The Fundamentals of Addiction Counseling: A Primer

TABLE OF CONTENTS

Section 2: Core Functions

Section 3: Specialty Information

Introduction

The road to becoming a drug and alcohol counselor takes a great deal of hard work and effort. A combination of educational knowledge plus workplace experience will be required in order to become credentialed. One problem though is that at the present time there is no single, unified credentialing process for drug and alcohol counselors. Each state has options that include licensure (state mandated credentials) and/or certification (a credential offered by a private body). Some credentials require college degrees; some only require a certain number of educational and experiential hours to be obtained. Most, regardless of the credential, require some sort of written and/or oral examination before granting the credential.

At this time, most states typically use one of two available national credentialing exams for basic drug/alcohol credentialing - one offered by the National Association of Alcoholism and Drug Counselors (NAADAC), and one by the International Certification & Reciprocity Consortium/Alcohol & Other Drug Abuse, Inc. (IC&RC/AODA). The processes used are very similar - both use a written, multiple-choice examination. NAADAC's written exam is 250 questions in length; IC&RC/AODA's is 150 questions long. IC&RC/AODA may also require a 12-question oral examination, depending on the state where you would become credentialed. (Please note – both groups also offer advanced credentialing and as such, advanced tests for these types of credentials.)

Both written exams test a candidate's knowledge on a variety of topics that have been determined to be the basic knowledge required for drug and alcohol counselors. NAADAC uses the following categories for their information: Pharmacology of Psychoactive Substances; Counseling Practice; Theoretical Bases; and Professional Issues. IC&RC/AODA uses these performance domains: Clinical Evaluation; Treatment Planning; Referral; Service Coordination; Counseling; Client, Family and Community Education; Documentation; Professional and Ethical Responsibilities.

Both require a certain level of proficiency to pass the exam (there is variation in the actual passing level based on certain statistical measures), and depending on the state where you credential, there may be limits to the number of times a candidate may sit for the examination. Regardless, if a candidate is unsuccessful in passing the exam, to take the test again requires additional dollars spent (typically $150 for each time a candidate must take the written exam) as well as the added stress and pressure to succeed.

The purpose of this text then is to help candidates learn much of the basic, need-to-know information that is typically required to perform the skills needed to be a drug/alcohol professional, as well as to obtain a variety of basic knowledge that will be the foundation for the credentialing examinations that will be required. Ultimately, the application of this knowledge will be performed while obtaining in-field experience while serving as an intern or a counselor-in-training at a treatment program or facility.

This text is intended to provide an overview of the more important facts and knowledge used by drug/alcohol professionals. It is comprised of three sections. The first section deals with information that is drug and alcohol specific. It looks at the field in general, reviews the commonly accepted theories of addiction, looks at specific drug and alcohol knowledge, and explores treatment approaches commonly used in the field.

The second section deals with the core functions of counseling. This section is largely presented in an outline format, reviewing such things as screening, assessment, intake, orientation, counseling (individual, group, and family), and other topics. The materials from this section were originally developed for the Project for Addiction Counseling Training, a CSAT program in the early 1990's that was intended to training minority counselors and assist them in entering the drug and alcohol field. The information, therefore, has been tested and used successfully by a variety of individuals across the nation.

The third section deals with more specialized areas of training – for example psychological theories of change, ethics, HIV/AIDS, co-occurring disorders, cultural information, and special populations. While not an all-inclusive set of specialized knowledge, it does represent a major portion of the knowledge base that will be included in the testing process used by both major credentialing bodies.

This text does not review the process of testing for either the IC&RC/AODA (written and oral) or NAADAC (written) examinations. Our website at www.ReadyToTest.com does offer materials to help you prepare for these exams when that time comes. For more information, visit our website at http://www.readytotest.com or e-mail us at readytotest@readytotest.com for more information.

Section 1, Chapter 1:

An Overview of Addiction and its Treatment

The following section is an adaptation of Chapter 1 from "Treatment for Alcohol and Other Drug Abuse, Opportunities for Coordination." Certain dates and statistic have been updated and revised b y the ReadyToTest.com staff to insure the information is current.

This publication was written by Ann H. Crowe, M.S.S.W., A.C.S.W., and Rhonda Reeves, M.A., of the Council of State Governments. Contributors to the publication were Thomas B. Kosten, M.D., of the Department of Psychiatry, Division of Substance Abuse, Yale University-School of Medicine, and Bert Pepper, M.D., and Jackie Massaro, C.S.W., of the Information Exchange. It was prepared under contract number 270-92-0007 from the Substance Abuse and Mental Health Services Administration (SAMHSA). Roberta Messalle of CSAT served as the Government project officer.

The opinions expressed herein are the views of the authors and do not necessarily reflect the official position of CSAT or any the part of the U.S. Department of Health and Human Services (DHHS).

DHHS Publication No.(SMA) 94-2075.

Almost everyone has had experience with addictive psychoactive substances. Alcohol is a legal substance that is frequently used in social situations by people from all walks of life. Most people consume it occasionally and experience no adverse effects. Nevertheless, it can be addicting, and for those who reach this level of use, there are potential health and social consequences. In addition to alcohol, mood-altering drugs include a variety of illegal and legal substances that are highly addictive and often result in impaired physical, social, and psychological functioning of users.

The most recent National Survey on Drug Use and Health reports some of the following findings:

- slightly more than half of Americans aged 12 or older reported being current drinkers of alcohol (51.1 percent). This translates to an estimated 126.8 million people.

- an estimated 19.9 million Americans aged 12 or older were current (past month) illicit drug users, meaning they had used an illicit drug during the month prior to the survey interview. This estimate represents 8.0 percent of the population aged 12 years old or older. Illicit drugs include marijuana/hashish, cocaine (including crack), heroin, hallucinogens, inhalants, or prescription-type psychotherapeutics used nonmedically.
- an estimated 22.3 million persons (9.0 percent of the population aged 12 or older) were classified with substance dependence or abuse in the past year based on criteria specified in the Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV). Of these, 3.2 million were classified with dependence on or abuse of both alcohol and illicit drugs, 3.7 million were dependent on or abused illicit drugs but not alcohol, and 15.5 million were dependent on or abused alcohol but not illicit drugs.
- the specific illicit drugs that had the highest levels of past year dependence or abuse in 2007 were marijuana (3.9 million), followed by pain relievers (1.7 million) and cocaine (1.6 million).
- an estimated 70.9 million Americans aged 12 or older were current (past month) users of a tobacco product. This represents 28.6 percent of the population in that age range. In addition, 60.1 million persons (24.2 percent of the population) were current cigarette smokers; 13.3 million (5.4 percent) smoked cigars; 8.1 million (3.2 percent) used smokeless tobacco.

For a complete review of these findings, visit the website at http://www.oas.samhsa.gov/ and look for the link to the NSDUH Report.

Because of the addictive properties of these substances, and the related physical, social, and psychological consequences they precipitate, treatment will be required for these individuals to recover from their addictions and achieve abstinence. Yet one additional finding from the NSDUH Report raises many concerns:

- 23.2 million persons aged 12 or older needed treatment for an illicit drug or alcohol use problem (9.4 percent of persons aged 12 or older). Of these, 2.4 million (1.0 percent of persons aged 12 or older and 10.4 percent of those who needed treatment) received treatment at a specialty facility. Thus, 20.8 million persons (8.4 percent of the population aged 12 or older) needed treatment for an illicit drug or alcohol use problem but did not receive treatment at a specialty substance abuse facility.

Those who have not had personal experiences using either socially acceptable or illicit drugs still may have been touched by the effects of these substances. Use and abuse of alcohol and other drugs has far-reaching effects. Family members, friends, co-workers, and others often are affected – sometimes tragically – by those who become involved in substance abuse.

In this section, the process of addiction – progressing from experimental and social use to dependency and addiction – will be examined. This process also includes recovery for many individuals who receive appropriate treatment interventions. Such recovery means a chance to return to productive roles in society that are not focused on procuring and using alcohol and other drugs at the expense of one's physical health and personal well-being. Its chronic and relapsing nature is also recognized as a part of the disorder of addiction. Recovery from addictive illness necessitates sobriety and abstinence, relapse prevention programs, and continuing supportive intervention for those who become dependent on mood-altering chemicals.

The majority of persons who use drugs or alcohol from time to time will not need treatment. Those who are not dependent or addicted may be able to decide to stop using chemicals. However, finding a social climate that is intolerant toward drug use will be important for them. The threat of social, legal, or employer sanctions often is significant enough to persuade them away from continued drug use.

Treatment is for those who cannot or will not stop their use of alcohol or drugs without the help of a special program – usually those who have become physically or psychologically dependent on alcohol or drugs. Without some form of intervention, compulsive alcohol and drug users usually are unable to stop their use for more than a few days at a time. Despite the personal and family consequences, of which they are usually aware, addiction makes it virtually impossible for them to abstain from abusing alcohol or other drugs. Their need for chemicals often forces them to deny the negative consequences they are experiencing.

