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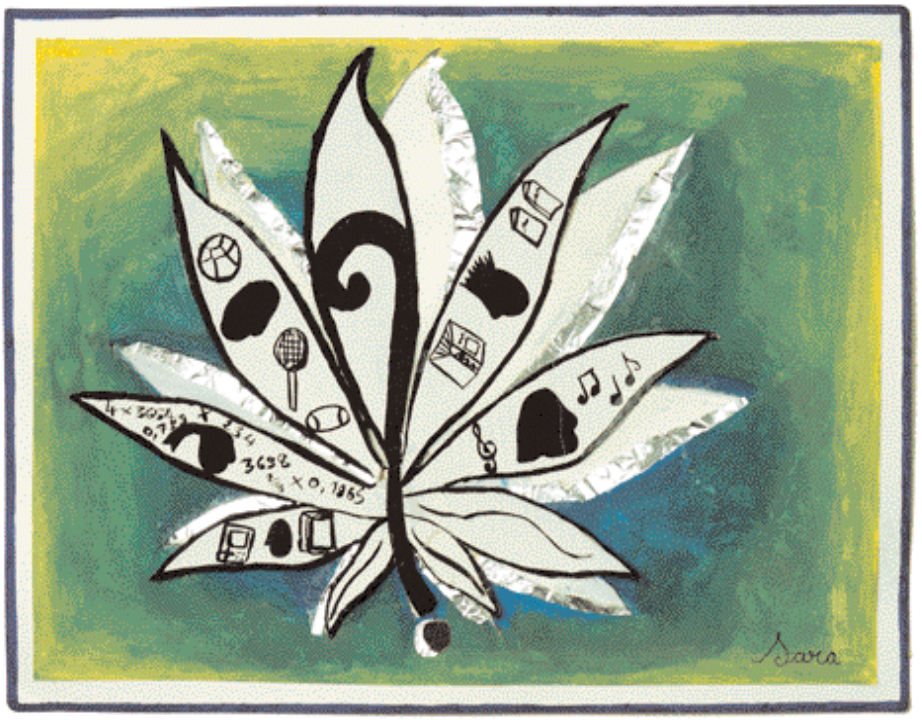

Psychological drug research: current themes and future developments

La recherche en psychologie sur les drogues: questions actuelles et perspectives

Jorge Negreiros

Council of Europe Publishing
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Psychological drug research: current themes and future developments

by

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POMPIDOU GROUP

The Co-operation Group to Combat Drug Abuse and Illicit Trafficking in Drugs (Pompidou Group) is an inter-governmental body formed in 1971. Since 1980 it has carried out its activities within the framework of the Council of Europe. Thirty five countries are now members of this European multidisciplinary forum which allows policy-makers, professionals and experts to exchange information and ideas on a whole range of drug misuse and trafficking problems. Its new mission adopted at the Ministerial Conference of Dublin in October 2003 is the promotion of dialogue and interaction between policy, practice and science with a special focus on the practical implementation of drug policies.

Through the setting up in 1982 of its group of experts in epidemiology of drug problems, the Pompidou Group was a precursor for the development of drug research and monitoring of drug problems in Europe. The multi-city study which aimed to assess, interpret and compare drug use trends in Europe is one of its major achievements. Other significant contributions include the piloting of a range of indicators and methodological approaches such as a methodology for school surveys which gave rise to the ESPAD (European School Survey Project on Alcohol and other Drugs)[1], treatment demand (Treatment Demand Indicator)[2], prevalence estimation (Estimating the Prevalence of Problem Drug Use in Europe" publication) and qualitative research. The most recent activity has been the holding of a conference in 2004 on linking research, policy and practice.

The present paper has been commissioned by the Pompidou Group from Jorge Negreiros, Professor in Faculty of Psychology and Educational Sciences, at the University of Porto and formed the starting point for discussions of the recently set up research platform. It is the first time that psychological drug research has been tackled by the Group.

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[1] initiated by the Swedish Council for Information on Alcohol and Other Drugs and supported by the Pompidou Group

[2] See Pompidou Group list of documents and publications at the end of this publication

CONTENTS

1. OVERVIEW

The goal of this review is to provide an overview of the current findings related with psychological research in the drug field. Three major themes are reviewed: 1) personality traits; 2) personality disorders and comorbid psychopathology and; 3) alcohol and drug related expectancies. For each of these domains, an exploration of important conceptual, theoretical and methodological aspects will be undertaken. A final section addresses important concerns in terms of limitations and future developments in this area of research.

2. SUMMARY

Psychological research in the drug field has witnessed important developments over the past 20 years. The major findings may be summarized as follows:

- Several personality traits have been shown to have an association with substance use/abuse and thus have a high predictive utility in psychological research in the drug field.
- The research effort to differentiate broad personality traits that correlate with drug use has lead to the identification of the general construct of disinhibition as an important personality dimension related to drug abuse.
- Sensation seeking and impulsivity, two highly similar indicators of this construct, appear to be the personality traits that better predict drug use patterns, across different classes of drugs.
- Recent research studies have shown that personality traits often precede the onset drug use, indicating that, at least for some classes of drugs, personality features may have a predictive value, acting as a predisposing factor for substance abuse.
- Some research also points to the possibility that an interactive effect may occur between drug abuse and specific personality traits thus indicating that these personality characteristics and drug use appear to mutually influence each other.
- Although sparse, research examining the relationship between personality traits and personality disorders in drug abuse has shown that certain personality characteristics (e.g., sensation seeking) are associated with psychiatric conditions. Moreover, some research has also recently suggested that personality may act as a predisposition factor that is independent of comorbid psychiatric conditions.
- Expectancy variables have been consistently indicated as potent predictors of drug use and its consequences. In addition, some research

has highlighted the point that alcohol and drug related expectancies have direct effects on drug use with expectancy constructs showing an even stronger predictive value than most personality variables.

3. INTRODUCTION

Different theoretical formulations have focused on sociocultural, psychological and biological constructs to explain the roots of drug abuse. A vast range of variables fall within the general domain of psychological dimensions of drug use/abuse. As so, the term "psychological dimensions of drug use" will be used in this paper in a somewhat inclusive sense. The term is made in reference to patterns of thought and behaviour, including behavioural traits, personality disorders, motives and expectancies as related to drug use/abuse.

In this review, we start by examining the complex issue of personality and drug abuse. Personality features have long been known to be associated with drug use. The possibility that certain personality traits are associated with particular patterns of substance use has been extensively examined by researchers. Nevertheless, it is important to clarify the meaning of the concept of "personality" as related to drug abuse since research questions may vary accordingly to the definition.

Historically, conceptualisations of alcoholism and drug addiction posited the existence of an addictive personality based in psychodynamic formulations of pathological dependency. This perspective is clearly stated within the first and second editions of the DSM which classified alcoholism and drug addiction as types of "sociopathic personality disturbances," and then later under a broader category of "personality disorders." This conceptualisation was abandoned with DSM-III (American Psychiatric Association, 1980) and its differentiation of substance use from personality disorders through their re-location on separate axes. According to Ball (2005), "this dissociation of personality from addiction expresses the failure during the preceding two decades to identify a single personality type" (p. 75).

It is now widely admitted that the addictive personality does not exist, or has, at least, been largely rejected (Kerr, 1996; Nathan, 1998). Nevertheless, research evidence points to individual differences in several personality traits that have been consistently associated with drug abuse and drug dependence. These traits are conceptualised as not simply consequences of drug abuse. In particular, several studies have shown that drug dependent individuals differ from controls on several personality

characteristics including, impulsivity, sensation seeking, and proneness toward social deviance.

These findings raised a number of important questions. First, the interest of the researchers has evolved toward the identification of personality traits that correlated with drug use, separating substance use from personality pathology. Second, this shift has lead to the recognition that a number of personality traits commonly observed in drug abusers do not express inevitably pathological processes (Wolff & Katleen, 2002; Odum et al., 2000). Consequently, the first section of this paper reviews evidence that supports the role of distinct personality traits involved in drug use/abuse. As so, the term *personality traits* will be used here to refer to non-pathological factors related to thought patterns and behaviours involved in drug use.

Although research comparing personality features of drug users/abusers has shown various inconsistencies, an extensive literature now supports an important role for personality in drug abuse. According to some authors (e.g., Conway et al., 2003), the discrepancies found in personality research and drug abuse may be partially due to problems related with the definition of drug abuse groups, level of polydrug involvement, comorbid psychopathology and measurement of personality.

Despite these inconsistencies, it is generally recognized that there are a limited number of broad personality traits that correlate with drug abuse. Although various personality traits have been investigated in their relation to drug abuse, recent efforts to identify these broad traits seem to be based on the general construct of disinhibition. This construct has been designated in different ways: 1) behavioural disinhibition (Watson & Clark, 1993; Conway et al., 2003; 2) behavioural undercontrol (Sher at al., 1991; Sheier, 2001); 3) trait disinhibition (McGue et al., 2001); 4) disinhibithory personality traits (Ball, 2005); 5) externalising disorders (Krueger et al., 1998).

Personality traits such as sensation seeking, novelty seeking, impulsivity, constraint and unconventionality are highly similar indicators of this general construct. As so, some authors (e.g. Conway et al., 2003) express the view that the research findings in this field inevitably lead to the conclusion that behavioural disinhibition (or other similar concepts that have been used to define this construct) is actually the most important personality dimension related to drug abuse. An additional important issue is that other personality traits not based on this construct seem to overlap with behavioural disinhibition indicators. For example, some authors (e.g., Sher & Trull, 1994) have suggested that the inconsistencies found in research on extraversion as a predictor of drug use may be due to the fact that some measures used to record this trait actually overlap with those used to

measure sensation seeking. This in itself would suggest that studies of extraversion are actually indirect measures of sensation seeking.

