

Designing Prevention Programs for Sensation Seeking Adolescents

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In their ancient past, humans learned to engage in the sometimes risky behavior of investigating novel objects in their environments, such as those that were possibly threatening or those which offered new sources of food or other reward, presumably as a means of survival. We call the propensity to seek out novelty, sensation seeking.

Today, an emerging body of research from both the biological and behavioral sciences suggests that understanding differences among adolescents in their propensity to seek out novel sensations offers a path to greater understanding of much drug use -- particularly among adolescents -- and clues on how to reach many of those most at risk for drug abuse with more effective prevention programs. This research draws on a long line of work by Marvin Zuckerman on sensation seeking, which he defines as a trait involving "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" (p. 27).

Individuals at highest risk tend to be those who are most likely to be novelty seekers or sensation seekers and it is these individuals who are the principal targets of some recent tests of a different kind of intervention program. This program is aimed at the highest seekers of novelty and does not assume that all individuals will engage in a decision-making process that is "rational."

In this chapter we bring together two complementary lines of research. One line of research is the result of studies conducted on laboratory animals. The second line of research was conducted on humans who were volunteer subjects in a variety of social science experiments. The value of combining these two kinds of research is that we can learn different things from studies conducted on laboratory animals and humans. Putting what we have learned from both types of studies together provides a wealth of information that has given us key insights into how programs can be more effective at accomplishing the goal of drug prevention. This chapter describes some of the background for drug abuse interventions. It draws upon this body of convergent research from a wide range of disciplines and some of the ways it has been employed.

The Biological Need for Novelty

Recent research that has examined how the brains of animals respond when they are given controlled doses of drugs has allowed us to learn not only where drugs act in the brain, but also how the process of drug ingestion actually works. Understanding how drugs work in the brain has given us several important clues. We have suggested that neurobiological responses to novelty-seeking and drug-seeking behaviors support the possibility that if we can provide novel or high sensation stimulation we may actually be able to provide a substitute for drug reward.

Drug use is thought to follow the same "laws" of psychology as any other behavior. Drug-taking may occur for at least two different reasons. The first reason, not to be

underestimated, is that drugs may cause intensely pleasurable feelings. These pleasurable feelings may be especially dramatic when the drug is first used, before any significant tolerance develops. The fact that the drug-taking behavior is followed immediately by the pleasurable drug rush, a very strong positive reinforcement, makes it more likely that the drug-taking behavior will be repeated.

Additionally, drug-taking may provide an escape from negative feelings. These negative feelings may include depressive symptoms, low self-esteem, and feelings of detachment caused by a weak, undependable family and social network. To cope with these preexisting problems, adolescents may turn to drugs as a remedy in the same way a person who suffers from allergies will turn to antihistamines. In its most radical form, this notion is referred to as the “self-medication” hypothesis. That is, drug-taking may be reinforcing because it effectively removes an aversive or painful pre-existing condition.

A considerable amount of research effort has been expended on identifying the brain mechanisms that are responsible for the positive and negative reinforcing effects of drugs. What we have learned from these studies thus far is that there is a set of neural circuits in the brain that respond to the presence of virtually all drugs of abuse. While this circuitry is quite complex and not yet fully mapped, we do know that one neural element, the mesolimbic dopamine reward pathway, which is thought to be responsible for producing reinforcement in the brain when drugs are used, is especially important. This pathway in the brain exists in every mammal that has ever been studied, including humans. When this system is activated artificially by electrical stimulation in laboratory animals, it causes a profound addiction to the stimulation. In neurosurgical case studies with humans, electrical stimulation of this pathway has been reported to produce an intense pleasurable feeling, greater than any natural source of pleasure patients have previously experienced. Drugs are thought to be pleasurable because they release the neurotransmitter dopamine in this pathway. In a very real sense, this pathway is the pleasure center of the brain. When it is stimulated, we feel pleasure.

Of course, the mesolimbic dopamine pathway does not exist so that we will be inclined to enjoy and abuse drugs. Instead, this system is the body’s natural signal to inform us about which stimuli in our environment are important for our survival. We eat because it tastes good, it gives us pleasure, and removes our aversive state of hunger. The same holds true for water consumption, sexual behavior, and engaging in other survival-oriented primitive behaviors. These behaviors are perceived as pleasurable and are reinforcing because they result in an activation of the mesolimbic dopamine pathway. We cannot survive without this pathway. Since each of us has this pleasure pathway, and since drugs activate the pathway, we are all, at least to some extent, susceptible to the positive reinforcing effects of drugs.

