangas (2000) observed that one of the primary limitations to much of the

research in the area of comorbidity is exemplary of Berkson's Paradox (Berkson, 1946). This is the phenomenon in clinical investigations in which selection is limited to those who are in treatment. The result of this selection bias is of course that the findings may not be externally valid for a broader, non-treatment-seeking population.

Explanations/Hypotheses of Comorbidity

Given the extensive evidence of comorbid mood disorders and substance abuse, we are left with the charge of explaining why this relation exists. However, defining and researching the comorbidity of alcohol abuse and mood disorders can be complicated. Several studies of comorbidity among alcohol and depression were conducted within the context of alcohol treatment programs (Curran, Flynn, Kirchner, & Booth, 2000). While this is certainly an important and appropriate subset of the population, one of the weaknesses inherent in this subset of comorbidity research is the difficulty of diagnosing depression when a patient presents for alcohol treatment (Curran, Flynn, Kirchner, & Booth, 2000). This difficulty stems from the fact that individuals who have recently become abstinent from drugs and alcohol frequently experience depression as a side effect of withdrawal. As such, any depression observed during this time could be either independent or substance-induced depression. To determine which, one must draw heavily on the retrospective self-report of a former drinker – typically not the most statistically reliable source of data.

The rates of comorbidity reported by various sources have been staggering. Indeed, it seems that one can safely agree with Khantzian (1985, p. 1261) that there is sufficient evidence to support “the concept that drug dependence is related to and associated with coexistent psychopathology.” While the association between and among substance use disorders and affective disorders has been well-documented (Kessler et al., 1994, 1997; Maier and Merikangas, 1996; Grant, 1995, Robins & Reiger, 1991 Keeler, Taylor, & Miller, 1979; Myers et al., 1984; Robins et al., 1984; Rounsaville, Weissman, Kleber, & Wilbur, 1982, Rounsaville, Dolinsky, Babor, & Meyer, 1987; Rounsaville et al., 1991; Robins & Reiger, 1991), the mechanisms of these associations are not as well understood (Swendsen). Merikangas (1990) proposed two basic classes into which any mechanistic explanation of this

comorbidity is likely to fall: causal explanations, and those of shared etiology. Over time, these two classifications have differentiated into four hypotheses which vie for the support of experts in the field. These include the shared-etiology hypothesis, the causal hypothesis, the artifactual hypothesis, and the self-medication hypothesis.

Shared Etiology

Researchers such as Maier and Merikangas (1996) and Cadoret et al. (1996) have proposed the shared-etiology explanation. In brief, this hypothesis states that depression may tend to co-exist with substance abuse because the two share “common underlying genetic and environmental factors, such as a disruptive family environment” (Hasin & Grant, 2002). The shared-etiology explanation has seen, at best, mixed support in the research (Maier & Merikangas, 1996; Cadoret et al., 1996). Studies seeking to make a case for this hypothesis have often been inconclusive; however, sufficient evidence exists to continue entertaining the shared-etiology hypothesis as a possible explanation.

Causal (Direct and Indirect)

A second hypothesis, generally referred to as the causal hypothesis, essentially proposes that depression is often comorbid with substance abuse – especially alcohol abuse – because the abuse of alcohol either directly or indirectly causes major depression. A direct causal relation would suggest that substance abuse “pharmacologically induces major depression and its symptoms” (Hasin & Grant, 2002, p. 794). Alternatively, an indirect hypothesis would suggest that the substance abuse causes factors that, in turn, lead to depression. Such factors might include unemployment, relational strains, and financial hardship. Direct or indirect, the causal hypothesis consistently views depression as the product of substance abuse.

Abraham and Fava (1999) believe both explanations of the direction of comorbidity among depression and substance use disorders; however, they posit that the direction of the relation depends on the substance used. They found the strongest support for this hypothesis in alcohol-dependents, who were disproportionately more likely than users of other substances to have their alcohol

dependence preceded by depression. For alcohol then, this position is more consistent with the self-medication hypothesis discussed below.

Markou, Thomas, and Koob (1998) postulate yet another possible explanation for the comorbidity rates observed among depression and substance abuse. Focusing on the neurobiological, they posit that substance abuse and depression may actually be symptomatic expressions of the same neurobiological abnormalities or imbalances. They also extend a version of the causal hypothesis discussed earlier by proposing that the use and abuse of drugs may have a biochemical effect on the brain, such that depression is actually chemically induced by substance use.

Artifactual

The artifactual hypothesis proposes that the high comorbidity rates are actually the product of misdiagnosis. The central idea here is that several aspects and symptoms of substance abuse disorders can manifest themselves in a manner that can appear very similar to depression. For example, withdrawal effects from alcohol and other substances commonly bring about depressive symptoms (McKim, 2003).

While the artifactual hypothesis brings up an important concern for diagnosis, this concern has essentially been addressed by the revisions found in the DSM-IV which has added distinctions to the diagnosis of major depression when a substance abuse or dependence disorder is present. The first distinction is referred to as primary major depressive disorder. This diagnosis indicates that the depression can be established prior to substance abuse and/or dependence. A diagnosis of secondary major depression indicates that the depression has persisted for more than 4 weeks following the cessation of use. By adding the secondary distinction, misdiagnosis of a depression that is actually withdrawal symptomatology becomes much more difficult (Hasin & Grant, 2002).

A study by Hasin and Grant (2002, p. 799) set out to determine “whether alcohol dependence and major depression were associated when acute intoxication or withdrawal effects were ruled out as an explanation. Their results indicated that an association was present, which serves as evidence against the artifactual

hypothesis. Further, their results were consistent with the causal hypothesis, but could not rule out the shared-etiology hypothesis. The results also suggested that treatment for depression should not be withheld from recovering or recovered addicts and alcoholics under the assumption that their symptoms are merely a product of withdrawal (Hasin & Grant, 2002).

Having explored the basic classes of explanations regarding the prominence of comorbidity among depression and substance use disorders, we can now focus on the specific explanation generally referred to as the self-medication hypothesis.

Self-Medication

Conceptualizations

Like many conceptualizations in medicine and psychology, theories and explanations of drug dependency have evolved. Early psychodynamic explanations from the 1950s and 1960s emphasized issues such as peer group pressure, escapism, euphoria-seeking, and self-destruction as possible bases for the development of substance abuse and dependence (Khantzian, 1985). However, during that same period, a branch of psychoanalysts began to look at substance abuse from a different perspective. These clinicians and theorists “emphasized that heavy reliance on and continuous use of illicit drugs are associated with severe and significant psychopathology” (Khantzian, 1985, p. 1259).

Edward Khantzian (1985) formulated one of the first self-medication hypotheses from a psychodynamic perspective. Focusing mainly on heroin and cocaine, he stated that “the specific psychotropic effects of these drugs interact with psychiatric disturbances and painful affect states to make them compelling in susceptible individuals” (p. 1259). Khantzian also observed that the subjective experiences of addicts provide instructive indications as to the extent to which these addicts often suffer from overwhelming disturbances of affect (such as those in depression) and how the short-term use of their drug of choice helps to combat these disturbances.

Preceding even Khantzian was Conger's tension reduction hypothesis (1956). His theory essentially states that "alcohol serves to reduce tension or anxiety, possibly because of the depressing or tranquilizing effects of alcohol on the nervous system. Drinking is thus reinforced by the tension reduction effects obtained" (1956, p. 175). Lewis and Vogeltanz-Holm (2002) noted that Conger's tension reduction hypothesis bears little theoretical difference from Khantzian's first articulation of the self-medication hypothesis.

Khantzian and Conger's theories converge in their conceptualization of substance use behavior as a reactive behavior, a behavior that will be made more likely in response to certain conditions. For Khantzian, these conditions are "painful affect," and while they may not directly lead to responsive drinking, he does suggest that these factors make an individual more susceptible to drinking. Conger's theory conceptualizes abusive alcohol use as a motivated response to the (presumably) unpleasant experience of "tension". If we consider the interpretive broadness of Conger's construct of tension, we can presume that the emotionally painful experiences of depression and anxiety would likely be exemplars of tension.

When we consider the implications of responsively engaging in a behavior in the presence of a negative affect state (presumably with the direct or indirect goal of reducing this affect state), we come to the notion of coping behavior. Social learning theory models of college student drinking conceptualize alcohol consumption as a general method of coping with daily demands that may become maladaptive when used excessively (Maisto, Carey, & Bradizza, 1999). There can be little argument that whether an individual is aware of the intentions and motivations, drinking to cope (especially that which is purposively driven) is undeniably synonymous with self-meditative drinking.

Discussion of coping, both adaptive and maladaptive, leads us to the consideration of psychological defense mechanisms. In an early study investigating the link between psychological defense mechanisms and substance abuse, Milkman and Frosch (1973) found that there was a link between an individual patient's compensatory defense needs and that patient's drug of choice. Namely, those who

abused heroin reported doing so to provide a conduit for withdrawal and isolation, while those who primarily abused amphetamine were generally inclined to do so to inflate their sense of self-worth and bolster their confidence for interacting with their environment. The researchers conceptualized these patients as unable to accomplish these goals without drugs due the nature of their psychopathology. Krystal and Raskin (1970) observed similar relationships, but with a focus on depression and anxiety. Their research indicated that because these disorders have a tendency to be somatized, unverbilized, and undifferentiated in addicts, a consequent “defective stimulus barrier” results, which in turn leaves them unable to adequately deal with their feelings and predisposes them to drug use.

In further illustration of psychodynamic conceptualizations of self-medication, Schiffer (1988) asserted that addicts attempt to adaptively self-medicate painful affect states. However, Khantzian (1989) refuted Schiffer’s claim that the maladaptive explanation of self-medication is explained by an unconscious drive or desire to destroy oneself. Instead, Khantzian argued that “the suffering of addicts is linked to attempts to change the passive, nameless dysphoria which they do not control to an active dysphoria which they do control” (1989, p, 75). Thus, a psychodynamic view of self-medication entertains the notion that the behavior is produced by a desire to gain control of the pain by inflicting it upon themselves, rather than allowing it to exist unchecked. While this does not necessarily address the conscious compulsions of the substance abuser, it does potentially help to explain the paradoxically maladaptive cycle of self-medication.

To summarize, self-medication hypotheses are those that conceptualize alcohol abuse (and the abuse of other substances) as a responsive reaction to a negative personal state of some variety. Generally speaking, this negative state can be thought of as the experience of unpleasant or painful physical or psychological states. While physical pain will usually lead one to seek the help of a physician, emotional pain or distress may lead to individual coping attempts that may or may not be successful. Self-medication conceptualizations would predict that an individual who is suffering from a diagnosable negative affect state (most notably

depression or anxiety) may drink in an effort to mentally escape, if only for a limited time, and in doing so dull the pain. Given the proliferation of the pharmacological treatment of depression and anxiety in recent years (McKim, 2003) self-medication could also be seen as the use of alcohol to achieve (though probably not effectively) the outcomes obtained through prescribed medication.

Theory-grounded Conceptualizations

Cognitive-Intentional

One way to conceptualize self-medicating behavior is to look at the substance use as a cognitive, intentional choice. That is, these individuals are actively thinking about their actions, and are choosing to use or abuse their substance of choice. Further, this choice is an intentional one in that the use is intended to effect a particular outcome, namely the reduction of a negative state. This negative state could be the experience resulting from comorbid depression or another affective disorder. Thus, an individual may engage in the following inner dialogue:

“I feel emotional pain.”

“I have noticed that the intensity of my pain is temporarily reduced when I drink/use drugs.”

“I will feel better if I drink/use drugs, so I will do just that.”

Self-medication has been proposed as an explanation in the etiology of substance abuse by both mental health providers (Khantzian, 1985; Wurmser, 1974) and biological researchers (Simon, 1981; Martin, 1980). Proponents of this model argue that drug use and abuse is directly related to the pharmacological effects of the drug. In other words, the drug is used to reduce the negative symptoms and enhance the positive symptoms commonly associated with psychiatric disorders. Rather than seeking prescription medication, these individuals find legal and illegal drugs that will approximate the medicinal effects of prescription drugs.

One problem with this hypothesis is that it is almost entirely based on anecdotal data, that is, drug users' self-reports of their motivations to use (Weiss, Griffin, & Mirin, 1992). Critics may also cite empirical studies that indicate the exacerbation of psychiatric symptoms concurrent with and following chronic

substance abuse. However, this apparently illogical trend does not necessarily invalidate the theory, as it may not be accurate to assume that a drug abuser is behaving rationally or logically. This trend also ignores the short-term vs. long-term effects of self-medication. Furthermore, it is also presumptuous to assume that the post-high worsening of a drug abuser's symptoms will be properly identified by the abuser as a product of the substance abuse.

In one of the first studies to identify self-medication as a hypothesis, Weiss et al. (1992) examined a group of 494 hospitalized drug abusers. They focused on the self-medication of depression because the frequency of depressive symptoms in substance abusers is known to be very high (Keeler, Taylor, & Miller, 1979; Rounsaville, Wiessman, & Crits-Cristoph, 1982). In addition, self-medication of depression was also ideal because of the known effectiveness of pharmacologic treatments (Weissman, 1979). Moreover, Weiss et al.'s (1992) approach could be characterized as "substance-first", meaning that they targeted substance-abuse diagnoses first and then looked for psychiatric symptoms within that population. They accepted the biophysical component of the self-medication hypothesis and endeavored to look at patients' claims as to why they used.

By separating depressed drug abusers from non-depressed drug abusers, the researchers were able to make several comparisons that were designed to determine if these two groups were using for different reasons. Thus, they compared the reported frequency and effectiveness of substance abuse, while checking for a potential moderating effect of depression on the drug's effectiveness for symptom reduction. The investigators also looked at the diagnosis of major depression, specifically whether knowledge of potentially self-medicative substance abuse (as a response to feeling depressed) is useful information for the clinician. Finally, given varying sex-related differences in drug abuse (Griffin, Weiss, & Mirin, 1989), they sought to investigate whether the utility of the self-medication hypothesis is moderated by gender. Unfortunately, the substance abusers they were able to examine did not include alcohol abuse, as these patients were assigned to a different unit in the hospital.

After investigating for differences between a depressed and non-depressed population of substance abusers, Weiss et al.'s study (1992) provided support for the self-medication hypothesis. The cognitive/intentional component was supported, with 63% of all patients (whether diagnosed as depressed or not) claiming that they used their drug of choice to reduce depressive symptoms. This result was not affected by differences in drug of choice. These results were more prominent in women than men, however, in that 73% of women reported this motivation for use compared to 58% of men. The strength of symptom reduction-motivated substance abuse was even more powerful in patients with comorbid major depression. Eighty-nine percent of these patients reported using their drug of choice expressly for the purpose of reducing their symptoms, versus 60% of non-depressives.

Of even more interest is their finding that diagnosed-depressive men are more likely to engage in self-medicating behaviors than are women. All of the depressed men reported self-medicative motives for abuse, while 81% of depressed women reported substance abuse in an effort to reduce depressive symptoms. However, only 55% of the non-depressed men reported self-medication motives for abuse while 75% of non-depressed women reported self-medication motives for their substance use (Weiss, 1992). One interpretation of these differences might be that women are more likely to self-medicate even sub-diagnosable levels of depression.

When considering the experienced effectiveness of the drug use reported by the patients in Weiss et al.'s study (1992), 68% of the patients indicated improved mood; however, there was no statistical relationship between reports of mood elevation and self-medicating behavior. This would seem to indicate that while these drugs do seem to temporarily elevate mood, the effect is not moderated by the motivation that drives the use. That is, self-medicators seem just as likely to enjoy mood elevation as are those whose use is not motivated by a desire to reduce depressive symptoms. Also of interest is the finding that 26% of both women and men who were motivated by symptom reduction actually experienced mood-worsening, the opposite of the desired effect.

Finally, Weiss et al.'s (1992) question regarding the utility of a client's perception that his/her substance abuse is self-medicative was only helpful in the diagnosis of men as having major depression. This does not, of course, imply that someone who does not report self-medicating behavior is not depressed. It merely indicates that if a substance abuser reports self-medicating behaviors, he/she is more likely to be clinically depressed (when defined as receiving an Axis I diagnosis).

These results suggest that the desire to reduce depressive symptoms, a principle component of the self-medication hypothesis, is present in a large and significant percentage of substance abusers. While there is evidence to suggest that symptom severity (operationalized in the form of an Axis I diagnosis) increases the likelihood of self-medication, this increase is much stronger in men and may not even be a factor in women, who seem to be equally likely to be motivated by self-medication regardless of symptom severity. There is also evidence here to support the application of the self-medication hypothesis to individuals who are abusing but not (yet) clinically diagnosable as major depressive.

The Weiss study does suffer from some limitations. Foremost among these is the reliance on self-report, as well as the lack of diversity among the patients, who were predominantly middle-class whites. Therefore, not only can the results of this study be validly applied to substance abusers who are severe enough to be admitted to a treatment facility, care must also be taken in attempts to apply these findings to more diverse populations and specifically to other ethnic and racial groups.

Whenever a researcher sets out to investigate the cognitive component of a behavior, he/she is invariably limited by the reliance upon self-report data, which can be inaccurate. The reliability of the data collected in the Weiss et al. study (1992) is further jeopardized by the use of retrospective self-reports, which draw on memory and are therefore even less reliable. Finally, this issue is exacerbated by the characteristics of the sample, in that substance abuse alters the both the biological and cognitive experience, making recollections potentially even more dubious. One must remember, however, that the patients were generally being asked questions

regarding their motivations for “taking” drugs. These motivations are experienced and (presumably) encoded into the memory or subjective experience before the drug is taken, and therefore before the patient’s mental state is altered; however, reliability remains suspect as these motivations need to be recalled.

Finally, replication of these results (Weiss et al., 1992) is hampered by the failure of the researchers to utilize a standardized interview. Without such a structure, the replicability is reduced, as is the integrity of the data gathered in the original study. While the results are clearly still useful and instructive, they would be greatly enhanced by methodological rigor in the form of some instrumentation. While the Weiss (1992) study was among the first to identify self-medication as a theory to be explicitly tested empirically, several other studies of comorbidity have revealed equally compelling results to support or suggest the validity of self-medication as a reactive coping behavior. These studies have been and will continue to be discussed throughout this text.

In further support of the self-medication model, a study by Kinnunen, Doherty, Militello, & Garvey (1996) linked depression to self-reports of smoking where the participants indicated that their smoking was driven by an attempt to increase arousal and reduce negative affect.

Working from a self-medication model in the investigation of cigarette smoking, Lerman, Caporaso, Main, Audrain, and Boyd (1998) examined the effects of differences in dopamine receptor genetics. Using the Horn-Waingrow Reasons for Smoking Scale (1966), they found that depressed individuals reported significantly more “negative-affect reduction” smoking ($t=3.7$, $p<.0003$) than did non-depressed persons, as identified by the Center for Epidemiologic Studies of Depression Scale (Radloff, 1977). They did not, however, find a significant difference between depressed and non-depressed participants.

Lerman et al.’s results indicate two conclusions. The first is that depressed smokers seem to be much more likely to smoke for its mood-enhancing and negative-affect-reducing rewards than smokers who are not depressed. The second conclusion is that while the self-medicating tendency appears to be conclusively tied

to a particular dopamine receptor genotype, this genotype is also extremely common to the extent that it may be active in 76% of the population. Integration of these conclusions supports the self-medication model for smoking as an explanation of the heightened levels of nicotine dependence observed in depressed individuals.

Behavioral/Biophysical

Though the cognitive/intentional model provides promising implications for intervention, it is not the only possible model of self-medication. Another potential model could be called the behavior/biophysical model. This model removes the necessity for thought and awareness on the part of the substance user who may be self-medicating. This is an important distinction, considering the possibility that many substance abusers may be all too aware of the longer-term negative outcomes associated with repetitive substance use.

Two schools of thought converge upon this less-cognitive view of self-medication. The first is the behavioral school of psychology. The second, generally extended by the medical arena in which psychiatry finds its home, is the biophysical model. The behavioral school argues the importance of reinforcers and their effects on behavior. Substances have a use-reinforcing reward component in terms of the subjective feeling that immediately follows their use. But this does not in itself imply self-medication. The self-medication component enters when one considers the differential salience/valence of the reward condition given the presence of a comorbid affective disorder. To understand the importance of reward salience, imagine the effect of attempting to train a starving animal versus a satiated animal using food. Food is highly salient to the starving animal but essentially non-motivating for the satiated animal. The relation between a substance and its effects are no different. Substance use carries a reward component regardless of the individual's mental state at the time of use. However, that reward component can be much more salient if the individual's mental state is one of pain or distress, both of which are states that can be temporarily reduced or reversed through substance use. Therefore, the salience of "getting high" may be far greater – and far more likely to promote substance use behavior – when the individual is "feeling low." The

result is that self-medicative behavior and dependence may develop completely independent of thought or intention.

Pomerleau, Collins, Shiffman, & Pomerleau (1993) posited that the reinforcing properties of nicotine might vary in accordance with biological and genetic differences, and that these differences may be related to variance in the propensity toward self-medicative smoking in depressed persons. This position was further supported by Corrigall, Franklin, Coen, & Clark (1992) who found that these reinforcing properties are strongly influenced by nicotine's effects on dopamine transmission.

Similarities exist between the reward and motivational properties of the substance abuse and depression, and these similarities may provide further evidence for the self-medication hypothesis. Both depression and substance abuse are characterized by alterations in the functioning of the brain's reward and motivational systems (Markou et al., 1998). Drug dependence has been defined as "neuroadaptations resulting from repeated drug use that have important motivational consequences in terms of determining the organization of the organism's behavior" (p. 138). The result of these neuroadaptations, then, may be a positive and negative reinforcement dynamic in which the addict or alcoholic is subjectively rewarded for use (positive reinforcement). The negative reinforcement might operate such that the addict or alcoholic is doubly reinforced for use because non-use becomes unpleasant.