Research has also shown that disinhibitory personality traits have not only been well validated as predictors of substance use both in adolescents and adults, but are also reliable predictors of earlier age of onset, polydrug use, chronic/heavy use, conduct and antisocial personality disorders, violence, arrests, substance dependence severity, HIV risk behaviours, psychiatric symptoms, mood disorders, suicide attempts, family history, and early dropout (Ball, 2005). Moreover, separate measures of personality have shown to be similar to indicators of behavioural disinhibition used in various investigations, namely, the personality traits of sensation seeking, novelty seeking and impulsivity. Consequently, the application of the construct of behavioural disinhibition could lead to "a parsimonious synthesis of the personality findings that might otherwise be interpreted as distinct" (Conway et al., 2003; p. 71).

The question addressed in the next section is generally related to personality disorders and problem drug use. As stated above, the differentiation of substance abuse behaviours from specific personality traits and personality disorders remains a central issue in psychological research in the drug field. We have, then, assumed, as other authors (e.g., Ball, 2005), the relevance of examining separately normal personality trait dimensions and personality disorder categories.

Researchers examining the relationship between drug abuse and personality disorders have traditionally explored these themes in terms of prevalence estimates of personality disorders among drug addicts, including the relationship between class of drug and personality disorders. A More promising approach would appear that oriented towards a clarification of the relationship between personality traits and disorders and problem drug use. Some studies addressing this issue present interesting results showing that specific personality characteristics (e.g., sensation seeking) are associated with comorbid personality disorders. An additional important issue involves the examination of the nature of the links between personality traits and disorders that are comorbid with drug abuse and drug dependence. Some studies have indicated, for instance, that personality traits lead to alcohol and drug abuse once controlling for comorbid personality disorders.

The research on alcohol and drug related expectancies also represent a very productive area of psychological research in the drug field that has grown exponentially over the past decades. The work on expectancies is associated with cognitive theories of alcohol and drug abuse that stress the importance of holding certain specific beliefs about the effects of alcohol and drugs that in themselves may act as predisposing factors of substance

abuse. In particular, the notion that the anticipated positive effects of using a drug may explain substance abuse is now widely accepted. This notion has been expressed in the concept of expectancies. This construct has been labelled in different ways to include outcome expectancy (Christiansen et al., 1989), perceived functions (Jessor & Jessor, 1977), subjective reasons for using a drug (White & Bates, 1993), and cognitive motivation (Stacy et al., 1991).

Expectancy variables have been consistently identified as strong predictors of drug abuse and its problem consequences. In general, positive expectancies about the effects of alcohol or drugs are associated with increased alcohol and drug use and related problems. Importantly, expectancies have been conceptualised as a final common pathway to drug abuse through which personality traits exert their influences (Sher et al., 1991; Williams & Clark, 1998). According to this formulation, expectancies mediate the effects of personality. If so, a specific personality trait may be manifested cognitively in expectancies that influence more directly drug behaviour. The influence of personality traits would then be mediated through expectancies, relegating personality traits per se to the background.

In other formulations, expectancies and personality traits are conceptualised as competing constructs in prediction of substance abuse. In this perspective, expectancy constructs are viewed as exerting a more direct effect on drug abuse. However, despite evidence supporting the predictive utility of expectancies, few studies if any have integrated the expectancy and trait approaches in research on alcohol and drug abuse. (Stacy et al, 1995).

4. CURRENT DOMAINS

4.1 Personality traits

Based on the analysis presented in the introduction, we have decided to explore in further detail two personality variables that have stimulated various investigations over the past 25 years and that have been most developed in personality models: 1) Sensation seeking (also designated novelty seeking or behavioural undercontrol) and; 2) Impulsivity. These two personality traits underlying alcohol and drug abuse fall under the general construct of disinhibitory personality traits or behavioural disinhibition discussed above.

4.1.1 Sensation seeking

Sensation seeking is a personality trait characterized by the extent of a person's desire for novelty and intensity of sensory stimulation (Andrew & Cronin, 1997). According to Zuckerman (1991), sensation seeking increases during adolescence and then levels off in the mid-to late 20s. Studies have shown that sensation seeking is related to various psychological indicators and behavioural expressions, particularly in the domains of vocational choices, habits, hobbies, risk perception, and risk appraisal (Roberti, 2004).

In general, individuals that score high in sensation seeking tend to get involved in behaviours that increase the amount of stimulation and arousal. These behaviours may include an interest in stimulating occupations or participation in risky activities such as mountain climbing (Cronin, 1991), sky-diving (Hymbaugh & Garret, 1974), auto racing and other high-risk sports (Franques et al., 2003). Conversely, sensation-seeking individuals show low interest in sport activities that are not associated with high risk and excitement, such as marathon running (Potgieter & Bisschoff, 1990). In a recent study, Desrichard and Denarié (2005), from the University of Savoie (France), have examined the tendency for risk taking in a sample of 201 young people. Sensation seeking emerged as the only significant personality variable, in a group of variables that also included positive affectivity and negative affectivity, that was associated both to occasional and frequent risk taking behaviours.

It is assumed that these types of experiences may have a biological basis. Moreover, these activities are rewarding probably because they fill some innate biological need for stimulation. Some research links the D4 dopamine receptor gene with novelty seeking (Benjamin et al., 1996; Cloninger et al., 1996; Ebstein et al., 1996). Probably, if sensation seeking and drug-seeking behaviours in humans activate a similar neurological system, high stimulation may function as substitutes for drug use (Bardo & Mueller, 1991; Bardo et al., 1996). This may be one of the main reasons why many researchers have hypothesized that the need for stimulation, present in sensation seeking individuals, makes them more vulnerable to drug abuse and more susceptible to the reinforcing effects of drugs (Zuckerman, 1979; Newcomb & Bentler, 1988; Andrucci et al., 1989; Watson and Clark, 1993; Stacey et al., 1993 Andrew & Cronin, 1996; Bardo et al., 1996).

Definition and measurement of sensation seeking

Sensation seeking is "a trait defined by the seeking of varied, novel, complex, and intense sensations and experiences, and the willingness to take physical, social, legal, and financial risks for the sake of such experience" (Zuckerman, 1994, p. 27). Currently, the explanation for sensation seeking is based on a model influenced by genetic, biological, psychophysiological, and social factors. It is, then, assumed that these types of experiences are rewarding presumably because they fill some innate biological need for novelty.

Sensation seeking has been measured as a personality trait (Pearson, 1970, 1971; Zuckerman, 1979, 1984, 1994; Zuckerman et al., 1972). Nevertheless, some authors (e.g., Donohew et al., 1998; Everett & Palmgreen, 1995) have been measuring this construct as part of a more general activation theory of information exposure. Sensation seeking traits can be measured via standard self-report questionnaires. The most used is Zuckerman's (1979) Sensation Seeking Scale (SSS-V). This instrument has proved to be a valid and reliable method for determining behavioural expressions of sensation seeking traits (Brocke et al., 1999; Zuckerman, 1994). These traits can be partitioned into four dimensions, corresponding to the four subscales of the SSS-V: thrill and adventure seeking, experience seeking, disinhibition, and boredom susceptibility (Zuckerman et al., 1978). Factor replication of the SSS-V has been demonstrated with clinical and non-clinical US, British, Australian, French, and Canadian samples (Ball et al., 1994; Zuckerman et al., 1978).

Some problems concerning internal reliability of the subscales have been raised in a recent reliability generalization study, which found low reliability coefficients for the subscales of the SSS-V (Deditius-Island et al., 2002), particularly in younger samples. This finding stresses the need to keep on assessing the factor structure and reliability of items in younger samples.

Sensation seeking and drug use/abuse

The relationship between sensation seeking (or novelty seeking) and substance abuse has been well demonstrated by several studies. A number of researchers have indicated that there is a strong relationship between sensation seeking and drug use and drug dependence (Kohn & Annis, 1997; Andrucci et al., 1989; Jaffe and Archer, 1987; Pedersen et al., 1989; Von Knorring et al., 1987; Ball et al., 1994).

Sensation seeking has been indicated as a potent precursor of drug abuse as well as a personality feature that strongly influences drug use patterns. Several studies view sensation seeking as the single most important personality predictor of substance use. Moreover, this personality trait has been shown to be the most powerful predictor of early onset of drug use and abuse across drug categories compared to other personality and psychopathology measures (Andrucci et al., 1989; Jaffe & Archer, 1987; Horvath et al., 2004).

Consistent evidence demonstrates that individuals with a high need for stimulation start using drugs at an earlier age and are more likely than low sensation seekers to become regular users (Bates et al., 1994; Kosten et al., 1994; Kilpatrick et al., 1976; Pedersen, 1991; Schwarz et al., 1978; Zuckerman, 1979, 1984, 1994). Cloninger and colleagues (1988) showed that novelty seeking at age eleven predicted alcohol use at age 27. Barnea and colleagues (1992) found that sensation seeking was the only personality trait that predicted substance use. It had a strong direct as well as indirect effect on drug use, on behavioural intentions, and on attitudes toward drugs. Stacy and colleagues (1993) found that sensation seeking predicted alcohol use over a nine-year period. Thus, sensation seeking seems to be an important personality trait given its consistent strength as a predictor of drug use and its apparent stability over lifespan.

While most of the research on sensation seeking in the drug field has focused on young adult populations, evidence shows that the relationship also holds true in adolescent populations. This measure of personality seems to be reliable at a relatively young age (Potts et al., 1995; Willis et al., 1998). Among the studies using adolescent populations, the total sensation seeking score has been shown to be a reliable predictor of drug use. In a study with high school students (12-18 years old), Donohew and colleagues (1990; 1998) found that, relative to low sensation seekers, high sensation seeking individuals used more drugs, including alcohol, marijuana and cocaine. Similarly, Schwartz and colleagues (1978) found a positive relationship between sensation seeking and alcohol use in college students and Segal and Singer (1978) report that compared to various other personality measures, sensation seeking provided the best discriminatory measure between user and nonuser groups. It is also important to note that some studies have indicated that the *disinhibition* and *experience seeking* subscales may be better predictors of the frequency and quantity of alcohol and drug use in adolescents (Andrucci et al., 1989; Bates et al., 1986).

