Chapter 2

FORMS OF COCAINE, METHODS OF USE, EFFECTS, AND DEPENDENCY

Chapter 2 of the 1995 Commission Report contained a thorough overview of the forms, methods of use, and pharmacology of cocaine. This section summarizes the core findings in that chapter and updates some of the research most relevant to evaluating federal cocaine sentencing policy. Specific findings include:

- Crack cocaine and powder cocaine are both powerful stimulants and both forms of cocaine cause identical effects.

- Although both are addictive, the risk of addiction may be greater for crack cocaine than for powder cocaine because of their different methods of usual administration (smoking crack cocaine versus typically snorting powder cocaine).

A. POWDER COCAINE AND CRACK COCAINE MANUFACTURING, PURITY, AND DOSES

Powder cocaine is a white, powdery substance produced by dissolving coca paste into hydrochloric acid and water. Potassium salt is then added to this mixture, followed by ammonia. Prior to distribution, powder cocaine often is "cut" or diluted by adding one or more adulterants (sugars, local anesthetics, other drugs, or other inert substances) and typically is sold to users by the gram.[44] As a result, the purity level of powder cocaine can vary considerably.[45]

Crack cocaine is made by dissolving powder cocaine in a solution of sodium bicarbonate and water. The solution is boiled and a solid substance separates from the boiling substance. After the solid substance is dried, the crack cocaine is broken into "rocks," each representing a single dosage typically weighing from one-tenth to one-half of a gram.[46] One gram of pure powder cocaine under ideal conditions will convert to approximately 0.89 grams of crack

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[44] *See* USSC, *supra* note 1, ch. 2, at 12; *see also* memo from Toni P. Teresi, Chief, Office of Congressional Affairs, Drug Enforcement Administration, to Stacy Shrader, Office of Rep. Asa Hutchinson, at 3 (March 8, 2001).

[45] *Id.*

[46] *See* Bernard Segal & Lawrence K. Duffy, *Biobehavioral effects of psychoactive drugs, in* DRUGS OF ABUSE AND ADDICTION: NEUROBEHAVIORAL TOXICOLOGY 25-64 (R.J.M. Niesink et al. eds., 1999); Teresi, *supra* note 44, at 1, 2.

cocaine. The processes used by some crack cocaine manufacturers, however, introduce impurities resulting in a product less pure than the powder cocaine from which it was derived.[47]

With respect to doses, one gram of powder cocaine generally yields five to ten doses, whereas one gram of crack cocaine yields two to ten doses. Thus, 500 grams of powder cocaine – the quantity necessary to trigger the five-year statutory minimum penalty – yields between 2,500 and 5,000 doses. In contrast, five grams of crack cocaine – the quantity necessary to trigger the five-year statutory minimum penalty – yields between ten and fifty doses.[48]

B. COCAINE'S EFFECTS, ADDICTIVENESS, AND METHODS OF ADMINISTRATION

Cocaine is a powerful anesthetic and the most potent stimulant of natural origin to the central nervous system.[49] In any form (coca leaves, coca paste, powder cocaine, freebase cocaine, and crack cocaine) cocaine produces the same types of physiological[50] and psychotropic[51] effects once the drug reaches the brain.[52] Taken in small amounts (up to 100 milligrams), cocaine usually makes the user feel euphoric, energetic, talkative, and mentally alert. The short-term physiological results are similar to those produced by other central nervous system stimulants (*e.g.,* amphetamine) and include constricted blood vessels, dilated pupils, increased temperature, increased heart rate, and elevated blood pressure. Large amounts (several hundred milligrams or more) intensify the user's high, but also may cause the user to experience tremors, vertigo, muscle twitches, paranoia, toxic reactions, and in rare instances, sudden death (from cardiac arrest or seizures followed by respiratory arrest).[53]

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[47] *See* USSC, *supra* note 1, at 14.

[48] *Id.* at 85-86.

[49] Written statement by Glen R. Hanson, PhD, DDS, Acting Director of the National Institute on Drug Abuse (NIDA), to the U.S. Sentencing Commission, regarding Drug Penalties (Feb. 25, 2002).

[50] Physiological effects are the effects of cocaine on human organs (*e.g.,* organs of the central nervous system).

[51] Psychotropic effects are the effects of cocaine on the human mind.

[52] Hanson, *supra* note 49. Cocaine blocks the dopamine re-uptake at the neuronal level, flooding the area of the brain called the ventral tegmental area and ultimately stimulating one of the brain's key pleasure centers. National Institute of Health (NIH), NIDA Research Report Series, *Cocaine Abuse and Addiction*, Pub. No. 99–4342, (May 1999). http://www.165.112.78.61/ResearchReports/Cocaine/cocaine3.html.