For youth, the criteria for those needing treatment services are somewhat different. In addition to illicit street drugs, the use of alcohol is also illegal for persons under the age of 21 in most States. Thus, lawfully, any use of these substances by adolescents can be considered abuse. Use of substances is also of particular concern for adolescents who are still developing, physically, socially, and emotionally. For youth, the stance is often taken that if use of alcohol or other drugs are creating problems in one or more areas of functioning, then assessment and intervention services should be provided. This affords a positive opportunity to prevent progression to more serious chemical dependency for many young persons.

Treatment is an essential and cost-effective factor in stemming the tide of substance abuse. Without treatment that is appropriate for the specific needs of individuals, the economic and human costs associated with substance abuse will continue to escalate. Treatment is vital for those whose use of alcohol and other drugs has progressed to the stage of dependence or addiction. This chapter will present a description of the five critical elements necessary for a comprehensive treatment approach.

THE PROCESS OF ADDICTION

No one begins using a mood-altering substance with the intention of becoming addicted to it. For example, the use of alcohol begins with the notion that it will be used only on social occasions, with certain friends, or for specific purposes. In some cases, it is possible to maintain that level of use.

However, for persons who have progressed to dependence on alcohol or other drugs, the sojourn has been difficult. Once past a certain point, there is no turning back. Continuing the journey, with any expectation of health and well-being, will require substance abuse treatment.

Abstinence from alcohol and other drugs is typical for most people most of the time. Occasional use of psychoactive substances may begin because of curiosity or because of the influence of friends. Initial experimental use of mood-altering substances usually occurs during the adolescent years, most often between 12 and 15 years of age. The typical pattern is experimentation with tobacco and alcohol, followed by initial use of marijuana. As use continues, other illicit drugs that can be inhaled or ingested orally may be consumed. Use of more potent drugs, particularly those requiring hypodermic administration, begins somewhat later. During this initial period, use of drugs is intermittent, and most people return to periods of complete abstinence during which they do not seek or consume drugs and experience no adverse consequences from their use. See **Table 1-A** for a brief summary of the characteristics of experimental and social use of alcohol and other drugs.

Table 1-A. - Stage 1: Experimental and Social Use of Drugs and Alcohol

Frequency of use: Occasional, perhaps a few times monthly. Usually on weekends when at parties or with friends. May use when alone.

Sources: Friends/peers primarily. Youth may use parents' alcohol.

Reasons for Use:

- to satisfy curiosity;
- to acquiesce to peer pressure;
- to obtain social acceptance;
- to defy parental limits;
- to take a risk or seek a thrill;
- to appear grown up;
- to relieve boredom;
- to produce pleasurable feelings; and
- to diminish inhibitions in social situations.

Effects: At this stage the person will experience euphoria and return to a normal state after using. A small amount may cause intoxication. Feelings sought include:

- fun, excitement;
- thrill;
- belonging, and;
- control.

Behavioral Indicators:

- little noticeable change;
- some may lie about use or whereabouts;
- some may experience moderate hangovers; occasionally, there is evidence of use, such as a beer can or marijuana joint.

(Sources: Beschner, 1986; Institute of Medicine, 1990, Jaynes & Rugg, 1988; Macdonald, 1989; Nowinski, 1990).

The metabolic effects of alcohol and other drugs alter the individual's chemistry because psychoactive drugs mimic, displace, block, or deplete specific chemical messengers between nerve cells in the brain. Certain areas of the brain control drives such as hunger, thirst, and sexual libido. When we are hungry we feel uncomfortable; when we eat, we feel satisfied – a positive reward. Psychoactive substances act upon the same areas of the brain and they can produce euphoria, an extremely pleasurable feeling, or cravings for the drug, an unpleasant feeling. With gradually increasing use of a substance, the cycle of euphoria and cravings results in dependence or addiction to the drug.

Problem use or abuse of alcohol or other drugs is the second stage in the process of addiction (see **Table 1-B**). The frequency of administration, as well as the amount of the drug use, increases. Use to the point of intoxication occurs often. The pleasurable, euphoric feelings produced with earlier use are still sought, but after the effects of the drug subside, pain, depression, and discomfort may occur. Unlike earlier stages of use, individuals progressing through this stage are likely to begin encountering consequences for use. These may include:

- work- or school-related difficulties;
- changes in friends;
- family problems;
- physical illnesses;
- weight loss and other physical problems;
- financial and legal complications; and
- personality and emotional changes.

Table 1-B. - Stage 2: Abuse

Frequency of use: Regular; may use several times per week. May begin using during the day. May be using alone rather than with friends.

Sources: Friends; begins buying enough to be prepared. May sell drugs to keep a supply for personal use. May begin stealing to have money to buy drugs/alcohol.

Reasons for Use:

- ♦ To manipulate emotions; to experience the pleasure the substances produce; to cope with stress and uncomfortable feelings such as pain, guilt, anxiety, and sadness; and to overcome feelings of inadequacy.

- Persons who progress to this stage of drug/alcohol involvement often experience depression or other uncomfortable feelings when not using. Substances are used to stay high or at least maintain normal feelings.

Effects:

- Euphoria is the desired feeling; may return to a normal state following use or may experience pain, depression and general discomfort. Intoxication begins to occur regularly, however.
- Feelings sought include:
  - pleasure;
  - relief from negative feelings, such as boredom, and anxiety; and
  - stress reduction.
- May begin to feel some guilt, fear, and shame.
- May have suicidal ideations/attempts. Tries to control use, but is unsuccessful. Feels shame and guilt. More of a substance is needed to produce the same effect.

Behavioral Indicators:

- school or work performance and attendance may decline;
- mood swings;
- changes in personality;
- lying and conning;
- change in friendships - will have drug-using friends;
- decrease in extra-curricular activities;
- begins adopting drug culture appearance (clothing, grooming, hairstyles, jewelry);
- conflict with family members may be exacerbated;
- behavior may be more rebellious; and
- all interest is focused on procuring and using drugs/alcohol.

(Sources: Beschner, 1986; Institute of Medicine, 1990, Jaynes & Rugg, 1988; Macdonald, 1989; Nowinski, 1990).

If substance abuse continues, the individual may reach the stage of dependency/addiction. Dependency occurs when a drug user experiences physical or psychological distress upon discontinuing use of the drug. Addiction implies compulsive use, impaired control over using the substance, preoccupation with obtaining and using the drug, and continued use despite adverse consequences. **Table 1-C** summarizes the characteristics of this stage, including almost continuous use to avoid pain and depression.

Dependent/addicted persons are unlikely to experience euphoria or other pleasant effects from the drug; continued administration is needed to achieve a state of homeostasis – feeling "normal" or not having pain.

Table 1-C. - Stage 3: Dependency/Addiction

Frequency of use: Daily use, continuous.

Sources:

- will use any means necessary to obtain and secure needed drugs/alcohol;
- will take serious risks; and
- will often engage in criminal behavior such as shoplifting and burglary.

Reasons for Use:

- drugs/alcohol are needed to avoid pain and depression;
- many wish to escape the realities of daily living; and
- use is out of control.

Effects:

- person's normal state is pain or discomfort;
- drugs/alcohol help them feel normal; when the effects wear off, they again feel pain;
- they are unlikely to experience euphoria at this state;
- they may experience suicidal thoughts or attempts;
- they often feel guilt, shame, and remorse;
- they may experience blackouts; and
- they may experience changing emotions, such as depression, aggression, irritation, and apathy.

Behavioral Indicators:

- physical deterioration includes weight loss, health problems;
- appearance is poor;
- may experience memory loss, flashbacks, paranoia, volatile mood swings, and other mental problems;
- likely to drop out or be expelled from school or lose jobs;
- may be absent from home much of the time;
- possible overdoses; and
- lack of concern about being caught - focused only on procuring and using drugs/alcohol.

(Sources: Beschner, 1986; Institute of Medicine, 1990, Jaynes & Rugg, 1988; Macdonald, 1989; Nowinski, 1990).

The current edition of the *Diagnostic and Statistical Manual of Mental Disorders, Text Revised* (DSM-IV-TR) enumerates diagnostic criteria for substance dependence – the term used by the American Psychiatric Association to describe AOD addiction (see **Table 1-D**). According to the DSM-IV-TR, a diagnosis of substance dependence requires the presence of three or more of these criteria at any time in the same 12-month period. Tolerance, physiological dependence, and withdrawal are not necessary to establish a diagnosis of AOD addiction.

