

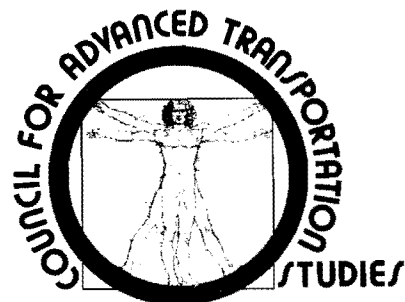
# **DRUGS AND THEIR EFFECT ON DRIVING PERFORMANCE**

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DRUGS AND THEIR EFFECT ON DRIVING PERFORMANCE

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For

Texas Office of Traffic Safety  
State Department of Highways and Public Transportation  
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## EXECUTIVE SUMMARY

Prescription and illicit drug use has become a common occurrence in the western world. Prescription drugs include the major and minor tranquilizers, antidepressant drugs, amphetamines and barbituates. Unwanted side effects from prescription drug use are varied but include such things as tremors, restlessness, Parkinsonian-like symptoms,<sup>1</sup> interference with the autonomic responses to stress and interference with visual and auditory perceptions,<sup>2</sup> drowsiness, loss of coordination, and dizziness.<sup>3</sup> The primary effect of these drugs is to alter mood; thus they aid in changing behavior. Research indicates that some of the major tranquilizers may affect performance on motor skills tests, with a particular result of slowing reaction times. Although few studies have been performed that measure the effects of the minor tranquilizers or antidepressants on driving skills, there is an indication that minor tranquilizers and antidepressants impair driving performance; and, therefore, further investigation is indicated. Additional evidence also suggests that the effects of alcohol in combination with psychotropic drugs increases impairment of motor skills and driving performance. Researchers highly recommend that patients undergoing drug therapy limit driving as much as possible and avoid drinking alcohol.

Marijuana, the hallucinogens and other illegally obtained drugs produce intoxicating effects. Research indicates a relationship between impaired driving skills and marijuana use. Increases in speedometer errors, impaired peripheral vision, insufficient caution and delayed action are among the skills affected by marijuana intoxication. Additional research reports that the effects of marijuana are similar to the effects of alcohol. Klein, Davis

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<sup>1</sup>N. Grant, Self Paced Drug Instruction Program: Basic Pharmacology, (Austin, Texas: The University of Texas at Austin Press, 1973), pp. 1-19.

<sup>2</sup>T. M. Eaton and M. H. Peterson, Psychiatry-Medical Outline Series, (Flushing, New York: Medical Examination Publishing Company, Inc., 1969).

<sup>3</sup>N. Grant, op. cit.

and Blackbourne<sup>4</sup> report that the decrement produced by the combination of alcohol and marijuana is significantly greater than alcohol alone or marijuana alone.

Although very little research is available with regard to the effects of the hallucinogens (lysergic acid, mescaline, psilocybin), Crancer and Quiring<sup>5</sup> report that all groups of illegal drug users had higher rates of accidents than a corresponding control group. The need for further research into the behavioral, physiological and psychological effects of marijuana and hallucinogens on driving safety is warranted. The unpredictable effects of these drugs, including flashbacks, plus their effects in combination with alcohol leads one to suspect that an individual's ability to perform the complex tasks of driving may be severely impaired.

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<sup>4</sup>A. W. Klein, J. H. Davis and B. D. Blackbourne, "Marijuana and Automobile Crashes," Journal of Drug Issues, 4 (January 1971), pp. 18-26.

<sup>5</sup>A. Crancer and D. L. Quiring, Driving Records of Persons Arrested for Illegal Drug Use: Report 011, (Washington Department of Motor Vehicles, May, 1968.)

## PREFACE

This is the fourth in a series of research reports describing activities and findings on accident research as part of the work conducted by the Council for Advanced Transportation Studies at the University of Texas at Austin under the auspices of the Texas Office of Traffic Safety, State Department of Highways and Public Transportation.

This report is concerned with the association of prescription and illicit drug use and accidents.

## ACKNOWLEDGMENTS

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## I. INTRODUCTION

Drug use in the western world has become more common. Drugs are used daily for their desirable and pleasant effects as well as for medicinal purposes.

Psychotropic drugs are widely prescribed by physicians for patients who are suffering from emotional symptoms or illnesses, alone or as an adjunct to therapy. The categories of psychotropic agents include the major tranquilizers (phenothiazines), minor tranquilizers, anti-depressants, sedatives, barbituates, amphetamines and others.

Gilbert states that in Ontario, Canada, prescriptions filled for minor tranquilizers increased 82 percent in the three years between 1970 and 1973 and total prescriptions filled increased 67 percent.<sup>1</sup> If this can be taken as an indication of how widespread the usage of medications prescribed to individuals to change mood and alter perception and behavior is, the implications for driving safety are considerable. Since most adults drink alcohol and most adults drive, adverse effects may also result from the medication-alcohol-driving interaction.

Marijuana (*cannabis sativa*), the hallucinogens (L.S.D., mescaline, psilocybin) and other illegal, "street drugs," provide an altered state of consciousness considered to be pleasurable by their users. "Street drugs" refer to unregulated drugs obtained illegally. These often include amphetamines, barbituates, cocaine, quaalude as well as combinations of these in one capsule. The increase in their use, particularly of marijuana, has been a widespread phenomenon in the United States. The effects of these "street drugs" may also have deleterious effects on driving performance.

Drugs are ingested to produce psychological or physical changes. In some cases, the primary purpose of an individual drug may not be to disrupt functioning; rather, however, the side effects are such that every day tasks, such as driving, are impaired.

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<sup>1</sup>R. Gilbert, "Drug Abuses as Excessive Behavior," Addictions, 22, No. 4 (Winter 1975), pp. 52-72.