Within this biological context, it is important to recognize that many stimuli are capable of activating the pleasure system of the brain. These stimuli can be quite varied, and may involve a host of healthy alternatives such as travel, sports, hobbies, movies and other challenging events. While these types of stimuli appear to promote a healthy lifestyle, it should be pointed out that over reliance on any one of these stimuli can be detrimental.

Take the example of Tom, an adolescent who collects baseball cards. On the surface, it seems like card collecting is a healthy behavior that should be promoted. But what if the card collecting becomes addictive? Suppose, for example, that Tom begins skipping his homework to shop at the local collector store. Then he steals money from his mother’s drawer to buy an especially rare card. Then he loses contact with a group of friends who get tired of him talking about his card collection. Is this overstimulation of the mesolimbic dopamine system? Probably not, but it is a case of addictive behavior that is reminiscent of the signs of drug addiction, including spending money, creating problems in school, and losing social

connections. Just as may occur with drug abusers, Tom has become over reliant on a narrow set of reinforcers.

Findings from Laboratory Research

Researchers are beginning to understand how non-drug alternative reinforcers may serve as potent deterrents to drug use and abuse. Much of this work involves controlled laboratory studies using either laboratory animals or human volunteers. For ethical reasons, the human studies are conducted only with people who currently use drugs and are not seeking or would like to seek drug abuse treatment. These subjects are healthy from a medical standpoint (that is, they have no heart problems, etc.) and are never exposed to a drug they have never used. Results from these studies have revealed that many types of reinforcing stimuli will reduce drug self-administration. For example, work conducted by Marilyn Carroll at the University of Minnesota has shown that laboratory animals will reduce their intake of heroin and cocaine if they are given a choice between a sweet drink and the drug. Similar results are obtained when humans are given a choice between self-administering a drug or a non-drug reinforcer such as food or money. When the drug is subsequently made available without any alternative reinforcers, drug intake returns to high levels. Thus, non-drug reinforcers are able to reduce drug self-administration, at least temporarily.

Not only do known positive reinforcers such as food and money decrease drug-self-administration, highly novel stimulus events may also be effective. In our laboratory research, we have examined rats who prefer a novel environment over a familiar one. We have learned how to chemically block the mesolimbic dopamine pathway with some experimental drugs. We have found that when we do this we can reverse these rats' novelty-seeking tendencies. Essentially, novelty seeking rats become very domestic, stay at home individuals when the possibility of reinforcement for exploration is eliminated.

Our work has also shown that when rats first enter a compartment they have never seen before, there is a rapid release of dopamine into the mesolimbic system. This effect produced by novelty is similar to the dopamine release that occurs when rats are injected with amphetamine. Importantly, there is no dopamine release when the rat enters a familiar stimulus compartment. In a sense then, biology prepares and perhaps predisposes us to become excited or aroused when we approach novel stimuli, but not familiar stimuli.

Findings from Research with Humans

These basic findings regarding preferences for novelty can also be demonstrated in humans across the lifespan. At three months of age, infants show a strong preference for novel visual stimuli over familiar stimuli. This is demonstrated by giving them a choice to view two different computer screens, one that contains a novel stimulus and one that does not. Infants spend more time attending to the novel screen. Later in life, novel stimuli continue to be preferred over familiar stimuli. Perhaps one reason teens seem to get bored easily has to do with this propensity to need novelty. Have you ever been with someone who likes to flip television channels with a remote control? Highly novel stimulus events may be preferred because they have a rewarding quality due to activation of the mesolimbic dopamine reward pathway.

In support of this idea, biomedical researchers at the Imperial College School of Medicine in London recently assessed the dopamine activity in the brain of human male volunteers playing a highly novel video game. The game involved using a computer mouse to move a tank through a treacherous battlefield. The object of the game was to destroy enemy tanks and collect as many field flags as possible, with the difficulty level of the game increasing

as the game went on. The overall performance of subjects was rewarded with money. During performance on the video game, brain activity was monitored using positron emission tomography (PET) scanning. This is a method of looking at activity in the brain by tracking the presence of chemicals that have been coded with low-level radioisotopes that are injected into the bloodstream. Data from the PET scan revealed that dopamine levels were increased during the video game compared to baseline levels and this increase was correlated with the difficulty of the game. That is, when the game was the most difficult, more dopamine was found in the brain. Importantly, the increase in dopamine was greatest in the brain region corresponding to the mesolimbic dopamine reward pathway. Thus, it appears that the dopamine release was responsible for the positive affect associated with the video game.