Table 1-D - **DSM-IV-TR Diagnostic Criteria For Substance Dependence**

The DSM-IV-TR defines AOD addiction as "substance dependence," which is described as a maladaptive pattern of substance use, leading to clinically significant impairment or distress, as manifested by 3 or more of the following occurring at any time in the same 12-month period:

1. Tolerance, as defined by either of the following:
   (A) The need for markedly increased amounts of the substance to achieve intoxication or desired effect.
   (B) Markedly diminished effect with continued use of the same amount of the substance.
2. Withdrawal, as manifested by either of the following:
   (A) The characteristic withdrawal syndrome for the substance.
   (B) The same (or closely related) substance is taken to relieve or avoid withdrawal symptoms.
3. The substance is often taken in larger amounts or over a longer period than was intended.
4. Persistent desire or unsuccessful efforts to cut down or control substance use.
5. A great deal of time is spent in activities necessary to obtain or use the substance, or to recover from its effects.
6. Important social, occupational, or recreational activities are given up or reduced because of substance use.
7. Continued substance use occurs despite knowledge of having had a persistent or recurrent physical or psychological problem likely to have been caused or exacerbated by the substance.

(Adapted with permission from the *Diagnostic and Statistical Manual of Mental Disorders, Text Revised.* Washington, D.C.: American Psychiatric Association, 2000.)

The physical, social, occupational, financial, legal, and psychological consequences continue in a downward spiral. Those who persist in drug use to this stage often begin using injectable drugs. On average, it may take from 5 to 10 years following the first experimental use of drugs until a person progresses to the stage of dependency/addiction. This means that many who initiate drug use in their early teens will be addicted by their late teens or early 20s. There are many personal and drug-related variables that can hasten or retard the process, but once dependent, obtaining and using a drug of choice is the focus of one's life.

As the use of mood-altering chemicals progresses through these stages, related physical, social, and psychological problems increase. During earlier stages many people can manage their drug and alcohol use and may move back and forth from abstinence to problem use. Each stage entail some risk of progression to the next, but this course is not inevitable. However, once the stage of dependency/addiction is reached, the individual has acquired chronic relapsing disorder that most professionals believe can never be "cured." Return to earlier stages of controlled use is no longer possible.

However, treatment helps addicted individuals enter a stage of recovery during which they abstain from substance use and experience improved physical, social, and psychological functioning. Because of relapse, the recovery process may be interrupted by periods of return to substance use. This requires attention to relapse prevention and continuing supportive therapeutic interventions. Many treatment modalities (such as methadone maintenance or Alcoholics Anonymous) are viewed as potentially lifelong commitments to maintain the recovery process.

Knowledge of the mechanisms of substance abuse and addiction has not advanced enough to provide a cogent understanding of the reasons some people manage their use of alcohol or drugs while others progress to a problem stage of abuse or addiction. It is likely that a combination of physiological, environmental, and psychological factors converge to exacerbate the problem for some individuals. Although found among all socioeconomic groups, persons already plagued by poverty, disease, and unemployment are over-represented among those afflicted by chemical addiction.

RECOVERY

Research indicates that, while it is not a curable disorder, *treatment for substance abuse does work*. With treatment, substance-dependent persons enjoy healthy and productive lives. Instead of creating health risks, committing crimes, and requiring public support, recovering individuals make positive contributions to society through their work and creativity. Recovery is the process of initiating and maintaining abstinence from alcohol or other drug use. It also involves making personal and interpersonal changes. Whether an individual is addicted to or abusing alcohol, illegal drugs, prescription drugs, or a combination of these, the most important goal is to discontinue the use of alcohol and/or drugs.

With relapse prevention programming and supportive treatment, recovery is a realizable goal. With improved treatment services and adequate resources, society also is protected from further consequences related to drugs and alcohol, including economic, social, health, and crime-related problems.

FIVE CRITICAL COMPONENTS OF EFFECTIVE TREATMENT

Treatment is an effective tool in reducing drug abuse and rehabilitating those affected by it. It is particularly important that treatment strategies incorporate the following five critical components to enhance effectiveness.

1. *Assessment* uses diagnostic instruments and processes to determine an individual's needs and problems. It is an essential first step in determining the possible causes of addiction for the person and the most appropriate treatment modality for his or her needs.
2. *Patient-Treatment Matching* ensure that an individual receives the type of treatment corresponding with his or her personality, background, mental condition, and the extent and duration of substance abuse determined by the assessment.
3. *Comprehensive services* include the range of services needed in addition to specific alcohol or drug treatment. The needs of addicted persons are often very complex, including health problems, financial and legal issues, psychological problems, and many others. Effective treatment must help people access the full extent of additional services needed to make their lives whole.

4. *Relapse prevention* is important because addiction is a chronic and relapsing disorder. Relapse prevention strategies are based on assessing an individual's "triggers" – those situations, events, people, places, thoughts, and activities – that re-kindle the need for drugs. Strategies for coping with these when they occur are then developed.
5. *Accountability* of treatment program is crucial for determining the success of specific approaches and modalities. The need for the program, its integrity, and its results, including abstinence, social adjustment, and reduction of criminal behavior by those treated in the program, must be evaluated.

Treatment programs for AOD addictions vary in style, purpose, philosophy, and type of patients treated. Certain components of treatment, however, are common to all models of treatment programs. The components of CSAT's model comprehensive AOD treatment program are described in **Table 1-E**.

Table 1-E. - Center for Substance Abuse Treatment - Model for Comprehensive Alcohol and Other Drug Abuse Treatment

A model treatment program includes:

- **Assessmen**t, to include a medical examination, drug use history, psychosocial evaluation, and, where warranted, a psychiatric evaluation, as well as a review of socioeconomic factors and eligibility for public health, welfare, employment, and educational assistance programs.
- **Same day intake**, to retain the patient's involvement and interest in treatment.
- **Documenting findings and treatment**, to enhance clinical case supervision.
- **Preventative and primary medical care**, provided on site.
- **Testing for infectious diseases**, at intake and at intervals throughout treatment, for infectious diseases, for example, hepatitis, retrovirus, tuberculosis, HIV/AIDS, syphilis, gonorrhea, and other sexually transmitted diseases.
- **Weekly random drug testing**, to ensure abstinence and compliance with treatment.
- **Pharmacotherapeutic interventions**, by qualified medical practitioners, as appropriate for those patients having mental health disorders, those addicted to heroin, and HIV-seropositive individuals.
- **Group counseling interventions**, to address the unique emotional, physical, and social problems of HIV/AIDS patients.

- **Basic substance abuse counseling**, including psychological counseling, psychiatric counseling, and family or collateral counseling provided by persons licensed or certified by State authorities to provide such services. Staff training and education are integral to a successful treatment program.
- **Practical life skills counseling**, including vocational and educational counseling and training, frequently available through linkages with specialized programs.
- **General health education**, including nutrition, sex and family planning, and HIV/AIDS counseling, with an emphasis on contraception counseling for adolescents and women.
- **Peer/support groups**, particularly for those who are HIV-positive or who have been victims of rape or sexual abuse.
- **Liaison services** with immigration, legal aid, and criminal justice system authorities.
- **Social and athletic activities**, to retrain patients' perceptions of social interaction.
- **Alternative housing** for homeless patients or for those whose living situations are conducive to maintaining the addictive lifestyle.
- **Relapse prevention**, which combines aftercare and support programs, such as Alcoholics Anonymous and Narcotics Anonymous, within an individualized plan to identify, stabilize, and control the stressors which trigger and bring about relapse to substance abuse.
- **Outcome evaluation**, to enable refinement and improvement of service delivery.

EXTENT OF SUBSTANCE ABUSE

Although some promising reports indicate a decline in drug use in the general population, other data indicate less encouraging results. Unfortunately, there is no single measurement that provides a clear picture of alcohol and drug use and its complex interaction with individual and social problems. Many large-scale studies use populations that are easily accessed, such as youth in high school or persons living at home who have telephones. However, these methods tend to overlook subgroups that are known to have high rates of substance abuse, such as those in prisons, homeless persons, and high school dropouts. Further, individuals may be reluctant to disclose alcohol and other drug use when they are questioned because they are concerned about potential punishment.

Estimated Drug Use Within the General Population

The National Survey on Drug Use and Health (NSDUH) is an annual survey of the civilian, non-institutionalized population of the United States aged 12 years old or older. Prior to 2002, the survey was called the National Household Survey on Drug Abuse (NHSDA). This brief Overview report provides a concise summary of the main results from the 2007 NSDUH, the most recent reporting period. A more complete presentation of the initial results of the survey is given in the full report, *Results from the 2007 National Survey on Drug Use and Health: National Findings*. Both reports present national estimates of rates of use, numbers of users, and other measures related to illicit drugs, alcohol, and tobacco products. Measures related to mental health problems also are included. State-level estimates from NSDUH will be presented in other reports to be released separately. For complete details and for the most current findings, see the SAMHSA website at http://www.oas.samhsa.gov/nhsda.htm.

Highlights of Findings

Illicit Drug Use

- In 2007, an estimated 19.9 million Americans aged 12 or older were current (past month) illicit drug users, meaning they had used an illicit drug during the month prior to the survey interview. This estimate represents 8.0 percent of the population aged 12 years old or older. Illicit drugs include marijuana/hashish, cocaine (including crack), heroin, hallucinogens, inhalants, or prescription-type psychotherapeutics used nonmedically.