One condition which is subjectively unpleasant is depression, and we know that depressive symptomatology increases, sometimes dramatically, once a substance user stops using (Hughes, 1993). While this effect is most commonly referred to in the literature as drug-induced depression or secondary depression, a more accurate term might be withdrawal-induced depression, because the onset of depression following abstinence is more likely caused by an upset of the neuroadaptations caused by the drug.

For individuals with primary depression (onset prior to substance abuse), Markou, Kosten, and Koob (1998, p. 158) proposed that self-medication might manifest itself such that “through experimentation with several drugs and through the simultaneous use of multiple drugs, people determine the drug or drug combination that best normalizes their neurochemical imbalance that is expressed behaviorally as depression.” They followed this proposal with a parallel explanation for self-medication in secondary depression (onset pursuant to substance abuse): “Repeated drug use can be conceptualized as self-medication to counterbalance the neuroadaptations produced with chronic drug administration, and thus, used as treatment for withdrawal symptomatology” (p. 158).

A final piece of evidence supporting the connection between depression and substance abuse is the indication that drugs of abuse affect the same neurotransmitter systems that are associated with depression. Consequently, these drugs may appear to the abuser to be useful medications for depressive symptomatology. Stimulants, for example, “would temporarily reverse potential serotonergic, dopaminergic, or noradrenergic deficits that may be found in depressed individuals” (Markou et al., 1998, p. 158). The result, of course, is a reduction in the symptoms associated with those deficits (i.e., depression).

After addressing the behavioral significance of neurotransmitter deficits, we consider the biophysical school of thought espoused by the medical arena. Like the behavioral explanation, the biophysical model does not rely on intentional behavior or thought. Instead the focus is on the neuro/biochemical characteristics of the depression, and the parallel effects of the substance on those characteristics. Thus, self-medication becomes a means of correcting biophysical problems/abnormalities associated with the comorbid affective state.

In a study of patients hospitalized for psychiatric symptoms and comorbid substance abuse, all of the heroin users and most of the alcohol users reported temporary symptomatic improvement after substance use (Castaneda, Galanter, & Franco, 1989). Castaneda did not, however, directly ask these patients their specific reasons for using substances. Thus, while this study cannot comment on the

cognitive-intentional component of self-medication, it can clearly speak to an underlying biophysical effect that could explain the persistence of substance use in spite of the conscious recognition of its ultimately harmful effects.

These conclusions are further supported by research on the substance abuse behaviors of a small (n=29) sample of schizophrenic patients with comorbid substance abuse diagnoses (Test, Wallisch, & Allness, 1989). Test and colleagues found that a substantial number of the patients claimed to experience symptomatic relief pursuant to their substance use. Like Castaneda et al. (1989), they did not investigate self-reported motives for abuse, nor were they able to look at differences in reports across various drugs because the sample was so small.

One definition of self-medication, proposed by Markou, Thomas, and Koob (1998), speculates that substance use is intended to reverse some of the neurobiological abnormalities associated with depression. Of note is the fact that this hypothesis works regardless of the causal order of the two disorders. That is, if the depressive abnormalities existed prior to substance abuse, then the substance abuse can be hypothesized to be intended to reverse these abnormalities. Alternatively, biochemical imbalances may occur as a result of mere substance use. The abuse that may follow would then still be aimed at reversing these depressive imbalances.

Markou et al.'s neurobiological abnormality hypothesis (1998) is further supported by the finding that substance use in depressed individuals declines when they are treated with antidepressants. This decline in use is observed regardless of whether the individual was depressed prior to substance use or became depressed as a consequence of drug use. The common element seems to be that when depressive symptomatology is reduced, so too is the need to self-medicate (Markou et al., 1998).

Other Evidence Supporting the Self-Medication Hypothesis

In one of the first studies to test the self-medication hypothesis, Woody, O'Brien, and Rickels (1975) examined the depressive symptomatology of narcotics addicts in a placebo-control treatment and a matched treatment with the

antidepressant doxepin. They found that the depressive symptoms and drug cravings of the addicts who were given the doxepin decreased. Comparatively, no reduction was observed in the placebo-control group. Similarly, a study of the efficacy of fluoxetine found the drug to be effective in reducing both depression and drinking within a sample of dual-diagnosis alcoholics (Cornelius et al., 1997). The researchers found, as predicted, that the depression experienced by the experimental group lifted, while those in the control group continued to suffer from depressive symptoms. In effect they had demonstrated the effectiveness of the drug in treating depression. Of far more interest, however, was the corresponding decrease in the misuse and abuse of drugs for the addicts in the treatment condition. This would seem to provide some of the first strong empirical evidence to support the idea that illicit drugs (rather than prescription drugs) can and may be used in an attempt to combat psychological distress. The addicts in the treatment group saw an elimination of their psychological distress pursuant to their use of doxepin. They no longer experienced a negative state requiring a remedy (via drugs), and thus their drug use decreased.

In their conclusion, Woody et al. (1975) went on to coin a phrase that would prove to be the basis for the more developed self-medication theories that would follow: “addicts might be medicating themselves for underlying psychopathology” (p. 449). This then led to the suggestion of administering psychopharmacologic agents that are designed to target the psychiatric symptoms as a method for treating substance addiction. While we know today that there is more to physiological addiction than a desire to curb psychological symptoms, this early recommendation was somewhat revolutionary for the time.

Clinical experience coupled with research has indicated that the treatment of the alcohol abuse in alcoholics with comorbid depression was simultaneously an effective approach to alleviating depressive symptoms (Mueller, 1999). However, the inverse of this treatment paradigm (targeting depression to treat alcohol abuse) was not so effective. Mueller argued that this could be interpreted as evidence against the self-medication hypothesis. However, he conceded that the strength of

the evidence was limited due to the time restricted methodology in the studies he reviewed (1999). Not only does repeated use of alcohol cause subjective feelings of depression, but it also produces neurovegetative symptoms of depression such as sleep and appetite disturbances, cognitive impairment and decreased energy (Deykin, Levy, & Wells, 1987). Following his review, Mueller reflected that “to achieve the best long-term outcome, treating the two simultaneously, and over a long period of time” (1999, p. 53). Of course, the viability of this proposal is not lost on Mueller, as he recognizes the impact of short-term treatment models and views his position as a challenge rather than an outright recommendation.

Evidence that supports or is consistent with the self-medication hypothesis is not limited to experimental trials in treatment facilities, however. Retrospective self-report of comorbid depression and alcohol misuse indicates that depression onset is more likely to precede rather than follow the onset of alcohol misuse (Deykin, Levy, & Wells, 1987). Their results also indicated that among college students who are diagnosable with both an alcohol-related and depressive disorder, 75% of whom indicated that their experience of depression preceded their disordered alcohol use (and in many cases, preceded even their first exposure to alcohol; no statistics reported in the study regarding this finding). Depression has also been found to increase the risk of intravenous drug use in an urban, non-clinical sample (Latkin & Mandell, 1993).

While not explicit evidence for the self-medication hypothesis, this relation is a necessary one for the hypothesis to hold true. In order for drinking to be self-medication, it must be responsive, and this is possible when the theorized stimulus (negative affect state) is present.

Further support for the self-medication hypothesis can be found by examining the results from the NIMH Epidemiologic Catchment Area Program, Christie, et al. (1988). In their examination of the age of onset (of mental disorders) data from the NIMH Catchment program, Christie, et al. found that of the portion of the sample that demonstrated comorbid depression or anxiety disorder and substance abuse disorder, 75% reported the development of their affective disorder preceding that of

their substance abuse. This is a particularly compelling finding because the Catchment Program surveys non-clinical populations in a door-to-door sampling of five communities. So while the results are specific to a particular geographical area, they are also free of sampling bias that comes from surveying only clinical populations.

Curran, Flynn, Kirchner, & Booth (2000) noted that the experience of depressive symptomology following alcohol treatment presents a serious risk factor for relapse among recovering drinkers. This finding supports the self-medication diagnosis inasmuch as this depressive symptomology precedes subsequent alcohol use, thus allowing for the possibility that this use was reactive (to the depressive state) and intended to alleviate it.

Relevant Findings

While there is limited research to directly test the validity of the self-medication hypothesis, there is a trove of relevant research that has been done over the past thirty years that is consistent with the hypothesis. Most of these studies have been conducted in an effort to help understand the cognitive and behavioral antecedents of alcohol abuse and misuse. Alcohol abuse has been examined in the context of such factors as personality variables, stress, mood variables, differences in motivation to drink, and differences in alcohol expectancies.

Personality variables and alcohol use

In an effort to discover variables which may be associated with different problematic alcohol use profiles (frequent drinking, heavy/binge drinking, and maladaptive drinking), a great deal of research has been conducted that examines the relation between alcohol use and personality. Below, the presents study reviews some of the results relevant to the self-medication hypothesis.

Of the big five personality traits, neuroticism has been most consistently linked to problematic alcohol use. In fact, Brennan et al. (1986) theorized that the anxious, neurotic drinker may be more likely to drink in a reactive manner in response to current problems and others stressors. Baer's (2002) review of college student drinking behavior found that neuroticism was positively correlated with

frequency but not quantity of drinking. Note also that these correlations were stronger among women. This gender effect could be explained in a number of ways, most notably as a product of differential societal acceptance of neuroticism and emotionality in females. That is, because society deems it more acceptable for women to express their emotionality, they can express more variance in this variable, allowing for a higher correlation. A second explanation might lie in the impact of gender-differential socialization processes on coping behavior.

In a study of the relations among the Big Five personality traits and drinking motives, Stewart and Devine (2000) found that Neuroticism and Introversion were positively associated with coping drinking motives. They elaborated by stating that “coping-motivated drinkers are prone to depressed mood and may use alcohol in an attempt to reduce their elevated dysphoria” (p. 505). While not one of the Big Five personality traits, there is also evidence that individuals who are dispositionally shy may use alcohol to alleviate their social anxiety (Bruch, Rivet, Heimberg & Lavin, 1997).

Coping self-efficacy has also been linked to drinking and drinking problems. Individuals who lack confidence in their ability to cope with negative affect are more likely to experience alcohol-related problems, and, to a lesser degree, to drink more (Kassel, Jackson, & Unrod, 2000). Not surprisingly, this lack of confidence is also associated with higher reported levels of avoidant coping. Additional research has demonstrated that individuals with lower levels of coping self-efficacy were more likely to drink in order to attain personal outcomes such as the alleviation of anxiety and depression (Skuttle, 1999). More generally, in a longitudinal research design, a deficiency in self-esteem significantly predicted alcohol diagnoses at three and four-year follow-ups (Walitzer, and Sher (1996). The possibility that heavy drinking created or led to self-esteem issues was reduced in this study.

Mood variables and alcohol use

Stress and coping

Several studies have examined the relation between stress, coping, and drinking behavior in some manner. Stress and coping are commonly examined

together because coping, as a response to stress, is such a critical moderator of the response to stressors experienced. In general, we consider a wide variety of stressors, but the level of stress experienced is often the variable of interest. Similarly, the coping style is often examined, but the effectiveness of the chosen style in decreasing one's stress level is of key importance. Additionally, several mediators are thought to exist between the experience of a stressor, a negative affect state, and perhaps ultimately drinking behavior. For example, irrational beliefs may act as a mediator in the relation between stress and the depressive response (i.e., the tendency to become depressed in response to elevated levels of stress; Cammata & Nagoshi, 1995).

The sheer number of stressors faced can often be a meaningful way of measuring stress. Cammata and Nagoshi (1995) reported that a greater number of life stressors were correlated with higher levels of alcohol use problems but not with rates of alcohol use. College students with at least a moderate level of stress have greater increases in problem drinking in the previous three months than students who are lower in stress (O'Hare & Sherrer, 2000). O'Hare and Sherrer (2000) also provide evidence to suggest that the relation between stress and drinking may be mediated by the experience of depressive or anxious affect. This affect must then be dealt with through any of several available coping styles. Conger suggested that stress may be physically and/or emotionally experienced as a sensation of tensions. As he outlined in his tension reduction hypothesis, Conger (1956) asserted that individuals sometimes consume/abuse alcohol because they believe that drinking reduces unpleasant, tension-type sensations.

Social learning theory may help explain observed differences between "healthy" drinkers and "unhealthy" drinkers. One extension of the theory allows for the position that healthy drinkers are better equipped to cope with the stress of life, while problem drinkers may turn to alcohol use as a means to cope due to deficits in ordinary coping strategies (Cooper et al., 1988). This potential relation leads to common elements of alcohol treatment programs, such as attempts to bolster a

patient's coping skills as well as efforts to modify a patient's expectations about the effectiveness of alcohol consumption as a coping strategy.

Depression

The relation among depression and drinking behavior is obviously central to any discussion of the self-medication hypothesis. While much of the research focused on the comorbidity of these disorders has already been discussed, a great deal of relevant research and scholarly thought remains in the area. In general, mixed support exists for a relation between college student drinking patterns and indices of emotional distress (Brennan et al., 1986).

Depression and anxiety have been found to be predictors of drinking problems (Pullen, 1994). Brennan, Walfish, and AuBuchon's (1986a) review of alcohol use among college students found four studies that indicated a relation between variables such as loneliness, frustration, depression, and boredom with drinking frequency, quantity and consequences for college women but not men. Over several studies, heavy-drinking women have shown higher levels of loneliness, frustration, depression, restlessness, boredom, and hopelessness than heavy-drinking males (Brennan, Walfish, & AuBuchon (1986a).

Other means of operationalizing depression have also been used to examine the relation to alcohol use. Cammatta and Nagoshi (1995) examined the relation among alcohol use and the presence of irrational beliefs and found a positive correlation. Thus, irrational beliefs and depression have been shown to be significant predictors of alcohol use problems. After controlling for shared variance, stress was not effective as a predictor (Cammatta & Nagoshi, 1995).

Alcohol is classified as a depressant because of its effects on the nervous system (McKim, 2003), but Carey and Correia (1997) asserted that "alcohol can either enhance positive mood states or alleviate negative mood states." In fact, the biphasic effects of alcohol allow a user to achieve enhanced positive affect or reduced negative affect depending on the rate of consumption (Russell & Mehrabian, 1975). This allows alcohol to be used as either an enhancer or an

emotional analgesic of sorts, depending on the state of mind at the time and the manner of consumption.

It is important to note that emotions can have strong motivational consequences. Negative emotions can motivate both cognitive and behavioral efforts designed to minimize, manage, or eliminate either the emotion or the problem/stressor from which the emotion stems (Cooper, Frone, Russell, & Mudar, 1995). The coping response to the negative emotions of depression and the stress that often stimulates them is commonly researched. "Individuals who rely on alcohol to cope with negative emotions presumably have learned to do so because they lack other more adaptive ways of coping with these emotions" (Cooper, 1994, p. 117). In fact, drinking to modify affect was found to be a significant predictor of alcohol consumption, number of times drunk in the last year, number of binges in the last year, psychological dependence, and role impairment (Holyfield, Ducharme, & Martin, 1995).

Anxiety

While not the focus of the present study, anxiety has been commonly linked to alcohol use as well as depression. Comorbid diagnosis of anxiety and alcohol-related diagnoses are on the rise (Kushner & Sher, 1993). Anxiety disorders have been found to be comorbid with alcohol use disorders in both cross-sectional and longitudinal studies (Baer, 2002). Multiple studies of the alcohol consumption patterns of college students have shown that anxiety and stress are associated with increases in the frequency but not the quantity of drinking behavior (Brennan, Walfish, & AuBuchon (1986a). Stress-reactive drinking has also been linked to the experience of social anxiety (Kidorf & Lang, 1999). In a seven-year, longitudinal follow-up study, Kushner, Sher, and Erickson found that the presence of an anxiety disorder in year 1 or 4 significantly predicted the presence of an alcohol use disorder in year 7. Alternatively, some studies have found that, contrary to most findings, those who drink more often experience less anxiety (Baer, 2002).

Beyond anxiety itself, higher levels of anxiety sensitivity have been associated with higher levels of coping motives for drinking (Stewart & Zeitlin, 1995).

Individuals reporting high levels of anxiety sensitivity have been found to drink significantly more than those with lower levels of anxiety sensitivity. These results would suggest that those with higher levels of anxiety sensitivity likely experience more negative affect, and subsequently may drink more in order to alleviate the effects of this negative affect (Stewart, Zvolensky, & Eifert, 2001).

Given the similarity between depression and anxiety, there is considerable basis for the application of relations among anxiety and drinking to have limited relevance to the relation among depression and drinking, and vice versa. In general however, we will treat anxiety as a separate construct from depression, despite their shared attribute of being negative, potentially painful mood states that may precede a self-medicative drinking response.

Drinking motives

One of the most extensively researched areas with respect to alcohol use and potential self-medication is research examining the relations between drinking motives and alcohol use. Some alcohol abuse researchers have posited that the drinking of an individual who drinks for “personal” rather than social motives may be more serious and warrant an elevated level of concern (Jung, 1997). From a cognitive behavioral perspective, motives precede behavior to the extent that a behavior is motivated or goal-oriented. Cooper (1994) argues for the importance of understanding the antecedents of drinking behavior for the purposes of enhancing treatment efficacy and improving prevention strategies.

In many treatment approaches, drinking motives are often assessed indirectly using a functional analysis (a behavioral technique in which a behavior is targeted, and the antecedents and consequences of that behavior are analyzed in order to better understand and modify the behavior) of drinking situations and behavior (Cooper, 1994).

Cox and Klinger (1988) provide a two-dimension, four-factor motivational model for alcohol use. The dimensions they delineate include reinforcement type (positive vs. negative) and personal locus (internal vs. external). By combining the two dimensions, the four factors can be derived as follows. Cox and Klinger define

the internal, positive reinforcing motive as the stimulus-seeking motive. These individuals seek to experience positive personal experience as a result of imbibing alcohol. The external, positive reinforcing motive is referred to as the social enhancement motive. These individuals seek to increase their experience of social rewards as a result of the use. The negative reinforcement dimension is characterized by a motivation to escape or alleviate a negative situation or state. The external motivation is called the conformity motive because it seeks to bring an end to social isolation through drinking. The internal motivation is called the “tension reduction” motivation by Cox and Klinger, in an apparent nod to Curt Lewin’s notion of tension as an uncomfortable state that we are motivated to end.

Coping-motivated drinking

Cooper, Russell, Skinner, and Windle (1992) showed that the Cox and Klinger’s (1988) four factor model was supported in the analysis drinking motives. They found discrete and reliable factors among enhancement motives, coping motives, and social motives (failing only to validate the conformity motive). This led to Cooper’s eventual exclusion of the conformity motive, thus reducing Cox and Klinger’s model from four to three factors of which only the coping motive is seen as based in the negative reinforcement consistent with self-medication. Cooper (1994) also asserts that coping and social drinking motives are discrete factors, only moderately correlated and each having its own set of antecedents and consequences. Subsequent research revealed that enhancement, coping, and social motives can be considered discrete and reliable factors of alcohol use motivation. Each motive domain is associated with a unique set of antecedents and consequences despite moderate intercorrelation among the factors (Cooper, Russell, Skinner, & Windle, 1992).

Cooper (1994) notes that motivational models of alcohol use and abuse share two common premises. The first premise is that people drink in order to attain “certain valued outcomes” (p. 117). The second premise is the assumption that drinking behavior that is motivated by different needs (different motives) will be characterized by different use and abuse patterns as well as different sets of

antecedents and consequences. Given this hypothetical relation, an understanding of the motives/reasons for which a person drinks provides insight into “the circumstances in which an individual is likely to drink, what the probable consequences are, and how best to intervene” (Cooper, 1994, p. 177).

Cooper, Frone, Russell, and Mudar (1995, p. 990) define coping motives for alcohol use as “the strategic use of alcohol to escape, avoid, or otherwise regulate negative emotions.” Drinking motivated by escape or relief has shown a consistent relation to increases in alcohol use and the presence of problem drinking (Brennan, Walfish, & AuBuchon, 1986a). Stewart, Zvolensky, and Eifert (2002) noted that coping motives appear to be the principal mediating variable in the relation they found between anxiety sensitivity and drinking behavior. Cooper et al. (1988) point out that coping-motivated drinking may be engaged in consciously or unconsciously. Coping motives for drinking have been identified as a unique domain of drinking motives, independent of social, enhancement, and conformity motives (Cooper, 1994, Carman, Fitzgerald, & Holmgren, 1983; Mann, Chassin, & Sher, 1987; Cooper, Russell, & George, 1988, 1992; Cutter & O’Farrel, 1984). Individuals who drink alcohol in order to cope with negative affect may do so because they have failed to learn other, more healthy and adaptive ways of coping with this emotion (Cooper, 1994; Cooper, Frone, Russell, & Mudar, 1995). Coping-motivated drinking is related to the presence of maladaptive coping skills, such as avoidance and denial, but does not appear to be related to coping skills deficits (e.g., problem-solving ability; Cooper, Russell, & George, 1988).

Coping-motivated drinking has been shown to be significantly related to other maladaptive forms of coping, including denial and avoidance (Cooper et al., 1988). Carey and Correia (1997) found that negative reinforcement (coping) motives accounted for a significant amount of the variance in college student drinking problems. Research has demonstrated that treatment for alcohol abuse is associated with differential drinking motivations (Carey & Correia, 1997). Specifically, those in treatment display a higher tendency to report negative reinforcement (per Cox & Klinger’s 1988 model) as their primary motivation to drink.

Individuals who drink to cope are more likely to drink more and to experience alcohol-related problems than those who do not report coping-motivated drinking (Cooper et al., 1988). Cooper and colleagues (1992) also found that individuals who are motivated to drink for coping purposes are also more likely to use depressant/dampening drugs like barbiturates and tranquilizers. While coping motives for drinking accounted for 4.2% of the variance in the use of these drugs, they did not significantly predict marijuana use (Cooper et al., 1992). Coping motives are also positively associated with alcohol withdrawal symptoms (Cooper et al., 1992). Coping motives were the only domain of drinking motives to significantly predict both social and occupational dysfunction as well as tolerance and withdrawal symptoms after controlling for alcohol consumption (Cooper et al., 1992). The level of negative affect experienced appears to be predictive of coping motives, while the level of positive affect does not predict enhancement motives (Cooper, Frone, Russell, & Mudar, 1995).

