

## **Testimony**

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Thank you for allowing science to have an important role in this discussion. I am Dr. Glen Hanson, the Acting Director of the National Institute on Drug Abuse (NIDA), a component of the National Institutes of Health. As the World's leading supporter of research on the health aspects of all drugs of abuse, NIDA's research has taught us much about what drugs can do to the brain and how best to use science to approach the complex problems of drug abuse and addiction.

My comments today will focus on what science has revealed about some of the stimulants and opiates that are to be addressed during this public hearing. Although the stimulant cocaine will be the focus of my attention today, I will also provide some brief comments for the record about methamphetamine and heroin.

Research supported by NIDA has found cocaine to be a powerfully addictive stimulant that directly affects the brain. Like other Central Nervous System (CNS) stimulants, such as nicotine, amphetamine and methamphetamine, the drug increases levels of the neurotransmitter dopamine and produces alertness and heightens energy. Heroin, on the other hand, belongs to a class of drugs known as opioids which were developed because of their pain relieving properties. This group of drugs tends to cause relaxation and CNS depression.

Stimulants, such as cocaine and methamphetamine, continue to be dominant drugs of abuse in this country, despite the known detrimental consequences. Although marijuana remains the most commonly used illicit drug in the country, according to the Substance Abuse and Mental Health Services Administration's National Household Survey on Drug Abuse (NHSDA) 1.2 million Americans were current cocaine users in 2000. This represents 0.5 percent of the population aged 12 and older. Although changes to the survey limit our ability to make trend comparisons, this figure of 0.5 percent for 2000 is well below the estimate in 1985, when 3.0 percent of the population 12 and older reported current use of cocaine. The estimated number of current crack users in 2000 was 265,000 (0.1 percent of the population). Crack was first added to the NHSDA in 1988 and over successive years of the survey, estimates of past month use of the substance have never exceeded 0.3 percent of the population 12 and older.

Two of the monitoring mechanisms that NIDA supports, the Community Epidemiology Work Group, a network of epidemiologists and researchers from 21 U.S. metropolitan areas who monitor community-level trends in drug use and abuse, and the Monitoring the Future (MTF) study, which provides data about high school drug use trends, have detected declines in recent years. The MTF Reports that cocaine use, including both cocaine powder and crack, decreased from 2000 to 2001 among 10th graders. Lifetime use of cocaine in any form declined from 6.9 percent to 5.7 percent in this group, lifetime use of crack decreased from 3.7 percent to 3.1 percent, and past year use of cocaine powder declined from 3.8 percent to 3.0 percent. This follows declines in cocaine use among 12<sup>th</sup> graders between 1999 and 2000 and reductions in the use of crack among 8<sup>th</sup> graders between 1998 and 1999.

There also appears to be a decline in the number of people admitted for treatment for cocaine addiction, according to Treatment Episode Data Set (TEDS). Primary cocaine admissions have decreased from approximately 292,000 in 1994 (18 percent of all admissions reported that year) to around 228,000 (14 percent) in 1999. Smoked cocaine (crack) represented 73 percent of all primary cocaine admissions in 1999, a proportion that has remained stable over the five-year period.

## The Pharmacology of the Two Forms of Cocaine

There are basically two chemical forms of cocaine: the hydrochloride salt and the "freebase." The hydrochloride salt, or powdered form of cocaine, dissolves in water and, when abused, can be administered intravenously (by vein) or intranasally (in the nose). Freebase refers to a substance prepared by neutralizing cocaine hydrochloride with an alkaline substance to form a volatile form of cocaine that is smokable.

“Crack” is the street name given to the freebase form of cocaine that has been processed from the powdered cocaine hydrochloride form to a smokable substance. Because crack is smoked, the user experiences a rapid, intense high. This rather immediate, euphoric effect is one of the reasons that crack became enormously popular in the mid-1980s.