This research has led us to conclude that there may be positive news on the horizon for drug abuse prevention programs in adolescents. Our work and the work of others has shown that a variety of different reinforcing stimuli are capable of activating the mesolimbic dopamine reward pathway. Drugs represent only one of many different stimulus events that activate this natural reinforcement system. It is important for us to provide the means by which children and adolescents are allowed and actively encouraged to pursue various non-drug reinforcers, particularly those reinforcers that are socially acceptable and incompatible with risky behaviors that have negative health consequences. As a salient example, one cannot be running a marathon race and smoking a cigarette. By engaging in alternative behaviors that are healthy, one is establishing a protection against drug use. As adults and teachers, we are challenged to teach this ideal to our children.

The Challenge of Developing Effective Programs

Think of all the unique problems that adolescents face for the first time. Learning to become an independent adult presents a host of issues related to joining peer groups, making career choices, and selecting a mate. Adolescents begin to search for an answer to the question, "Who am I?" This is a developmental period during which many new options are on the horizon and choices need to be made.

One of the choices facing adolescents is whether or not to use drugs. Selecting to use drugs can be a one-time experiment that is never repeated or is only repeated on rare occasions, or it may be the gateway experience that begins the downward spiral of drug addiction. Researchers in the field of drug abuse have begun to identify some of the risk factors that determine which adolescents will choose to use drugs and which individuals are most susceptible to be sucked into the downward spiral of addiction.

Preventing adolescents from entering the downward spiral is difficult, however, because it is unlikely that the availability of drugs will ever be eradicated in our modern, open society. Adolescents may forever be faced with the temptation to use drugs. We may not be able to prevent all drug use by eliminating its availability. However, we may be able to prevent an increase in the number of adolescents who move into the downward spiral. At least two lines of defense are needed. The first is to reduce the number of individuals who choose to use drugs for the first time. The second is to intervene with those who are already using but have not progressed far in the downward spiral. Prevention efforts designed for adolescents who have not yet initiated drug use may be quite different from those that target adolescents who have initiated drug use.

Take cigarette smoking as an example. Research indicates that the highest rate of initiation of cigarette smoking occurs between 12-17 years of age, with about 1 in 10 in this age group picking up a daily cigarette habit. The rate of first-time use and daily use begins to decline between 18-25 years of age. Beyond the age of 26, only about 1 in 1000 nonsmokers

will initiate smoking. In other words, vulnerability to cigarette smoking is not a life-long threat, but a threat that is most intense during a relatively short, but important, period of our overall lifespan.

Prevention efforts during this critical developmental period must match the intensity of the problem, targeting both nonusers before they enter this period and users who have not yet become addicted. Since prevention programs designed for nonusers may be completely ineffective among adolescents who have initiated drug use, it is critical that the development of any prevention program defines the problem and target population. Are we trying to prevent first use or chronic use among those who have already initiated use? While some intervention strategies may be useful among both populations, many will not. For example, efforts to train peer group resistance may be effective in nonusers, but not in users who have already become members of a drug-using peer group. Thus, the notion that “one size fits all” does not apply to drug abuse prevention.

One thing that should be clear is that there is no magical formula that guarantees a successful prevention effort. At present, the overwhelming number of controlled laboratory- and field-based studies that show evidence for effective prevention interventions show only relatively modest effects. While statistically significant, and therefore scientifically valid, the impact of these studies is not particularly impressive when one realizes that only a minority of individuals seems to benefit from these programs. The fact that many adolescents do not respond to prevention messages leads us to conclude that improvements and fresh ideas in the field are sorely needed.

So what do we have to offer at the present time? We tend to emphasize what choices adolescents should not make. That is, we say “just don’t use drugs.” What we should be emphasizing, however, is that adolescents have choices or alternatives. But what alternatives are we suggesting? What do we want adolescents to say “yes” to? Are we promoting and reinforcing healthy alternatives, especially those that are not consistent with using drugs?