[53] *Id.*

Cocaine in any form also is potentially addictive.[54] Recent research reports that cocaine users can develop tolerance to the effects of cocaine, requiring the use of larger quantities to experience its intoxicating effects and causing withdrawal symptoms if use is abruptly discontinued.[55] Cocaine's powerful psychotropic effects can cause the user to use the drug compulsively, regardless of any adverse effects that may occur. The drug can create vivid, long-term psychological memories that form the basis for subsequent craving for the drug, which contributes significantly to cocaine's abuse potential.[56]

The risk and severity of addiction to drugs generally – including cocaine – are significantly affected by the way they are administered into the body. The method of administration determines the onset, intensity, and duration of the effects from drug use. Generally the faster a drug reaches the bloodstream, the faster it is distributed throughout the body, and the faster the user feels the desired effects.[57] The intensity of a drug's effects generally is greater for methods of administration that deliver it most rapidly to the brain. However, the methods of administration that bring about the most intense effects – smoking and injection – also have the shortest duration, thereby necessitating repeated doses to sustain its effects and increasing the likelihood the user will develop an addiction. Smoking (inhalation) and injection typically produce quicker onset, shorter duration, and more intense effects from drug use than snorting and therefore increase the risk of addiction. (*See* Diagram 1.)[58]

With respect to cocaine, powder cocaine is soluble in water and therefore can be ingested, injected orally, or snorted, but not readily smoked. When administered by injection, powder cocaine produces effects with similar onset, duration, and intensity as crack cocaine (described below).[59] Most typically, however, powder cocaine is snorted.[60] When administered

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[54] *Id; see also*, Karen Bolla et al., *The Neuropsychiatry of Chronic Cocaine Abuse,* 10 JOURNAL OF NEUROPSYCHIATRY AND CLINICAL NEUROSCIENCES 280-289 (1998) for discussion of a neurobiological mechanism of addiction to cocaine.

[55] Segal & Duffy, *supra* note 46.

[56] USSC*, supra* note 1, at 23 (citing F. Gawin & E. Ellinwood, *Cocaine and Other Stimulants: Actions, Abuse and Treatment,* 318 NEW ENGLAND JOURNAL OF MEDICINE 1173 (1988)).

[57] *Id.* at 14-15. Absorption of a drug into the bloodstream is regulated by two primary factors: the amount of blood flowing to the site of ultimate absorption (*e.g.*, the stomach or small intestine) and the surface area over which the drug is absorbed. The surface area for snorting is limited to the nasal mucosa in the nasal cavity. In contrast, when a drug is smoked, it is absorbed by air sacs in the lungs that have a surface area the size of a football field.

[58] *See* Hanson, *supra* note 49.

[59] *Id.*

[60] Data from the National Household Survey indicate that of the approximately 1.5 million persons 12 years of age and older who reported cocaine use in the past month, 2.8 percent reported using

by snorting through nasal passages, the drug appears in the blood three to five minutes after use, with about 30 to 60 percent of the drug being absorbed into the bloodstream. Maximum physiological effects occur within 40 minutes, and maximum psychotropic effects occur within 20 minutes. Physiological and psychotropic effects fade in 45 to 60 minutes.

By comparison, crack cocaine is not soluble in water and therefore can only be readily smoked. Smoking the drug produces a quicker onset, shorter duration, and more intense effects than snorting powder cocaine.[61] Facilitated by the large surface area of the lungs' air sacs, smoked crack cocaine is absorbed almost immediately into the bloodstream and reaches the brain in only 19 seconds, with 30 to 60 percent of the drug being absorbed into the bloodstream. Maximum physiological effects from smoking crack cocaine are attained within two minutes; maximum psychotropic effects occur within one minute. These effects are experienced for a shorter period of time than for snorted powder cocaine, *i.e.* between 10 and 20 minutes, but are similar to injected powder cocaine.

In sum, although both powder cocaine and crack cocaine are potentially addictive, administering the drug in a manner that maximizes the effect (*e.g.,* injecting or smoking) increases the risk of addiction. It is this difference in *typical* methods of administration, not differences in the inherent properties of the two forms of the drugs, that makes crack cocaine more potentially addictive to *typical* users. Smoking crack cocaine produces quicker onset of, shorter-lasting, and more intense effects than snorting powder cocaine. These factors in turn result in a greater likelihood that the user will administer the drug more frequently to sustain these shorter "highs" and develop an addiction.

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the drug by injection. NIDA Communication, 1999 National Household Survey on Drug Abuse (March 18, 2002).

[61] *See* Hanson, *supra* note 49.