Cocaine, in any form, produces the same effects once it reaches the brain. It produces similar physiological and psychological effects, but the onset, intensity and duration of its effects are related directly to the method of use and how rapidly cocaine enters the brain. The difference in the ways that powdered cocaine and crack are prepared have a huge impact on how they are introduced into the body. The principal routes of administration for cocaine are oral, intranasal, intravenous, and inhalation (**SEE GRAPHIC**)

Oral absorption is the slowest form of administration exerting an effect within 45-60 minutes. It passes through the digestive tract until the drug reaches the stomach and intestine where they are absorbed into the bloodstream.

Intranasal use, or snorting, is the process of inhaling cocaine powder through the nostrils, where it is absorbed into the blood stream through the nasal tissues. The onset of activity after intranasal administration is within 3-5 minutes and the blood level peaks at 10-20 minutes fading in 45-60 minutes.

Intravenous use, or injection, introduces the drug directly into the bloodstream and heightens the intensity of its effects because it reaches the brain faster than oral administration.

The onset of the IV cocaine “rush” is within 30-45 seconds and the drug’s effects last for 10-20 minutes.

Cocaine inhalation became popular because it produces the quickest and highest peak blood levels in the brain without the risks attendant to IV use such as exposure to HIV from contaminated needles. Inhalation or smoking involves the inhalation of cocaine vapor or smoke into the lungs, where absorption into the bloodstream is as rapid as by injection. It is delivered to the pulmonary vascular bed and is pumped by the heart directly into the brain. It requires only 8-10 seconds until the user experiences the “high.”

Repeated cocaine use by any route of administration can produce addiction and other adverse health consequences.

### **Acute Effects of Cocaine**

Cocaine's stimulant effects appear almost immediately after a single dose, and disappear within a few minutes or hours. Taken in small amounts (up to 100 mg), cocaine usually makes the user feel euphoric, energetic, talkative, and mentally alert, especially to the sensations of sight, sound, and touch. It can also temporarily decrease the perceived need for food and sleep. Some users find that the drug helps them to perform simple physical and intellectual tasks more quickly, while others can experience the opposite effect.

The short-term physiological effects of cocaine include constricted blood vessels; dilated pupils; and increased temperature, heart rate, and blood pressure. Large amounts (several hundred milligrams or more) intensify the user's high, but may also lead to bizarre, erratic, psychotic and even violent behavior. These users may experience tremors, vertigo, muscle twitches, paranoia, or, with repeated doses, a toxic reaction closely resembling amphetamine poisoning. Some users of cocaine report feelings of restlessness, irritability, and anxiety. In rare instances, sudden death can occur on the first use of cocaine or unexpectedly thereafter.

Cocaine-related deaths are often a result of cardiac arrest or seizures followed by respiratory arrest.

### **Medical Consequences of Cocaine**

There are significant medical complications associated with cocaine use. Some of the most frequent complications are cardiovascular effects, including disturbances in heart rhythm and heart attacks; such respiratory effects as chest pain and respiratory failure; neurological effects, including strokes, seizure, and headaches; and gastrointestinal complications, including abdominal pain and nausea. Different routes of cocaine administration can produce different adverse effects.

Research has revealed a potentially dangerous interaction between cocaine and alcohol. Taken in combination, the two drugs are converted by the body to cocaethylene. Cocaethylene has a longer duration of action in the brain and is more toxic than either drug alone.

Cocaine abusers, especially those who inject, are also at increased risk for contracting such infectious diseases as human immunodeficiency virus (HIV/AIDS) and hepatitis. Use and abuse of illicit drugs, including crack cocaine, is one of the leading risk factors for new cases of HIV. Drug abuse-related spread of HIV can result from direct transmission of the virus through the sharing of contaminated needles and paraphernalia among injecting drug users or through other high risk drug using or sexual behaviors. It can also result from indirect transmission, such as an HIV-infected mother transmitting the virus perinatally to her child. This is particularly alarming, given that more than 60 percent of new AIDS cases are women. Research has also shown that drug use can interfere with judgement about risk-taking behavior, and can potentially lead to reduced precautions about having sex, the sharing of needles and injection paraphernalia, and the trading of sex for drugs, by both men and women. Additionally, hepatitis C has spread rapidly among injection drug users; studies indicate infection rates of 65 to 90 percent in populations of intravenous drug users. New cases of infection are associated with high frequency cocaine injection and needle sharing.