A fundamental assumption that we make is that drug use occurs in a predictable manner. It is not a random process that has an equal probability of striking any one of us. Rather, it is process that begins well before the first drug experience, with some individuals being at greater risk for drug use and abuse than others. This assumption implies that we should be able to identify antecedent or preexisting factors early in life. Such identified factors include a family history of drug abuse, weakened parental attachments, sexual or physical abuse, and poor performance in school. These factors are thought to be linked to both genetic and environmental variables, although the degree of influence exerted by these variables is not known currently.

Prevention Programs That Accommodate Sensation Seeking Tendencies

When we consider the many accomplishments humans have been able to achieve – the great music, art, literature, inventions, and advanced forms of government – it is easy to assume they must be highly rational creatures and to overlook fundamental biological constraints affecting their behaviors, as discussed above. It is sometimes easy to forget that while humans are more intelligent than other creatures on the planet, they are still subject to the same forces of nature.

The fact that individuals differ on their apparent need for novelty is important for prevention. As noted earlier, individuals who are high sensation seekers are far more likely to engage in risky behaviors. Adolescents who are high sensation seekers tend to start using drugs earlier than other persons, use more drugs than others, and engage in other risky

behaviors such as having multiple sexual partners or using alcohol or drugs before sex. In general, there are relatively small differences in these behaviors between males and females.

If we are to design more effective messages and interventions, we need to take into account these biological tugs and constraints and find ways to use them to our advantage. This is particularly true for attracting and holding attention of intended audiences and persuading them to engage in more positive behaviors. Information that appeals to individuals' sense of reason may not be persuasive to those who primarily pay attention to things that satisfy their need for novelty and stimulation.

In fact, individuals often are not paying particular attention to anything. Instead, they are operating at a low level of awareness of what is going on about them, which some writers such as psychologist Ellen Langer have described as operating on "automatic pilot." While in this state, the guidance of their systems may be left to over learned and familiar routines or to emotions of which they are not aware. Decisions to attend or not attend to a message are left to things which vaguely feel good. Much of the time when we are engaging in routine, although possibly complex behaviors, such as driving home from work or choosing what we will watch on television, guidance of our systems appears to be left more to routines that are over learned and familiar, or to affect rather than cognition. Even driving home from work, a somewhat complicated task involving steering in the correct lane, observing traffic signals, and making turns often is accomplished without the drivers being aware of what they are doing. Instead, they may engage in conversation with passengers or merely daydream all the way home. It is only when something unexpected intrudes on the environment, like a siren or flashing light of an emergency vehicle, that they return to full awareness of what is taking place around them.

It should be noted, then, that it is something out of the ordinary, something providing novelty or sensation, which attracts attention. Our needs for novelty and sensation appear to affect the initial alerting process, making it possible for higher level processing of realistic persuasive appeals to take place. In other words, when novel or stimulating events occur, they are likely to encourage a shift in attention to that event. Without an attention-getting element, messages may not be attended to.

Although high sensation seekers are more likely to become involved in risky situations, how they make decisions also affects the likelihood that they will engage in risky and potentially harmful activities. Those who are most impulsive are the most likely to move ahead without planning, whereas those who are more rational in their decision-making tend to be more conscientious of consequences. Thus, while higher sensation seekers tend to get involved in riskier situations, some are open to information warning them of the dangers of engaging in the behaviors and are more likely to heed this information. These persons perhaps should be the principal targets for prevention efforts since the payoff with them is likely to be higher than with high sensation seekers who cannot pay attention to and process information about risk even when it is presented in a format that captures their attention.

In research on human attention to persuasive messages about drug use, we have found that individuals with higher needs for novelty and sensation are more attracted to messages which are: (1) novel, creative, or unusual; (2) complex; (3) intense, emotionally powerful, or physically arousing; (4) graphic or explicit; (5) ambiguous in terms of meaning or intent; (6) unconventional; (7) fast-paced; or (8) suspenseful. Research conducted with humans in controlled laboratory settings as well as in real life settings has shown that messages with "high sensation value," those which possess higher levels of several of the attributes described here, are most effective with this prime target audience. This is true both when the messages

are presented in the form of televised public service announcements or in classroom instruction, such as that which involves considerable individual involvement.