Cooper (1994) tested the hypothesis that coping motives would significantly and positively correlate with alcohol use. She also posited that drinking to cope would be positively related to solitary drinking as opposed to social drinking. She further pointed out that these hypotheses reflect the deficit in adaptive coping strategies which may serve as the mediator between a depressive state and coping-motivated drinking.

Coping-motivated drinking is a reactive process. Negative emotion is experienced, and this emotion begets a reaction. In the case of the coping-motivated drinker, that reaction is to drink in order to minimize the unpleasant impact of the negative emotion (Cooper et al., 1995). Coping-motivated drinking has been found to positively correlate with the experience of drinking-related problems ($r = .33$) as well as with heavy drinking ($r = .33$; Cooper, 1994). In other words, those who report that they drink in order to cope with the experience of negative affect are more likely to experience problems resulting from their drinking, and they are also more likely to drink in heavier amounts. Positive (but weaker) correlations with coping-motivated drinking were also reported with quantity and frequency (Cooper,

1994). Cooper et al. (1988) developed and empirically supported one of the first models of the relations among general coping, alcohol expectancies, alcohol coping, heavy alcohol use, and alcohol abuse. The model, based in social learning theory, espouses that the impact of general coping on heavy alcohol use is mediated by its effect on coping drinking. Thus, a deficit in general coping strategies will lead to a higher dependence on alcohol coping, which in turn will lead to higher levels of use.

Coping motives have been found to significantly predict quantity of drinking, frequency of drinking, a heavy drinking composite variable, and drinking problems. Coping motives are the single best predictor (among motive domains) of drinking problems, and the second-strongest predictor of heavy drinking (second to enhancement motives; Cooper, 1994). Coping motives have been shown to predict increases in the yearly frequency of excessive drinking (Stewart, Zvolensky, & Eifert, 2001). Essentially, this means that those who report drinking to cope with negative affect are likely to be drinking excessively with greater frequency in the future.

Coping motives are the only motives among Cooper's four domains of motives to positively correlate with drinking at home (Cooper, 1994). While this relation is small, it is notable that it was the only relation of the four to be positive. While this result does indicate that coping-motivated drinkers are slightly more likely to drink at home than other types of drinkers, it may also suggest that these drinkers are drinking alone.

Cooper and colleagues (1995) proposed an interaction among coping motivated drinking, negative emotion, alternative coping ability, and alcohol expectancies. They proposed that those with the highest level of negative emotion, the lowest level of alternative coping ability, and the most positive (in terms of tension-reduction) expectancies for alcohol use would be the most likely to use alcohol as a coping strategy. Their results supported this theory, as tension-reduction expectancies did moderate the relation between depression, coping, and drinking to cope.

Coping-motivated drinking and predictions of alcohol use

Cooper and colleagues (1992) found an interesting pattern in their investigation of drinking motives. Enhancement motives were the best predictors of heavy drinking, yet coping motives were the best predictors of abusive levels of use and alcohol-related problems. They surmised that this paradox could be explained by a lessened capacity of coping drinkers to exercise control over their drinking in order to keep it from being problematic in their lives (see also Cooper, Frone, Russell, & Mudar, 1995). Cooper and colleagues (1992) also posited that coping drinkers may be more likely to develop a dependence upon alcohol to help them cope with negative emotions. This dependence would then make it theoretically more difficult for those individuals to stop drinking despite the onset of alcohol-related problems.

In a review of research investigating factors that may account for variance in college-student drinking behavior, Baer (2002, p. 45) found that “two types of drinking motives generally emerge: drinking for social purposes, and drinking for emotional escape or relief.” Baer (2000) also concludes that drinking motives associated with managing negative affect (i.e. self-medication) are correlated with higher levels of problems associated with drinking, but not necessarily drinking amounts or frequencies. In general, alcohol problems may be best predicted from self-meditative reasons for drinking, while alcohol use may be better predicted from enhancement and social reasons for drinking (Cammata & Nagoshi, 1995).

Carey and Correia (1997) found that drinking motives significantly contribute to the prediction of alcohol related problems after controlling for high-risk drinking behavior. In other words, there are individuals who engage in high-risk drinking behavior (frequent intoxication, binge-drinking, etc.) who do not fall victim to subsequent alcohol-related problems. Carey and Correia's (1997) research suggests that the difference between those who do and do not experience alcohol-related problems can be distinguished on the basis of their motives for drinking. Specifically, those who report drinking for coping purposes (to manage or escape from negative affect) are more likely to be experiencing problems.

Similarly, it has been shown that drinking for pathological, self-medication reasons is the single best predictor of drinking problems, as well as a significant predictor of the quantity and frequency of alcohol consumption (Wood, Nagoshi, & Dennis, 1992). Based on their research, Wood, Nagoshi, and Dennis (1992) observed that “normal” manifestations of drinking are often driven by social norms and positive, celebratory reasons. They also noted, however, that “those who advanced to more problematic drinking behavior are those who are trying to self-medicate negative mood states” (p. 474).

In summary, coping-motivated drinking is a negative-reinforcement motive. In other words, the motivation is to arrest an unpleasant state/situation. In general, this unpleasant state is a negative affect state such as depression. Just as other motivated behavior does not require a cognitive awareness of the motivation behind a given behavior, coping-motivated drinking can be similarly subtle. While not the most powerful predictor of frequency or quantity of drinking, coping motives have been strongly linked to problem drinking and the experience of alcohol-related problems.

Alcohol Expectancies

Almost any consideration of reasoned or motivated behavior includes some consideration of outcome expectancy. Alcohol consumption is no different. Generally speaking, alcohol expectancies are a set of beliefs regarding what will happen when one engages in the behavior of drinking alcohol. Expectancies and the questions they answer can vary in specificity from “what will happen if I drink this shot of tequila?” to “how will I feel if I drink a case of beer over the next five hours?”

Alcohol expectancies are important because it is thought that they can help predict and explain behavior (Brown, 1985). Past studies have found that alcohol expectancies and coping style can account for as much as 22% of the variance in drinking behavior amount and frequency (McKee, Hinson, Wall, & Spreil, 1998). In his work developing the “Reasons for Drinking Scale,” Cronin (1997) cited several studies that demonstrate how alcohol outcome expectancies predict future alcohol use (Stacey et al., 1990; Werner et al., 1993; Oei and Baldwin, 1994; and

Henderson et al., 1994). This follows from the theory that any motivated behavior is engaged in purposively (i.e., in order to gain some favorable). It has been empirically demonstrated that clear expectations about the effects of alcohol are formed prior to the time that a person consumes and alcohol (Christiansen, Goldman, & Inn, 1982). Thus, a 35-year-old business man might settle down after a long day to a couple of glasses of bourbon with the expectation that drinking the bourbon will help him relax and “take the edge off.” Alternatively, a nervous and inhibited college freshman might consume her first beer at a party expecting that it will “loosen her up” and help her be socially successful.

Given the potential utility of linking certain expectancies to drinking behavior, a great deal of research has been devoted to uncovering the various relations that may exist. The cornucopia of results is beyond the scope of the review, but results potentially relevant to the self-medication hypothesis are reviewed as follows. In developing a new instrument for the measurement of alcohol expectancies, an exploratory factor analysis revealed a factor labeled by the authors as “tension reduction” which did not seem to assess for the alleviation of depression, but did seem to denote a decrease in anxiety (Fromme, Stroot, & Kaplan, 1993). This tension reduction factor was nothing new in the area of alcohol expectancies. Exploratory investigations into the expectancies people hold for alcohol use have revealed a set of expectancies best labeled “tension reduction” which would appear to capture many of the expectancies that would theoretically precede self-medicative drinking (Brown, Goldman, Inn & Anderson, 1980).

Brown (1985) used the Alcohol Expectancy Questionnaire to measure expectations held by drinkers for their consumption behavior and to look at relations between these expectations and drinking variables. She found that the class of expectancies labeled “tension reduction” was a powerful predictor of a problematic drinking style. Conversely, social and physical pleasures were the expectations most predictive of frequent but non-problematic drinking. Brown also points out that alcohol use expectancies may discriminate heavy drinkers who experience alcohol problems from those who do not. She provides evidence to suggest that

expectancies of relaxation and tension reduction are stronger predictors of problem drinking than expectancies of social or physical pleasure. Tension reduction expectancies (and those that appear similar to this factor) have been linked repeatedly to problem drinking. Research in alcohol expectancies suggests that problem drinkers are more likely to expect tension reduction from drinking, while social drinkers are more likely to expect social enhancement (Brown, 1985). Young, Oei, and Knight (1990) noted that tension reduction expectancies tend to be considerably higher among problem drinkers versus non-problem drinkers.

If we broaden our consideration of expectancies to include those that are essentially negative-reinforcement expectancies (i.e., expectations that a negative state will be lessened or lifted), we find even more expectancy-based evidence for self-medication. Kassel, Jackson, and Unrod (2000) note that some individuals hold high expectations of their ability to manage negative affect because of (rather than in spite of) their drinking behavior. Problem drinkers are more likely to anticipate that alcohol use will reduce negative emotional states (e.g., depression and anxiety) than non-problem drinkers (Holyfield et al., 1995). Reece, Chassin, and Molina (1994) tested a hypothesis that personal effects-oriented alcohol expectancies (such as the expectation that drinking will reduce negative affect) would be more effective at predicting problem alcohol use, while social effects-oriented expectancies would be more effective at predicting normal alcohol use. Though their data did not support this hypothesis, their ideas seem worthy of note.

Alcohol expectancies have also been linked to other variables, such as experience with alcohol, social coping, and long-term consequences. Some alcohol expectancy research (Brown, Goldman, Inn, & Anderson, 1980) has suggested that inexperienced drinkers tend to hold more global expectancies, while more experienced drinkers are more likely to endorse more refined expectancies (e.g. tension reduction, social facilitation, pleasure, etc.). Bruch, Rivet, Heimberg, and Levin (1997) found that women with high expectations for alcohol's ability to help them cope in social situations were far more likely to experience negative consequences as a result of their drinking. Research suggests that problem

drinkers have positive expectancies about the immediate effects of alcohol rather than long-term negative consequences (Lewis & O'Neill, 2000).

Finally, alcohol expectancies have been linked to coping styles. The avoidant coping style has been shown to be a significant predictor of drinking to cope only among individuals with high alcohol expectancies (Cooper et al., 1995). This seems to indicate the importance of expectancies in this relation, as it is clear that depressed, avoidant coping-styled individuals (those one would expect to be the most likely to cope by drinking) only do so when they have conscious, cognitive expectations that alcohol will meet their coping needs.

To summarize, alcohol expectancies appear to be an important cognitive step on the road to the behavior of drinking. Negative reinforcement expectancies of several varieties have been associated with a higher incidence of alcohol-related problems (just as with coping-motivated drinking), but not generally with frequency or amount of alcohol consumed.

Gender-moderated

Given the sex differences in alcohol consumption among college students (Ham & Hope, 2003), there is reason to believe that, on average, men and women differ in both their actual alcohol consumption and their reasons for drinking in general. In a discriminant analysis of drinking behavior in college students, Billingham, Parillo, and Gross (1993) found that more factors emerged in women (they identified more reasons for drinking) than in men. Not only do women's reasons for drinking appear to outnumber those of men, Baer's (2002) review of studies investigating college student drinking revealed that women are more likely to drink in order relieve stress and negative affect.

It has also been found that drinking in the presence of emotional pain separates high intensity women drinkers from low intensity women drinkers. This effect does not appear in men, whose alcohol use appears to be better explained by social facilitation and disinhibition (Beck, Thombs, Mahoney, & Fingar (1995). Women who drink heavily are more likely to do so in the context of emotion pain than are their lower-drinking female peers (Thombs, Beck, & Mahoney, 1993).

Thombs, Beck, and Mahoney also found that “women who drink heavily typically do so in effort to relieve negative affect states such as depression, anxiety, and feelings of worthlessness” (1993, pp. 117).

Consumption types

Given the vast quantity of research that has been conducted in an attempt to profile and understand the occasionally pathological act of drinking, some researchers have attempted to identify “types” of drinkers in an effort to make sense of trends and correlations that have been found. The first level of differentiation addresses this issue of pathology. Brennan, Walfish, and AuBuchon (1986b) noted that certain factors may help discriminate serious drinking from non-serious drinking. They suggest factors including the presence of anxiety, neuroticism, low self-esteem, and drinking for personal reasons (as opposed to social reasons). Within this context of serious drinking, we also observe differences in amount and frequency of drinking, which separates heavy drinkers from those who are not heavy drinkers. Christiansen, Vik, and Jarchow (2002) found that heavy drinkers who more commonly drink alone manifest higher levels of depression than heavy drinkers who drink in social settings. Individuals whose drinking motives are primarily to achieve “personal coping” effects are more likely to drink heavily than those who do not drink to achieve these types of effects (Holyfield, Ducharme, & Martin, 1995).

The social particulars of a drinker’s behavior may also be of interest. Solitary drinking patterns may be related to alcohol use motives such that solitary drinking is more likely to be observed in individuals who are drinking for escape, to reduce or avoid emotion distress, and generally in a manner consistent with the self-medication hypothesis (Christiansen et al., 2002). Drinking context is another variable which has been examined empirically. Christian, Vik, and Jarchow (2002) suggested and confirmed that individuals who drink heavily by themselves are more likely to drink for personal coping purposes, to drink more often, to have lower self-esteem, to report depressive symptoms, and are more vulnerable to alcohol consequences than social heavy drinkers.

Effectiveness of self-medication

If self-medication is a viable explanation for some of the comorbidity observed between depression and substance use disorders, then the question of effectiveness arises. That is, if substance use is intended (cognitively or not) to “medicate” or correct depression or some other psychiatric disorder, does it work?

In a study of the comorbidity of alcoholism and agoraphobia, Bibb and Chambless (1986) found that 10-20% of diagnosed agoraphobics meet criteria for a diagnosis of alcoholism. They also compared alcoholic agoraphobics to those who were not alcohol dependent, and found strong results indicating that the alcohol abusers were uniformly more depressed, more socially phobic, more likely to engage in catastrophic thinking, and generally more likely to experience elevated symptoms. Panic attacks among the alcohol group were also found to be more intense. Of the alcoholics, 91% reported symptom-reductive self-medication as their primary motivation for alcohol use, while 43% of non-alcoholics also reported alcohol use for this reason. Anxiety reduction was the main target symptom reported by these patients, with some indicating use targeted toward reducing disturbing cognitions and others even using alcohol to allow them to venture into public.

Bibb and Chambless’ research (1986) is exemplary of the disorder-first approach, as they begin with a subpopulation of agoraphobics and then look for alcoholism within this group. Like most self-medication inquiries, they depend on self-report data gathered through interviews of patients in the throws of receiving care. These were outpatients, however, which means that this sample’s symptomatology, while severe enough to seek treatment, is not so severe that they must be hospitalized. While there is nothing profound about this sample (other than the specific implications it holds for alcoholic agoraphobics) it does provide more information in the range of moderate severity. Essentially, conclusions drawn about the tendency toward self-medication with substance use cannot be so easily dismissed as a phenomenon limited to severe abusers or those suffering from very severe symptomatology.

This research also supports the curious nature of self-medication practices: that these attempts are ineffective. This, of course, is an overly simplistic statement. Rather, an alternative and more accurate observation may be that self-medication does not work in the long-term. In fact, it seems to exacerbate the symptoms it is intended to mediate. Unfortunately, this requires either advanced knowledge or trial-and-error experimentation on the part of the individual. The “advanced knowledge” mode of prevention-through-education seems unlikely to inspire abstinence (even if it is attended to), which itself may be unlikely. The “trial-and-error” alternative may also be problematic. For more socially prominent substances like alcohol and nicotine, the development of the addiction is more progressive, and may take as long as several years. By the time depressive symptom exacerbation is actually noticed (if it is even noticed), addiction/dependence may have already set in. In the case of more immediately addictive substances, such as crack cocaine, methamphetamine, or opioids such as heroin and methadone, one trial may be enough to lock in the addiction, effectively depriving the individual of the opportunity to learn that the drug will not be effective (in the long-term) in reducing their symptoms. Worse yet, these drugs may be particularly effective in the short-term in numbing emotional pain without correcting the neurochemistry that will determine the return of depressive symptoms.

Evidence also exists (Weiss et al., 1992) that speaks to the temporary effectiveness of the self-medicating behavior, as symptom severity and the distress associated with it do appear to be reduced following use. Not only might this immediate benefit work to maintain the behavior of self-medication, it may also help to obscure the long-term effects of the substance abuse (both in terms of addiction and eventual symptom aggravation). If the individual’s immediate impression of the drug or drink is that it simply “makes them feel better,” it seems likely that the worsening of symptoms associated with substance abuse will not be attributed to the self-medicating behavior. In fact, such an attribution may not even take place (and certainly is not necessary). Instead, individuals can simply seek comfort in the one place they have come to expect that they can find it. Unfortunately, they may do so

in spite of the fact that this may be one of the driving forces behind the distress they are seeking to quell.

In a four-part, multi-phase study spanning one year, Aneshensel & Huba (1983) found that heavy alcohol use appears to have a causal impact on depression levels. While they found that heavy drinking does appear to worsen depression levels, this effect does not appear until the 12 months after the heavy drinking is observed. More importantly, the pattern of results found in this study revealed a tendency for experienced depression to lead to short-term elevation in alcohol use. Aneshensel & Huba (1983) suggest that this increase is a product of those individuals attempting to self-medicate their depression with alcohol use. Though this study does not measure the short-term effectiveness of this mode of coping, it does indicate that the long-term impact of alcohol use in an individual with depression is the exacerbation of that depression. Thus, the substance abuse and the decline in symptoms become an auto-catalyzing downward spiral. That is, as symptoms worsen, reactive abuse increases, which leads to further decline in symptoms, which thus leads to further abuse, and so on and on.

Treatment Issues

Identifying whether an individual's alcohol use may be of the self-meditative variety may be useful in determining the optimal treatment strategy. Various approaches beyond this point exist. For example, Cooper and colleagues (1995) expounded on their findings regarding the variables associated with drinking to cope by proposing differential intervention strategies contingent on this variable. Thus, for individuals who are depressed and are drinking to cope, the best intervention may be one that is aimed at reducing the individual's stress and providing more constructive and healthy ways of coping with negative affect.

Severity

When considering the issue of treatment, severity will often be one of the first concerns. Swendsen and Merikangas (2000) noted that the Epidemiologic Catchment Area Study (ECA; Robins & Reiger, 1991) and the National Comorbidity Study (NCS; Kessler et al, 1994, 1997) both found that the severity of disorders

increases relative to their natural severity if combined with a comorbid diagnosis. Hagnell and Grasbeck (1990) found that comorbidity was often associated with an increase in the severity of each of the disorders relative to the severity that would be expected with an individual occurrence of either of the two disorders.

There may also be concerns regarding the treatment complications that can arise from comorbidity of these disorders. For example, after examining the effects of smoke-free inpatient units on their psychiatric patients, Hughes (1993) suggested that the cessation of smoking may induce depression. The withdrawal symptoms that can result from abstaining from substance use following the development of dependence may also be cause for concern. As mentioned earlier, many of these withdrawal symptoms look a great deal like depressive symptoms. If the individual in treatment had developed his/her substance dependence through self-medication for a past or current depression, then it may be more difficult for that individual to remain sober, as he/she may feel compelled to self-medicate his/her withdrawal depression.

A final concern was brought up in 1999 when Mueller observed that only a few years prior, clinicians were given 4-8 weeks of intensive treatment to help depressed alcohol abusers to achieve sobriety, while “today we only have a few days” (p. 52). Accepting this reality of the post-managed case era, the concern over the treatment of substance abuse becomes even more acute, as does the necessity of fully understanding the behavior.

Relapse Prevention

Most studies of the comorbidity between depression and substance use seem to be conducted in the spirit of developing treatment recommendations through an enhanced understanding of the relationship between these disorders. Exemplary in this point is an early study conducted by Woody, O'Brien, and Rickels (1975). They found that the treatment of substance use in those who are comorbidly depressed is drastically improved if the patients are given anti-depressant medication. An obvious theory for why this approach may work is that the provision of anti-

depressants alleviates the need to self-medicate the depression with alcohol or illicit drugs.

In an investigation of alcoholics seeking treatment for their alcohol abuse, Brown and Schuckit (1988) found that depressive symptoms within those alcoholics often remit after 2-4 weeks of abstinence from alcohol. Brown et al. (1995) found that for comorbidly depressed patients who present with alcohol use disorders, the depressive symptoms generally subside over time, provided that the patient remains sober.

Brown et al. (1995) conducted a four-level comparison examining the persistence of depressive symptoms for in-treatment patients being treated for depression, primary depression with secondary alcohol dependence, primary alcohol dependence with secondary depression, and alcohol dependence alone. Their results were instructive in the issue of treatment in comorbidity, given that depressive symptoms declined in those with primary alcoholism, but not in those who primary diagnosis was depression. Perhaps even more interesting is the finding that comorbid secondary depression may actually improve alcohol-related treatment outcomes in primary alcoholics (Kranzler, Del Boca, & Rounsaville, 1996). Swendsen and Merikangas (2000, p. 176) posited that this rather counterintuitive relationship may be attributable to the idea that “the successful treatment of depression may encourage alcoholics to stay in treatment.”

CHAPTER 3. PURPOSE

After reviewing and integrating literature relevant to the self-medication hypothesis, we can begin to address the questions that have yet to be answered and thus define the purpose of the present study. Table 1 provides a brief reference for the issues that were covered. Each question and its companion hypothesis will be presented in greater detail on the following pages.