- The rate of current illicit drug use among persons aged 12 or older in 2007 (8.0 percent) was similar to the rate in 2006 (8.3 percent).

- Marijuana was the most commonly used illicit drug (14.4 million past month users). Among persons aged 12 or older, the rate of past month marijuana use in 2007 (5.8 percent) was similar to the rate in 2006 (6.0 percent).

- In 2007, there were 2.1 million current cocaine users aged 12 or older, comprising 0.8 percent of the population. These estimates were similar to the number and rate in 2006 (2.4 million or 1.0 percent).

- Hallucinogens were used in the past month by 1.0 million persons (0.4 percent) aged 12 or older in 2007, including 503,000 (0.2 percent) who had used Ecstasy. These estimates were similar to the corresponding estimates for 2006.

- There were 6.9 million (2.8 percent) persons aged 12 or older who used prescription-type psychotherapeutic drugs nonmedically in the past month. Of these, 5.2 million used pain relievers, the same as the number in 2006.

- In 2007, there were an estimated 529,000 current users of methamphetamine aged 12 or older (0.2 percent of the population). These estimates were not significantly different from the estimates for 2006 (731,000 or 0.3 percent).

- Among youths aged 12 to 17, the current illicit drug use rate remained stable from 2006 (9.8 percent) to 2007 (9.5 percent). Between 2002 and 2007, youth rates declined significantly for illicit drugs in general (from 11.6 to 9.5 percent) and for marijuana, cocaine, hallucinogens, LSD, Ecstasy, prescription-type drugs used nonmedically, pain relievers, stimulants, methamphetamine, and the use of illicit drugs other than marijuana.

- The rate of current marijuana use among youths aged 12 to 17 declined from 8.2 percent in 2002 to 6.7 percent in 2007. The rate decreased for both males (from 9.1 to 7.5 percent) and females (from 7.2 to 5.8 percent).

- Among young adults aged 18 to 25, there were decreases from 2006 to 2007 in the rate of current use of several drugs, including cocaine (from 2.2 to 1.7 percent), Ecstasy (from 1.0 to 0.7 percent), stimulants (from 1.4 to 1.1 percent), methamphetamine (from 0.6 to 0.4 percent), and illicit drugs other than marijuana (from 8.9 to 8.1 percent).

- From 2002 to 2007, there was an increase among young adults aged 18 to 25 in the rate of current use of prescription pain relievers, from 4.1 to 4.6 percent. There were decreases in the use of hallucinogens (from 1.9 to 1.5 percent), Ecstasy (from 1.1 to 0.7 percent), and methamphetamine (from 0.6 to 0.4 percent).

- Among those aged 50 to 54, the rate of past month illicit drug use increased from 3.4 percent in 2002 to 5.7 percent in 2007. Among those aged 55 to 59, current illicit drug use showed an increase from 1.9 percent in 2002 to 4.1 percent in 2007. These trends may partially reflect the aging into these age groups of the baby boom cohort, whose lifetime rates of illicit drug use are higher than those of older cohorts.

- Among persons aged 12 or older who used pain relievers nonmedically in the past 12 months, 56.5 percent reported that the source of the drug the most recent time they used was from a friend or relative for free. Another 18.1 percent reported they got the drug from just one doctor. Only 4.1 percent got the pain relievers from a drug dealer or other stranger, and 0.5 percent reported buying the drug on the Internet. Among those who reported getting the pain reliever from a friend or relative for free, 81.0 percent reported in a follow-up question that the friend or relative had obtained the drugs from just one doctor.

- Among unemployed adults aged 18 or older in 2007, 18.3 percent were current illicit drug users, which was higher than the 8.4 percent of those employed full time and 10.1 percent of those employed part time. However, most illicit drug users were employed. Of the 17.4 million current illicit drug users aged 18 or older in 2007, 13.1 million (75.3 percent) were employed either full or part time.

- In 2007, there were 9.9 million persons aged 12 or older who reported driving under the influence of illicit drugs during the past year. This corresponds to 4.0 percent of the population aged 12 or older, similar to the rate in 2006 (4.2 percent), but lower than the rate in 2002 (4.7 percent). In 2007, the rate was highest among young adults aged 18 to 25 (12.5 percent).

Alcohol Use

- Slightly more than half of Americans aged 12 or older reported being current drinkers of alcohol in the 2007 survey (51.1 percent). This translates to an estimated 126.8 million people, which was similar to the 2006 estimate of 125.3 million people (50.9 percent).

- More than one fifth (23.3 percent) of persons aged 12 or older participated in binge drinking (having five or more drinks on the same occasion on at least 1 day in the 30 days prior to the survey) in 2007. This translates to about 57.8 million people, similar to the estimate in 2006.

- In 2007, heavy drinking was reported by 6.9 percent of the population aged 12 or older, or 17.0 million people. This rate was the same as the rate of heavy drinking in 2006. Heavy drinking is defined as binge drinking on at least 5 days in the past 30 days.

- In 2007, among young adults aged 18 to 25, the rate of binge drinking was 41.8 percent, and the rate of heavy drinking was 14.7 percent. These rates were similar to the rates in 2006.

- The rate of current alcohol use among youths aged 12 to 17 was 15.9 percent in 2007. Youth binge and heavy drinking rates were 9.7 and 2.3 percent, respectively. These rates were essentially the same as the 2006 rates.

- Past month and binge drinking rates among underage persons (aged 12 to 20) have remained essentially unchanged since 2002. In 2007, about 10.7 million persons aged 12 to 20 (27.9 percent of this age group) reported drinking alcohol in the past month. Approximately 7.2 million (18.6 percent) were binge drinkers, and 2.3 million (6.0 percent) were heavy drinkers.

- Among persons aged 12 to 20, past month alcohol use rates in 2007 were 16.8 percent among Asians, 18.3 percent among blacks, 24.7 percent among Hispanics, 26.2 percent among those reporting two or more races, 28.3 percent among American Indians or Alaska Natives, and 32.0 percent among whites.

- In 2007, 56.3 percent of current drinkers aged 12 to 20 reported that their last use of alcohol in the past month occurred in someone else's home, and 29.4 percent reported that it had occurred in their own home. About one third (30.2 percent) paid for the alcohol the last time they drank, including 8.2 percent who purchased the alcohol themselves and 21.8 percent who gave money to someone else to purchase it. Among those who did not pay for the alcohol they last drank, 37.2 percent got it from an unrelated person aged 21 or older, 20.7 percent from another person under 21 years of age, and 19.5 percent got it from a parent, guardian, or other adult family member.

- In 2007, an estimated 12.7 percent of persons aged 12 or older drove under the influence of alcohol at least once in the past year. This percentage has decreased since 2002, when it was 14.2 percent. From 2006 to 2007, the rate of driving under the influence of alcohol among persons aged 18 to 25 decreased from 24.4 to 22.8 percent.

Tobacco Use

- In 2007, an estimated 70.9 million Americans aged 12 or older were current (past month) users of a tobacco product. This represents 28.6 percent of the population in that age range. In addition, 60.1 million persons (24.2 percent of the population) were current cigarette smokers; 13.3 million (5.4 percent) smoked cigars; 8.1 million (3.2 percent) used smokeless tobacco; and 2.0 million (0.8 percent) smoked tobacco in pipes.

- The rate of current use of any tobacco product among persons aged 12 or older decreased from 29.6 percent in 2006 to 28.6 percent in 2007, but the rates of current use of cigarettes, smokeless tobacco, cigars, and pipe tobacco did not change significantly over that period. Between 2002 and 2007, past month use of any tobacco product decreased from 30.4 to 28.6 percent, and past month cigarette use declined from 26.0 to 24.2 percent. Rates of past month use of cigars, smokeless tobacco, and pipe tobacco were similar in 2002 and 2007.

- The rate of past month cigarette use among 12 to 17 year olds declined from 13.0 percent in 2002 to 9.8 percent in 2007. However, past month smokeless tobacco use was higher in 2007 (2.4 percent) than in 2002 (2.0 percent).

- Among pregnant women aged 15 to 44, combined data for 2006 and 2007 indicated that the rate of past month cigarette use was 16.4 percent. The rate was higher among women in that age group who were not pregnant (28.4 percent).

Initiation of Substance Use (Incidence, or First-Time Use) within the Past 12 Months

- In 2007, an estimated 2.7 million persons aged 12 or older used an illicit drug for the first time within the past 12 months. A majority of these past year illicit drug initiates reported that their first drug was marijuana (56.2 percent). Nearly one third initiated with psychotherapeutics (30.6 percent, including 19.0 percent with pain relievers, 6.5 percent with tranquilizers, 4.1 percent with stimulants, and 1.1 percent with sedatives). A sizable proportion reported inhalants (10.7 percent) as their first illicit drug, and a small proportion used hallucinogens as their first drug (2.0 percent).

- The illicit drug categories with the largest number of past year initiates among persons aged 12 or older were nonmedical use of pain relievers (2.1 million) and marijuana use (2.1 million). These estimates were not significantly different from the numbers in 2006.