Sensation seeking was also found to be related to alcohol use/abuse in adults (Cohen & Fromme, 2002; Zuckerman, 1994). Various researchers have found a correlation between alcohol use and scores on the sensation seeking scale, especially the subscales of disinhibition and experience

seeking. Earleywine and colleagues (1991), for instance, found that behavioural disinhibition was related to drinking patterns. Moreover, sensation seeking was related to drinking habits and behavioural disinhibition. The authors assumed that the relation between behavioural disinhibition and drinking habits appeared to be the result of a connection with each other and a preference for sensation seeking. In a similar way, Forsyth and Hundleby (1987) also found that sensation seeking influences both frequency of drinking and desire to drink in social situations. This personally trait has also been investigated in alcohol dependent individuals, showing that it may be an important component in alcoholism typologies (Babor et al., 1992; Cadoret et al., 1995). Recently, Dom and colleagues (2006) found higher levels of sensation seeking in early-onset alcoholics compared to late-onset alcoholics. A recent meta-analysis (Hittner & Swickert, 2005) of 61 studies revealed a small to moderate size effect between alcohol use and sensation seeking total scales scores. In addition, analysis of the four sensation seeking dimensions indicated that disinhibition was most strongly correlated with alcohol use.

There is a growing body of evidence supporting the relation between sensation-seeking and opiate drug use. In France, Franques and colleagues (2003) found that opioid dependent subjects showed higher levels of sensation seeking than normal controls. In addition, high-risk sport practicing subjects differed from normal controls in sensation seeking scores, indicating a similar tendency to seek intense and varied stimulation as opioid dependent subjects. Simons and colleagues (2005) found that sensation seeking and marijuana use were positively associated with use frequency. This personality trait was also found to be a significant factor in polydrug use (Bates et al., 1994; Dom et al., 2006; Kilpatrick et al., 1976; Pedersen, 1991; Schwarz et al., 1978; Zuckerman, 1979, 1994;).

Moreover, changes or stability in sensation-seeking scores have also been linked to changes in substance use patterns. For example, Bates and colleagues (1994) report that, over time, relative increases in sensation seeking scores are associated with increases in adolescent drug use. Decreases in need for sensation seeking appear to limit increases in drug use but do not necessarily lead to reductions in use. In a study with Israeli adolescents, sensation seeking was found to be related to lifetime drug use, as well as to use within the last 30 days (Teichman et al., 1989).

Recent studies have also now addressed the possible mutual influence between sensation seeking and drug abuse. Horvath and colleagues (2004), for instance, using a longitudinal design, concluded that sensation seeking and drug abuse "exert a reciprocal influence on each other" (p. 180). The findings showed that higher levels of sensation seeking at $9^{th}/10^{th}$ grade were linked to higher levels of drug use at the ages of 19/21 years,

suggesting that earlier drug use also seems to influence the levels of this personality trait. According to the authors, "sensation seeking could be affected by substance use because of the disinhibiting effects of alcohol and drugs" (p.181).

4.1.2 Impulsivity

Impulsivity has been of interest to researchers for many years. It is a major criterion used to diagnose a variety of clinical disorders including bulimia nervosa, attention deficit disorder, pathological gambling (Alessi & Petry, 2003), substance abuse, pyromania, kleptomania, obsessive-compulsive disorder and other psychopathological diagnosis as well as several personality disorders (e.g., antisocial personality disorder, borderline personality disorder).

Impulsivity is thus considered a central aspect of drug abuse. This trait and its associated features have been recognized in many nosological systems for substance use disorders. For instance, impulsive and aggressive behavioural patterns are important clinical features of Type A (Babor et al., 1992) and Type II (Cloninger, 1988) alcoholism. The DSM-IV (American Psychiatric Association, 1994) diagnostic criteria for substance dependence also includes impulsive behaviour (Evenden, 1999). Some studies have also suggested that impulsivity not only increases the risk of substance abuse but also the occurrence of negative life events (Hayaki et al., 2005). Researchers have identified several different forms of impulsivity, at least some of which involve reduced transmission of nerve signals involving the neurotransmitter 5-HT (also known as serotonin).

Definition and measurement issues

The definition of impulsivity varies among investigators but most definitions have similar components (Barratt & Patton, 1983; Halperin et al., 1995; Dawe & Loxton, 2004). In general, the term "impulsivity" describes an individual's tendency to make rapid behavioural changes regardless of negative consequences or the loss of a postponed reward of greater intensity (e.g., taking a drug despite knowing the potential adverse effects on health). Impulsivity has also been described as a "consistent tendency for persons to show fast or slow decision times in situations of high uncertainty" (Heckel et al., 1989).

Reward delay and rapid response represent two distinct ways in which one may operationalise impulsivity (Swann et al., 2002). The concept of reward delay is based on an animal model of reward dependence in which the organism favours immediate reward, even if it is smaller (Ainslie, 1975; Logue et al., 1986; Monterosso & Ainslie, 1999). In this model, researchers

have measured the level of impulsivity by comparing whether animals preferentially press a lever to receive a larger, delayed food reward or a smaller, rapidly available reward.

In behaviour analysis, impulsivity has also been defined as the inability to tolerate long delays to reinforce presentation (i.e. delay of gratification) and has been specifically examined in delay discounting procedures. Hence, it has been stated that most definitions of impulsivity can be related to a choice for a smaller more immediate reinforcer over a larger but more delayed reinforcer. In contrast, self-control would, then, be described as the opposite: the ability to wait for larger more delayed reinforcers.

The concept of rapid response, also designated response inhibition or non-planning impulsivity, includes several aspects of the present behaviour, including quick decision-making, inability to withhold action, and action without regard to consequences (Evenden, 1999; Lane et al., 2003; Moeller et al., 2001). Although both approaches have been implicated in substance abuse, some researchers have suggested that this second subtype of impulsivity is more strongly associated with psychopathology (Swann et al., 2002).

It has also been argued that each dimension of impulsivity reflects a different aspect of drug abuse (e.g., Lane et al., 2003). For instance, the reward delay type of impulsivity may serve as an underlying vulnerability that may promote drug abuse onset, whereas the rapid response modality may contribute to the maintenance of drug abuse among individuals who already use. Alternatively, reward delay impulsivity is initiated during an individual's decision to use or abstain from drugs, whereas rapid response impulsivity may be activated during more automatic drug use patterns such as cue-reactive behaviours.

Despite the fact that the concept has originated various definitions, most researchers conceptualise impulsivity as a multidimensional construct (Gerbing et al., 1987; Malle & Neubauer, 1991; Petry, 2001; Dawe & Loxton, 2004). Conceptual definitions of impulsivity often include one or more of the following components or dimensions: lack of premeditation, sensation seeking, rashness, lack of perseverance, urgency, and reward sensitivity (Whiteside & Lynam, 2003). For example, Petry (2001) suggested that impulsivity "... includes orientation toward the present, diminished ability to delay gratification, behavioural disinhibition, risk taking, sensation seeking, boredom proneness, reward sensitivity, hedonism and poor planning" (p. 30).

Other authors (Patton et al., 1995) define impulsivity as a collection of subtraits, such as acting without thinking ('motor'), quick decision making ('cognitive'), thinking about the present rather than the future

('nonplanning'), and difficulty in concentrating ('attentional'). Recently, Dawe and colleagues (2004), after reviewing published factor analytic studies, proposed two independent dimensions of impulsivity as related to substance abuse: reward sensitivity and rash impulsiveness. The first component involves a "heightened sensitivity to unconditioned and conditioned rewarding stimuli (Dawe et al., 2004; p. 1399); rash impulsiveness is basically associated to response disinhibition.

In addition to a number of self-report measures of impulsivity, another useful method for studying impulsivity is assessment of choices in a behavioural paradigm. Most of these behavioural paradigms are based on Ainslie's definition of impulsivity which is the "choice of a small, short term gain at the expense of a large, long term loss" (Ainslie, 1974). Most behaviour that is considered impulsive fit well into this definition. Continued drug use may also be classified as choosing the immediate reward (direct pharmacological effects) in contrast to delayed long-term rewards (e.g., health, income, relationships).

In summary, the diversity of definitions have resulted in a vast number of measures used to quantify impulsivity. Overall however, two broad categories of measures are used. The first category of measures includes self-report measures of impulsivity (Patton et al., 1995). The second category includes performance-based neuropsychological tests which can be used to assess different components of impulsivity (e.g., initial thinking time) (Fray et al., 1996).

Impulsivity and drug abuse

Many recent studies on impulsivity have emerged from the field of drug and alcohol research. In general, substance abusers have been found to have higher levels of impulsivity as compared with control subjects (e.g., Sher et al., 2000; Sher & Trull, 1994). Within clinical populations it has been demonstrated that drug users score higher than controls on self-reports measures of impulsivity (Allen et al., 1998; Petry, 2001). Furthermore, impulsivity has shown to be linked to the severity of drug abuse and poor treatment retention (Moeller et al., 2001; Patkar et al., 2004).

Impulsivity is also strongly related to substance abuse in children and adolescents. Longitudinal studies have identified impulsivity in children as a high-risk factor for early substance use and later substance abuse (Dawe, et al., 2004). Some studies also show higher levels of impulsiveness to be associated with substance use and abuse in college students (Jaffe & Archer, 1987).