Before we begin discussing the questions, however, it is necessary to identify an operationalization issue that is central to the present study. Because self-medication is a cognitively-defined behavior, it is inherently more complicated and difficult to measure. The fact that it cannot be merely observed makes it doubly difficult to measure because a depressed individual's drinking may or may not constitute self-medication. Because the differentiation lies entirely in cognitive motivation (and in some cases behavioral reinforcement contingencies which are buried in the past) there is little to rely on beyond the self-report of motivational foundations. Fortunately, we can reasonably assume that individuals who engage in self-medicative behavior usually will have at least a subtle level of cognitive and motivational awareness. Of course, strict behavioral theory (in which behavior is based on reinforcement history alone) dismisses this notion as unnecessary; in theory, behavior without any level of conscious awareness is possible. Indeed, it may even be likely that those with significant self-medicative behavior may actively engage in self-delusion in an effort to maintain their coping strategy.

For the purposes of the present study, we assumed that individuals whose drinking behavior does not constitute self-medication would lack certain pre-behavioral factors. Such factors would include the self-report of a motivation to use alcohol in order to cope with problems and the acknowledgment of similar outcome expectancies that show an individual's beliefs about what effects his/her drinking will engender. Conversely, and more-assuredly, we were able to assume that an individual who did exhibit such self-reports (as well as reporting drinking behavior) was likely to be self-medicating on some level. To simplify and measure this

concept, we used a proxy of self-medication by measuring self-reported variables such as coping drinking motives and related outcome expectancies that should precede self-medicative behavior. Figure 1 provides a visual depiction of the posited relations among depression, pre-behavioral self-medication indicators, and drinking.

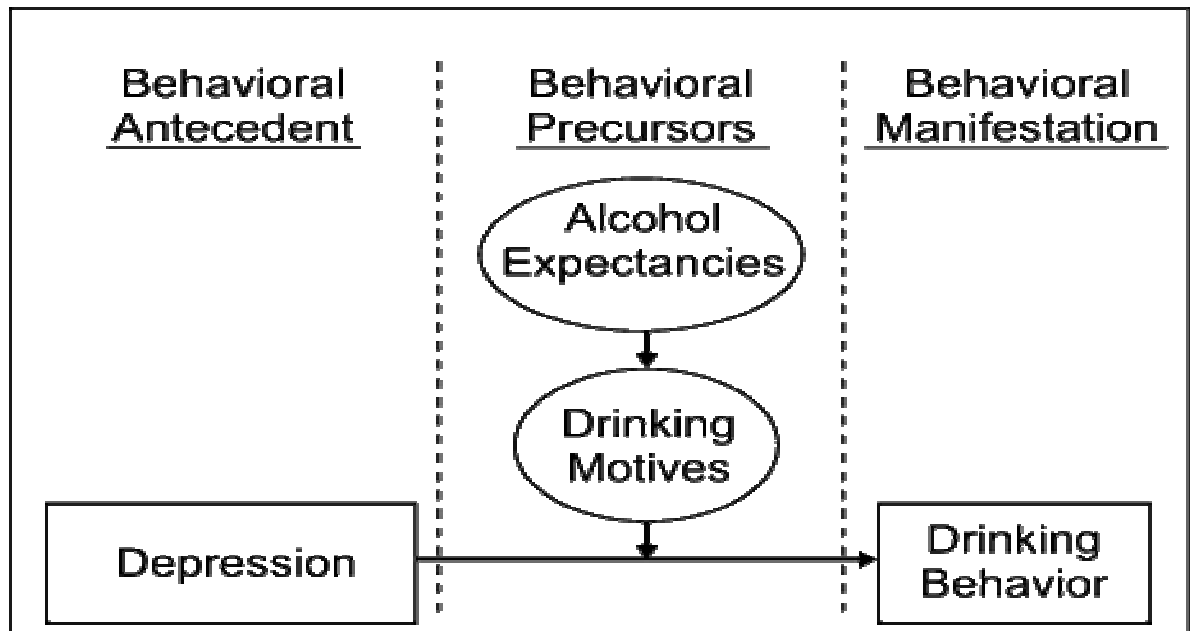


Figure 1. Pertinent variables in the measurement of self-medication and their relation to one another

The research base for the relations among self-medicative factors, depression, and alcohol-related variables is extensive, as has been documented, but the following questions were found to be relatively unanswered. These questions, and the answers predicted based on Self-Medication Theory, formed the outline of the purpose of the present study. Each question is articulated below.

Question 1. Is there a relation between sub-clinical depression and self-medicative indicators?

The present study was proposed to explore several as yet unanswered questions about the self-medication hypothesis. We begin with the breadth and generalizability of the theory. Specifically, are some individuals still prone to self-medication behavior, even at sub-diagnosable levels of depressive symptomology?

Most individuals who would be described as “heavy drinkers” will not necessarily meet the diagnostic criteria for alcohol abuse or dependence, though their patterns of use and intake volume could be considered pathological (Aneshensel & Huba, 1983). Depression is no different; some degrees of experienced depression can represent pathology without meeting criteria for diagnosis. Assuming that this is true, the study of a non-treatment sample within which alcohol use and depression will co-vary in an unrestricted manner could provide important insights into a very significant subset of many collegiate and young populations. The present study was limited only in its ability to generalize beyond the collegiate sample available for this study. However, given the research to indicate that drinking and depression are significant issues on many college campuses, perhaps this limitation is less pressing. In their extensive review of college student drinking literature, Ham and Hope (2003, p. 720) observed that “heavy and or problematic alcohol use among college students represents a major public health concern.” In a longitudinal study of adults in university communities, Gilman and Abraham (2001) found that the magnitude of baseline depressive symptoms was associated with the odds of a subsequent diagnosis of alcohol dependence one year later. This relation was especially true for females and demonstrated that depressive symptoms represent risk factors for alcohol dependence.

Table 1.

Questions and the manner in which they will be addressed

Question	Variables*	Analysis
1. Does self-medication appear to occur at sub-diagnosable levels of depression?	-Depression (excluding clinically depressed individuals) -Drinking motives & expectancies	Correlation
2. Do self-medicative drinking motives or expectancies predict drinking behavior?	-Drinking motives & expectancies -Alcohol-related problems -Alcohol consumption	Multiple Regression
3. To what extent (if any) do self-medicative drinking motives and expectancies moderate the relation between depression and drinking variables?	-Stress -Depression -Antidepressant use -Marijuana use -Drinking motives & expectancies -Alcohol consumption	Multiple Regression
4. Does self-esteem moderate the relation between depression and coping drinking motives?	-Depression -Self Esteem -Drinking Motives	Multiple Regression
5. Does an increase in depressive symptoms over time relate to an increase in coping motives for drinking or an increase in alcohol consumption?	-Depression -Coping Motives -Alcohol Consumption	Multiple Regression

Note *. For the instruments used to measure these variables, please refer to Table 2.

Adults aged 18-24 years exhibit the highest rates of alcohol use as well as the largest percentage of problem drinkers (Ham & Hope, 2003). This review also revealed that as much as 80% of college students were drinking at some level during the 1990s. Binge drinking is also a serious issue among college students, and is defined as consuming five or more drinks in one sitting for men and four or more for women. Vik and colleagues (2000) found that 84% of college students have engaged in binge drinking within the previous 90 days. This number falls to

only 44% if the time period measured is decreased to the last two weeks (Welscher et al., 1999). Numbers from the same study demonstrate that while 44% of the student population has engaged in binge drinking over the last two weeks, these individuals account for the consumption of 91% of all alcohol consumed. There can be little doubt that drinking (especially binge drinking) is a problem on many college campuses.

If the present study is successful, the present study will have taken a step toward determining whether self-medication occurs at sub-diagnosable levels of depression and alcohol use. If we accept that the transition from “normal” to “disordered” is not the flip of a switch but rather a decline into pathology, then there may be important implications for supporting this middle ground. Beyond establishing and profiling the entire range of the co-occurrence of depression and alcohol use, the present study also hoped to describe how and when self-medication appears to occur among this vast subpopulation. To answer the question of whether self-medication still appears to occur at sub-diagnosable levels of depression, the present study examined the relation between depressive symptoms and self-medicative indicators like coping motivation and tension-reduction alcohol expectancies. This analysis excluded participants who do not drink and those whose CES-D score was above the clinical cut-off of 16. The analysis proceeded with the hypothesis that a significant relation does exist between depression and self-medicative indicators, even among this “non-clinical” population.

Question 2. Do self-medicative drinking motives or expectancies predict drinking behavior?

Research has demonstrated that treatment for alcohol abuse is associated with differential drinking motivations (Carey & Correia, 1997). Specifically, those in treatment display a higher tendency to report negative reinforcement contingencies (per Cox & Klinger’s 1988 model) as their primary motivation to drink. However, past studies have failed to find a consistent link between drinking motives and expectancies and drinking variables such as amount (consumed) and frequency (of consumption). Given that these data are already being measured, it warranted

repeating these analyses to determine if this non-relation held true for the current sample. To test the hypothesis that these relations do exist, the correlation between level of depression and drinking consumption was determined and tested for significance.

In addition to examining alcohol consumption, past studies have also shown the experience of problems related to drinking to be the only variable which routinely correlates with drinking motives and expectancies. To test the hypothesis that this relation existed, the correlation among drinking motives and the experience of alcohol-related problems was determined and tested for significance.

Question 3. To what extent (if any) do stress, self-esteem, prescription anti-depressant use, marijuana use, and self-medicative indicators (drinking motives and expectancies) moderate the relation between depression and alcohol use?

One possible theory of the relation between depression, self-medicative indicators, and alcohol use is that indicators such as motives and expectancies moderate the relation between depression and drinking behavior (see figure 1). The Self-Medication Theory would hold that as different individuals experience depression, their likelihood of engaging in self-medicative drinking will differ depending on their stated motives for drinking and their reported expectancies for what the consumption of alcohol will effect. Individuals who experience high levels of depression but do not report high levels of self-medicative indicators are unlikely to drink as an attempt to self-medicate their distress (though they may be likely to drink for other reasons). However, individuals who demonstrate higher levels of self-medicative indicators would be seen as more likely to drink as a means of coping with their depression. Thus, the strength of the relation between depression and self-medicative drinking is predicted to be effected by the level of self-medicative indicators such as coping drinking motives and tension-reduction alcohol use expectancies. To test this hypothesis, hierarchical multiple regressions were conducted to determine whether depression, drinking motives and alcohol expectancies (as well as their interaction terms) were significantly related to the

amount of alcohol consumed. Levels of stress and self-esteem were also explored as potential predictors in these analyses, as was use of prescription anti-depressants and marijuana.

Question 4. Does self-esteem moderate the relation between depression and coping drinking motives?

Self-esteem is a construct that has seen relatively little attention (if any) in the self-medication literature. It was included in the present study to test whether it played a role in the relation between depression and coping motives. Theoretical underpinnings for this relation might suggest that individuals with lower self-esteem are more likely to see themselves as inadequate self-providers of coping support, thus ruling out more direct and healthy styles of coping while also promoting reliance on external sources of coping (such as alcohol use). Conversely, individuals with higher self-esteem might be more likely to believe that they can overcome their difficulties with depression, leading them to avoid drinking to as a means of dealing with their depression. Given that this hypothesis supposes that self-esteem may have an impact on the strength of the relation between depression and coping drinking motives, a hierarchical multiple regression was conducted within which self-esteem, depression, and their interaction were used as predictor variables while coping drinking motives was used as the criterion variable. This allowed us to determine: a) the proportion of the variance in coping motives explained by depression, and b) whether self-esteem had a moderating effect on that relation if it was found to exist.

Question 5. Does an increase in depressive symptoms over time relate to an increase in coping motives for drinking or an increase in alcohol consumption?

Having measured depression, self-medicative indicators, and alcohol-related variables at two different times (four weeks apart), we are in a position to look for changes in various key variables over time, as well as whether any trends observed in this variable change were significantly related to changes in other variables. Returning to the self-medication hypothesis – that an increase in depressive

symptoms can lead to changes in self-medicative precursors (such as coping motives for drinking and possibly alcohol expectancies like global positive change and tension-reduction) and ultimately to changes in alcohol use behavior – there are certain sets of changes one would expect to be related. The most notable of these relations would predict that an increase in depressive symptomology would likely be associated with an increase in self-medicative precursors/indicators.

Table 2.

Constructs to be measured

Construct	Page	Instrument
Recent Alcohol Use	p. 117	2-week Alcohol Calendar
Health History	p. 116	Brief questions regarding antidepressant use, marijuana use, & stress
Drinking Motives	p. 120	Drinking Motives Questionnaire (DMQ; Cooper, 1994)
Alcohol Expectancies	p. 121	Alcohol Expectancy Questionnaire (AEQ; Brown, Christiansen, & Goldman, 1987)
Drinking Problems & Consequences	p. 124	Drinking Problems Index (DPI; Finney & Moos, 1991)
	p. 125	College Alcohol Problems Scale (CAPS; O'Hare, 1997)
Self Esteem	p. 125	Rosenberg Self Esteem Scale (Crandel, 1973)
Depressive Symptomology	p. 126	Center for Epidemiological Studies Depression Scale (CES-D, Radloff, 1977, 1992)

CHAPTER 4. METHOD

Participants

Participants were 491 undergraduate students obtained from two large undergraduate psychology courses at a large Midwestern university. Participants completed an online questionnaire in the fall of 2006, hosted by the website [surveymonkey.com](http://www.surveymonkey.com) (<http://www.surveymonkey.com>). The sample consisted of 36% males and 64% females. Many of the respondents were freshman (48%), though sophomores (28%), juniors (15%), and seniors (8%) were also represented. The mean age of the sample was 19.3 ($SD = 1.9$). The most common ethnicity was Caucasian (88.6%), though African-American (1%), Latino (2%), Asian-American (6%), and Multiracial (1%) ethnicities were also represented. Of these initial 491 participants, 444 chose to participate in the second-phase follow-up study approximately four weeks after their initial participation, for a retention rate of 90.4%. While this level of retention is unusually high, it is likely that the ease of online participation provided an added incentive for participants to volunteer for the second session. Demographic breakdowns did not change notably from Session I to Session II.

Procedure

The following procedure was approved by the Iowa State Internal Review Board (ISU IRB# 05-461, see Appendix A for a copy of the approval). Individuals were initially made aware of the availability of the study through the computerized online research participation system, SONA, which is overseen by the ISU psychology department. Potential volunteers were able to review the study and determine whether they would like to participate. The only restriction elucidated was that participants must be at least 18 years of age. Reviewing this summary also made volunteers aware that their completion of session one would make them eligible for participation in a follow-up session (Session II). 500 volunteers (nine signed up but did not participate) were able to sign up for the initial phase (Session I) of the study.

Having signed up for the study, participants were provided with a web link that allowed them to access the study on the surveymonkey.com web-server. The initial screen displayed the informed consent form (see Appendix B) and informed them that clicking the “next” link would take them to the study and would be taken as evidence that they were consenting to continue. Having tacitly given their consent by continuing, participants were then directed to a series of screens, each containing a digital version of the questionnaire materials, each with clickable choices or drop-down menu choices as appropriate. Having completed the final screen of survey materials, volunteers were afforded an open-ended comment opportunity wherein they could make comments or raise concerns about the study or their participation. After exiting this screen, they were thanked for their participation and reminded that they would be contacted via email about a follow-up opportunity in approximately four weeks. Data collection for Session I continued over the next two weeks, with over 80% of the data collected in the first five days, and 95% of the data collected within the first two weeks. As participants’ completed records were compiled, they were awarded credit via the SONA system as directed by the psychology department and the University IRB.

After a period of four weeks had passed from the beginning of data collection for Session I, an email (Appendix C) was sent to all participants who had completed Session I. This email provided a password which would allow participants to sign up for Session II of the study. They were informed in this email that doing so would allow them to earn additional extra credit, but that they were under no obligation to participate. The four-week duration was chosen to allow time for potential changes in depression, drinking behavior, drinking motives, and the experience of alcohol-related problems. It is also notable that the timing of the study found the participants in the beginning of their semesters (with theoretically little stress of immediately upcoming exams), while the follow-up period likely found many of the participants preparing for their first round of mid-term exams.

Collection of the Session II data was conducted in the same manner as in Session I, with the lone exception being that upon completion of the material, participants were directed to a debriefing screen (Appendix E), which informed them about the basis of the study and the value of their participation. Completed data records were compiled, and volunteers were awarded their extra credit through the SONA system on an ongoing basis.

Once the data collection on Session I and II had concluded, the data was transferred from the surveymonkey.com server to the PI's computer and converted to a password-secured Microsoft Excel file. Once the Session I and Session II data had been merged, all identifying information regarding the participants (names and emails) was deleted from the file. The data file was then converted to an SPSS file, and the analyses were conducted as reported. To preserve the evidence of informed consent having been obtained, the survey data from the original files was removed, but names were left intact, and the file was password-protected. This was necessary because no paper documentation of consent was obtained, and names could not be entered on the website without first indicating consent (therefore the presence of the name in the file indicates that consent was given).

Materials

The materials were presented on the website in a consistent order (see Appendix D) and each instrument was presented on a different scrollable screen. These materials included an informed consent screen (requiring the participant to click a link to advance, and thereby indicate their consent) as well as several instruments to measure variables including self-reported drinking behavior, health information, drinking motives, alcohol expectancies, alcohol use-related problems, self-esteem, depression, and general personality. Appendix D contains each measure in the order in which they are presented to the participant.

Informed Consent

The content from the informed consent screen can be found in appendix B.

Health Information

Participants were asked to indicate whether they were currently taking or had been recently (within the last six months) taking anti-depressant medication. To increase the reliability of responding, an up-to-date list of antidepressant medications was included. Information regarding use of antidepressants was gathered so that anti-depressant use could be added to multiple regression analyses in effort to reduce error variance and potentially increase power. An additional question was used to ascertain whether the participant was using an herbal supplement which is marketed for its anti-depressant benefits (such as St. John's Wort). Participants were also asked to indicate the frequency with which they had used marijuana over the previous two weeks. Frequency was assessed using a five-point Likert scale ranging from "I have never used marijuana" to "more than five times." Finally, participants were asked to rate the amount of stress they have been under over the last two weeks by choosing among five anchored responses ranging from "I have not been under much stress lately" to "I've been under more stress than I could possibly handle lately."

Alcohol Use

Alcohol use was assessed using an Alcohol Use Calendar (AUC). The use of such a calendar has been advocated by many alcohol use researchers as a means of measuring an individual's self-reported drinking behavior (Cooper, Frone, Russell, & Mudar, 1995; Christian, Vik, & Jarchow, 2002; Ham & Hope, 2003). Of course, the ideal means of measuring alcohol use (or any behavior) is to measure it through observation as it is occurring. Unfortunately this often proves to be methodologically and logistically impossible. Therefore, alcohol-use researchers must usually depend on measuring alcohol use through retrospective self-report. There are several predictable difficulties with measuring alcohol use in this manner. As with all self-report, the validity and reliability of the information obtained can be questionable. Self-report depends on the human capacity to both remember correctly and report correctly, and for this reason its use as a method of data collection demands a higher level of scrutiny. Additionally, the self-report of alcohol use is doubly difficult

because alcohol use, by virtue of its properties as an intoxicant, makes the accuracy of a respondent's recollection even less reliable. The accuracy of the report is also more complicated with alcohol use reporting because individuals may be more likely to under-report their use due to the embedded social values associated with drinking. However, this effect is likely to be minimized by the impact of an often pro-drinking culture in which many college students live.

Given this myriad of difficulties, it becomes clear that steps must be taken to mitigate these factors as much as possible. The Alcohol Use Calendar used in this study was designed with these factors in mind. Ideally, the AUC will maximize the accuracy of self-report by shortening the period of time over which the respondent is asked to recall his/her drinking behavior. The AUC as used in this study measures use over the previous two weeks, ending on the most recent Sunday, and beginning on the Monday two weeks prior. By providing a specific and recent frame within which to draw upon the memory, recall may also be improved because the information being requested can be tied to activities and locations that act as cues, potentially improving recall. The requirement of the AUC that the respondent itemize his/her drinks by type may also improve the respondent's accuracy of recollection.

While the accuracy of retrospective self-report is certainly dependent upon the quality of recall and the motivation of the respondent to invoke such accurate recall, the issue of accuracy in reporting (independent of recall) also requires attention. This problem is embodied when an individual can very accurately recall what he/she had to drink on a given night, but is unwilling or hesitant to report this information accurately. Ideally, the calendar format may help to reduce the impact of social influence by eliminating categorical questions regarding the individual's drinking behavior. The respondent's report is not framed within a response structure that can send messages to the individual about how their drinking may relate to expectations. Misreporting due to concerns about getting in trouble was also reduced in this study by repeatedly assuring the participants of the confidentiality of the responses. As a result, participants may be less swayed by social influence

effects and concerns about the consequences their reports may have, again leading to potentially more accurate responding.

The combination of the attributes delineated in the preceding paragraphs and the fact that they constitute revisions to previously accepted measures make the AUC a strong candidate as an approach for measuring alcohol use while minimizing the problems associated with retrospective self-report. In addition to these advantages, the AUC also offers several measurement possibilities by virtue of the raw information it collects. For instance, an individual's mean "weekday intake" can be calculated separately from his/her mean "weekend intake". Binge drinking can be parsed from other forms of drinking. Effects related to type of alcohol used can also be derived. The flexibility of this instrument is extensive, making this means of measuring alcohol use an even more attractive alternative to other, less flexible measures.