- In 2007, there were 775,000 persons aged 12 or older who had used inhalants for the first time within the past 12 months; 66.3 percent were under age 18 when they first used. There was no significant change in the number of inhalant initiates from 2006 to 2007.

- The number of past year initiates of methamphetamine among persons aged 12 or older was 157,000 in 2007. This estimate was significantly lower than the estimate in 2002 (299,000), 2003 (260,000), 2004 (318,000), and 2006 (259,000).

- Ecstasy initiation remained essentially unchanged from 2006 (860,000) to 2007 (781,000), but was lower in 2007 than in 2002 (1.2 million).

- Most (85.9 percent) of the 4.6 million past year alcohol initiates were younger than age 21 at the time of initiation.

- The number of persons aged 12 or older who smoked cigarettes for the first time within the past 12 months was 2.2 million in 2007, which was significantly lower than the estimate in 2006 (2.4 million) but significantly higher than the estimate for 2002 (1.9 million). Most new smokers in 2007 were under age 18 when they first smoked cigarettes (59.7 percent).

Youth Prevention-Related Measures

- Perceived risk is measured by NSDUH as the percentage reporting that there is great risk in the substance use behavior. Among youths aged 12 to 17, there were no changes in the perceived risk of marijuana, cocaine, or heroin use between 2006 and 2007. However, between 2002 and 2007, there were increases in the perceived risk of smoking marijuana once a month (from 32.4 to 34.5 percent) and smoking marijuana once or twice a week (from 51.5 to 54.7 percent). On the other hand, the percentage of youths who perceived that trying heroin once or twice is a great risk declined from 58.5 percent in 2002 to 57.0 percent in 2007, and those who perceived that using LSD once or twice a week is a great risk declined from 76.2 to 74.2 percent.

- Almost half (49.1 percent) of youths aged 12 to 17 reported in 2007 that it would be "fairly easy" or "very easy" for them to obtain marijuana if they wanted some. Around one quarter reported it would be easy to get cocaine (24.5 percent). About one in seven (14.1 percent) indicated that heroin would be "fairly" or "very" easily available, and 14.4 percent reported easy availability for LSD.

- The percentage of youths aged 12 to 17 reporting that it would be easy to obtain cocaine declined from 25.9 percent in 2006 to 24.5 percent in 2007. In addition, the perceived availability decreased between 2002 and 2007 for marijuana (from 55.0 to 49.1 percent), heroin (from 15.8 to 14.1 percent), and LSD (from 19.4 to 14.4 percent).

- A majority of youths aged 12 to 17 (91.0 percent) in 2007 reported that their parents would strongly disapprove of their trying marijuana or hashish once or twice. Current marijuana use was much less prevalent among youths who perceived strong parental disapproval for trying marijuana or hashish once or twice than for those who did not (4.6 vs. 28.1 percent).

- In 2007, 11.3 percent of youths aged 12 to 17 reported that they had participated in substance use prevention programs outside of school within the past year. Almost four fifths (77.9 percent) reported having seen or heard drug or alcohol prevention messages from sources outside of school, lower than in 2002 when the percentage was 83.2 percent. Most (59.6 percent) youths reported in 2007 that they had talked with a parent in the past year about the dangers of drug, tobacco, or alcohol use.

Substance Dependence, Abuse, and Treatment

- In 2007, an estimated 22.3 million persons (9.0 percent of the population aged 12 or older) were classified with substance dependence or abuse in the past year based on criteria specified in the *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition (DSM-IV-TR). Of these, 3.2 million were classified with dependence on or abuse of both alcohol and illicit drugs, 3.7 million were dependent on or abused illicit drugs but not alcohol, and 15.5 million were dependent on or abused alcohol but not illicit drugs.

- Between 2002 and 2007, there was no change in the number of persons with substance dependence or abuse (22.0 million in 2002, 22.3 million in 2007).

- The specific illicit drugs that had the highest levels of past year dependence or abuse in 2007 were marijuana (3.9 million), followed by pain relievers (1.7 million) and cocaine (1.6 million).

- Adults aged 21 or older who had first used alcohol before age 21 were more likely than adults who had their first drink at age 21 or older to be classified with alcohol dependence or abuse (9.6 vs. 2.2 percent).

- The rate of substance dependence or abuse for males aged 12 or older in 2007 was about twice as high as the rate for females (12.5 vs. 5.7 percent). Among youths aged 12 to 17, however, the rate of substance dependence or abuse among males was the same as the rate among females (7.7 percent for both).

- Treatment need is defined as having a substance use disorder or receiving treatment at a specialty facility (hospital inpatient, drug or alcohol rehabilitation, or mental health centers) within the past 12 months. In 2007, 23.2 million persons aged 12 or older needed treatment for an illicit drug or alcohol use problem (9.4 percent of persons aged 12 or older). Of these, 2.4 million (1.0 percent of persons aged 12 or older and 10.4 percent of those who needed treatment) received treatment at a specialty facility. Thus, 20.8 million persons (8.4 percent of the population aged 12 or older) needed treatment for an illicit drug or alcohol use problem but did not receive treatment at a specialty substance abuse facility in the past year.

- Of the 20.8 million people in 2007 who were classified as needing substance use treatment but did not receive treatment at a specialty facility in the past year, 1.3 million persons (6.4 percent) reported that they felt they needed treatment for their illicit drug or alcohol use problem. Of these 1.3 million persons who felt they needed treatment, 380,000 (28.5 percent) reported that they made an effort to get treatment, and 955,000 (71.5 percent) reported making no effort to get treatment.

Mental Health

- Serious psychological distress (SPD) is an overall indicator of past year nonspecific psychological distress that is constructed from the K6 scale administered to adults aged 18 or older in NSDUH. In 2007, there were an estimated 24.3 million adults aged 18 or older in the United States with SPD in the past year. This represents 10.9 percent of all adults in this country, a rate similar to the SPD rate in 2006 (11.3 percent) but below the rate in 2004 (12.2 percent).

- Rates of SPD in 2007 were highest for adults aged 18 to 25 (17.9 percent) and lowest for adults aged 50 or older (7.0 percent).

- The prevalence of SPD among women aged 18 or older (13.4 percent) was higher than that among men in that age group (8.2 percent).

- SPD in the past year was associated with past year substance dependence or abuse in 2007. Among adults aged 18 or older with SPD in 2007, 22.1 percent (5.4 million) were dependent on or abused illicit drugs or alcohol. The rate among adults without SPD was 7.6 percent (15.0 million).

- Among the 24.3 million adults with SPD in 2007, 10.8 million (44.6 percent) used mental health services in the past year. Among all adults with SPD, 38.8 percent received a prescription medication, 27.3 percent received outpatient services, and 5.1 percent received inpatient services for a mental health problem in the past year.

- Among the 5.4 million adults with both SPD and substance dependence or abuse (i.e., a substance use disorder) in 2007, nearly half (46.5 percent) received mental health care or substance use treatment at a specialty facility; 10.4 percent received both mental health care and specialty substance use treatment, 33.3 percent received only mental health care, and 2.8 percent received only specialty substance use treatment.

- In 2007, 7.5 percent of persons aged 18 or older (16.5 million persons) had at least one major depressive episode (MDE) in the past year. Almost 1 in 20 adults (4.6 percent or 10.1 million persons) had a past year MDE with severe impairment.

- Having MDE in the past year was associated with past year substance dependence or abuse. In 2007, adults aged 18 or older with past year MDE had higher rates of past year illicit drug use than those without MDE (27.4 vs. 12.8 percent). Adults with past year MDE were more likely than those without MDE to be dependent on or abuse illicit drugs (8.8 vs. 2.1 percent) and alcohol (17.0 vs. 7.0 percent).

- Among adults aged 18 or older who had MDE in the past year, 64.5 percent received treatment (i.e., saw or talked to a medical doctor or other professional or used prescription medication) for depression in the same time period, which was lower than in 2006 (69.1 percent).

- Among adults aged 18 or older with MDE in the past year in 2007, women were more likely than men to receive treatment for depression in the past year (68.0 vs. 57.8 percent), though the treatment rate for women was significantly lower than in 2006 (73.7 percent).

- In 2007, there were 2.0 million youths (8.2 percent of the population aged 12 to 17) who had MDE during the past year. An estimated 1.4 million (5.5 percent) had MDE with severe impairment in one or more role domains (chores at home; school or work; close relationships with family; or social life).

- The rate of MDE in the past year was higher for adolescent females (11.9 percent) than for adolescent males (4.6 percent). The prevalence of MDE with severe impairment was 8.2 percent for females and 3.0 percent for males.

- Among 12 to 17 year olds who had past year MDE in 2007, 35.5 percent had used illicit drugs during the same period. This was higher than the rate of 17.2 percent among youths who did not have past year MDE. Similarly, the rates of past month daily cigarette use and heavy alcohol use were higher for youths with MDE (4.8 and 3.8 percent, respectively) than for youths who did not have MDE (2.3 and 2.2 percent, respectively).