Individuals with a history of drug dependence also show greater impulsivity than those with no such history (Allen et al., 1998). Among substance abusers, impulsivity appears to be associated with greater substance use severity. Thus, individuals who are polydrug users report greater trait impulsivity than those who are dependent on a single drug (O'Boyle & Barratt, 1993; Butler & Montgomery, 2004)). In addition, negative affect and impulsivity have been associated with earlier age of substance abuse onset, more substance-related negative consequences, and higher rates of substance abuse among relatives (Henderson et al., 1998).

Dependence on nicotine has been found to be associated with high levels of impulsivity (Mitchell, 1999; Litlle, 2000). Studies using self-report measures of impulsivity or behavioural tasks (e.g. delay-discounting) have consistently indicated higher levels of impulsiveness in smokers than in non-smoking subjects (Baker et al., 2003; Bickel et al., 1999; Dinn et al., 2004; Jaroni et al., 2004; Mitchell, 1999; Reynolds, et al., 2004). Recently, Skinner and colleagues (2004) found smoking alcoholics to have higher levels of impulsivity than non-smoking alcoholics.

An increase in impulsive behaviour has also been associated with alcohol use (Poulos et al. 1995). High levels of impulsive traits have also been found within alcohol-dependent patients (Patton et al., 1995). More specifically, not only do alcohol dependent subjects show greater levels of impulsivity but also this personality feature is often present prior to the manifestation of alcohol related problems (Caspi et al., 1997).

Recently, Dom, Hulstijnb, and Sabbec (2006), from the Psychiatric Centre Brothers Alexians and the Institute for Cognition and Information in the University of Antwerp (Belgium) examined early onset alcoholics (EOAs) and late onset alcoholics (LOAs) and their personality traits of impulsivity and sensation seeking. The results showed that the EOAs had higher levels of impulsivity than the LOAs. In addition, age of onset correlated inversely with impulsivity. It is important to note that this last finding has also been recently reported for cocaine dependent subjects (Moller et al., 2001). In fact, compared with the LOAs, the EOAs were characterized by a higher severity of alcohol dependence and related problems and had longer substance-abusing trajectories. They also had more frequently a current or a lifetime history of polydrug use. This finding suggests that impulsivity does influence the person's initial use of alcohol and also possibly the development of dependence.

Among cocaine-dependent individuals, a significant association between impulsivity and severity of drug use has also been documented (Moeller et al., 2001). High scores on impulsivity have also been associated with worse treatment outcomes in cocaine-dependent individuals (e.g.,

negative correlation with number of days in treatment and positive correlation with dropout rate) (Patkar et al., 2004).

Similarly, studies on MDMA users have found that users of this illicit drug have higher levels of impulsivity as compared to control subjects (Parrott et al., 2000; Butler & Montgomery, 2004). In another study on MDMA users, Morgan (1998) reported that MDMA users showed elevated levels of impulsivity on both self-report and behavioural measures; a significant positive correlation between amount of MDMA consumed and level of impulsivity was also identified. More recently, a study conducted by Butler and Montgomery (2004) from the University of Greenwich (London) indicated significant correlations between impulsiveness and the largest amount of MDMA used on one occasion as well as the number of tablets consumed per occasion. The authors discuss this association admitting two possible explanations. In one explanation, serotonin depletion as a consequence of ecstasy use might have caused an increase in impulsivity. Alternatively, impulsivity was a consequence of "pre-existing low levels of serotonin" (p.60).

4.2 Personality disorders and comorbidity psychopathology

Personality disorders can co-occur with substance use disorders. Consequently, the term "comorbidity" in general refers to the co-occurrence of two or more personality disorders within the same individual. The term "dual diagnosis" refers more specifically to the co-occurrence of substance (alcohol or drug) use disorders and other psychiatric disorders. Recently, both terms have been combined to produce definitions of homotypic comorbidity, the co-occurrence of disorders within a diagnostic grouping (e.g., sedative dependence and alcohol use disorders) and heterotypic comorbidity, the co-occurrence of two disorders from different diagnostic groupings (e.g., alcohol use disorders and major depression) (Stinson et al., 2005).

There is considerable agreement among researchers that drug addicts suffer from severe psychopathology. Studies using the DSM-IV (APA, 1994) show that substance use disorders co-occur with both Axis I (e.g. posttraumatic stress disorder, depression) and Axis II disorders (e.g. antisocial personality disorder) at rates exceeding those found by the base rates of these disorders (Ross et al., 2003; Verheul et al., 2000). For example, the lifetime prevalence of mental health disorders in the general population is estimated to be between 10-14% (Weissman, 1993; de Girolamo e Reich, 1993), while the prevalence of mental health disorders in the drug abuser population has been found to be as high as 100% (Bowden-Jones et al., 2004). Specifically, research studies have shown that DSM Axis

II psychopathology is highly prevalent among individuals with substance use disorders.

In a recent national survey conducted in the U.S., Stinson and colleagues (2005) found a prevalence of 1,1% for comorbid alcohol and drug use disorders (homotipic comorbility) and a prevalence of 7,3% for alcohol use disorders only and of 0.9% for drug use disorders only. Large differences were found in the three groups in terms of sociodemographic and psychopathologic correlates "with the drug use disorder and comorbid groups significantly more likely to be young, male, never married and of lower socioeconomic status than the alcohol use disorder only group" (p 105). Individuals in the drug-only and comorbid groups were more likely to have a current comorbid mood, anxiety or personality disorder than individuals in the alcohol-only group.

Prevalence estimates of personality disorders among drug addicts have shown large variations. These variations have been attributed to differences in study method and type and nature of the sample used. For instance, rates of comorbidity among drug abusers are commonly greater in studies using patient samples than in studies using community samples. Clearly, the vast majority of research on the relationship between personality disorders and drug use among adults has been conducted using patient samples. Variations are also related to diagnosing personality disorders at different time points in the treatment process (Banken et al., 1999).

Overall, comorbidity is greater for illicit drugs than for alcohol, ranging from a low of 44% for alcohol to a high of 79% for opioid dependent subjects (Ball, 2005). Similar results were found in countries such as Germany, the Netherlands, Canada, Mexico and the United States in an international study where the same methods were used in each country (Merinkingas et al., 1998). In the United Kingdom, Bowden-Jones and colleagues (2004) recently conducted a very comprehensive assessment of personality disorders in drug and alcohol treatment populations. They found an overall prevalence of personality disorders in drug abuse services of 37% and of 53% in alcohol abuse treatment services. In drug treatment populations, among those with a disorder, cluster B disorders were most common (emotionally unstable - borderline and impulsive -histrionic and dissocial). In alcohol service population, cluster C disorders (anxious, dependent and anankastic personality disorders) were most common.

Numerous studies have examined the relationship between type of drug and personality pathology. As expected, estimates of rates of comorbidity have shown extreme wide variation. For example, comorbidity in cocaine dependent individuals ranged from 30% to 75% in inpatient samples (Weiss et al., 1993; Kranzler et al., 1994; Fieldman & Woolfolk, 1995). Rounsaville and colleagues (1987) found that 87% of opioid dependent individuals in

treatment met criteria for at least one personality disorder. In a study using a methadone maintenance sample (Haas et al., 1996), anxiety disorder was diagnosed in 55% of opioid addicts and affective disorders in 57,8%. Agosti and colleagues (2002) also reported rates of 73,1% and 47,8%, respectively for anxiety and mood disorders in a U.S. sample of cannabis dependent individuals. Schifano and colleagues (1998) reported that 14% of MDMA users met Diagnostic and Statistical Manual of Mental Disorders-III criteria for an impulse control disorder.

Research has also shown that dependence on multiple drugs is usually associated with higher rates of psychiatric syndromes and a larger variety of comorbid psychopathology (Delong et al., 1993; Kandel et al., 2001). Some studies, for instance, (e.g., DeJong et al., 1993) have reported that 90% of individuals dependent on multiple drugs have diagnosed with personality disorders .

Highest comorbidity of drug dependence has been observed with antisocial personality disorder followed by mood and anxiety disorders (Kandel et al., 2001). For example, antisocial personality disorder has been linked to alcohol and drug dependent individuals, with comorbidity estimates ranging from 15% to 50% (Malow et al., 1989; Nace at al., 1991; DeJong et al., 1993). Borderline personality disorder has also been identified in approximately 13%-34% of alcohol dependent individuals (Skinstad & Swain, 2002).

Overall, investigations have shown that personality traits are related to substance use disorders. Individuals who met the criteria for any substance dependence disorder showed higher scores on disinhibition and negative affectivity than a group with no disorder (Krueger et al., 1996). Similarly, some studies have indicated that alcohol dependent individuals demonstrate greater negative emotionality and impulsivity than non alcohol dependent subjects (Sher & Trull, 1994; Prescott at al., 1997).

The relation between personality traits and personality disorders is an area of growing interest that has been only partially explored by a number of researchers. Some studies have shown that specific personality characteristics are associated with comorbid personality disorders. Scourfield and colleagues (1996), for instance, have examined the relationship between sensation seeking and drug use in subjects with comorbid personality disorders. The authors found that "pure" female drug users had higher thrill and adventure sensation seeking scores than the subjects with comorbid anxiety disorders. In addition, Ball and colleagues (1994) have documented that individuals with high scores in sensation seeking were more likely to report both a lifetime history of family psychopathology and of antisocial personality disorder, attention deficit disorder, and conduct disorder.

However, little research has examined the interactions between certain characteristics of personality and personality disorders in drug abuse. In fact, the study of personality characteristics and personality disorders in drug abusers has evolved in parallel, with not much done on examining normal personality dimension differences in individuals with personality disorders (Ball et al., 1999). One exception is the research conducted by the Yale University School of Medicine (USA) and the University of Bordeaux (France) (Conway et al., 2002). The authors investigated the association between drug abuse, drug of choice, comorbidity and several personality traits, in particular behavioural disinhibition. According to the authors, taking into consideration "the nature of links between personality and substance-use disorders (…) may help to elucidate the nature of links between personality and substance-use disorders" (p. 226). The research assumes that personality disorders that are comorbid with drug dependence and their relation to personality traits may also vary by drug of choice. Findings demonstrate that individuals with substance abuse/dependence scored higher on disihinibition, compared to those without, after controlling for socio-demographic variables and comorbid psychiatric disorders. Importantly, the relation between disinhibition and drug of choice "remained after adjusting for antisocial personality disorder" (p. 231). The authors interpret this finding as indicating that personality traits "serve as pre-existing factors that guide individual's choice of substances" (p. 231).