For example, in a classroom intervention designed to prevent high-risk sexual behaviors among high school students, we introduced greater novelty into the instruction by having students do role plays that were built around a popular talk show. The role plays were specifically created to be involving for high sensation seekers. They were emotionally intense, fast paced, and they allowed participants to deal with ambiguous social situations. Unconventional responses to questions were encouraged and tolerated. The role plays were videotaped and played back by a student videographer. To develop the materials for these types of programs, we assemble groups of students who are identified as high sensation seekers on a questionnaire. The materials are pilot tested for their novelty and attention-attracting ability with this group of students before they are used in a large scale campaign. Even though we have learned a great deal about the kinds of things high sensation seekers respond to, our intuition is not always correct and it is best to use pilot testing to identify what appeals to this type of student.

Other researchers have also supported the notion that interventions should be tailored to meet the biological and personality characteristics of adolescents. Avshalom Caspi and his associates have described the role of a “risky personality” type in health behaviors and the importance of designing programs specifically to reach individuals on the basis of their different needs. They found that different types of individuals may attend to, comprehend, accept, and retain different types of messages. They proposed tailoring prevention programs to target the motivations, attitudes, and feelings of the individuals who were the focus of the intervention. This recommendation is consistent with findings from research on communication and health campaigns which have established that interventions designed to meet higher needs for novelty and sensation considerably advance our ability to capture the attention of target individuals likely to engage in health-risk behaviors, enhance information processing, and motivate attitude and behavior change.

This is particularly true when we design and carry out interventions that are designed to change health behaviors, such as drug use. These involve either implicit or explicit assumptions about the nature of human beings which guide our decisions about what we think will attract and hold attention and lead to desired health behaviors. Interventions that assume individuals are rational decision-makers have a checkered history. Vicki Freimuth of the Centers for Disease Control has argued that the assumption that human beings are rational decision-makers has led to disappointing results in the effort to change HIV-preventive behaviors. She contends that “most adolescents, and many adults, do not seem to approach the AIDS issue from such a logical perspective.”

Others agree. Changing human behavior is a far more challenging task than we might think. Individuals differ widely not only on what they have learned from their environments while growing up, but also in genetic differences inherited from their ancestors. Individuals differ considerably in their need for novelty and sensations. Some of us inherit DNA sequences which make us more pleasurable excited by novelty and sensation. Others seem to have much less need for novelty; indeed, there are some for whom novelty is aversive. Ultimately, differences in our need for novelty are biologically expressed through the mesolimbic dopamine pathway, which is believed to be responsible for producing reinforcement.

Support for the effectiveness of tailoring messages to meet the psychological needs of high sensation seekers has been found in a number of other studies, both in gaining the attention of risk-takers and in changing their behaviors. In one of the early studies the appeal of the materials to intended target audiences was tested. This involved a television campaign

featuring high-sensation-value messages embedded in similarly high-sensation programs. Viewers were invited to call into a hot line to learn about alternative activities that might appeal to high-sensation seekers, but not specifically labeled as such. We found that 72% of callers to the hotline were high sensation seekers.

Various types of persuasive appeals have been tested that have incorporated elements that were intended to attract the attention of sensation seekers. These have included messages describing exciting but safer alternatives to drug use as well as mild but realistic fear appeals. Both media-based and classroom-based interventions which have been designed for those most likely to seek novelty and sensation -- the higher risk takers -- have demonstrated substantial reductions in risky health behaviors, including drug use.

Conclusion

There are two aspects of novelty that are relevant to designing prevention interventions. Perhaps most important is the need to develop activities that grab and hold the attention of risk-takers. This group of students has traditionally been a challenge for teachers to reach, particularly when the instruction focuses on learning facts and concepts. Without this essential ingredient, intervention messages are less likely to be attended to or processed by those we most want to reach.

The second aspect of novelty relates to the issue of providing attractive alternatives to the drug experience or other risky behaviors. It is our view that if the need for activation of the mesolimbic reward pathway is not met through socially acceptable stimuli, it will be satisfied in a less acceptable way through other stimuli, including some that can pose significant health risks. The challenge for those designing prevention interventions is to find ways to teach adolescents to engage in healthy behaviors which are exciting and interesting.

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