- In 2007, 38.9 percent of youths aged 12 to 17 with past year MDE received treatment for depression (saw or talked to a medical doctor or other professional or used prescription medication). Among youths with past year MDE, 20.5 percent saw or talked to a medical doctor or other professional only, 2.5 percent used prescription medication only, and 15.6 percent received treatment from both sources for depression in the past year.

- In 2007, 3.1 million youths aged 12 to 17 (12.5 percent) received treatment or counseling for problems with behavior or emotions in the specialty mental health setting (inpatient or outpatient care). Additionally, 11.5 percent of youths received services in the education setting, and 2.8 percent received mental health services in the general medical setting in the past 12 months. Mental health services were received in both the specialty setting and either the education or general medical settings (i.e., care from multiple settings) by 5.1 percent of youths.

THE RESPONSE TO SUBSTANCE ABUSE

The incidence of substance abuse remains unacceptably high, and both substance abusers and other persons are adversely affected by this disease. New information about the effectiveness and economic benefits of providing treatment are emerging rapidly. Efforts to evaluate treatment have led the Office of National Drug Control Policy (1990b, p. 30) to state unequivocally, “We now know on the basis of more than two decades of research that drug treatment can work.”

Various perspectives have viewed addiction as a matter of personal choice, as a medical illness, or as deviant, criminal behavior. Thus, responses to addicted persons have ranged from ignoring them to hospitalization to imprisonment.

The medical view of addiction understands that addicted persons have a treatable disease, much like other diseases, such as diabetes. Addiction is a chronic disorder that is prone to relapse, even after significant periods of recovery. Thus, the individual needs treatment that is appropriate for his or her particular needs and problems based on an assessment of the cause and course of the disease. The mission of treatment agencies focuses on helping individuals make positive changes. Treatment approaches have evolved in two basic categories:

1. Pharmacological modalities, which affect physiological processes (such as detoxification and methadone maintenance), and
2. Behavioral modalities, which influence behavior or learning processes.

These often are combined to produce a greater effect (NIDA, 2001).

The criminal view of addiction defines drug use as a criminal behavior. The focus of intervention in the criminal justice system is first to protect the health, safety, and welfare of the public, and then to rehabilitate offenders, if possible. Prison crowding and an overwhelming drain on community corrections resources have resulted from increasing numbers of drug-involved offenders. However, as caseloads continue to rise, it is difficult to see that this approach, at least without concomitant treatment, has positively affected the problem of substance abuse.

CONCLUSION

Substance addiction is a chronic, progressive, relapsing disorder affecting all citizens in one way or another. If not directly involved, many have family members with alcohol or other drug-related problems. Highways and places of employment are sometimes unsafe because of the effects of alcohol and drugs on motorists and co-workers. It is a devastating disease to individuals, families, and communities. The exorbitant financial toll includes increased health care costs and reduced productivity, as well as higher law enforcement costs, thefts, and destruction of property. With the onset of HIV/AIDS and other infectious diseases for which transmission is directly or indirectly attributable to substance abuse factors, addiction is truly a deadly disease.

While prevention efforts are successful in lowering rates of substance abuse among some segments of the population, addiction is a pervasive problem among others. However, treatment is a cost-effective strategy for intervening to stop the cycle of destruction and despair. Treatment programs providing comprehensive services and attending to the continuing treatment needs of individuals are most beneficial. These programs include the five critical components of treatment – *comprehensive assessment, patient-treatment matching, comprehensive services, relapse prevention, and accountability.*

With coordination of efforts, appropriate application of resources, and a vision for a better future, great achievements in substance abuse treatment will occur.

Section 1, Chapter 2:

The Neurobiology of Addiction

In understanding the affects of the psychoactive drugs, it is important to understand the nature and function of the nervous system. You don't have to be a scientist or a physician to understand the various elements that make up this system. It is only necessary to develop a basic understanding of how drugs alter nerve functions, mental processes, mood, feelings, consciousness, perception and behavior. This can be done by reviewing the basic aspects of the nervous system.

The nervous system is comprised of the specialized structures that control and coordinate all body activities through the process of stimulus and response. The process of stimulus and response occurs in three stages:

1) sensory reception - some type of stimuli is detected either from outside or within the body,
2) interconnection - the stimuli creates an electrical message that is then transmitted from one part of the system to another, and
3) motor response - an appropriate response is triggered, such as a muscular contraction, as a result of a message being sent back to a body part by a nerve center.

The nervous system consists of three major structures: the brain, the spinal cord, and the peripheral nerves. Each structure is composed mainly of neurons, highly specialized and unique cells which are capable of receiving stimuli and transmitting electrical messages or impulses.

The nervous system (**Figure 2.1**) has two major parts:

1. The central nervous system (CNS), which is composed of the brain and the spinal cord. Psychoactive drugs have their primary effect on the central nervous system;
2. The peripheral nervous system, which consist of all the nerves that branch out from the central nervous system and connect the system to other body parts, including the hands and feet.

Additionally, there are two subdivisions of the peripheral nervous system:

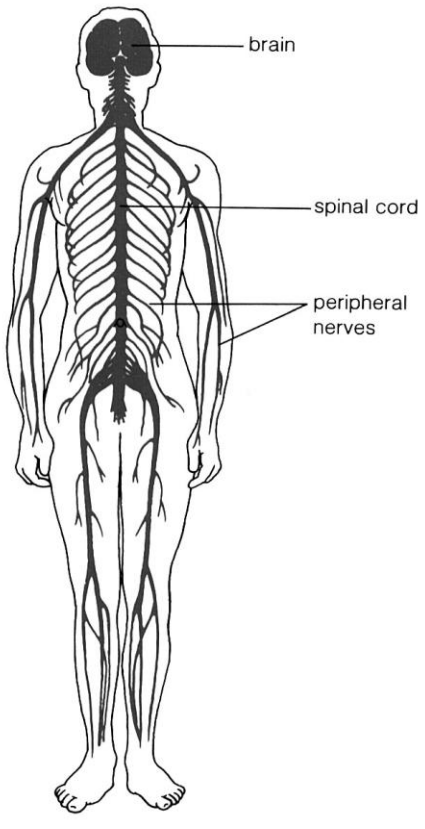
a. The somatic system - comprised of the cranial and spinal nerves which connect the CNS to the skin and the skeletal muscles.

b. The autonomic system - the nerves which connect the central nervous system to the various body organs, including the heart, stomach, intestines, and various glands. These nerves function involuntarily (controlled by the brain automatically, without conscious control or effort). There are two subdivisions of this system:

1) The sympathetic division, which prepares the body for activities which expend energy, and

2) the parasympathetic division, which aids the body in returning to normal after a period of expending energy. This division works to counterbalance the activities of the sympathetic division.

Figure 2.1 - Nervous System



nervous

The neuron (**Figure 2.2**) is the basic unit of the nervous system. It is capable of both receiving stimuli and transmitting electrical messages or impulses throughout the system. Extending from the neuron are two types of nerve fibers. Dendrites are fibers that send nerve impulses toward the cell body, while axons carry impulses away from the cell body. Each neuron has several dendrites but only one axon.

Electrical impulses originate in the dendrite and are then transmitted down the axon. Psychoactive drugs do not act primarily on the axon, with the exception of local anesthetics (thus blocking the transmission of pain impulses to the brain). At the junction between the axon of one cell and the dendrite of another (known as the synapse), the electrical impulse must cross a narrow space or gap, called the synaptic cleft. This gap is filled with a special type of fat that acts as an insulator between the cells. The cross-over process is accomplished not by electrical impulse, but by chemical

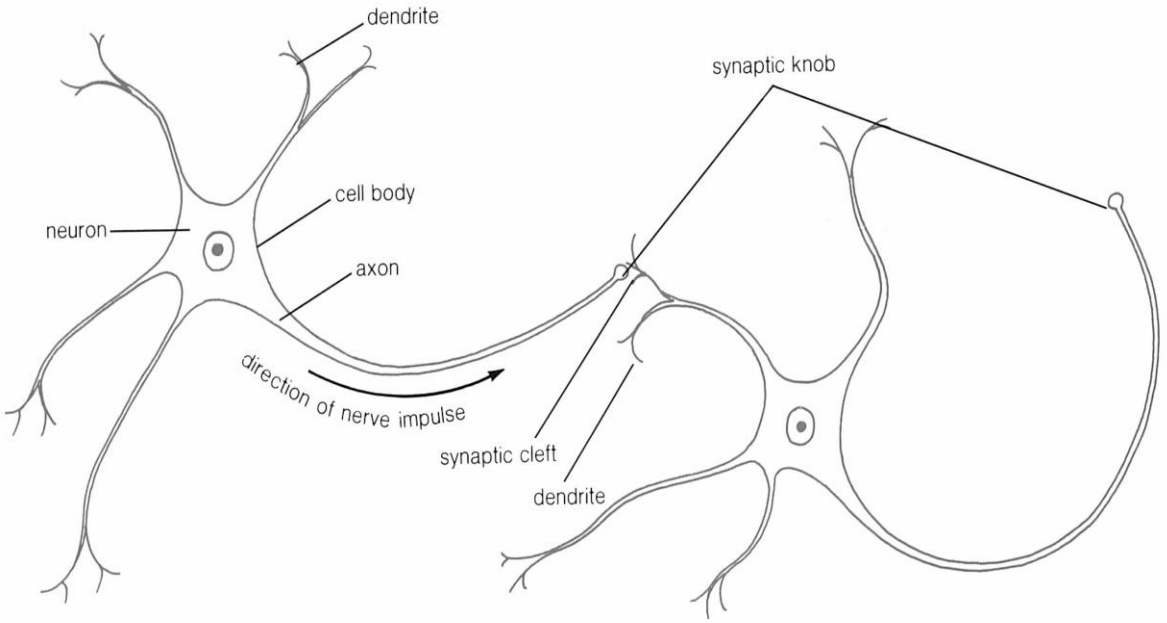
transmission. It is here that other chemicals, specifically the psychoactive drugs, have their major effect. Depressant drugs tend to thicken the medium, thus slowing down the transmission. Stimulant drugs tend to thin the medium, thus causing a more rapid transmission. Certain types of drugs, especially marijuana, have been found to actually fill the gap, thus preventing the transmission from occurring.