Quantity of alcohol consumed was the primary alcohol-use statistic gleaned from the AUC for the present study. Though the measurement of quantity provides important information about drinking behavior, several researchers have argued that these measurements alone are not enough. It has been recommended that drinking consequences and problems also be measured to account for those who may not drink a lot or very often, but nonetheless experience considerable problems when they drink (Ham & Hope, 2003). Temporal stability estimates for the AUC in the present study were encouraging ($r_{\text{test-retest}} = .79$; 4-week interim period). Internal consistency in the present study was acceptable ($\text{Alpha} = .74$).

Alcohol-Related Problems

The experience of alcohol-related problems was measured using two relatively short instruments, the College Alcohol Problems Scale – Revised (CAPS-r; O'Hare, 1997) and the Drinking Problems Index (DPI; Finney & Moos, 1991). The CAPS-r is an 8-item self report measure in which the respondent uses a 6-pt anchored Likert scale to indicate the number of times he/she has experienced each of eight alcohol-related problems within the last year (please refer to Appendix D page 120 for a complete list of the items). Example problems include "engaged in

unplanned sexual activity” and “drove under the influence.” Scores range from 0 (no alcohol problems experienced) to 40 (high levels of alcohol-related problems). A factor analysis found the CAPS-r to measure two sub-factors, socio-economic problems and community problems. Chronbach’s alpha internal consistency estimates for the two scales are high (.88 and .79, respectively). The CAPS-r was also tested for concurrent validity against the Quantity-Frequency Index (QFI; Strauss & Bacon, 1953) and both factors were found vary to significantly and as expected (Wilks lambda = .94, $F = 9.61$ (2,309), $p < .01$). Test-retest reliability over a 4-week period for the CAPS-r in the present study was acceptable ($r_{\text{test-retest}} = .79$), and internal consistency was good (Alpha = .82).

The DPI (Finney, Moos, & Brennan, 1991) is a 17-item self-report measure of problems experienced as a result of drinking. Each item lists a problem, and respondents indicate (via 5-pt anchored Likert scale) the frequency with which they have experienced each problem in the last 12 months (please refer to Appendix D page 119 for a complete list of the items). Example problems include “had a friend worry or complain about your drinking” and “lost friends because of your drinking.” Scores range from zero (no alcohol problems experienced) to 17 (high levels of alcohol-related problems). Research has demonstrated that the DPI has excellent psychometric properties, with an internal consistency reliability estimate of .94, a cross-temporal correlation over a 1-yr interval of .66, and cross-sectional correlations with alcohol consumption of .37 and .42. The strength of the relationship between alcohol consumption and DPI scores was impressive, given that drinking problems were assessed over a 12 month interval while alcohol consumption was assessed with respect to the prior month. The construct validity of the DPI was supported further by significant concurrent correlations with depression, self-confidence, and social activities (Finney, Moos, & Brennan, 1991). Four-week test-retest reliability for the DPI in the present study was acceptable ($r_{\text{test-retest}} = .79$), and internal consistency was good (Alpha = .87).

Drinking Motives

Motives for drinking were assessed using the Drinking Motives Questionnaire (DMQ; Cooper, 1994). The DMQ is a four-factor, 20-item self-report instrument that uses a 5-pt, anchored Likert scale to measure the frequency with which the respondent drinks for potential reasons presented in the item stems. The score on each item loads on one of four factors which constitute domains of drinking motives. These domains include drinking to cope, drinking to enhance, drinking to conform, and drinking to be social. Participants respond to how often they drink for the reason listed in each item stem using a Likert frequency scale ranging from one (never/almost never) to five (almost always/always). No test-retest reliabilities were available prior to those obtained in this study, but internal consistency reliabilities for each factor have been found to range from .83 to .91 (Neighbors, Larimer, Geisner, & Knee, 2004). Strong convergent validity evidence exists for the DMQ, with high correlations between each of the four factors and its theory-consistent expectancy factor (tension-reduction expectancies, socioemotional enhancement expectancies, depression, and avoidance coping; respectively, $r = .58, .69, .36, .53$; Cooper et al., 1995). Test-retest reliability for the four subscales of the DMQ were acceptable to excellent overall ($r_{\text{test-retest (Social Scale)}} = .81$; $r_{\text{test-retest (Coping Scale)}} = .75$; $r_{\text{test-retest (Enhancement Scale)}} = .85$; $r_{\text{test-retest (Conformity Scale)}} = .62$). The overall internal consistency of the DMQ was excellent ($\text{Alpha} = .92$). Only the coping subscale was used in for data-analytic purposes in the present study.

Alcohol Expectancies

Alcohol Expectancies were assessed using the Alcohol Expectancy Questionnaire (AEQ; Brown, Christinansen, & Goldman, 1987). The AEQ is a 69-item self-report questionnaire in which each item poses a statement expressing an effect alcohol might have on an individual. Respondents indicate whether they believe each potential alcohol effect to be true or false. The AEQ measures six factors, including global positive changes, sexual enhancement, physical and social pleasure, increased social assertiveness, relaxation and tension reduction, and arousal and aggression. The global positive change scale ranges from 28-56, with

higher scores indicating more of a belief that alcohol acts as a global transformation agent, changing a wide variety of experiences in a positive way. The sexual enhancement scale ranges from 7-14, with higher scores indicating more of a belief that alcohol improves sexual experience and enhances sexual arousal. The physical and social pleasure scale ranges from 9-18, with higher scores indicating more of a belief that alcohol enhances physical and social pleasures. The social assertiveness scale ranges from 11-22, with higher scores indicating more of a belief that alcohol creates positive and socially assertive personality changes. The relaxation and tension reduction scale ranges from 9-18, with higher scores indicating more of a belief that alcohol produces relaxation and tension reduction. Finally, the arousal and aggression scale ranges from 5-10, with higher scores indicating more of a belief that alcohol increases feelings of arousal and aggression.

The psychometric properties of the AEQ are adequate, with coefficient alphas ranging from .72 to .93 (Brown, et al., 1987). A study of the temporal stability of the AEQ over an 8-week period found the reliability coefficient to be .64 (Brown, et al., 1987). The temporal stability of the AEQ over a 4-week period in the present study varied by scale ($r_{\text{test-retest}}$ (Global Scale) = .81; $r_{\text{test-retest}}$ (Sexual Enhancement Scale) = .75; $r_{\text{test-retest}}$ (Enhancement Scale) = .84; $r_{\text{test-retest}}$ (Positive Social Change Scale) = .85; $r_{\text{test-retest}}$ (Tension Reduction Scale) = .62; $r_{\text{test-retest}}$ (Aggression Scale) = .62). The internal consistency reliability in the present study was excellent (Alpha = .96). Only the tension-reduction subscale was used for data-analytic purposes in the present study.

Self-Esteem

Self-Esteem was assessed using the Rosenberg Self Esteem Scale (RSES; Rosenberg, 1965; Rosenberg, 1989). The RSES is a 10-item self-report measure using a 4-pt Likert scale ranging from “strongly agree” to “strongly disagree.” Individuals respond to each of ten statements which are designed to measure the extent to which they maintain a positive self-view. Scores range from 0 to 40. A high score on the measure indicates a high self-esteem, while a low score indicates a low self-esteem and overall negative self-view. The RSES has been widely used a measure of self-esteem and has provided solid psychometric properties in studies of

its strength as a measure. Chronbach's Alpha has been found to range from .74 to .80. Stability coefficients range from .77 over one year and .85 over a two-week interval. Convergent validity has been established with the Health Self-Image Questionnaire ($r = .83$), the Coopersmith Self-Esteem Inventory ($r = .60$), and the Global Self-Worth Scale ($r = .76$; Rosenberg, 1965; Rosenberg, 1989). Four-week test-retest reliability for the RSES in the present study was acceptable ($r_{\text{test-retest}} = .80$), and internal consistency was acceptable ($\text{Alpha} = .78$).

Depression

Level of depressive symptomology was measured with the Center for Epidemiologic Studies Depression scale (CES-D; Radloff, 1977). The CES-D was designed to measure depressive symptomology in a normal population. It is a 20-item measure using a 4-pt Likert scale where each anchor refers to a different frequency with which a given depressive symptom may have been experienced during the preceding week. These anchors range from "rarely or none of the time (less than 1 day)" to "most or all of the time (5-7 days)." Participants choose one of the four anchors for each of the 20 items, all of which are commonly accepted depressive symptoms. Total scores range from 0-60. The higher the score, the more symptoms the individual is experiencing and the more often they are being experienced. In this manner, the CES-D provides a meaningful measure of the level of depression an individual may be experiencing. Developers of the CES-D have indicated that scores above 16 should be considered indicative of clinically significant depression (Radloff, 1977). However, two separate recent studies of college students using the CES-D have found mean scores equal to 16.1 (Bucceri, et al., 2005; Williams & Galliher, 2006). For the purposes of this study,

Having been developed specifically for research in the area of depression, the psychometrics of the CES-D are excellent. Coefficient alphas have been found to range from .84 to .90. Temporal stability estimates prove to be less impressive, ranging from $r = .67$ after four weeks to $r = .59$ after eight weeks. It should be noted, however, that the construct of depression and depressive symptomology can be highly variable depending on the respondent's mood when answering the

questionnaire. As a result, test-retest reliability scores in the range of .59 to .67 are quite reasonable. Convergent validity estimates are sound, ranging from .43 to .60 with other self-report instruments (Radloff, 1977). Four-week test-retest reliability for the CES-D in the present study was acceptable ($r_{\text{test-retest}} = .73$), and internal consistency was excellent ($\text{Alpha} = .89$).

CHAPTER 5. RESULTS

Data Collection & Retention

Four-hundred and ninety-one volunteers completed the materials for Session I. All participants who began their participation completed all or at least some sections of the materials, and no one elected to terminate their participation prior to completion. Of the 491 participants from Session I who were invited to participate in Session II, 448 participants signed up for Session II. Of these, 444 completed Session II before the participation deadline elapsed. This level of participation in Session II constitutes a 90.4% retention rate from Session I. To ensure that there were no confounding factors leading to differential attrition; t-tests were performed for age, gender, and year in school, as well as on the difference scores for each of the variables under study. None of the t-tests were statistically significant, indicating that none of the variables were differentially affected by the small attrition that did occur. As a final check for attrition effects, the Session I marijuana and alcohol use means for Session II responders vs. non-responders were compared in a pair of 2-samples t-tests. Both of these t-tests were found to be non-significant, providing further evidence that there did not appear to be any confounds of differential attrition. The distributions of stratifiable variables for each session are provided in Table 3.

Table 3.

Distributions of variables by session and intra-variable level

Variable Level	Session I		Session II	
	n	(%)	n	(%)
Age				
18	228	(46.4)	205	(46.4)
19	115	(23.4)	108	(24.4)
20	69	(14.1)	62	(14.0)
21	36	(7.3)	30	(6.8)
22+	43	(8.7)	37	(8.4)
Gender				
Male	177	(36.0)	153	(34.6)
Female	314	(64.0)	289	(65.4)
Total Drinks/week (last 2 weeks)				
0	143	(29.1)	118	(26.7)
1-20	201	(40.9)	202	(45.7)
21-40	86	(17.5)	71	(16.1)
41+	61	(12.4)	51	(11.5)
Marijuana Use (last 2 weeks)				
Never used	341	(69.5)	306	(69.2)
Previous use	105	(21.4)	106	(24.0)
1-2 times	22	(4.5)	16	(3.6)
3-5 times	8	(1.6)	8	(1.8)
6+ times	9	(1.8)	6	(1.4)
Stress Level (last 2 weeks)				
"Not much"	85	(17.3)	33	(7.5)
"A little"	245	(49.9)	189	(42.8)
"Stressed out"	100	(20.4)	146	(33.0)
"Ton of stress"	48	(9.8)	66	(14.9)
"More stress than I can handle"	7	(1.4)	8	(1.8)
Depression (CES-D)				
0-11	287	(59.5)	266	(60.7)
12-15	50	(10.4)	61	(13.9)
16+	114	(23.0)	111	(25.3)

Descriptives

Normality and Necessary Variable Transformations

Means, standard deviations, and frequencies were calculated as appropriate for each variable. Given that regression analyses would be used in the present study, the normality of residual scores was assessed for all variables used in the regression model. All but two variables (total alcohol consumption and coping motives for drinking) were found to be acceptably normal. The skew and kurtosis for these skewed variables can be found in Table 4. As these initial levels of non-normality violated the assumption of residual normality for regression, these two variables were transformed using a natural log transformation. After the transformation was applied, the resulting skew and kurtosis scores for Session I alcohol use were decreased from skew = 2.09 (.13), kurtosis = 4.99 (.26) to skew = -.44 (.13) and kurtosis = -.51 (.26). Similar improvements can be noted in table 4 for Session II transformations as well as improvements in skew and kurtosis for coping motives in Session I and II. The resulting transformed variables were sufficiently normal to satisfy the residual normality assumption. These log-transformed variables were used in all subsequent analyses.

Table 4.

*Skew and kurtosis values before and after log-transformations for skewed variables**

Variable	Skew		Kurtosis	
	Stat	S.E.	Stat	S.E.
Alcohol Use (Session I)	2.09	.13	4.99	.26
Alcohol Use (Session I; log-transformed)	-.44	.13	-.51	.26
Alcohol Use (Session II)	1.71	.13	3.42	.26
Alcohol Use (Session II; log-transformed)	-.66	.14	.40	.29
Coping (Session I)	1.27	.13	1.38	.26
Coping (Session I; log-transformed)	.57	.13	-.50	.26
Coping (Session II)	1.22	.14	1.29	.27
Coping (Session II; log-transformed)	.49	.14	-.54	.27

*Note**. Excludes non-drinkers

Health Information Results

Mean data for each of the variables measured is displayed in Table 3.

Of the initial sample (Session I), 12.8% of participants ($n = 63$) indicated that they had been diagnosed with depression, while 10% of participants endorsed this question in Session II. Thus, there was an attrition of 13 “depressed” participants from Session I to II. The incidence of diagnosed anxiety disorders was 8% ($n = 39$) in Session I and 7% in Session II (attrition of seven “anxious” participants, for an overall attrition of anxious participants of 21%).

Anti-depressant use was relatively minimal, with only 25 (5.2%) of all participants taking prescription anti-depressants in Session I, and 21 (4.3%) in Session II. Only one of the initial 491 participants indicated the use of non-prescription anti-depressant supplements like St. John’s Wort.

Marijuana use in Session I varied among participants, with 341 respondents (70%) indicating that they had never used marijuana. An additional 21.6% ($n = 105$) of the participants indicated that they had used marijuana before, but not in the last two weeks. Of those remaining, 22 (4.5%) indicated that they had smoked marijuana 1-2 times in the last two weeks, eight people (1.6%) indicated 3-5 uses, and nine participants (1.9%) endorsed a level of marijuana use exceeding five uses over the last two weeks. These levels remained relatively stable when assessed four weeks later during Session II and can be found in Table 3.

Levels of perceived stress also varied considerably. Distributions of reported stress can be found in Table 3, but Session I statistics are summarized below. Half of Session I participants indicated they were experiencing “a little more stress than usual” (49.9%; $n = 245$); 17.3% ($n = 85$) indicated “not much stress”; 20.4% ($n = 100$) indicated that they were “stressed out”; 9.8% ($n = 48$) indicated that they were under a “ton of stress”; and seven individuals (1.4%) indicated that they were under “more stress than they could handle.”

Alcohol Use Results

Three hundred forty-eight (70.9%) students reported some level of drinking behavior during the two weeks measured in Session I. This number increased to 73.3% ($n = 324$) in Session II. Of those who did drink prior to Session I, most (40.9%; $n = 201$) drank between one and twenty drinks over the course of two weeks. Heavier drinking was less common but still notable, with 17.5% ($n = 86$) of drinkers reporting 21-40 drinks consumed, and 12.4% ($n = 61$) of drinkers reporting more than 40 drinks consumed. Please see Table 3 for more details on Session I alcohol use as well as the corresponding information for Session II alcohol use. Table 5 displays descriptive statistics for all of the relevant variables. Among drinkers, the average number of drinks consumed per week was 10.6 ($SD = 13.0$) for Session I and 9.7 ($SD = 10.3$) for Session II. Thirty-nine percent ($n = 143$) denied alcohol use entirely. Pattern binge drinking (two separate instances of 5+ drinks in one day within a 2-week period) was also assessed. Of the drinkers in the total sample, 50.1% ($n = 174$) had not engaged in pattern binge drinking, while 49.9% ($n = 173$) had engaged in binge drinking on more than one occasion over the 2-week period.

Drinking Motives Results

The endorsement of the various domains of drinking motives was relatively consistent with previous research (Cooper, 1992 & 1994) in that the positive Social and Enhancement motives for drinking were the most heavily endorsed, while negative motivations (Coping and Conformity) were less commonly endorsed (see Table 5). Scale scores for each motivation domain ranged from 1 (low drinking motivation from this domain) to 25 (highest level of motivation from this domain). In Session I, the average Social motivation score was 13.2 ($SD = 5.8$) and the average Enhancement score was 11.7 ($SD = 5.6$). In contrast, the average Session I Coping motivation score was 7.6 ($SD = 3.2$), and the average Conformity motivation score was 6.7 ($SD = 2.4$).

Table 5.

Descriptive statistics^e

Variable	Session I			Session II		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
Age	491	19.3	1.9	444	19.3	1.9
Weekday Drinks/week ^{a,c}	397	3.6	6.0	349	2.1	3.9
Weekend Drinks/week ^{b,c}	397	7.0	8.1	349	7.6	7.5
Total Drinks/week ^{c,d}	397	10.6	13.0	349	9.7	10.3
Drinking Motives Questionnaire						
Social	479	13.2	5.8	440	13.2	5.9
Coping ^d	479	7.6	3.2	440	7.7	3.2
Enhancement	479	11.7	5.6	440	12.0	5.9
Conformity	479	6.7	2.4	440	6.5	2.3
Alcohol Exp. Questionnaire						
Global Expectancies	479	34.2	6.1	441	34.5	6.6
Sexual Enhancement	479	8.8	2.1	441	8.9	2.2
Enhancement of Pleasure	479	16.0	3.2	441	16.1	3.2
Positive Social Change	479	17.1	4.1	441	17.0	4.2
Tension Reduction	479	13.2	2.8	441	13.3	3.0
Aggression	479	7.0	1.2	441	7.0	1.2
DPI ^c	391	4.3	3.2	348	4.6	3.5
CAPS-r ^c	391	7.5	7.3	348	8.0	7.4
Rosenberg Self-Esteem Scale	483	31.1	3.9	443	31.0	4.3
CES-D	484	11.0	8.7	441	11.4	9.5

Note^a. "Weekdays" include Mon., Tues., Wed., & Thurs.

Note^b. "Weekends" include Fri., Sat., & Sun.

Note^c. Excludes non-drinkers

Note^d. These means reflect untransformed data

Note^e. Please see Appendix F for information on the range of possible scores on each scale and for a correlation matrix of key variables used in study analyses

Alcohol Expectancy Results

The levels of alcohol expectancies observed in the present study were consistent with previous research findings for each scale (Brown et al., 1987). Please see Table 5 for more details. The mean score of AEQ Tension Reduction subscale in Session I was 13.2 ($SD = 2.8$) and 13.3 ($SD = 3.0$) in Session II. These means would be consistent with a participant endorsing approximately 4 out of 9 tension-reduction expectancy statements and would be consistent with a belief that alcohol does possess tension reduction properties. Means and standard deviations for other AEQ subscales not relevant to the present study can be found in Table 5.

Alcohol-Related Problems

As indicated in Table 5, the average score on the DPI in Session I was 4.3 ($SD = 3.2$), and 4.6 ($SD = 3.5$) in Session II. A score at this level on the DPI indicates that the participant has reported four infrequent but existent alcohol-related problems or one or two alcohol-related problems that occurring regularly. Non-drinkers were excluded from these calculations, as their non-experience of alcohol-related problems is not instructive given that they do not drink. Similarly, the mean score on the CAPS-r was 7.5 ($SD = 7.3$) in Session I and 8.0 ($SD = 7.4$) in Session II. For purposes of interpretation, a score of eight on the CAPS-r would be equivalent to the participant reporting having experienced four out of eight problems one to two times over the past year or two problems six to nine times each over the past year.

Self-Esteem Results

Mean scores on the Rosenberg Self-Esteem Scale were 30.9 ($SD = 4.4$) for Session I, and 30.5 ($SD = 5.7$) for Session II (see Table 5). Overall, these results are consistent with previous RSES means for college student populations (Mar, DeYoung, Higgins, & Peterson, 2006), and indicate high levels of self-esteem.

Depression Results

The results of the CES-D depression instrument revealed mean scores of 11.0 ($SD = 8.7$) for Session I and 11.4 ($SD = 9.5$) for Session II (see Table 5).

These means are predictably below the clinical cut-off for clinical depression of 16, which would be expected given that this is a normal population and not an inpatient psychiatric population. Of the 483 participants who completed the CES-D in Session I, 102 participants (21.2%) had scores above the clinical cut-off of 16. Of the 444 Session II participants who completed the CES-D, 112 participants (25.3%) had scores above the clinical cut-off. Inspection of the skew and kurtosis statistics for the Session I and II CES-D distributions revealed them to be acceptable.

Analyses

Exploratory Analyses

Before conducting the analyses required for testing the five primary hypotheses posed in the present study, an exploratory analysis was conducted to examine the aggregate predictive power of the model that can be constructed with the tested variables. Specifically, this analysis would be used to determine the model's ability to predict pattern binge drinking among drinkers. Pattern binge-drinking was defined as the consumption of five or more drinks, in a single day, on two or more separate days within a 2-week period. Of the 348 drinkers in the sample, just over half (174; 50.1%) did not engage in pattern binge-drinking while 173 (49.9%) did. A centering procedure was performed on the variables included in the interaction terms (depression, coping and tens. red. exp.) and only individuals who reported alcohol use were included in the analysis.