In a similar way, Flory and colleagues (2002) have explored the substance abuse-personality relationship also taking into consideration symptoms of comorbid psychopathology. The results have shown moderate relations between alcohol and marijuana abuse and antisocial personality disorders. However, "personality remained significantly related to symptoms of substance abuse even after we controlled for its overlap with antisocial symptoms" (p. 1295). According to the authors, these results question the proposition that "antisocial behaviour, rather than personality, leads to alcohol and drug abuse" (p.1295).

4.3 Alcohol and drug - related expectancies

The role of drug use expectancies (also referred as beliefs, perceived functions, outcome expectancies or cognitive motivations), as cognitive mediators of alcohol and drug use have been investigated in the past two decades by a number of researchers. Drug expectancies have been defined as beliefs, both positive and negative, about the effects of drugs on behaviour, mood and emotions. The decision to use alcohol or drugs is thought to be mediated by an individual's beliefs or expectancies about the desirable consequences of using drugs.

Researchers also have posited that expectancies are cognitive mediators that serve to "filter" various social learning influences. However, the prevailing view is that expectancies develop, possibly before experience with drugs (Christiansen et al., 1989; Christiansen & Goldman, 1983; Christiansen et al., 1982;), largely through social learning mechanisms and are mediated by other cognitive dimensions. In fact, some research has demonstrated that drug-related cognitions are formed prior to any significant contact with drugs. Whatever the theoretical explanations of how expectancies may influence alcohol and drug abuse, the literature on expectancies has provided a valuable framework for understanding drug behaviour.

Expectancies about the effects of alcohol appear to be largely negative at age 8-10, with positive expectancies increasing significantly between ages 9 and 10 (Hipwell et al., 2005). Researchers have examined the relative contribution of positive and negative expectancies. While positive and negative expectancies may both predict drug abuse, positive expectancies have consistently been stronger predictors (Neighbors et al., 2003; Noar et al., 2003; Jones et al., 2001; Williams & Clark, 1998; McKee et al., 1998; Wood et al., 1992). Research has also demonstrated relationships between expectancies and alcohol and drug problems (Colder et al., 1997; Wood et al., 1992).

Most of the research on expectancies has been directed toward adolescent and young adult populations and has been mainly focused the use of alcohol (Wood et al., 1992; Williams & Clark, 1998; Anderson et al., 2005). In general, drug and alcohol expectancies have been consistently identified as strong predictors of alcohol and drug abuse and its problem consequences. In the past 20 years a number of longitudinal investigations have contributed to clarify the role of expectations or cognitive motivations in promoting drug abuse. Newcomb and colleagues (1988), for instance, using a follow-up of 10th through 12th graders, identified four specific dimensions of expectancies in an adolescent sample including reducing negative affect, enhancing positive affect and creativity, social cohesion, and addiction. Furthermore, Stacey and colleagues (1991) found that early alcohol expectancies predicted later drug problems and early cannabis expectancies predicted later drug use quantity and frequency.

Some recent research has examined the relationship between personality and drug and alcohol related expectancies. Anderson and colleagues (2005), for instance, found that extraversion significantly predicted alcohol expectancies in fifth grade students thus indicating that extraverted adolescents "had more positive expectancies for drinking, despite having not yet initiated regular alcohol use" (p. 328). However, disinhibition, operationalized by the interaction of neuroticism and

extraversion, was not found positively related with favourable expectancies for alcohol. As so, disinhibition was directly related to drinking behaviour but not to expectancies for alcohol. Contrary to these findings, other research, using college students, has found support for the relationship between disinhibition and alcohol related expectancies (McCarthy et al., 2001).

Stacy and colleagues (1995) have analysed the associations between various personality traits (depression, sensation seeking, social conformity and loneliness) and cognitive motivation (expectancies) in order to test a direct-effect versus a mediational model of cocaine use. The most striking finding was that expectancy constructs had direct effects on cocaine and other drug use showing them to be a more potent predictor of cocaine use than most personality variables. According to the authors, "this finding alone does not rule out the possibility that more distal personality characteristics may affect cocaine use indirectly, mediated by cognitive motivation" (p.664).

5. CONCLUSIONS AND FUTURE DEVELOPMENTS

Psychological drug research has basically proposed trait and cognitive explanations for the prediction of substance use. Within that framework, personality models have often focused on disinhibition, including impulsivity and sensation seeking. Research both on trait explanations and on cognitive processes of drug abuse have shown the predictive utility of these constructs. In addition, many studies have looked at the association between drug dependence and mental illness. This section will now examine some relevant issues and limitations in each identified domain with possible implications for future developments in the drug field from a psychological perspective.

1. Personality trait and expectancy research in the drug field

Although the research in this specific domain has been important in terms of identifying relations between a number of different personality traits and substance use/abuse, there are some limitations of significance. It is evident that terminological problems related with the definition of various personality dimensions and personality traits still exist. For example, different designations are used to define the same basic personality traits, making difficult the task of specifying the exact number and designations of these traits.

It also important to note, that the impact of different personality traits in the initiation and maintenance of drug use is poorly understood. For example, sensation seeking and impulsivity may have a differentiated influence on drug abuse. A high level of sensation seeking may be a predisposing factor to start using drugs at an early age while impulsivity may be more influential for the continuation of drug use and the development of dependence. However, further longitudinal research is needed to test this hypothesis. In addition, there is little or no research that has investigated the relationship between specific personality traits and particular classes of drugs. For example, personality traits among heroin and cocaine abusers have not been clearly distinguished, although some research has shown that both are more impulsive than alcohol abusers.

Moreover, as demonstrated in the present review, most of this research has looked for single personality features. Focusing on single dimensions, in absence of an organized theoretical framework, can only provide an incomplete picture of the current body of knowledge regarding the personality - drug use relation. Thus, little attempts have been made to integrate in an overall structural model the research results concerning the relationship between personality traits and drug use (e.g., Adams et al., 2003).

It also worth noting that these limitations seem to have had a negative impact in terms of our understanding of the overall relationship between personality and drug abuse. Although personality traits are related to drug abuse there is considerable disagreement as how personality and drug abuse are causally related. Some perspectives postulate that drug use predicts and possible change personality rather than vice-versa (Sher & Trull, 1994). According to this view, personality features are a consequence of drug abuse. However the dominant view claims that certain personality characteristics precede the onset of drug abuse, acting as predisposing factors. This perspective is based on empirical evidence showing that personality traits often predate the onset of alcohol or drug dependence, indicating that, at least for some classes of drugs, personality features may have a high predictive value.

However, there has been limited research concerning whether personality factors influence behaviour either directly or indirectly. Some researchers (e.g., Flory et al., 2002) propose that a direct effect may occur in these personality traits that share a biological basis (e.g., impulsivity). Alternatively, the impact of personality traits in drug abuse may be mediated by environmental influences and cognitive variables. Linking personality research with expectancy research could possibly contribute to further illuminate these issues. In a recent study, Mobini and colleagues (2005)

found that individuals with high impulsivity had significantly higher levels of dysfunctional cognitions and sensation seeking.

Clearly, there is a need to test integrated models, incorporating both personality and cognitive constructs, as expectancies, to examine additive and interactive influences of these constructs on drug use/abuse. Whether expectancies mediate personality traits or are merely a "spurious epiphenomena" (Stacy et al., 1995; p. 654) of specific personality characteristics is still an issue open to discussion. The few studies that have taken these issues into account have shown various inconsistencies. Further longitudinal research is then necessary to better characterize the relation between personality and expectancies in the drug field.

2. Personality traits and personality disorders

Although considerable agreement has been reached concerning the relationship between comorbidity and drug dependence, insufficient attention has been paid to the overall issue of the causal relationship between personality pathology and drug abuse (Hartnoll, 2004; Verheul et al., 2000). Thus, although we do know that different psychiatric conditions are highly comorbid with substance abuse, many of the mechanisms by which these influences occur are not yet known.

Indeed, it is not yet well understood whether comorbid conditions start simultaneously or whether one predates the other or even if personality psychopathology and drug use might be linked to a third factor, such as genetic predisposition. The empirical evidence for the self-medication hypothesis or even for the view that chronic drug use may contribute to the development of different types of psychopathology is largely inconclusive.

Finally, the factors that mediate the relationship between personality traits and psychiatric conditions that are highly comorbid with substance abuse have only started to be examined. As demonstrated above, few studies, have for instance, systematically investigated the relationship between sensation seeking or impulsivity and drug use in subjects with different types of psychopathology.

6. REFERENCES

Adams, J. B., Heath, A. J., Young, S. E., Hewitt, J. K., Corley, R. P. & Stallings, M. C. (2003). Relationships between personality and preferred substance and motivations for use among adolescent substance abusers. *The American Journal of Drug and Alcohol Abuse, 3,* 691-712.

Anderson, K. G., Brown, S. A., Paulus, M.P., Schweinsburg, A. & Tapert, S. (2005). Examining personality and alcohol expectancies using functional magnetic resonance imaging (fMRI) with adolescents. *Journal of Studies on Alcohol, 66*, 323-330.

Andrew, M., & Cronin, C. (1997). Two measures of sensation seeking as predictors of alcohol use among high school males. *Personality and Individual Differences, 22*, 393-401.