When an electrical impulse reaches the end of an axon, tiny, saclike structures known as synaptic knobs manufacture chemicals, called neurotransmitters. The following sequence of events occurs rapidly:

1. A nerve impulse reaches the synaptic knob;
2. A neurotransmitter substance is released into the synaptic cleft;
3. The neurotransmitter substance is diffused across the synaptic cleft;
4. The neurotransmitter reacts with the membranes of the dendrite on the other side of the cleft;
5. The nerve impulse is reestablished in the dendrite and transmission is continued through the cell;
6. The neurotransmitter substance breaks down to prevent continued stimulation of the dendrite.

This process is repeated in each cell until the transmission is complete.

Figure 2.2 – Neuron



There are a variety of neurotransmitter substances within the nervous system. Among these are:

Acetylcholine - an excitatory neurotransmitter released by axons;

Norepinephrine - a neurotransmitter found in the brain, associated with arousal reactions and moods;

Dopamine - a neurotransmitter found in the brain, associated with body movement and pleasure;

Serotonin - a brain neurotransmitter associated with regulation of sensory perception, sleep and body temperature - alterations in the serotonin functioning have been found to be related to mental illness and certain drug-induced hallucinations;

Gamma-aminobutyric acid or GABA - an inhibitory neurotransmitter substance (one that blocks the transfer of a nerve impulse to an adjoining neuron) in the brain) - when the normal function of GABA is disrupted, convulsions may occur;

Glycine - an inhibitory neurotransmitter substance found in the spinal cord;

Enkephalins and endorphins - first discovered in 1975, both compounds have been extracted from the brain and pituitary gland - both compounds have pain killing properties that are more powerful than morphine, with endorphins being 40 times more powerful than enkephalins, and 100 times more powerful than morphine.

Current research seems to suggest that the presence or absence of such compounds as endorphins and enkephalins and especially dopamine may explain several conditions including compulsive drug abuse, chemical dependence, pain management, sexual activity, schizophrenia, and the natural "high" of exercise that many people experience. Further research is needed to help us identify exactly how this knowledge may be applied to successful treatment and recovery issues.

The Life Cycle and Action of Neurotransmitters

There is still a great deal that science can not tell us about the brain, especially with regards to the neurotransmitters. There is still uncertainty as to exactly where these substances are produced. It does appear, however, that the neurotransmitters that are used to communicate between neurons are made inside the brain cell from which they are to be released. This would seem to make sense, because if they were freely produced everywhere in the tissues of the brain, the release of a tiny amount from a nerve ending wouldn't be able to have any impact in transferring information from one neuron to another. However, the raw materials, or precursors, from which the neurotransmitter are made are found circulating in the blood supply and in the brain.

A cell that is going to make a particular neurotransmitter may need to bring in the right precursor in a greater concentration than exists in the whole brain. Brain cells apparently have a mechanism built into that cell's membrane for active uptake of the precursor. The precursors themselves are often amino acids that are derived from proteins in the diet, and these amino acids are used in the body for many things besides making neurotransmitters.

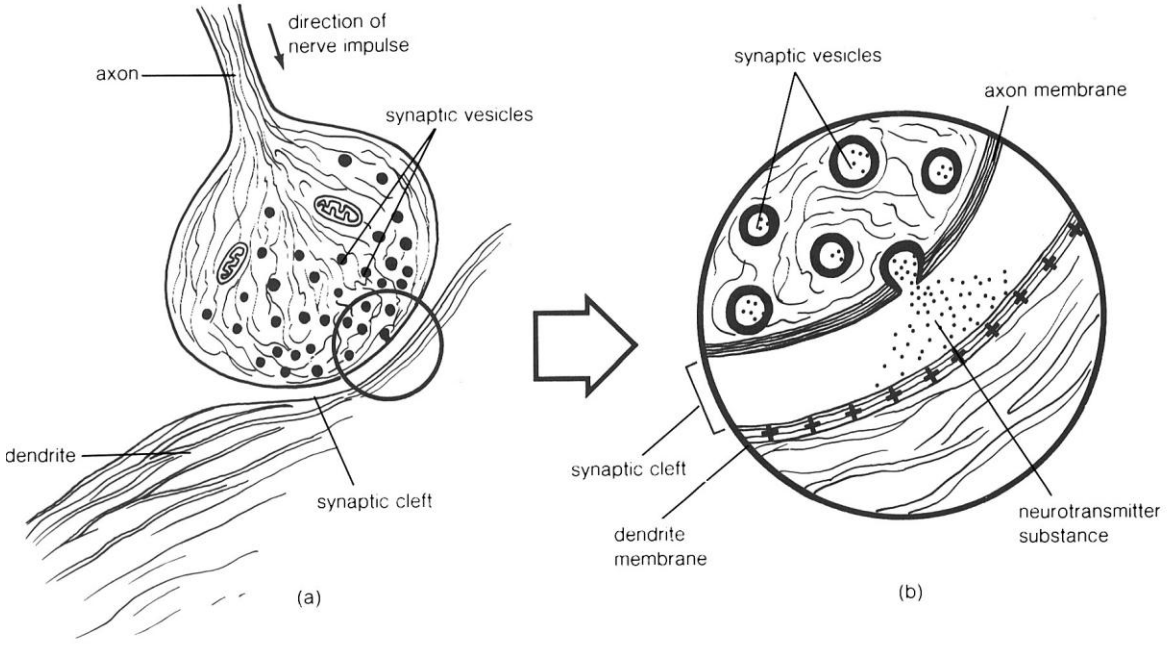
After the precursor molecule has been taken up into the neuron, it must be changed, through one or a series of chemical reactions, into the neurotransmitter molecule. This process is known as synthesis. At each step of the synthetic chemical reactions, the reaction is helped along by an enzyme. These enzymes are themselves large molecules that recognize the precursor molecule, attach to it briefly, and hold it in such a way as to allow the synthetic chemical reaction occur.

When the neurotransmitter molecules have been synthesized, they are stored in the small, round packages in the synaptic knob (which is found at the end of the axon), called synaptic vesicles, from which they will be released. When an electrical signal arrives from the neuron to the synaptic knob, some of the vesicles fuse with the cell membrane and then open, releasing many thousand neurotransmitter molecules at once. This process of neurotransmitter release takes place within a few thousandths of a second after the electrical signal reaches the synaptic knob.

Once the neurotransmitter molecules are released into the small synaptic cleft between neurons, a particular molecule may just float around briefly, or it may be one of the ones that bind to the receptor on the dendrite of the next neuron. This receptor represents the most important recognition site in the entire process, and it is also one of the most important places for drugs to interact with the natural neurotransmitter. With literally thousands of neurotransmitter molecules floating freely in the synaptic cleft, some will come near these receptors, bind to them briefly, and then float away again. In the process of binding, the neurotransmitter may distort the receptor so that a tiny passage is opened through the membrane, allowing an electrical current in the form of charged ions moving through the membrane. This opening does not last long, however, and within a few thousandths of a second the neurotransmitter molecule has left the receptor and the ion channel is closed.

The small, localized electrical current found at a single receptor might not have much effect all by itself. However, these electrical currents do spread, and, if enough receptors are activated at about the same time, then an electrical signal will be sent up the dendrite to the cell body of the neuron, then all the way down the axon to the synaptic knob and a transmitter will be released there. It is this action which takes place over and over that creates the electrical signals which carry information in and around the brain.

Figure 2.3 – Neurotransmission



Because activity in the nervous system occurs continuously and at a high rate, once a signal has been sent from one neuron to another, it is important to terminate that signal so that a new signal can be transmitted. Therefore, the thousands of neurotransmitter molecules released by a single electrical signal must be removed from the synaptic cleft. Two methods are used for this:

1. In some cells a process of reuptake takes place, in which the neurotransmitter is recognized by a part of the membrane on the neuron from which it was released. The releasing neuron then expends energy to recapture its released neurotransmitter molecules.