Included in the predictive model were depression (CES-D), self-reported stress, self-reported marijuana use, anti-depressant use, coping motives for drinking (DMQ; log-transformed), and tension reduction expectancies (AEQ), as well as two interaction terms. The included interaction terms were the interaction of depression with each of the two self-medicative indicators (coping motives and tension-reduction expectancies). The overall predictive hit-rate of the model indicated that 72.6% of the participants were being correctly classified as pattern bingers or non-pattern bingers. The predictive power of the model was relatively equal, with pattern drinkers being correctly predicted 71.1% of the time and non-pattern bingers being correctly predicted 74.1% of the time. These data are summarized below in Table 6.

Table 6.

*Prediction of “pattern binger” vs. “regular drinker” among drinkers as indicated by binary logistic multiple regression**

Actual Status	Predicted Status		% correct
	Non-pattern binger	Pattern binger	
Non-pattern binger	79	48	74.1
Pattern binger	26	321	71.1
Total Overall			72.6

Note*. Predictor variables included dep., stress, marijuana use, antidepressant use, coping motives, tens.-red. exp., dep. x coping, and dep. x tens. red. exp.

The significance of each predictor used in the binary logistic regression was also assessed and the results are summarized in Table 7. Examination of Table 7 reveals that depression, coping motives (log-transformed), tension-reduction expectancies, and marijuana use were all statistically significant in the prediction of drinking status. These results indicate that a one-point increase in tension-reduction expectancies corresponds to a 1.22-point increase in the odds of an individual being classified as a pattern binger. A one-point increase in depression corresponds to a .93-pt increase in the odds of an individual being classified as a pattern binger. Similarly, a one-point increase in marijuana use corresponds to a 1.92-point increase in the odds of an individual being classified as a pattern binger.

The interpretation of the coping motives significance is made more complicated because this variable has been log-transformed to promote normality in distribution. The reader is reminded that logarithmic transformations are non-linear, so a change of one point in the log-transformed coping scale has a variable effect on the amount of change in the original coping scale. As neither of the interaction terms were found to be significant, there is no evidence to indicate the existence of a moderator effect of either of the self-medicative indicators on the predictive power of depression.

Table 7.

Predictor variable statistics for binary logistic multiple regression and the prediction of “pattern binger” vs. “regular drinker” status among drinkers

Predictor Variable	B	S.E.	Exp (B)	Wald Statistic
Depression	-.08	.02	.93	12.13*
Stress	-.20	.16	.82	1.63
Anti-depressant Use	1.31	.71	3.72	3.47
Tension-Reduction Exp.	.20	.06	1.22	9.97*
Coping Motives ^a	2.25	.48	9.48	22.24*
Marijuana Use	.65	.17	1.92	16.46*
Dep. x coping ^a interaction	.10	.05	1.11	3.60
Dep. x tens. red. interaction	-.01	.01	.99	1.92

Note^a. Log-transformed

Note*. $p < .01$

Hypothesis 1.

To address the question of whether self-medication appears to occur at sub-diagnosable levels of depression, correlations were calculated between CES-D scores and self-medicative indicators (coping motives and tension reduction expectancies). To ensure that the results properly addressed the issue of sub-diagnosable levels of depression, only individuals with CES-D scores below the clinical cut-off of 16 were included in the analysis. Session I data was used for the analysis because of the larger available n . The hypothesis was supported for both correlations. Results indicated that a small but statistically significant relation exists between sub-diagnosable depression and the self-medicative indicators of coping motives ($r = .17, p < .001$) and tension-reduction alcohol expectancies ($r = .16, p < .001$). Thus, it appears that as one begins to experience more depressive symptoms, the tendency to use alcohol as a means of coping increases as well. Perhaps more importantly, this relation exists even among individuals who self-report sub-clinical levels of depression. Similarly, as one experiences more depressive symptoms, one becomes more likely to endorse the tension-reduction

properties of alcohol. Higher levels of this expectancy domain indicate a belief that alcohol can help a person to sleep better, feel better, escape emotional pain, and have more fun. The evidence of these relations indicates not only an association between depression and these self-medicative indicators, but also supports the validity of the self-medication hypothesis at sub-diagnosable levels of depression.

Hypothesis 2.

Having established that a relation does exist between sub-clinical depression and self-medicative indicators, the present study moved next to the question of whether these indicators are predictive of alcohol use behavior. While a binary logistic regression was used earlier in the present study to predict pattern binge-drinkers among regular drinkers based on multiple predictors, the analyses of the present study shift now to simultaneous multiple regressions where the amount of variance in a given criterion variable is explained by variance in a set of continuous predictor variables will be determined.

To answer the question of whether self-medicative indicators are predictive of alcohol use behavior, a series of multiple regressions (using simultaneously entered predictor variables) were calculated using alcohol consumption and (in a separate analysis) alcohol problems as dependent criterion variables. All multiple regression analyses (see text below and Tables 8 and 9) were conducted in accordance with the data analytic directives and suggestions made by Wampold & Freund (1987). Coping motives (log-transformed) and tension-reduction expectancies were entered as independent variables, as were interactions terms to test for possible moderator effects. Because drinkers vs. non-drinkers constitute two distinct sub-populations, and because non-drinkers by definition yield no variance in alcohol use behavior, only drinkers were included in the analyses. As reported in previous sections, log-transformations of alcohol consumption and coping variables were performed in an effort to normalize the data as much as possible.

The overall model for the prediction of alcohol use was statistically significant, $F(2, 345) = 44.88, p < .001, R^2 = .21$ (Adjusted $R^2 = .20$). Therefore, 20.6% of the variance in alcohol use is explained by the variance in coping and tension-reduction

expectancies. The predicted relations were found in all analyses. Coping drinking motives (log-transformed) were found to be significantly predictive of total alcohol consumption ($\beta = .73$, $t(345) = 3.66$, $p < .001$), and tension-reduction expectancies were also found to be related to alcohol use behavior ($\beta = .16$, $t(345) = 5.69$, $p < .001$). Thus, the results indicate that as an individual's tendency to be motivated to drink by coping motives increases, he/she tends to drink more, even when controlling for tension-reduction alcohol expectancies. Similarly, higher levels of tension-reduction alcohol expectancies were associated with a tendency to drink more, even when controlling for level of coping motivation to drink.

Alcohol-related problems have also been a variable of great interest in the study of risk-behavior and alcohol use. Because the diagnosis of alcohol abuse and dependence is a function not of total consumption but of the experience of problems due to one's alcohol use, the examination of the relation between self-medicative indicators and alcohol-related problems becomes an additional point of interest. It was hypothesized that a statistically significant relation would exist between both self medicative indicators and alcohol-related problems. Therefore, an addition regression was performed to determine the relation between coping motives, alcohol expectancies, and alcohol-related problems as the criterion variable.

The overall model was statistically significant, $F(2, 345) = 71.08$, $p < .001$, $R^2 = .29$ (Adjusted $R^2 = .29$). Therefore the overall model using tension-reduction and coping was able to account for 29% of the variance in the experience of drinking problems. These results provide extensive evidence that self-medicative indicators are predictive of alcohol problems. Standardized beta coefficients were computed to test this hypothesis, and all four possible relations were found to be strongly significant. Specifically, the relation between coping motives and the Drinking Problems Index (DPI) was strong ($\beta = .35$, $t(345) = 8.09$, $p < .001$), as was the relation between coping motives and the College Alcohol Problems Scale ($\beta = .34$, $t(345) = 7.20$, $p < .001$). Similarly, tension-reduction expectations were related to the DPI ($\beta = .37$, $t(345) = 8.45$, $p < .001$), as well as to the CAPS-r ($\beta = .28$, $t(345) = 5.98$, $p < .001$).

Hypothesis 3.

A link has been established between depression and self-medicative indicators. The present study has also established a relation between these same indicators and alcohol consumption behavior and the experience of alcohol-related problems. However, the mechanism of these relations is not yet clear. Perhaps the most compelling theory of this mechanism, as extrapolated from self-medication theory, would be that self-medicative indicators operate as moderators of the relation between depression and alcohol use. To test this hypothesis of moderation, a simultaneous multiple regression was conducted using stress, depression, coping motives (log-transformed), tension-reduction expectancies, anti-depressant use, and marijuana use as the predictors for the criterion variable of alcohol consumption (log-transformed). Coping motives and tension-reduction expectancies were both tested as potential moderators by creating interaction terms between both variables and depression and entering them into the regression. A moderator effect would be indicated if these interaction terms were found to be significant. As in the previous multiple regression, non-drinkers were excluded from the analysis, and coping motives and alcohol consumption were log-transformed so that their distribution would conform to the normality assumptions required for a multiple regression. Additionally, to reduce the potential effects of multicollinearity on the interaction terms, a centering procedure was performed on the depression, coping and tension reduction expectancies variables. Standardized and unstandardized beta weights are listed in Table 8.

Table 8.

*Simultaneous Regression – Summary of Standardized and Unstandardized Betas in the prediction of Alcohol Use***

Variables	<i>n</i>	B	SEB	β
Stress	338	-.14	-.07	-.11*
CES-D Depression	338	.07	.05	-.46
Antidepressant Use	338	.42	.30	.06
Tension Reduction Exp.	338	.17	.04	.32*
Coping Motives (log-transformed)	338	.71	.32	.20*
Marijuana Use	338	.35	.06	.25*
Depression x Coping	338	.03	.02	.40
Depression x Tens. Reduction	338	.00	.00	-.09

Note*. $p < .05$;

Note**. Significance of aggregate model: $F(8, 338) = 19.68$, $p < .001$, $R^2 = .32$ (Adjusted $R^2 = .30$)

The results of the analysis (see Table 8) were surprising, as the hypothesis of moderation was predicated upon the presence of a statistically significant relation existing between depression and alcohol use. Clearly the question of whether coping motives and tension reduction expectancies might moderate the relation between depression and alcohol use becomes moot when no such original empirical relation exists in the present study's results. Possible reasons for this finding will be addressed in the discussion section. While the hypothesis was not supported, and no interaction effects were found, statistically significant relations with alcohol use continued to be found with coping motives ($\beta = .20$, $t(338) = 2.26$, $p < .05$) and tension-reduction expectancies ($\beta = .32$, $t(338) = 3.81$, $p < .001$). Statistically significant relations with alcohol use were also found among marijuana use ($\beta = .25$, $t(338) = 5.52$, $p < .001$) and stress ($\beta = -.11$, $t(338) = -2.11$, $p < .05$).

Hypothesis 4.

To answer the fourth question posed in the present study, a simultaneous multiple regression was performed to establish whether self-esteem might serve as a moderator in the relation between depression and the endorsement of coping motives for drinking behavior. Standardized and unstandardized beta weights are listed in Table 9. As in the previous multiple regressions, non-drinkers were excluded from the analysis log-transformed coping scores were used, and a centering procedure was performed both of the initial variables.

Table 9.

*Simultaneous Regression – Summary of standardized and unstandardized betas in the prediction of coping motives***

Variables	N	B	SEB	β
CES-D Depression	342	.00	.003	.29*
Self-Esteem	342	-.00	.006	-.19*
Depression x Self-Esteem	342	.00	.001	.03

Note*. $p < .005$

Note**. Significance of aggregate model: $F(3, 342) = 24.41, p < .001, R^2 = .18$ (Adjusted $R^2 = .17$)

Inspection of the results indicates a small but statistically significant relation between depression and coping motives when accounting for the variance in coping motives associated with variance in self-esteem ($\beta = .29, t(342) = 4.59, p < .001$). While self-esteem is also related to coping motives ($\beta = -.19, t(342) = -3.22, p < .001$), there is no evidence to indicate that it serves as a moderating variable as the depression x self-esteem interaction term was not significant. These results and the possible reasons why the hypothesis was not supported will be addressed in the discussion section.

Hypothesis 5.

The final hypothesis tested in the present study sought to address the role of time and change in the self-medicative hypothesis, specifically by seeking to determine if theory-consistent relations existed over time based on observed changes in key variables. As the present study was conducted over two sessions, and assessed all variables at times “ t_1 ” and “ t_2 ” ($t_1 + 4$ weeks), we were able to test whether a relation existed between changes over time in the three key variables of self-medication. These three variables were depression, alcohol use, and coping motives (tension reduction expectancies were not included because they considered to be less-likely to change over time). Based on the self-medication hypothesis, one would predict that individuals who become more depressed (increase in CES-D score) over four weeks would also evidence an increase in coping motives and alcohol use over time (hypothesis five).

To test hypotheses five, a step-wise multiple regression was performed in effort to predict Session II alcohol use. Predictor variables were entered in the following order: Step 1) Session I coping motives (log-transformed; centered) and Session I depression (centered); Step 2) Session I alcohol use (log-transformed), Step 3) Session II depression (centered); and Step 4) Session II coping motives (log-transformed; centered). By examining the statistical significance of the change in the model's predictive power after each step, it was possible to examine the impact of changes in depression and coping over time on the consumption of alcohol in Session II while controlling for each individual's alcohol consumption during session I. This allows the present study to reveal the relation between changes in the predictor variables and changes in alcohol use over time.

Table 10.

Summary of Step-wise Multiple Regression Analysis for prediction of Session II Alcohol Use

Step	Total R^2	ΔR^2	F(ΔR^2)	dfs
1. Depression ^a _(ses. I) & Coping Motives ^{a,b} _(ses. I)	.11	+.11	17.47*	2,281
2. add Alcohol Use _(ses. I)	.51	+.40	225.17*	1,280
3. add Depression ^a _(ses. II)	.51	+.00	.03	1,279
4. add Coping Motives ^{a,b} _(ses. II)	.53	+.02	13.53*	1,278

Note^a. Variable has been centered

Note^b. Log-transformed

Note*. $p < .005$

The results of the step-wise multiple regression (see Table 10) revealed statistically significant relations between changes in coping motives and alcohol use over time ($\Delta R^2 = .02$, $F(\Delta R^2; 2, 278) = 13.53$, $p < .005$). There is not; however, significant evidence to suggest that changes in depression over time are associated with a change in alcohol use. These results support hypothesis 5, and are consistent with other finding of the present study in that depression was not found to be related to alcohol use or changes in it.

CHAPTER 6. DISCUSSION

Review

Substance-abuse and depressive disorders co-occur at a much higher rate than would be statistically predicted based on their respective individual base-rates (Kessler et al., 1994). Many theories have been offered as to why this relation appears to exist, but perhaps one of the most promising may be the self-medication hypothesis. Its definition has evolved over the last 20+ years as one of the leading theories attempting to explain the comorbidity rates of depression and substance abuse. As such, the various theoretical conceptualizations that have coalesced to form the literature base of the self-medication theory might best be summarized with the following definition: Self-medication can be defined as the use of alcohol or another drug by an individual who is experiencing psychological distress and/or pain due to a mental disorder which would likely benefit from a pharmaceutical intervention. However, in the absence of that medication, the individual initiates his/her own means of chemically coping with his/her psychological distress by abusing alcohol and/or other substances.

As was addressed in the introduction, this definition is characterized by the presence of the diagnosable psychiatric disorder, the absence of a treatment (usually an anti-depressant), and the abuse of alcohol or other substances as a means of “medicating” the emotional pain caused by the disorder. In the present study, alcohol is a focus for a numbers of reasons. Perhaps the most important of these reasons is that it is accepted in this society/culture, which allows widespread use and misuse on scale much grander than that found with substances generally referred to as “street drugs.” Therefore, we are primarily concerned with the definition of self-medication as it pertains to alcohol abuse among depressed individuals.

The definition of comorbidity itself has also been a key element of shaping the generally-accepted definition of self-medication in that it has historically been used to explain the co-occurrence of two disorders (depression and substance abuse) at a level that meets diagnostic criteria. While defining self-medication based upon the occurrence of comorbidity is certainly useful and informative for clinical samples and populations, it is also very selective in that it applies only to manifestations of pathology severe enough to meet diagnostic criteria.

One of the central goals of the present study was to explore a possible expansion of this definition. Such an expansion would allow self-medication to become more than a potential explanation of higher-than-expected comorbidity, but also as a means to describe a particular type of drinking behavior. If successful, such a finding could be an informative tool in conceptualizing and treating alcohol abuse and dependence. Further, this broader definition would support the notion that maladaptive coping strategies are sought even at sub-diagnosable levels of depression. If this is so, and this type of self-medicative drinking does occur, then it may become possible to intervene with preventative strategies for those identified as being “at risk” for self-medicative alcohol use, which has been shown to be correlated with higher rates of alcohol-related problems (Cooper, 1994).

While expanding the self-medication hypothesis to address sub-diagnosable levels of depression and alcohol use, the present study also sought to investigate the role certain theory-consistent variables might play in the manifestation of self-medication. Key among these variables were coping motives for drinking, tension-reduction expectancies of alcohol use, self-esteem, and the experience of alcohol-related problems. In particular, the present study sought to identify coping motives and tension-reduction expectancies as “self-medicative indicators” due to their theorized role in the manifestation of self-medicative drinking. These indicators may be central to future examinations of the self-medicative hypothesis because of the role that they play in operationalization. Recall that self-medicative drinking is a behavior. Unfortunately, it is not outwardly distinguishable from other types of drinking because from an observational standpoint; alcohol consumption is alcohol

consumption. However, as self-medicative drinking is a thought to be a cognitively and motivationally unique subset of drinking behavior, one must identify the cognitive and motivations constructs that provide the basis for the ensuing observed behavior. Figure 1 (p. 47) diagrams how these indicators provide an additional means of measuring self-medication by examining the presence of these precursors in the presence of depressive symptoms and alcohol use. By integrating the measurement of these variables in a more theoretically broad study of self-medication, we can ascertain their usefulness for future study, as well as validate their use in the model.

Findings

Examination of the results indicated that the sample obtained in the present study was consistent with other collegiate self-report samples regarding predominance of alcohol use, incidence of alcohol-related problems, levels of self-esteem, and incidence of depression (O'Hare, 1997; Finney & Moos, 1991, O'Hare & Sherrer, 2000). Depression rates were notable, with 25.3% of the sample reporting meaningfully elevated levels of depression ($CES-D \geq 16$). While such a seemingly high level of depressive symptomology would seem to be surprising, recent studies have actually found *means* in the vicinity of 16, suggesting that 50% of college students meet the clinical cut-off for depression in the CES-D (Bucceri, et al., 2005; Williams & Galliher, 2006). If anything, these results call into question the appropriateness of using $CES-D \geq 16$ as a clinical cut-off; however, the results of the present study seem to be closer to what one would expect in terms of prevalence of depression.

Among drinkers, the average number of drinks consumed per week was 10.6 ($SD = 13.0$) for Session I and 9.7 ($SD = 10.3$) for Session II. The magnitude of these findings is not alarming when viewed alone, but if one notices the size of the standard deviation associated with these means, it becomes apparent that college students vary *considerably* in the amount of alcohol they consume. For example, 11 of the 397 participants who indicated that they were drinkers claimed to have consumed more than 100 drinks over the two-week period preceding Session I.

Sixty-three of the 397 drinkers indicated consumption of 40 or more drinks over those two weeks. Some of these amounts may be the product of exaggeration, but it would be naïve to believe that none of these accounts are accurate based on the popular acceptance of drinking as a subculture on college campuses. A check for differences between drinkers and non-drinkers revealed little in the way of meaningful group differences; however, non-drinkers reported higher GPAs and were much less likely to use marijuana than their alcohol-using peers. The study's alcohol use results also indicated that a notable portion of this collegiate sample engages in serial or "pattern" binge-drinking (49.9%). While this percentage may seem alarmingly high considering the added risk associated with binge-drinking vs. "regular drinking" (Ham & Hope, 2003), it is not surprising given the manner in which college students report they typically drink (Ham & Hope, 2003). When one considers that the modal drinking behavior of the typical college student is to engage in binge drinking with the intent of "getting drunk", such a student only needs to decide to drink in his/her usual fashion once each weekend to qualify as a pattern binge-drinker.

In terms of the purposes of the study, the results obtained represent an important step toward providing empirical support for the validity of the self-medication theory. Perhaps more importantly, these results also provide an empirical basis for expanding the bounds of the hypothesis as it is applied to understanding risky and potentially pathological behavior of alcohol misuse and abuse. Of the five hypotheses posited, three were empirically supported to some degree. The three theory-consistent results provided a basis for expanded future conceptualizations of the theory. Additionally, because the failure to find statistical significance in the remaining two hypotheses can be explainable within the context of the theory (and its application within the present design), these results were less discouraging.

We will begin the discussion of the study's results by examining the first hypothesis. One of the foundational purposes of the present study was to examine whether there was a basis to expand the definition of the self-medication hypothesis

to encompass a relation between depression and alcohol use at sub-diagnosable levels of each. As has been discussed earlier in this section, self-medication has historically been limited to the discussion of the comorbid occurrence of diagnosable major depressive disorder and substance dependence. Such an expansion of the concept to persons who experience depressive symptoms at sub-diagnosable levels of depression could be especially important in the examination of risk-factors for the development of alcohol dependence. This examination could also be beneficial in gaining a heightened understanding of the risk-behavior of college students. To explore the empirical basis for this proposed expansion, correlations were calculated and a statistically significant relation was observed among depression and self-medicative indicators, even when diagnosably depressed individuals had been removed from the sample. The significance of this result is important because it represents the first step toward establishing the self-medication hypothesis as a potential link between depressive symptomology and the often maladaptive use of alcohol for coping purposes.

The second hypothesis posited a relation between the self-medicative indicators (coping motives and tension reduction expectancies) and both alcohol use and the experience of alcohol problems. The hypothesized relations were found between the indicators and alcohol use, but even stronger relations were found between the indicators and alcohol problems. These results are notable because they establish another important link between the self-medicative indicators and the experience of alcohol-related problems. Having established this relationship, the question becomes how do we use this information? These questions will be addressed in the implications section later in this document.