## **Prenatal Exposure to Drugs of Abuse**

NIDA estimates that about 5.5 percent, or 221,000 women, used an illicit drug at least once during pregnancy, and thus 221,000 babies were born drug exposed. Cocaine was used during pregnancy by 1.1 percent or 45,000 women.

Babies born to mothers who abused drugs during pregnancy often are prematurely delivered, have low birth weights, smaller head circumferences, and are often shorter in length. Estimating the full extent of the consequences of maternal drug abuse is difficult, and determining the specific hazard of a particular drug to the fetus and newborn is even more problematic given that most drug users use more than one substance. Factors such as the amount and number of all drugs used, inadequate prenatal care, socio-economic status, poor maternal nutrition, other health problems, and exposure to sexually transmitted diseases are just some examples of why it is difficult to determine the exact effects of prenatal drug exposure. Sorting out these confounding factors is extremely difficult. This is one of the reasons why we must be cautious in drawing causal relationships in this area, especially with a drug like cocaine.

Drug use during pregnancy, particularly the use of cocaine, has received significant attention in recent years as a serious threat to public health. Through the use of sophisticated instruments and approaches, researchers have found the effects not to be as devastating as originally believed, especially for children up to six years of age. There does appear to be an association between prenatal cocaine exposure and some developmental outcomes (e.g. attention and emotional regulation) that needs to be further explored. More research is needed to understand this relationship and to determine if there are any other subtle, not so subtle, short or long-term outcomes that can be attributed to prenatal cocaine exposure.

## **Drugs and Violence**

There is very little research on the role that drugs of abuse, such as stimulants like cocaine or amphetamine actually play in violence. Research has not been able to validate a causal link between drug use and violence. There appears to be no one single drugs-crime relationship. Rather there are drugs-crime relationships, most of which are complex and difficult to sort out.

Violence that is associated with drug use, can be thought of in three categories. The violence can be psychopharmacologically induced, referring to how people may react to certain drugs: it can be economic compulsive, meaning the individuals get aggressive or violent to get drugs; or it can be more systemic, where the violence results from living in the drug culture.

There does appear to be a correlation between youth illicit drug use and violence as reported by SAMHSA. According to the 1999 NHSDA, youths who participated in violent behaviors during the past year were more likely to use alcohol and illicit drugs than youths who did not participate in violent behaviors during this time period. /For example, 18 percent of youths who had participated in a serious fight at school or work during the past year reported past month use of illicit drugs compared with 7 percent of youths who had not participated in a serious fight at school or work during the past year.

## **Methamphetamine**

Methamphetamine, like cocaine and crack, is a powerfully addictive stimulant that dramatically affects the central nervous system. The drug is made easily in clandestine laboratories with relatively inexpensive over-the-counter ingredients. Methamphetamine's chemical structure is similar to that of amphetamine. Like amphetamine, it causes increased activity, decreased appetite, and a general sense of well-being. The effects of methamphetamine can last 6 to 8 hours typically longer than the effects of the cocaine. After the initial "rush," there is usually a state of high agitation that in some individuals can lead to dangerous behavior.

## **Heroin**

Heroin belongs to a completely different category of drug than stimulants such as methamphetamine, amphetamine, crack and cocaine. Heroin is both the most frequently abused and the most rapidly acting of the opiates. It is processed from morphine, the naturally occurring substance extracted from the seedpod of certain varieties of poppy plants. Because of its chemical structure heroin is able to very rapidly enter the brain where it is actually converted into morphine. In the brain, morphine attaches to the natural opioid receptors (natural targets of endorphins) where it can initiate its multiple physiological effects, including pain reduction, depression of heart rate and the slowing of respiration. It is usually sold as a white or brownish powder, or in some regions of the country as a black sticky substance known on the street as “black tar heroin.” Heroin can be injected, sniffed/snorted or smoked. Like cocaine, regardless of how the drug is taken it is extremely addictive and can lead to other detrimental consequences as well.

Thank you for inviting me to participate in this important public hearing. I will be happy to respond to any questions you may have.