2. With other neurotransmitters, enzymes present in the synapse metabolize, or break down, the molecules. (This appears to be especially true with the neurotransmitter Dopamine. It is this loss from metabolism, and the body's inability to reproduce all or part of the Dopamine that appears to play a significant role in the addiction process.)

In either case, as soon as neurotransmitters are released into the synapse some of them are being removed or metabolized and never get to bind to the receptors on the other neuron. All neurotransmitter molecules may be removed in less than one hundredth of a second from the time they are released. (see **Figure 2.3**)

Examples of Drug Actions

The reason for learning about the action and life cycle of a typical neurotransmitter molecule is so that you can understand how foreign molecules, that enter the brain in the form of psychoactive drugs, interact with and alter the normal mechanism for synthesizing, storing, releasing, binding, reuptaking, and metabolizing those neurotransmitters.

One drug that interferes with the synthesis of the neurotransmitters dopamine and norepinephrine is methyldopa, which is used to treat high blood pressure. Methyldopa looks like DOPA, one of the chemicals produced during the synthesis of dopamine and norepinephrine. In the autonomic nervous system, methyldopa is acted on by some of the enzyme molecules that normally act on DOPA. The eventual result is the creation of false norepinephrine (methylnorepinephrine), which the neuron then stores and releases along with

some regular norepinephrine molecules. However, the false norepinephrine molecules do not activate the norepinephrine receptors in the heart or the blood vessels. Since norepinephrine usually causes increases in blood pressure, the false norepinephrine molecules reduce this effect.

The majority of drugs have their actions and effects at the receptors sites for neurotransmitters. Because the drug molecule resembles the natural transmitter in its structure, the receptor recognizes the drug molecule. Then the drug molecule may have the same type of action as the neurotransmitter itself does on those receptors. For example, the stimulant drug amphetamine is structurally similar to norepinephrine and dopamine, and one of its effects is to mimic norepinephrine at its receptors. In other cases a drug molecule may bind to the receptor but not activate it (for instance, not distort it so as to open an ion channel). If there are enough drug molecules and they have enough of a tendency to bind to the receptor, they may prevent most of the neurotransmitter molecules from having access to a receptor. The major tranquilizers such as chlorpromazine (Thorazine), which are used in treating psychotic behavior, act by blocking receptors for dopamine in the brain, thus reducing the activity in those dopamine pathways.

Some drugs work by slowing the removal of a neurotransmitter from the synaptic cleft, so that the molecules stay around and continue to bind to the receptors for a longer period than normal. The stimulant drug cocaine interferes with the reuptake of dopamine and norepinephrine, thus effectively increasing the duration and magnitude of each signal in those pathways. However, if too much neurotransmitter is left in the synapse so that the receptors are constantly bound to neurotransmitter molecules, information flow can cease. One of the most dramatic examples of this effect are the nerve gases, which are made up of molecules that bind irreversibly to the enzyme that normally breaks down the molecules of the neurotransmitter acetylcholine. With the enzyme thus tied up, the acetylcholine rapidly builds up in the synapse (there is no reuptake process for acetylcholine). Within minutes of exposure to a lethal dose of a nerve gas, respiration ceases and suffocation results.

The Brain

The brain (**Figure 2.4**) is the most complex structure in the nervous system. It is estimated that there are between 10 and 1,000 billion neurons contained within these tissues. It controls and integrates all human behavior. We are born with all the neurons we will ever have. These specialized cells cannot be reproduced by the body, so once a cell is destroyed it is gone for good. Cells can die during the natural aging process, and various drugs

(especially alcohol and inhalant drugs) can destroy several thousand cells at a time. Fortunately, even if we killed off 100,000 neurons each day, we would still die with over 7 billion cells.

Changes in mood and behavior which result from the use of psychoactive chemicals can be best understood when one is aware of the major structural and functional units within the brain:

The Medulla Oblongata - the portion of the brain which connects with the spinal column. It is composed of ascending and descending nerve fibers. The medulla controls the vital centers of the brain - breathing (respiration center), blood pressure (vasomotor center), heart rate (cardiac center), contraction of heart musculature, function of the gastrointestinal tract, sleeping and waking, behavioral alerting, attention and arousal, coughing, sneezing, swallowing, and vomiting. Some drugs can so severely depress these centers that death may occur, often due to respiratory failure. Such drugs include opiates and barbiturates.

A complex network of nerve fibers within the medulla is known as the reticular formation. Part of this formation is known as the ascending reticular activating system, or ARAS. The ARAS is involved in controlling sleeping, waking, and behavioral alerting. It also serves as a filter for incoming sensory impulses. Alcohol and other depressants block normal activity in the ARAS, while amphetamines increase ARAS activity. If nerve stimulation into the ARAS is increased so rapidly as to intensify alertness beyond normal limits, hallucinations often occur. This can happen with both excess stimulation and severe depression of the medulla's ability to filter outside stimuli.

Pons - the pons is a rounded bulge on the underside of the brain stem which connects the medulla to the mid- brain. It contains ascending and descending nerve fibers that relay impulses among the cerebrum, cerebellum and spinal cord.

Midbrain - the midbrain is a short segment of the brain stem located just above the pons. It contains bundles of nerve fibers that serve as motor pathways between the cerebrum and lower parts of the nervous system. Within the midbrain are housed the centers which control visual and auditory reflex as well as head movement. Psychedelic drugs work here to create visual or auditory hallucinations.

Cerebellum - a large, convoluted mass of nerve tissue located below the cerebrum and behind the pons and medulla. It serves as a reflex center, coordinating and integrating skeletal muscle movements. When depressed by psychoactive drugs, especially by alcohol intoxication, there is a loss of muscle coordination, staggering and a loss of balance.

Thalamus - located between the cerebrum and the mid- brain, the thalamus, in conjunction with the cerebral cortex, functions as a central relay station of the brain, where all incoming sensory impulses, except for smell, are channeled to the appropriate regions of the cerebrum. It is also responsible for interpreting sensations as either painful or pleasurable and is associated with body temperature and pressure.

Subthalamus - a small area situated beneath the thalamus and above the midbrain, which functions along with the cerebellum in controlling and coordinating motor activity.

Hypothalamus - located near the junction of the thalamus and midbrain, its function is to maintain homeostasis (body normal) by regulating various body activities and by linking the nervous system with the endocrine system. The hypothalamus has several important functions. It controls heart rate, arterial blood pressure, water and electrolyte (chemical) balance, hunger, body weight, movements and glandular secretions of the gastrointestinal tract, sexual behavior, and the synthesis of neurochemical substances that stimulate hormonal production by the pituitary gland. It also functions in the regulation of emotions and behavior. It is a prime site of action of many of the psychoactive drugs.

Limbic System - this system is actually the area where the cerebrum, thalamus and hypothalamus interconnect. It functions in the regulation of emotions, including fear, anger, pleasure and sorrow. It has a significant effect on behavior, especially those aspects which promote survival. Many tranquilizing drugs, especially Librium and Valium, depress the limbic system at doses far below the dose that depresses other brain functions. Rather than behavior being depressed, such drugs result in a tranquilizing and calming effect for the relief of anxiety.

Cerebrum - the largest and most complex part of the brain, which contains billions of neurons as well as nerve centers that have sensory, association and motor functions. It coordinates and interprets internal and external stimuli, and is the site of higher mental functions such as memory and reasoning. It is composed of two large masses or hemispheres, and is divided into various lobes. These lobes, and their functions, are:

> Frontal lobes - Motor areas which control movements of voluntary skeletal muscles. Association areas control higher intellectual processes, such as concentration, planning, problem solving, and judgment of the consequences of behavior.
>
> Parietal lobes - Sensory areas which are responsible for temperature, touch, pressure, and skin pain. Association areas function to help us understand speech and to use words to express thoughts and feelings.

Temporal lobes - Sensory areas responsible for hearing. Association areas used to interpret sensory experiences and in the memory of visual scenes, music and other complex sensory impulses.

Occipital lobes - sensory areas responsible for vision. Association areas involved in combining visual images with other sensory input.

The outermost area of the cerebrum, the cerebral cortex, is the gray, wrinkled matter that would be visible if you peered inside the skull and looked at the brain. Beneath the cortex are masses of white matter which contain nerve fibers, as well as more gray matter with neurons that relay impulses between the cortex and spinal cord. Many psychoactive drugs affect cerebral function either directly or indirectly. Stimulants increase neuron activity, sometimes to the point of hallucinations. Depressants decrease nerve cell function, affecting concentration as well as the perception of other stimuli.

For more detailed information on the anatomy of the brain, visit the Digital Anatomist Program of the University of Washington at: http://www9.biostr.washington.edu/da.html.

Figure 2.4 - The Brain