As interesting and potentially important as these findings are, discussion of the hypothesized yet unsupported relations may be just as important. The most notable of these findings was observed in the analysis of the third hypothesis, which sought to investigate the potential moderator role of the self-medicative indicators in the relation between depression and alcohol use. Surprisingly, no such original relation existed in the present data set. That is to say, depression and alcohol use

were not empirically related. Individuals who were very depressed were just as likely to drink a lot as to drink very little. Similarly, individuals who drank a great deal were just as likely to be depressed as not. While at first surprising, further reflection and critical analysis may reveal a potential contributor to this finding.

That contributor may be the college student nature of the sample used in the present study. What makes college students such an interesting and important population for the study of self-medication also makes for a tenuous foundation for generalizability to a broader population. College students live in a subculture where binge-drinking is not just accepted, it is often celebrated (O'Hare & Sherrer, 2000; Ham & Hope, 2003). As indicated in the results section of this study, a wide variety of alcohol use behavior was observed in the sample. However, the popular embrace of binge-drinking may actually lead to unusually high proportions of depressive pathology-free individuals who are nonetheless abusing alcohol in large quantities. A college sample of 100 drinkers could have 80 persons who state that they drink, and perhaps 40 of these might drink "to excess." Only 10 of these 40 might be suffering from depression, however, which may be the level of depression occurring in each of the other tiers of alcohol use. Conversely, a sample of 100 non-collegiate adults might find that only 70 persons drink alcohol, and of them only 20 drink to excess. The sheer over-representation of depression among alcoholics (who very frequently drink to excess) would then dictate that perhaps as many as 15 of these 20 suffer from depression, while that proportion would be substantially smaller in the rest of the sample. Thus, the exaggerated drinking behavior of college students may allow subjectively "healthy" people to engage in decidedly "unhealthy" behavior, especially heavy binge-drinking during the first two years of college. Continuing on this point, freshman and sophomore students represent a substantial portion of the present sample.

The failure to find a relation between depression and alcohol use in the present study should not be taken as evidence that such a relation does not exist, but rather as evidence that exaggerated alcohol use behavior in college students is not necessarily correlated with higher levels of depression. Clearly, a parallel study

which examines these variables among a sample of adults who are not currently in college would be needed to examine whether this theorized relation does in fact exist. Regardless, without a clear relation between depression and alcohol use, it is impossible to examine the potential moderator effect of the self-medicative indicators of coping motives and tension-reduction expectancies.

The potential role of self-esteem (SE) was also examined in the present study under hypothesis four, despite little to no mention of SE in previous treatment on the issue of comorbidity and self-medication. As a result, the inclusion of self-medication was designed primarily as an exploratory exercise, rather than one of theory validation. Self-esteem was hypothesized to be a potential moderator in the relation between the experience of depressive symptoms and the development of coping motives for drinking. The rationale for this hypothesis was that self-esteem represents a positive belief set about the self. A high SE might include a greater belief that one can be an effective agent in controlling his/her own state and conditions. As a result, individuals who are experiencing depressive symptoms but also maintain a high SE may be less likely to engage in short-term, avoidant coping strategies (like alcohol use) because they hold the belief that they can fall back on their own resources to battle their depression. Conversely, individuals who are depressed but lack a strong SE might likely feel powerless over their own condition. The result would be that avoidant coping strategies (as opposed to direct strategies that depend on the agency of the individual) might hold a stronger appeal. While this attempt to integrate SE into the theoretical structure of self-medication was not supported, it is the author's belief that future research in the area should consider the role SE might play in discriminating those who choose to self-medicate versus those who choose to engage in more healthy and productive coping strategies. While the present study failed to find statistically significant evidence of the hypothesized moderation effect, SE was found to be related to alcohol use when controlling for depression. Thus, individuals with higher self-esteems were found to drink less, regardless of their level of depression.

While examinations of the first four hypotheses revealed mixed but compelling results, one is left to consider the final hypothesis. This fifth hypothesis allowed us to explore the role of time and change in the present study. By re-examining the participants approximately four weeks after the date of their initial participation, we were able to observe natural changes in the various key variables like depression, alcohol use, and the self-medicative indicators of coping motives and tension-reduction hypotheses. While depression is not a variable that can be ethically manipulated in a controlled experiment, it is subject to natural change over time. By using a two-phase design, we were able to determine whether a change over time in depression and coping motives might lead to the hypothesized change in alcohol use.

The hypothesis was partially supported in that changes in coping motives for drinking were found to be related to changes in alcohol use. Thus, individuals who found themselves experiencing higher levels of motivation to drink for coping purposes over time were also likely to use larger amounts of alcohol in the second session compared to in the first. As in the results for the third hypothesis, depression was not significantly related to alcohol use, as changes in depression did not lead to significant changes in alcohol use over time. Explanations for this non-effect have been discussed above (in the discussion of the hypothesis three results) and are not thought to be rendered moot by introducing consideration of change over time. Additionally, college students have multiple factors which combine to influence their alcohol use. For example, a participant could average 20 drinks per week in t_1 , have a dramatic increase in depression and coping motives over the next four weeks, and still average 20 drinks per week in t_2 . Such a finding would not undermine the self-medication theory because the percentage of self-medicative alcohol use (within the total alcohol use) cannot be unequivocally known. Therefore, total alcohol use behavior could remain invariant (or even decrease) while total self-medicative alcohol use could actually increase. This is why self-medicative indicators (coping motives for drinking and tension-reduction alcohol expectancies)

must be used to try to approximate the amount of self-medicative drinking that may be occurring.

Implications and Future Directions

Perhaps the most important impact of the present study is the expansion of the construct of self-medication to include persons with sub-diagnosable levels of depression. The results of this study suggest that we are no longer limited to discussing self-medicative behavior as an explanation for diagnosis-level comorbidity. Historically, research on self-medication had been primarily limited to examinations of the depressive symptomology among inpatient alcohol treatment facilities and alcohol abuse among inpatient psychiatric treatment centers. The findings of the present study suggest that research on self-medication can now be expanded to examine the relation between potentially problematic alcohol use for self-medicative reasons and sub-diagnosable depressive symptoms experienced in non-clinical populations.

While research on clinical populations is certainly very important, the findings of this study suggest that it is important to examine potentially pathological behavior and cognitions before they meet diagnostic criteria in order to provide opportunities for prevention. For example, the present study found a relation between depressive symptoms and coping motives for alcohol use, as well as with tension reduction expectancies. It seems that some college students have acquired the idea that alcohol can be a means of coping with emotional difficulties and, potentially, stress. Therefore, preventative education which targets this set of beliefs and attempts to convincingly supplant it with more effective, less dangerous alternatives might be a step in the right direction.

One means of providing such an intervention might be within the context of the university-mandated orientation all incoming freshman experience at virtually every college across the country. Often, these orientation sessions include discussion of alcohol misuse and abuse, as alcohol consumption is an expectation among most incoming students. However, discussion of the various reasons that different people drink might be helpful, as might an assertion that some

reasons/motives to drink are in fact healthier than others (e.g., social enhancement versus coping) given that some have been shown to be significantly less connected to alcohol problems (Cooper, 1994). In addition, a discussion of the link between depressive symptoms and coping motives could lead to the caution that coping-motivated, self-medicative alcohol use is not only ineffective in the long run, but that there are other more effective coping strategies and resources available (like counseling centers, social support, exercise, etc.). Of course, such an intervention would also be an extremely compelling research opportunity, as randomly selected groups of incoming freshman could be assigned to treatment and control orientation sessions in which only the treatment group would receive the discussion about coping-motivated drinking and healthy alternatives. Then, a follow-up study could measure and compare the alcohol use between the two groups, as well as the level of coping motives and tension reduction expectancies. If successful, the treatment group might evidence lower levels of self-medicative drinking, and further evidence for self-medication hypothesis would be found.

Future research in this area need not be limited to programmatic evaluations of preventative interventions. Perhaps the most compelling present need in the literature is a valid and reliable way of measuring self-medicative drinking that does not rely on inference of the self-medicative nature of measured alcohol use (inference is often necessary because self-medicative drinking is a subset of drinking behavior which is characterized by an cognitive-emotional state). The design and validation of such an instrument is beyond the scope of this study, but it might include such elements as a respondent's estimation of the percentage of their total alcohol intake which was attributable to each of the four domains of drinking motives. Of course, the validity of such an instrument would difficult to conclusively and convincingly show, but many of our tasks as researchers involve finding novel and compelling ways of addressing these methodological challenges.

Potential Strengths and Limitations

Potential Strengths

While it is inherently difficult to design and execute the ideal study, the present study offered a number of desirable qualities that may enhance the credibility of the results obtained. One of the most notable strengths of the present study was the large obtained sample size. Such a sample size allowed a number of statistically analyses to be carried out with a great deal of power, thereby maximizing our ability to detect small effects if in fact they were thought to exist. While the sample size would have constituted a strength in and of itself, it was bolstered by an over 90% level of retention for the second phase of the study. Such a high rate of retention allows time-related observations and results to be obtained with a confidence that the results are minimally impacted by differential attrition or other such confounds that can limit longitudinal research designs.

Indeed, the longitudinal design of the study presented another strength, as a two-stage, repeated measures design allowed for the observation of natural change in the variables over time and the analysis of statistically significant relations among these changes over time. Finally, the longitudinal, repeated measures design allowed for the calculation of temporal stability for all of the instruments used providing another means of measuring the reliability of those same measures.

Reliability of measurement was itself another strength of the present study, with strong levels of internal consistency and temporal stability observed in all of the major instruments used. While having been previously established as reliable, and having that reliability reinforced in the obtained results, those same measures were chosen due to their demonstrated validity in prior research.

Of all of the instruments used in the present study, only one (the Alcohol Use Calendar; AUC) had not been psychometrically established by the alcohol measurement literature, though a measure of its kind had been recommended by several alcohol researchers (Cooper, Frone, Russell, & Mudar, 1995; Christian, Vik, & Jarchow, 2002, Ham & Hope, 2003) in discussing means to improve the self-report measurement of alcohol use. Though not an established instrument, initial

assessment of the internal consistency and temporal stability reliabilities were acceptable (see p. 59 for more details). The AUC may also have offered several unique strengths of its own, such as the level of specificity of information obtained, the value/judgment-free style of its presentation in obtaining usage levels, and the amount of alcohol-use information obtained. Specifically, the AUC's 2-week time span minimizes potential error in measurement due to undersampling. By sampling alcohol use over a 2-week interval, multiple data points are obtained, giving a more accurate representation of an individual's natural variance in alcohol use.

Another and perhaps easily overlooked strength of the present study may have been its method of administration. As noted in the procedure, the present study was conducted using an online survey-data administration website (surveymonkey.com), which allowed volunteers to sign up and participate in the study with maximum convenience and efficiency. Not only could potential volunteers participate whenever they wanted, but they could also do so from the privacy of their own dorm room or apartment, or from a campus computer lab or the library. It seems highly likely that this considerable level of convenience was very influential in the rapid collection of a large sample size, as well as in the maintenance of a high level of retention. While there is no doubt that a great number of important psychological research projects require the participants to be physically present for the study, the results of the present study argue that, in the absence of such requirements, online administration should be considered.

Finally, the results were also bolstered by a high completion percentage, with 96% of all Session I surveys being completed in full, and 97.5% of all Session II surveys being completed in full. This result could have been due to the ease of participation, or perhaps due to the ease of understanding the survey materials. Regardless, with such high percentages of completion, we can be more assured of the strength and generalizability of the obtained results.

Potential Limitations

While the online nature of the study's administration carries several benefits, they may be tempered somewhat by parallel limitations. One of the factors that

made participation in the present study easy and attractive (the volunteers' freedom to participate wherever and whenever they wanted) also made it impossible to control the conditions under which participation occurred. Thus, some individuals may have completed their instruments in their dorm rooms during an afternoon break between classes. Others, however, may have completed their survey materials at 3:00 a.m. after returning from an off-campus party. There was simply no way of knowing or controlling the individual circumstances for each participant. Failing such a level of control, we can examine whether the potential effect was uniform across participants (it was) and ask whether this lack of control would be likely to have had a predictable or statistically significant impact on the reliability or validity of the results (doubtful). The data obtained through the measures used was not performance data (e.g., reaction times, which can be highly impacted by distractors in the environment) and therefore would not likely be differentially impacted based on the respondent's circumstances of participation.

While the lack of control over the circumstances of participation is a concern worthy of attention, it is not so assuredly a limitation as was the strictly self-report nature of the survey materials. While self-report data must generally be viewed with an element of caution given the participant's ability (intentional or not) to manipulate his/her own responses, the issue is amplified when a judgment-loaded construct like alcohol use is being measured. Some students, for example, might under-report their alcohol use in an effort to appear more socially desirable. However, the opposite phenomenon (over-reporting to appear more socially desirable) may also occur, as many students view their ability to consume alcohol as a collegiate badge of honor among their peers.

Apart from intentionally skewed self-representation, self-report measures are also jeopardized in their reliability because they rely on recall for accuracy. Human beings are notoriously bad at remembering specific aspects of an event, but may be even worse when asked to remember their quantity of alcohol use, given that alcohol use has been shown to impair judgment and memory (Cooper, Frone, Russell, & Mudar, 1995; Christian, Vik, & Jarchow, 2002; Ham & Hope, 2003).

While self-report (especially the self-report of alcohol use) is far from ideal, it is unfortunately the only method available to social scientists who are attempting to measure constructs such as beliefs, expectations, motives, and feelings, all of which are inexorably tied to internal personal experience and thus self-report. While alcohol use could theoretically be measured via observation rather than self-report, the resulting boost in reliability would be tempered by a parallel loss of ecological validity, as the observed drinking would likely need to take place in a laboratory setting of some kind. Finally, as has been addressed earlier in discussing the difficult nature of measuring self-medicative drinking, even laboratory observation of alcohol use cannot measure self-medicative drinking, because it is a subset of drinking behavior defined by motives and expectations, two constructs which are dependent upon self-report for quantification.

As discussed above, the self-report measurement of alcohol use can be influenced by inclinations toward social desirability. As such, a check of the respondent's tendency to give socially desirable answers is often used in conjunction with measures of alcohol use. While no such check of social desirability was used in the present study, it may be that the level of specificity in the AUC makes it difficult for a respondent to systematically alter their responding. Additionally, given the 4-week interval between sessions, it would also be very difficult for an individual to skew his/her reports in Session II to match or be less than Session I, given that he/she will not be likely to have accurate recollection of the responses he/she gave four weeks ago. Regardless, social desirability is an important concept in the area of alcohol use and measurement, and future studies similar to the present study would be well advised to utilize such a check if possible.

Whenever a multi-measure study is conducted, we must always be concerned with the potential for fatigue effects as the participants move through the second half and final quarter of their participation. While the present study certainly has a number of scales and items (239 items over eight scales) it was found that the average completion time using the web-page administration was just over 20 minutes. Therefore, it is unlikely that fatigue could be a factor, as 20 minutes is fairly

short amount of time for research participation and could be considered even shorter if one takes into account the fact that there is no preparation time for the participant in terms of traveling to the research location or waiting for administration to begin.

Finally, we address one of the main weaknesses of the present study, that is, its strictly correlational design. We are always interested in applying experimental methods whenever possible, as the results obtained can be discussed with more clarity and specificity than those obtained through non-intervention observation alone. While the questions addressed in the present study did not directly lend themselves to experimental manipulations, causal inferences might be desirable goals for future research endeavors. Regardless, it would have been interesting had the present study included some manner of randomly assigned experimental intervention and control group so that change due to the manipulation could have been observed. Of course, two of the principle variables (depression & alcohol use) can be difficult to ethically manipulate and the other two principle variables (drinking motives and alcohol use expectancies) can also be difficult to manipulate. However, a simple intervention, such as a randomly administered challenge for a person to terminate their alcohol use for the next four weeks, might have had some effect on alcohol use, and parallel effects on other theoretically related variables (depression, drinking motives, etc.) could also have been explored.

While an experimental design of some kind might have strengthened the present study, its correlational nature can hardly be taken as evidence contradicting its worth, as a great number of important and rigorous psychological studies are conducted every year without the benefit of a manipulation and resulting access to causal inference. Additionally, as the present study was essentially an exploration of an emerging area in the literature, it will surely be an informative precursor to potential experimental designs which may follow it and build upon its results.

Conclusions

Comorbidity among depression and alcohol abuse has established a relation between these two types of pathology. Self-medication is an emerging and compelling way of conceptualizing one explanation of how this relation may be activated. As a result of the present study, there is now suggestive evidence to support the incidence of self-medication in sub-diagnosable levels of depression and alcohol use. This result may provide an important step toward broadening the definition of self-medication in a manner which both accurately captures its expression among college students and allows future research to examine the impact of self-medication at sub-diagnosable levels of pathology.

Though self-medicative drinking is a difficult construct to measure, the use of self-medicative indicators like coping motives and tension-reduction expectancies may provide an initial window into tapping the incidence of this subtype of drinking. The results of the present study provided a foundation for the utilization of these variables, as a relation was found between these variables and depression, alcohol abuse, and the experience of alcohol-related problems, which have already been differentially linked to variance in coping motives (Cooper, 1994).

By continuing the study of self-medication, we may develop and increasingly specific and instructive understanding of problem-drinking and drinking in general. While the individuals who choose to drink may choose to do so for a number of reasons known and unknown to researchers, self-medication may prove to be an important subset of this behavior for purposes of both preventative and treatment intervention.

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APPENDIX A. IRB APPROVAL

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office of Research Compliance
Vice Provost for Research
1138 Pearson Hall
Ames, Iowa 50011-2207
515 294-4566
FAX 515 294-4267

DATE: October 10, 2005

TO: Reed Robinson

FROM: Human Subject Research Compliance Office

RE: IRB ID # 05-461

STUDY REVIEW DATE: October 9, 2005

The Institutional Review Board has reviewed the project, "Exploring the Self Medication Hypothesis" requirements of the human subject protections regulations as described in 45 CFR 46.101(b)2. The applicable exemption category is provided below for your information. Please note that you must submit all research involving human participants for review by the IRB. Only the IRB may make the determination of exemption, even if you conduct a study in the future that is exactly like this study.

The IRB determination of exemption means that this project does not need to meet the requirements from the Department of Health and Human Service (DHHS) regulations for the protection of human subjects, unless required by the IRB. We do, however, urge you to protect the rights of your participants in the same ways that you would if your project was required to follow the regulations. This includes providing relevant information about the research to the participants.

Because your project is exempt, you do not need to submit an application for continuing review. However, you must carry out the research as proposed in the IRB application, including obtaining and documenting (signed) informed consent if you have stated in your application that you will do so or required by the IRB.

Any modification of this research must be submitted to the IRB on a Continuation and/or Modification form, prior to making any changes, to determine if the project still meets the Federal criteria for exemption. If it is determined that exemption is no longer warranted, then an IRB proposal will need to be submitted and approved before proceeding with data collection.

cc: Psychology
Norman Scott

APPENDIX B. INFORMED CONSENT

INFORMED CONSENT DOCUMENT

Title of Study: Alcohol Use and Mental Health (Session 1)
Investigators: Reed J. Robinson, M.S. – Principle Investigator
Norman A. Scott, Ph.D. – Project Supervisor

This is a research study. You must be 18 years old or older to participate. Please take your time in deciding if you would like to continue and feel free to ask questions at any time.

INTRODUCTION

The purpose of this study is to learn more about the drinking behavior of college students, as well as other factors which may be associated with their drinking. You are being invited to participate in this study because you are an ISU student who has indicated interest in volunteering for psychological studies.

DESCRIPTION OF PROCEDURES

If you agree to participate in this study, your participation will consist of this appointment and a second appointment if you choose to participate in the follow-up. Each appointment will last approximately fifty minutes. During the each appointment of the study you may expect the following study procedures to be followed. You will be asked to complete a 2-week calendar recounting your recent drinking history as well as a series of questionnaires designed to measure your personal health history, motives for drinking, alcohol expectancies, alcohol-related problems, self-esteem, and depression. You may skip any question that you do not wish to answer or makes you feel uncomfortable.

RISKS

While participating in this study you may experience the following risks: Individuals who are not yet of legal drinking age will be asked to report about their alcohol consumption, which is illegal. However, in order to protect these individuals, identifying information will be removed from the response data within one week of data collection. Additionally, some of the questions could bring up thoughts and feelings which are cause of concern or distress. In the event that this happens, information will be provided for services available to ISU students to address these concerns.

BENEFITS

If you decide to participate in this study there may be no direct benefit to you other than to learn about psychological studies from a participant's perspective. It is hoped that the information gained in this study will benefit society by providing valuable insight into the drinking behavior of college students and associated factors which may be correlated with their drinking behavior.

COSTS AND COMPENSATION

You will not have any costs from participating in this study. You will be compensated for participating in this study by receiving one extra credit point toward your psychology 101 or 230 course for every 50 minutes of participation. In addition, participants who complete both appointments will be awarded a bonus extra credit point. If you decide not to participate today you will still receive one extra credit point but will not be eligible to return for the follow-up appointment.

PARTICIPANT RIGHTS

Your participation in this study is completely voluntary and you may refuse to participate or leave the study at any time. If you decide to not participate in the study or leave the study early, it will not result in any penalty or loss of benefits to which you are otherwise entitled.

CONFIDENTIALITY

Records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available. However, federal government regulatory agencies and the Institutional Review Board (a committee that reviews and approves human subject research studies) may inspect and/or copy your records for quality assurance and data analysis. These records may contain private information.

To ensure confidentiality to the extent permitted by law, all identifying information will be removed from the response sets so there will be no possibility of connecting your responses to you. If the results are published, only group data and not individual responses will be reported and your identity will remain confidential.

QUESTIONS OR PROBLEMS

Due to the online nature of this study, it will often not be possible to answer questions you might have in real time. However, a space will be provided at the end of the survey for you to insert questions or comments if you would like to do so.