Agosti, V., Levin, F. & Nunes, E. (2002). Rates of psychiatric comorbidity among U.S. residents with lifetime cannabis dependence. *American Journal of Drug and Alcohol Abuse, 28*, 643-651.

Andrucci, G. L., Archer, R. P., Pancoast, D. L., & Gordon, R. A. (1989). The relationship of MMPI and Sensation Seeking scales to adolescent drug use. *Journal of Personality Assessment, 53*, 253-266.

Allen, T. J., Moeller, F. G., Rhoades, H.M. & Cherek, D.R., (1998). Impulsivity and history of drug dependence. *Drug and Alcohol Dependence, 50*, 137-145.

Alessi, S. M. & Petry, N. M., (2003). Pathological gambling severity is associated with impulsivity in a delay discounting procedure. *Behavioural Process, 64*, 345–354.

Ainslie, G., (1975). Specious reward: A behavioural theory of impulsiveness and impulse control. *Psychological Bulletin, 82,* 463–496.

Ainslie, G.W., (1974). Impulse control in pigeons. *Journal of Experimental Analysis of Behavior, 21*, 485–489.

American Psychiatric Association (1980). Diagnostic and statistical manual of mental disorders (DSM-III). American Psychiatric Association. Washington, DC.

American Psychiatric Association (1987). *Diagnostic and statistical manual of mental disorders* (DSM-III-R), third revised ed. American Psychiatric Association. Washington, DC.

American Psychiatric Association (1994). *Diagnostic and statistical manual of mental disorders,* (DSM-IV). Washington, DC.

American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders,* (DSM-IV-TR). Washington, DC.

Babor, T. F., Hofmann, M., Del Boca, F. K., Hesselbrock, V. M., Meyer, R. E., Dolinsky, Z. S., Rounsaville, B. J. (1992). Types of alcoholics. I: Evidence for an empirically derived typology based on indicators of vulnerability and severity. *Archives of General Psychiatry, 49,* 599-608.

Baker, F., Johnson, M. W., & Bickel, W. K. (2003). Delay discounting in current and never-before cigarette smokers: Similarities and differences across commodity, sign, and magnitude. *Journal of Abnormal Psychology, 112*, 382-392.

Ball, S. A. (2005). Personality traits, problems and disorders: Clinical applications to substance use disorders. *Journal of Research in Personality, 39,* 84-102.

Ball, S. A., Carroll, K. M. & Rounsaville, B. J. (1994). Sensation seeking, substance abuse, and psychopathology in treatment-seeking and community cocaine abusers. *Journal of Consulting and Clinical Psychology, 62,* 1053-1057.

Ball, S. A., Tennen, H., Polling, J., Kranzler, H. & Rounsaville, B. J. (1999). Personality, temperament and character dimensions and the DSM-IV personality disorders in substance abusers. *Journal of Abnormal Psychology, 106*, 354-356.

Banken, J. A., Melchert, T. P & Thomas, V. H. (1999). Substance dependence and personality disorders: Comorbidity and treatment outcome in an inpatient treatment population. *Journal of Studies on Alcohol, 60*, 271, 283.

Bardo, M.T. & Mueller, C.W. Sensation seeking and drug abuse prevention from a biological perspective (1991). In: Donohew, L., Sypher, H.E. & Buroski, W.J. (Eds.), *Persuasive communication and drug abuse prevention.* Hillsdale, NJ: Lawrence Erlbaum Assocs., Inc. (pp. 195-207).

Bardo, M. T.; Donohew, R.L.; Harrington, N. G. (1996). Psychobiology of novelty seeking and drug seeking behavior. *Behavioural Brain Research, 77*, 23-43.

Barnea, Z., Teichman, M., & Rahav, G. (1992). Personality, cognitive, and interpersonal factors in adolescent substance use: A longitudinal test of an integrative model. *Journal of Youth and Adolescence, 21*, 187-201.

Barratt, E. S., Patton, J. H. (1983). Impulsivity: cognitive, behavioural, and psychophysiological correlates. In: Zuckerman, M. (Ed.), *Biological bases of sensation seeking, impulsivity, and anxiety*. Erlbaum, Hillsdale, NJ.

Bates, M. E., Labouvie, E. W. & White H. R. (1986). The effect of sensation seeking needs on alcohol and marijuana use in adolescence. *Bullettin of the Society for Psychology of Addictive Behaviors, 5*, 29-36.

Bates, M. E., White, H. R. & Labouvie, E. (1994). Changes in sensation-seeking needs and drug use. In: Venturelly, P.J. (Ed.), *Drug Use in America: Social, Cultural, and Political Perspectives*. Sudbury, MA: Jones & Bartlett Publishers, Inc. (pp. 67-75).

Benjamin, J., Li, L., Patterson, C., Greenberg, B. D., Murphy, D. L. & Hamer, D. H. (1996). Population and familial association between the D4 dopamine receptor gene and measures of novelty seeking. *Nature Genetics 12*, 81-84.

Bickel, W. K., Odum, A. L., & Madden, G. J. (1999). Impulsivity and cigarette smoking: Delay discounting in current, never, and ex-smokers. *Psychopharmacology, 146*, 447-454.

Bowden-Jones, O., Iqbal, M., Tyrer, P., Seivewright, N., Cooper, S., Judd, A. & Weaver, T. (2004). Prevalence of personality disorder in alcohol and drug services and associated comorbidity. *Addiction, 99*, 1306-1314.

Brocke, B., Beauducel, A., & Tasche, K. G. (1999). Biopsychological bases and behavioural correlates of sensation seeking: Contributions to a multilevel validation. *Personality and Individual Differences, 26*, 1103–1123.

Butler, G. K., & Montgomery, A. M. (2004). Impulsivity, risk taking and recreational ecstasy (MDMA) use. *Drug and Alcohol Dependence, 76*, 55-62.

Caspi, A., Begg, D., Dickson, N., Harrington, H., Langley, J., Moffitt, T. E., Silva, P. A. (1997). Personality differences predict health-risk behaviors in young adulthood: Evidence from a longitudinal study. *Journal of Personality and Social Psychology 73*, 1052-1063.

Christiansen, B. A. & Goldman, M. S. (1983). Alcohol-related expectancies versus demographic/background variables in the prediction of adolescent drinking. *Journal of Consulting and Clinical Psychology, 51*, 249-257.

Christiansen, B. A. & Goldman, M. S. & Inn, A. (1982). Development of alcohol-related expectancies in adolescents: Separating pharmacological from social-learning influences. *Journal of Consulting and Clinical Psychology, 50*, 336-344.

Christiansen, B. A., Smith, G. T., Roehling, P.M. & Goldman, M. S. (1989). Using alcohol expectancies to predict adolescent drinking behavior after one year. *Journal of Consulting and Clinical Psychology, 57*, 93-99.

Cloninger, C. R., Sigvardsson,S.,& Bohman, M. (1988). Childhood personality predicts alcohol abuse in young adults. *Alcoholism: Clinical and Experimental Research*, 12, 494-505.

Cloninger, C. R., Adolfsson, R. & Svrakic, N. M. (1996). Mapping genes for human personality. *Nature Genetics, 12*, 3-4.

Cohen, E. S., & Fromme, K. (2002). Differential determinants of young adult substance use and high-risk sexual behavior. *Journal of Applied Social Psychology, 32,* 1124–1150.

Colder, C. R., Chassin, L., Stice, E. M., & Curran, P. J. (1997). Alcohol expectancies as potential mediators of parent alcoholism effects on the development of adolescent heavy drinking. *Journal of Research on Adolescence, 7*, 349-374.

Cronin, C. (1991). Sensation seeking among mountain climbers, *Personal and Individual Differences, 12*, 653-554.

Conway, K. P., Swendsen, J. D., Rounsaville, B. J., Merikangas, K. R. (2002). Personality, drug of choice, and comorbid psychopathology among substance abusers. *Drug and Alcohol Dependence*, *65*, 225-234

Conway, K. P.; Kane, R. J.; Ball, S. A.; Poling, J. C. & Rounsaville, B. J. (2003). Personality, substance of choice, and polysubstance involvement among substance dependent patients. *Drug and Alcohol Dependence, 71*, 65-75.

Dawe, S., & Loxton, N. J. (2004). The role of impulsivity in the development of substance use and eating disorders. *Neuroscience and Biobehavioural Reviews, 28*, 343-351.

Dawe, S., Gullo, M. & Loxton, N. (2004). Reward drive and rush impulsiveness as dimensions of impulsivity: Implications for substance misuse. *Addictive Behaviors, 29*, 1389-1405.

DeJong, C.A., van den Brink, W., Hartevedt, F.M.& van der Wielen, E.G. (1993). Personality disorders in alcoholics and drug addicts. *Comprehensive Psychiatry, 34*, 87-94.

Desrichard, O. &, Denarie, V. (2005). Sensation seeking and negative affectivity as predictors of risky behaviors: A distinction between occasional versus frequent risk-taking. *Addictive Behaviors, 30*, 1449-1453.

Dom, G., Hulstijn, W. & Sabbe, (2006). Differences in impulsivity and sensation seeking between early-and late-onset alcoholics. *Addictive Behaviors, 31*, 298-308.

Dinn, W. M., Aycicegis, A., & Harris, C. L. (2004). Cigarette smoking in a student sample: Neurocognitive and clinical correlates. *Addictive Behaviors, 29*, 107-126.

Donohew, L., Finn, S. & Christ, W. (1998). The nature of the news revisited: The role of affect, schemas and cognition. In L. Donohew, H. Sypher and T. Higgins (Eds.), *Communication, social cognition and affect*. Lawrence Erlbaum Associates, Hillsdale, NJ, (pp. 195-218).

Donohew, L., Helm, D., Lawrence, P. & Shatzer, M. (1990). Sensation seeking, marijuana use and responses to prevention messages: implications for public health campaigns. In R. Watson (Ed.), *Prevention and treatment of drug and alcohol abuse*. Humana Press: Clifton, NJ (pp. 77-93).