- For further information about the study contact Reed Robinson, M.S. at (515) 520-0780 or Norman A. Scott, Ph.D. at (515) 294-1509.
- If you have any questions about the rights of research subjects or research-related injury, please contact Ginny Austin Eason, IRB Administrator, (515) 294-4566, austingr@iastate.edu, or Diane Ament, Director, Office of Research Assurances (515) 294-3115, dament@iastate.edu, 1138 Pearson Hall.

APPENDIX C. EMAIL TO PARTICIPANTS

This is a special notice regarding the study Alcohol Use and Mental Health (Session 2) #147. The researcher is Reed Robinson.

You are receiving this email because you have completed participation in Session 1 of the "Alcohol Use and Mental Health" research series. During your completion of that study, you were made aware that this is a two-part study which will allow you to participate in a second session. The purpose of this email is to provide you with the password you will need to use to sign up for Session 2.

Please note that you have already been awarded one credit for your completion of Session 1. Be aware that completion of Session 2 will allow you to earn TWO credits for the same amount of time. This is because you will be compensated both for your time (1 credit) and given a bonus point for completing both halves of a two-part study (1 credit). Also, please note that the deadline to sign-up and participate in this second session is OCTOBER 5th, 2006. No further participation can be obtained after this date, so if you plan to participate, please do before this deadline.

If you would like to sign up for Session 2, click on the link to sign-up and when prompted, enter the following password:

password = session2

You will then be provided with a link to the survey's website. Once you have completed the survey, you should be awarded your 2 credit within a few days. If you have any questions, please contact me at rjrobins@iastate.edu.

Thank you for your participation in Session 1 and I hope to see you in Session 2!

Reed Robinson
Principle Investigator
Iowa State University
Psychology Department

APPENDIX D. MEASURES

Demographic Information

Age: _____	Gender: <input type="checkbox"/> Male <input type="checkbox"/> Female	Major: _____
<u>Ethnicity (Please check one of the below):</u>		
<input type="checkbox"/> Caucasian/White	<input type="checkbox"/> African-American	<input type="checkbox"/> Black
<input type="checkbox"/> Latino-American	<input type="checkbox"/> Asian-American/ Pacific Islander	<input type="checkbox"/> Multi-racial American
<input type="checkbox"/> Native American	<input type="checkbox"/> Alaskan-American	<input type="checkbox"/> International Student
<input type="checkbox"/> Other		

Health Information

Instructions: Please respond to each item according to the options given:

1. Please indicate your class standing:
 - A = Freshman
 - B = Sophomore
 - C = Junior
 - D = Senior
 - E = Graduate Student
2. Please estimate your current GPA:
 - A = 3.5 – 4.0
 - B = 3.0 – 3.49
 - C = 2.5 – 2.99
 - D = 2.0 – 2.49
 - E = < 2.0
3. Have you been diagnosed with or suffered from depression in the last 12 months?
 - A = Yes
 - B = No
4. Have you been diagnosed with or suffered from anxiety in the last 12 months?
 - A = Yes
 - B = No
5. Are you currently taking a prescribed antidepressant medication (see list below for examples) or an herbal supplement marketed for its antidepressant effects (such as St. John's Wort)?
 - A = Yes
 - B = No

Common Antidepressant Medications

Adapin Celexa Cymbalta Desyrel (Trazadone) Effexor	Elavil (Amitriptyline) Focalin Lexapro Luvox Paxil (Paroxetine)	Prozac (Fluoxetine) Nefazadone (Serzone) St. John's Wort Wellbutrin Zoloft
-------------------------------------------------------------------	-----------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------

6. Please describe your marijuana use over the last 2 weeks
- A = 1-2 times
 - B = 3-5 times
 - C = More than five times
 - D = I have never used marijuana
 - E = I have used marijuana, but not in the last 2 weeks
7. Which statement most accurately describes your stress level over the last 2 weeks?
- A = I have not been under much stress lately.
 - B = I've been under a little extra stress lately.
 - C = I've really been feeling stressed out lately.
 - D = I've been under a *ton* of stress lately.
 - E = I've been under more stress than I could possibly handle lately.

Alcohol Use Calendar

Below you will find a partial calendar depicting the two weeks leading up to and including last weekend. This calendar will help us get the most accurate possible breakdown of your drinking experiences over that time period. This assessment depends on your honest and accurate reporting of your drinking. Please follow the instructions listed on the following page to find out how to complete it.

Instructions: Please read each of the following steps and complete the calendar on page 1 as directed

Step 1: Begin by filling in the start and end dates. These will be provided on the board by the proctor.

Step 2: Next, start with the first day on the calendar and think back to what you were doing that day and that particular evening. Did you drink any alcohol that day? If no, draw an X over the entire day. If you did drink alcohol, proceed to step 3.

Step 3: Since we're trying to get a picture of your drinking experiences during these two weeks, let's start out with beer. Try to think about how many drinks of beer you consumed on that particular day/night. If you were drinking past midnight you should still count the drinks consumed after midnight on the same day. Remember that 1 drink of beer is about 12oz. Once you have your best guess as to the total number of beers you had on this day, put that number in the space next to "Beer". Again, this is the total number of beers you estimate that you had on that day/evening.

Step 4: Now, before moving on to the next day, let's also get the number of glasses of wine you remember drinking on that day/evening. A drink of wine is defined as 4-6oz. Once you have your best guess as to the total number of glasses of wine you had on this day, put that number in the space next to "Wine". Again, this is the total number of glasses of wine you estimate that you had on that day/evening.

Step 5: Now, staying on that same day, let's also get the number of shots and mixed drinks you remember drinking on that day/evening. We're going to count a mixed drink as any mixture of beverages containing at least one 1.5 oz. shot of hard alcohol. If you remember having some "doubles", count those as two. If you had straight shots, count these in this category as well. Once you have your best guess as to the total number of mixed drinks and shots you had on this day, put that number in the space next to "Mixed:" Again, this is the total number of mixed drinks and shots you estimate that you had on that day/evening.

Step 6: Now that you have recounted the number of each type of drink that you had on this day, add them together and record the total next to "Total"

Step 7: Before moving on to the next day, we would also ask whether any of the drinks that you had on that day/evening were consumed when you were alone. If yes, place a check in the box next to "Alone?"

Step 8: Finally, if any of the following statements were true for your drinking on that day, place a check next to "Reaction"

- "I was feeling down that day."
- "I was drinking to try to forget something."
- "I was hoping drinking would make me feel better."

Step 9: Now that you've completed the first day, do the same for each of the next 13 days. **If you have *any* questions, please raise your hand and a test proctor will come to help.**

Step 10: In the small box below the calendar, please indicate your current age, major, and the ethnicity with which you identify. If you are an international student, please indicate your home country.

[illegible]

Drinking Motives (DMQ; coping motives items have been bolded)

Instructions: The following items are a list of reasons people sometimes give for drinking alcohol. Thinking of the times that you drink, how often would you say that you drink for each of the following reasons. Mark the answer sheet for each item according to:

A = almost never/never
 B = some of the time
 C = half of the time
 D = most of the time
 E = almost always/always

How often would you say you drink:

1. **To forget your worries**
2. Because your friends pressure you to drink
3. Because it helps you enjoys a party
4. **Because it helps you when you feel depressed or nervous**
5. To be sociable
6. **To cheer up when you are in a bad mood**
7. Because you like the feeling
8. So the others won't kid you about *not* drinking
9. Because it's exciting
10. To get high
11. Because it makes social gatherings more fun
12. To be in with a group you like
13. Because it gives you a pleasant feeling
14. Because it improves parties and celebrations
15. **Because you feel more self-confident and sure of yourself**
16. To celebrate a special occasion with friends
17. **To forget about your problems**
18. Because it's fun
19. To be liked
20. So you won't feel left out

Alcohol Expectancies (AEQ; tension-reduction items have been bolded)

Instructions: The following items are a list of feelings and beliefs that people may have about drinking alcohol. Please respond to these items according to what you personally believe to be true about alcohol. Mark the answer sheet for each item according to:

**RESPOND TO THESE ITEMS ACCORDING TO WHAT YOU PERSONALLY
BELIEVE TO BE TRUE ABOUT ALCOHOL**

A = Agree
B = Disagree

1. Alcohol can transform my personality.
2. Drinking helps me feel whatever way I want to feel.
3. Some alcohol has a pleasant, cleansing, tingly taste.
4. Alcohol makes me feel happy.
5. Drinking adds a certain warmth to social occasions.
6. Sweet, mixed drinks taste good.
7. When I am drinking, it is easier to open up and express my feelings.
8. Time passes quickly when I am drinking.
9. When they drink, women become more sexually relaxed.
10. Drinking makes me feel flushed.
11. I feel powerful when I drink, as if I can really influence others to do as I want.
12. Drinking increases male aggressiveness.
13. Alcohol lets my fantasies flow more easily.
14. Drinking gives me more confidence in myself.
15. Drinking makes me feel good.
16. I feel more creative after I have been drinking.
17. Having a few drinks is a nice way to celebrate special occasions.
18. I can discuss or argue a point more forcefully after I have had a few drinks.
19. When I am drinking I feel freer to be myself and to do whatever I want.
20. Drinking makes it easier to concentrate on the good feelings I have at the time.
21. Alcohol allows me to be more assertive.
22. When I feel "high" from drinking, everything seems to feel better.
23. A drink or two makes the humorous side of me come out.
24. If I am nervous about having sex, alcohol makes me feel better.
25. Drinking relieves boredom.
26. I find that conversing with members of the opposite sex is easier for me after I have had a few drinks.
27. After a few drinks, I feel less sexually inhibited.
28. Drinking is pleasurable because it is enjoyable to join in with people who are enjoying themselves.

29. I like the taste of some alcoholic beverages.
30. ***If I am feeling restricted in any way, a few drinks make me feel better.***
31. Men are friendlier when they drink.
32. It is easier for me to meet new people if I've been drinking.
33. After a few drinks, it is easier to pick a fight.
34. Alcohol can eliminate feelings of inferiority.
35. Alcohol makes women more sensuous.
36. If I have a couple of drinks, it is easier to express my feelings.
37. ***I feel less bothered by physical ills after a few drinks.***
38. Alcohol makes me need less attention from others than I usually do.
39. Alcohol makes me more outspoken or opinionated.
40. After a few drinks, I feel more self-reliant than usual.
41. After a few drinks, I don't worry as much about what other people think of me.
42. When drinking, I do not consider myself totally accountable or responsible for my behavior.
43. Alcohol enables me to have a better time at parties.
44. ***Anything which requires a relaxed style can be facilitated by alcohol.***
45. Drinking makes the future seem brighter.
46. ***I am not as tense if I am drinking.***
47. I often feel sexier after I have had a couple of drinks.
48. ***Having a few drinks helps me relax in a social situation.***
49. I drink when I am feeling mad.
50. ***Drinking alone or with one other person makes me feel calm and serene.***
51. After a few drinks, I feel brave and more capable of fighting.
52. Drinking can make me more satisfied with myself.
53. There is more camaraderie in a group of people who have been drinking.
54. My feelings of isolation and alienation decrease when I drink.
55. A few drinks makes me feel less in touch with what is going on around me.
56. Alcohol makes me more tolerant of people I do not enjoy.
57. ***Alcohol helps me sleep better.***
58. Drinking increases female aggressiveness.
59. I am a better lover after a few drinks.
60. Women talk more after they have had a few drinks.
61. ***Alcohol decreases muscular tension.***
62. Alcohol makes me worry less.
63. A few drinks make it easier to talk to people.
64. ***After a few drinks I am usually in a better mood.***
65. Alcohol seems like magic.
66. Women can have orgasms more easily if they have been drinking.
67. At times, drinking is like permission to forget problems.
68. ***Drinking helps me get out of a depressed mood.***
69. After I have had a couple of drinks, I feel I am more of a caring, sharing person.

- 70. ***Alcohol decreases my feelings of guilt about not working.***
- 71. I feel more coordinated after I drink.
- 72. Alcohol makes me more interesting.
- 73. A few drinks make me feel less shy.
- 74. ***If I am tense or anxious, having a few drinks makes me feel better.***
- 75. Alcohol enables me to fall asleep more easily.
- 76. ***If I am feeling afraid, alcohol decreases my fears.***
- 77. A couple of drinks make me more aroused or physiologically excited.
- 78. ***Alcohol can act as an anesthetic, that is, it can deaden pain.***
- 79. I enjoy having sex more if I have had some alcohol.
- 80. I am more romantic when I drink.
- 81. I feel more masculine/feminine after a few drinks.
- 82. When I am feeling antisocial, drinking makes me more talkative.
- 83. Alcohol makes me feel better physically.
- 84. Sometimes when I drink alone or with one other person it is easy to feel cozy and romantic.
- 85. I feel like more of a happy-go-lucky person when I drink.
- 86. Drinking makes get-togethers more fun.
- 87. ***Alcohol makes it easier to forget bad feelings.***
- 88. After a few drinks, I am more sexually responsive.
- 89. If I am cold, having a few drinks will give me a sense of warmth.
- 90. It is easier to act on my feelings after I have had a few drinks.
- 91. I become lustful when I drink.
- 92. A couple of drinks make me more outgoing.
- 93. A drink or two can make me feel more wide awake.
- 94. Alcohol decreases my hostilities.
- 95. Alcohol makes me feel closer to people.
- 96. ***I tend to be less self-critical when I have something alcoholic to drink.***
- 97. I find that conversing with members of the opposite sex is easier for me after I have had a few drinks.
- 98. Drinking makes me feel flushed.
- 99. It is easier to remember funny stories or jokes if I have been drinking.
- 100. After a few drinks, I am less submissive to those in positions of authority.
- 101. Alcohol makes me more talkative.
- 102. I am more romantic when I drink.
- 103. Men can have orgasms more easily if they have had a drink.
- 104. A drink or two is really refreshing after strenuous physical activity.
- 105. Alcohol enables me to have a better time at parties.
- 106. I can be more persuasive if I have had a few drinks.
- 107. Drinking makes people feel more at ease in social situations.
- 108. ***Alcohol helps me sleep better.***
- 109. ***After a drink or two, things like muscle aches and pains do not hurt as much.***
- 110. Women are friendlier after they have had a few drinks.

111. Alcohol makes me worry less.

- 112. Alcohol makes it easier to act impulsively or make decisions quickly.
- 113. Alcohol makes me feel less shy.
- 114. Alcohol makes me more tolerant of people I do not enjoy.
- 115. Alcohol makes me need less attention from others than I usually do.
- 116. A drink or two can slow me down, so I do not feel so rushed or pressured for time.
- 117. I feel more sexual after a few drinks.
- 118. Alcohol makes me feel better physically.
- 119. Having a drink in my hand can make me feel secure in a difficult social situation.
- 120. Things seem funnier when I have been drinking, or at least I laugh more.

Drinking Problems Index (DPI)

Instructions: The following items are problems people sometimes experience as a result of drinking alcohol. IN THE LAST 12 MONTHS how often have you done each of the following. Mark the answer sheet for each item according to:

- A = never
- B = once or twice
- C = occasionally
- D = fairly often
- E = often

IN THE LAST 12 MONTHS how often have you:

- 1. become "high" after drinking
- 2. had a fall or accident as a result of drinking
- 3. felt confused after drinking
- 4. had a friend worry or complain about your drinking
- 5. neglected your appearance because of your drinking
- 6. had problems occur between you and a member of your family because of your drinking
- 7. gone to anyone for help about your drinking
- 8. neglected your work because of your drinking
- 9. lost friends because of your drinking
- 10. become intoxicated or drunk after drinking
- 11. had a family member worry or complain about your drinking
- 12. felt you were spending too much money on drinking
- 13. felt isolated from people because of your drinking
- 14. had a drink to help you forget your worries
- 15. neglected the appearance of your living quarters because of your drinking

College Alcohol Problems Scale – Revised (CAPS-r)

Instructions: The following items are problems college students sometimes experience as a result of drinking alcohol. IN THE LAST 12 MONTHS how often have you had each one of the following problems. Mark the answer sheet for each item according to:

- A = never
- B = yes, but not in the past year
- C = 1-2 times
- D = 3-5 times
- E = 6-9 times
- F = 10 or more times

IN THE LAST 12 MONTHS how often have you experienced each of the following problems as a result of drinking alcoholic beverages?

1. Feeling sad, blue, or depressed
2. Nervousness, irritability
3. Caused you to feel bad about yourself
4. Problems with appetite or sleeping
5. Engaged in unplanned sexual activity
6. Drove under the influence
7. Did not use protection when engaged in sexual activity
8. Engaged in illegal activities associated with drug use

Rosenberg Self-Esteem Scale

Instructions: Below is a list of statements dealing with your general feelings about yourself. Please respond to each statement according to your degree of agreement or disagreement. Mark the answer sheet for each item according to:

- A = Strongly Agree
- B = Agree
- C = Disagree
- D = Strongly Disagree

1. On the whole, I am satisfied with myself.
2. At times, I think I am no good at all.
3. I feel that I have a number of good qualities.
4. I am able to do things as well as most other people.
5. I feel I do not have much to be proud of.
6. I certainly feel useless at times.
7. I feel that I'm a person of worth, at least on an equal plane with others.
8. I wish I could have more respect for myself.
9. All in all, I am inclined to feel that I am a failure.
10. I take a positive attitude toward myself.

Center for Epidemiologic Studies Depression Scale (CES-D)

Instructions: Below is a list of ways you may have felt. Please respond to each statement according to how often you have felt that way during the past week according to:

- A = Rarely or none of the time (less than 1 day)
B = Some or a little of the time (1-2 days)
C = Occasionally or a moderate amount of time (3-4 days)
D = Most or all of the time (5-7 days)

1. You were bothered by things that usually don't bother you.
2. You did not feel like eating; your appetite was poor.
3. You felt that you couldn't shake off the blues even with help from your family or friends.
4. You felt that you were just as good as other people.
5. You had trouble keeping your mind on what you were doing.
6. You felt depressed.
7. You felt that everything you did was an effort.
8. You felt hopeful about the future.
9. You thought your life had been a failure.
10. You felt fearful.
11. Your sleep was restless.
12. You were happy.
13. You talked less than usual.
14. You felt lonely.
15. People were unfriendly.
16. You enjoyed life.
17. You had crying spells.
18. You felt sad.
19. You felt that people disliked you.
20. You could not get "going."

APPENDIX E – DEBRIEFING STATEMENT

DEBRIEFING STATEMENT – Exploring the Self Medication Hypothesis

Thank you for participating in this research study. The information you have provided will be a valuable component of a research project that is designed to investigate the self-medicative drinking behavior. Self-medication is the act of drinking alcohol or using drugs in response to psychological distress such as depression or anxiety. The purpose of use is to temporarily numb emotional pain or escape persistent negative thoughts. This study was designed to measure the extent to which self-medication may occur in a college population as well as to examine possible contributing factors which may lead to self-medication, such as personality variables, self-esteem, and anti-depressant use.

Since you have completed both phases of the study, you will receive your one extra credit for your psychology 101 or 230 course (for today's session) plus an additional bonus point (for completing both phases of the study).

If, as a result of your participation in this study, you suspect that you may have a substance abuse problem or that you may be experiencing symptoms of depression or anxiety, you should be aware that there are help services available to you on campus and in the community. In the event of such a concern or other distress you are advised to seek free services at the ISU Student Counseling Services (SCS), located on the 3rd floor of the Student Service building. SCS can be reached at 294-5056.

If you have further questions about the study, please contact Principle Investigator Reed Robinson at (515) 520-0780 or via email at rjrobins@iastate.edu or Norman A. Scott at (515) 294-1509 (Office: W271 Lagomarcino Hall).

Questions about the rights of research subjects or research-related injury should be directed to Ginny Austin Eason, IRB Administrator, (515) 294-4566, austingr@iastate.edu, or Diane Ament, Research Compliance Officer (515) 294-3115, dament@iastate.edu, 1138 Pearson Hall.

APPENDIX F – SUPPLEMENTARY TABLES

Table 11.

Minimum and maximum scores by scale

Variable	<i>Min. Possible</i>	<i>Max. Possible</i>
Weekday Drinks/week	0	N/A
Weekend Drinks/week	0	N/A
Total Drinks/week	0	N/A
DMQ – Social	5	25
DMQ – Coping	5	25
DMQ – Enhancement	5	25
DMQ – Conformity	5	25
AEQ – Global Expectancies	28	56
AEQ – Sexual Enhancement	7	14
AEQ – Enhancement of Pleasure	9	18
AEQ – Positive Social Change	11	22
AEQ – Tension Reduction	9	18
AEQ – Aggression	5	10
DPI	0	60
CAPS-r	0	40
Rosenberg Self-Esteem Scale	10	40
CES-D	0	60

Table 12.

Correlation matrix for key variables from both sessions (Session II correlations displayed below the diagonal)^{a,b}

Variable	<i>r</i>							
	1.	2.	3.	4.	5.	6.	7.	8.
1. CES-D	[.68*]	.16*	.19*	.37*	.37*	.24*	-.01	.68*
2. Anti-Dep. Use	(-.20*)	[.87*]	.03*	-.18*	-.12*	-.02	.03	-.01
3. Marijuana Use	(.14*)	(-.01)	[.77]	.10*	.15*	.16*	.30*	.32*
4. Stress	(.39*)	(-.09)	(.01)	[.35]	.19*	.14*	-.04	.21*
5. Coping	(.30*)	(-.08)	(.21*)	(.19*)	[.71]	.49*	.38*	.48*
6. Ten-Red. Exp.	(.11*)	(-.01)	(.14*)	(-.01)	(.59*)	[.71]	.44*	.50*
7. Alcohol Use	(-.01)	(.01)	(.39*)	(-.07)	(.39*)	(.41*)	[.70]	.62*
8. DPI	(.18*)	(.01)	(.35*)	(.07)	(.59*)	(.54*)	(.55*)	[.77]

Note*. $p < .01$

Note^a. (Session II correlations displayed in parentheses)

Note^b. [Inter-session correlations displayed in brackets]