Earleywine, M., & Finn, P. (1991). Sensation seeking explains the relation between behavioural disinhibition and alcohol consumption. *Addictive Behavior, 16*, 123-128.

Ebstein, R.P., Novick, O., Umansky, R., Priel, B., Osher, Y., Blaine, D., Bennett, E.R., Nemanov, L., Katz, M. & Belmarker, R.H. (1996). Dopamine D4 receptor (D4DR) exon III polymorphism associated with the human personality trait of novelty seeking. *Nature Genetics, 12*, 78-80.

Evenden, J.L., (1999). Varieties of impulsivity. *Psychopharmacology 146*, 348-361.

Everett, M. W. & Palmgreen, P. (1995). Influences of sensation seeking, message sensation value, and program context on effectiveness of anti-cocaine public service announcements. *Health Communication, 7*, 225-248.

Forsyth, G. and Hundleby, J. D. (1987). Personality and situation as determinants of desire to drink in young adults, *International Journal of the Addicions, 22*, 653-669.

Franques, P., Auriacombe, M., Piquemal, E.; Verger, M., Brisseau-Gimenez, S., Grabot, D. & Tignol, J. (2003). Sensation seeking as a common factor in opioid dependent subjects and high risk sport practicing subjects. A cross sectional study. *Drug and Alcohol Dependence, 69,* 121-126.

Gerbing, D. W., Ahadi, S.A., Patton, J. H., (1987). Toward a conceptualisation of impulsivity: components across the behavioural and self-report domains. *Multivarariate Behavioural Research, 22*, 357-379.

de Girolamo, G. & Reich, J. H. (1993). *Personality disorders*. Geneva: World Health Organization.

Fieldman, N. P. & Woolfolk, R. L. (1995). Dimensions of self-concept: A comparison of heroin and cocaine addicts. *American Journal of Drug and Alcohol Abuse, 21*, 315-323.

Fisher, L.A., Elias, J.W., Ritz, K., (1998). Predicting relapse to substance abuse as a function of personality dimensions. *Alcohol and Clinical Experimental Research 22*, 1041 -1047.

Flory, K., Lynam, D., Milich, R., Leukefeld, C. & Clayton, R. (2002). The relations among personality, symptoms of alcohol and marijuana abuse, and symptoms of comorbid psychopathology: Results from a community sample. *Experimental and Clinical Psychopharmacology, 10*, 1064-1297.

Haas, N., Huggins, N., Khuder, S., Mclellan, A., Milby, M., Schumaker, J., Sims, M. & Woody, G. (1996). Psychiatric comorbidity: Prevalence in methadone maintenance treatment. *American Journal of Drug and Alcohol Abuse, 22,* 95-102.

Hartnoll, R. (2004). *Drugs and drug dependence: Linking research, policy and practice*. Strasbourg: Council of Europe Publishing.

Hayaki, J.; Stein, M.; Lassor, J.; Herman, D. & Anderson, B. (2005). Adversity among drug users: relationship to impulsivity. *Drug and Alcohol Dependence, 78*, 65-71.

Hipwell, A. E., Loeber, R., Sembower, M. A., Stouthamer-Loeber, M. & White, H. R. (2005). Young girls' expectancies about the effects of alcohol, future intentions and patterns of use. *Journal of Studies on Alcohol, 66*, 630-641.

Hittner, J. B. & Swickert, R. (2005). Sensation seeking and alcohol use. *Addictive Behaviors* (in press).

Horvath, L. S., Milich, R., Lynam, D. Leukefeld, C. & Clayton, R. (2004). Sensation seeking and substance use: A cross-lagged design. *Individual Differences Research, 2*, 173-183.

Hymbaugh, K. & Garrett, J. (1974). Sensation seeking among skydivers. *Perceptual and Motor Skills, 38*,118-123.

Jaffe, L.T. & Archer, R.P., (1987). The prediction of drug use among college students from MMPI, MCMI, and sensation seeking scales. *Journal of Personality Assessment 51*, 243 - 253.

Jaroni, J. L., Wright, S. M., Lerman, C., & Epstein, L. H. (2004). Relationship between education and delay discounting in smokers. *Addictive Behaviors, 29*, 1171-1175.

Jessor, R. & Jessor, S. L. (1977). *Problem behavior and psychosocial development: A longitudinal study of youth*. New York: Academic Press.

Jones, B.T., Corbin, W. & Fromme, K. (2001). A review of expectancy theory and alcohol consumption. *Addiction, 96*, 57-72.

Kandel, D. B.; Huang, F. & Davies, M. (2001). Comorbidity between patterns of substance use dependence and psychiatric syndromes. *Drug and Alcohol Dependence, 64*, 233-241.

Kerr, J.S. (1996). Two myths of addiction: the addictive personality and the issue of free choice. *Human Psychopharmacology, 11*, 9-13.

Kilpatrick, D. G., Sutker, P. B. & Smith, A. D. (1976). Deviant drug and alcohol use: The role of anxiety, sensation seeking, and other personality variables. In: Zuckerman, M. & Spielberger, C.D. (Eds.) *Emotions and Anxiety: New Concepts, Methods, and Applications*, Hillsdale, NJ: Lawrence Erlbaum Assocs., Inc., (pp. 247-278).

Kohn, P. M. & Annis, H. M. (1997). Drug use and four kinds of novelty seeking. *British Journal of Addiction, 72*, 135-142.

Kosten, T. A., Ball, S. A. & Rounsaville, B. J. (1994). A sibling study of sensation seeking and opiate addiction. *Journal of Nervous and Mental Diseases, 182*, 284-289.

Kranzler, H. R., Satel, S. & Apter, A. (1994) Personality disorders and associated features in cocaine-dependent inpatients. *Comprehensive Psychiatry, 35*, 335-340.

Krueger, R. F., Caspi, A., Moffitt, T. E., Silva, P. A. & McGee, R. (1996). Personality traits are differentially linked to mental disorders: A multitrait-multidiagnosis study of an adolescent birth cohort. *Journal of Abnormal Psychology, 105*, 299-312.

Krueger, R. F., Caspi, A., Moffitt, T. E., & Silva, P. A. (1998). The structure and stability of common mental disorders (DSM-III-R): A longitudinal-epidemiological study. *Journal of Abnormal Psychology, 107*, 216-227.

Lane, S. D., Cherek, D. R., Rhoades, H. M., Pietras, C. J. & Tcheremissine, O. V. (2003). Relationships among laboratory and psychometric measures of impulsivity: Implications in substance abuse and dependence. *Addiction Disorders and Their Treatment 2,* 33-40.

Logue, A. W., Pena-Correal, T. E., Rodriguez, T. E. & Kahela, E. (1986). Self-control in adult humans: Variations in positive reinforcer amount and delay. *Journal of Experimental Analysis of Behavior, 46*, 159-173.

Malle, B. F. & Neubauer, A. C., (1991). Impulsivity, reflection, and questionnaire response latencies: No evidence for a broad impulsivity trait. *Personality and Individual Differences 12*, 865-871.

Malow, R. M., West, J. A., Williams, J. L., & Sutker, P. B. (1989). Personality disorders classification and symptoms in cocaine and opioid addicts. *Journal of Consulting and Clinical Psychology, 57*, 765-767.

McCarthy, D. M., Miller, T. L., Smith, G. T. & Smith, J. A. (2001). Disinhibition and expectancy in risk for alcohol use: Comparing black and white college samples. *Journal of Studies on Alcohol 62*, 313-321.

McGue, M., Iacono, W. G., Legrand, L. N. & Elkins, I. (2001). Origins and consequences of age of first drink: II. Familial risk and heritability. *Alcoholism Clinical Experimental Research, 25*, 1166-1173.

McKee, S. A., Hinson, R. E., Wall, A. & Spriel, P. (1998). Alcohol outcome expectancies and coping styles as predictors of alcohol use in young adults. *Addictive Behaviors, 23,* 17-22.

Merinkingas, K. R.; Mehta, R. L.,Molnar, B. E., Walters, E. E. & Swedsen, J. D. (1998). Comorbidity of substance use disorders with mood and anxiety disorders: Results of the International Consortium in Psychiatric Epidemiology. *Addictive Behaviors, 23*, 893-907.

Mitchell, S. H. (1999). Measures of impulsivity in cigarette smokers and non-smokers. *Psychopharmacology, 146*, 455-464.

Mobini, S., Pearce, M., Grant, A., Mills, J. & Yeomans, M. (2005). The relationship between cognitive distortions, impulsivity and sensation seeking in a non-clinical population sample. *Personality and Individual Differences, 40,* 1153-1163.

Moeller, F. G., Barratt, E. S., Dougherty, D. M., Schmitz, J. M. & Schwann, A. C. (2001). Psychiatric aspects of impulsivity. *American Journal of Psychiatry, 158*, 1783-1793.

Nace, E.P., Davis, C.W. & Gaspari, J.P. (1991). Axis II comorbidity in substance abusers. *American Journal of Psychiatry, 148*, 118-120.

Nathan, P.E., (1988). The addictive personality is the behavior of the addict. *Journal of Clinical and Consulting Psychology 56*, 183 -188.

Neighbors, C., Walker, D. & Larimer, M. (2003). Expectancies and evaluations of alcohol effects among college students: Self-determination as a moderator. *Journal of Studies on Alcohol, 64*, 292-300.

Newcomb, M. D., & Bentler, P. M. (1988). *Consequence of Adolescent Drug Use: Impact on the Lives of Young Adults*. Sage, Beverly Hills, CA.

Newcomb, M. D., Chou, C. P., Bentler, P. M., & Huba, G. J. (1988). Cognitive motivations for drug use among adolescents: Longitudinal tests of gender differences and predictors of change in drug use. *Journal of Counseling Psychology, 35*, 426-438.

Noar, S. M., Laforge, R. G., Maddock, J. E. & Wood, M. D. (2003). Rethinking positive and negative aspects of alcohol use: Suggestions from a comparison of alcohol expectancies and decisional balance. *Journal of Studies on Alcohol, 64*, 60-68.

Odum, A.L., Madden, G J., Badger, G. J. & Bickel, W. K., (2000). Needle sharing in opioid-dependent outpatients: Psychological processes underlying risk. *Drug and Alcohol Dependence, 60*, 259-266.

Patton, J. H., Stanford, M. S. & Barratt, E. S. (1995). Factor structure of the Barratt impulsiveness scale. *Journal of Clinical Psychology, 51,* 768-774.

Patkar, A. A., Murray, H. W., Manelli, P., Gottheil, E., Weinstein, S. P., & Vergare, M. J. (2004). Pre-treatment measures of impulsivity, aggression, and sensation seeking are associated with treatment outcome for African-American cocaine-dependent patients. *Journal of Addictive Disorders, 23*, 109-122.

Pedersen, W. (1991). Mental health, sensation seeking, and drug use patterns: A longitudinal study. *British Journal of the Addictions, 86*, 195-204.

Pedersen, W., Clausen, S. E. & Lavik, N. J., (1989). Patterns of drug use and sensation seeking among adolescents in Norway. *Acta Psychiatrica Scandinavia 79*, 386-390.

Petry, N. (2001). Substance abuse, pathological gambling, and impulsiveness. *Drug and Alcohol Dependence, 63*, 29 -38.

Potgieter, J. & Bisschoff, F. (1990). Sensation seeking among medium and low risk sports. *Perceptual and Motor Skills, 71*, 1203-1206.

Potts, R., Martinez, I. G., & Dedmon, A. (1995). Childhood risk taking and injury: Self-report and informant measures. *Journal of Pediatric Psychology, 20* , 5-12.

Poulos, C. & Parker, J.L. (1995). Impulsivity predicts individual susceptibility to high levels of alcohol self-administration. *Behavioural Pharmacology 6*, 810-814.

Prescott, C.A., Neale, M.C., Corey, L.A., & Kendler, K.S. (1997). Predictors of problem drinking and alcohol. dependence in a population-based sample of female twins. *Journal of the Studies of Alcohol 58*, 167-181.

Reynolds, B., Richards, J. B., Horn, K., & Karraker, K. (2004). Delay discounting and probability discounting as related to cigarette smoking status in adults. *Behavioural Processes, 65*, 35-42.

Roberti, J. (2004). A review of behavioural and biological correlates of sensation seeking. *Journal of Research in Personality 38,* 256-279.

Rounsaville, B. J., Weissman, M. M., Kleber, H., & Wilber, C. (1987) Heterogeneity of psychiatric diagnosis in treated opiate addicts. *Archives of General Psychiatry 39*,161-166.

Ross, S.; Dermatis, H., Levounis, P & Galanter, M. (2003). A comparison between dually diagnosed inpatients with and without Axis II comorbidity and the relationship to treatment outcome. *American Journal of Drug and Alcohol Abuse, 29*, 263-275.

Sheier, L. M. (2001). Etiologic studies of adolescent drug: A compendium of data resources and their implications for prevention. *The Journal of Primary Prevention, 22*, 125-168.

Schwartz, R. M., Burkhart, B. R. & Green, B. (1978). Turning on or turning off: Sensation seeking or tension reduction as motivation determinants of alcohol use. *Journal of Consulting and Clinical Psychology, 46*,1144-1145.

Scourfield, J., Stevens, D. E. & Merikangas, K. R. (1996). Substance abuse, comorbidity and sensation seeking: Gender differences. *Comprehensive Psychiatry, 37*, 384-392.

Segal, B. & Singer, J. L. (1976). Daydreaming, drug and alcohol use in college students: a factor analytic study. *Addictive Behaviors, 1*, 227-235.

Sher, K. J., Bartholow, B. D., & Wood, M. D. (2000). Personality and substance use disorders: A prospective study. *Journal of Consulting and Clinical Psychology, 68*, 229-818.

Sher, K. J., & Trull, T. J. (1994). Personality and disinhibitory psychopathology: Alcoholism and antisocial personality disorder. *Journal of Abnormal Psychology, 103*, 92 -102.

Sher, K. J., Walitzer, K. S., Wood, P. K. & Brent, E. D. (1991). Characteristics of children of alcoholics: Putative risk factors, substance use and abuse, and psychopathology. *Journal of Abnormal Psychology, 100*, 427-448.

Simons, J. F., Gaher, R. M., Correia, C. J. & Bush, J. A. (2005). Club drug use among college students. *Addictive Behaviors, 30*, 1619-1624.

Skinstad, A. H. & Swain, A. (2002). Comorbidity in a clinical sample of substance abusers. *American Journal of Drug and Alcohol Abuse, 27*, 45-52

Skinner, M. D., Aubin, Henri-Jean, & Berlin, I. (2004). Impulsivity in smoking, non-smoking, and ex-smoking alcoholics. *Addictive Behaviors, 29*, 973-978.

Swann, A.C., Bjork, J. M., Moeller, F. G. & Dougherty, D. M., (2002). Two models of impulsivity: Relationship to personality traits and psychopathology. *Biological Psychiatry, 51,* 988-994.

Stacy, A. W., Newcomb. M. D. & Bentler, P. M. (1991). Cognitive motivation and problem drug use: A nine-year longitudinal study. *Journal of Abnormal Psychology, 100*, 502-515.

Stacy, A. W., Newcomb, M. D., & Bentler, P. M. (1993). Cognitive motivation and sensation seeking as long-term predictors of drinking problems. *Journal of Social and Clinical Psychology, 11*, 1-21.

Stacy, A. W., Newcomb, M. D., & Bentler, P. M. (1995). Expectancy in mediational models of cocaine use. *Personal and Individual Differences, 19,* 655-667.

Stinson, F. S., Grant, B. F., Dawson, D. A., Ruan, W. J., Huang, B. & Saha, T. (2005). Comorbidity between DSM-IV alcohol and specific drug use disorders in the United States: Results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Drug and Alcohol Dependence, 80*, 105-116.

Teichman, M., Barnea, Z. & Rahav, G. (1989). Sensation seeking, state and trait anxiety and depressive mood in adolescent substance users, *International Journal of the Addicions, 24*, 87-99.

Watson, D., & Clark, L. A. (1993). Behavioural disinhibition versus constraint: A dispositional perspective. In Wegner, D. M., and Pennebaker, J. W. (eds.), *Handbook of mental control*. Prentice Hall, Englewood Cliffs, N.J.

Weiss, R. D., Mirin, S. M., Griffin, M. L., Gunderson, J. G. & Hufford, C. (1993). Personality disorders in cocaine dependence. *Comprehensive Psychiatry, 34*, 145-149.

Weissman, M. M. (1993). The epidemiology of personality disorders: A 1990 update. *Journal of Personality Disorders,1,* 44-62.

Williams, A. & Clark, D. (1998). Alcohol consumption in university students: The role of reasons for drinking, coping strategies, expectancies, and personality traits. *Addictive Behaviors, 23*, 371-378.

Willis, T. A., Windle, M. & Cleary, S. (1998). Temperament and novelty seeking in adolescent substance use: Convergence of dimensions of temperament with constructs from Cloninger's theory. *Personality Processes and Individual Differences, 74,* 387-406.

White, H. R. & Bates, M. E. (1993). Self-attributed consequences of cocaine use. *International Journal of the Addictions, 20*, 187-209.

Whiteside, S. P., & Lynam, D. R. (2003). Understanding the role of impulsivity and externalizing psychopathology in alcohol abuse: Application of the UPPS impulsive behavior scale. *Experimental and Clinical Psychopharmacology, 11*, 210 –217.

Wood, M. D., Nagoshi, C.T. & Dennis, D. A. (1992). Alcohol norms and expectations as predictors of alcohol use and problems in a college student sample. *American Journal of Drug and Alcohol Abuse, 18*, 461-470.

Wolff, M. W. & Kathleen, A. (2002). Personality characteristics as a function of frequency and type of substance use, *Adolescence, 37*, 844-852.

Von Knorring, L., Oreland, L. & Von Knorring, A. L., (1987). Personality traits and platelet MAO activity in alcohol and drug abusing teenage boys. *Acta Psychiatrica Scandinavia 75,* 307 -314.

Verheul, R., Kranzler, H. R., Poling, J., Samuel, H. & Rounsaville, B. J. (2000). Axis I and Axis II disorders in alcoholics and drug addicts: Fact or Artifact. *Journal of Studies on Alcohol, 61*, 101-111.

Zuckerman, M. (1971). Dimensions of sensation seeking. Journal of *Consulting and Clinical Psychology, 36*, 45-52.

Zuckerman, M. (1979). *Sensation seeking: Beyond the optimal level of arousal*. Erlbaum, Hillsdale, NJ.

Zuckerman, M. (1984). Sensation seeking: A comparative approach to a human trait. *Behavior Brain Science, 7*, 413-471.

Zuckerman, M. (1991). *Psychobiology of personality*. Cambridge New York: University Press.

Zuckerman, M. (1994). *Behavioural expressions and biosocial bases of sensation seeking*. New York: Cambridge University Press.

Zuckerman, M., Eysenck, S., & Eysenck, H. J. (1978). Sensation seeking in England and America: Cross-cultural, age, and sex comparisons. *Journal of Consulting and Clinical Psychology, 46*, 139–149.

Zuckerman, M., Bone, R. N., Neary, R., Mangelsdorff, D., & Brustman, B. (1972). What is the sensation seeker? Personality trait and experience correlates of the Sensation Seeking Scales. *Journal of Consulting and Clinical Psychology, 39*, 308–321.