The effect of alcohol on driving safety is the topic of another booklet; however, the psychotropic and mind-altering, illegal drugs in interaction with alcohol are discussed in this booklet.<sup>2</sup> The first section addresses itself to the effects of some of the psychotropic agents, including the amphetamines, in relation to traffic safety, and the second section deals with the mind-altering, illegal drugs, such as marijuana and the hallucinogens, in relation to accident causation.

Although extensive research has been conducted documenting primary effects, dose-response effects and psychological and physical changes, little research has specifically addressed itself to drugs in relationship to driving skills and accident causation. For the most part, experimentation has not been duplicated and, thus, verification or refutation of results is scanty. Caution must be used in drawing conclusions from drug research as it relates to traffic safety. General implications and tendencies, however, can provide information for future research.

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<sup>2</sup>R. Young , D. Valentine and M. Williams, Alcohol and Accidents, (Austin, Texas: Council for Advanced Transportation Studies, The University of Texas at Austin, 1977).

## II. PSYCHOTROPIC DRUGS

Drug therapy for individuals suffering from emotional and psychological problems became more widespread in the early 1950's. Psychiatry and the mental health profession found that the use of drug therapy allowed more patients to be cared for outside the psychiatric hospital. Family and group therapy, as well as psychotherapy and occupational and recreational therapy, was used as an adjunct to drug therapy. Kline and Davis report that approximately 65 to 75 percent of schizophrenic patients are helped by these drugs as compared with only 35 percent of the patients who are given a placebo.<sup>3</sup> They state that "there is evidence to indicate that drug treatment helps about three times as many patients as are helped by a placebo, and that drug therapy also prevents many patients from becoming worse."<sup>4</sup>

The use of any drug, however, carries with it a certain risk of unwanted side effects. This risk must be weighed against the effectiveness of the drug and the need for its use. Hypersusceptability (a greater than normal response to the ordinary dose of a drug) the presence of other medication or other causes of variation in response may exacerbate unpleasant side effects. Drug idiosyncrasies of specific individuals may also produce unexpected results. Independent reactions to the combined effect of two or more drugs may also increase or decrease the effect expected from a single drug. These risks, in addition to the generally expected side effects of the psychotropic drugs, have obvious implications for accident research.

Three general categories of psychotropic drugs are discussed in relation to accident research: the major tranquilizers, the minor tranquilizers and the anti-depressants. Barbituates and amphetamines are also briefly discussed.

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<sup>3</sup> N. S. Kline and J. M. Davis, "Psychotropic Drugs," American Journal of Nursing, 73, No. 1 (1973), pp. 54-63

<sup>4</sup> Ibid., p. 55.

## MAJOR TRANQUILIZERS

The major tranquilizers (primarily the phenothiazine group) are used primarily for their calming, anti-psychotic effect in schizophrenic patients. The major tranquilizers are believed to exert their main effect on lower brain centers rather than on the cerebral cortex. This drug group does not produce a tranquilization, however, rather it may cause the withdrawn schizophrenic patient to become active or it may sedate the excited schizophrenic patient. "Thus," Kline and Davis state, "they help to 'normalize' psychoses rather than produce uniform sedation or tranquilization."<sup>5</sup>

The major tranquilizers are most useful in treating conditions of excessive psychomotor activity. They often reduce the psychotic patient's panic, fear, and hostility. Hallucinating or delusional symptoms are often reduced; thus combative, destructive behavior often decreases.

It is important to remember that the major tranquilizers are anti-psychotic agents and may make depressive reactions worse and be of no value in treating hysteria, obsessive-compulsive behavior and other neuroses.<sup>6</sup>

The major tranquilizers or anti-psychotic agents have a variety of unwanted side effects. Grant lists Parkinsonian-like symptoms, including tremor at rest, rigidity, thickened or slurred speech, drooling, shuffling walk, and restlessness, as common side effects of these drugs.<sup>7</sup> Other side effects may include profuse sweating, pallor, fever, reactions involving the muscles of the face and neck, a feeling of inner disquiet, inability to sit or sleep, intolerance of inactivity, and continuous agitation.

Eaton and Peterson mention that the major tranquilizers (phenothiazines) may interfere with the autonomic responses to stress.<sup>8</sup> This may endanger

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<sup>5</sup> Ibid., p. 56

<sup>6</sup> N. Grant, Self Paced Drug Instruction Program: Basic Pharmacology, (Austin, Texas: The University of Texas at Austin Press, 1973), pp. 1-19.

<sup>7</sup> Ibid.

<sup>8</sup> T. M. Eaton and M. H. Peterson, Psychiatry-Medical Outline Series, (Flushing, New York: Medical Examination Publishing Company, Inc., 1969).

the patient who is exposed to an unexpected stress. They also state that in some cases the phenothiazines interfere with visual, auditory and kinesthetic perception, as well as possibly interfering with motor skills and coordination. Decrease in blood pressure, dizziness or fainting when the patient sits up or stands rapidly, changes in the eyes, and blurring of vision, among other unwanted side effects, have been noted.

Although these unpleasant side effects appear to be overwhelming, their positive effect for the emotional well being of the seriously disturbed patient must be taken into consideration. It is interesting to note that much of the behavior stereotypical of the hospitalized psychotic patient is a result of the side effects of their medication. Some of the side effects, as listed by Kline and Davis are shown in Table 1.

Milner and Landauer tested two major tranquilizers, thioridazine (mellaril) and chlorpromazine (largactil) against a placebo for their relationship with driving behavior.<sup>10</sup> Motor skills tests and a questionnaire were administered to 21 male subjects, equally divided into three groups, before and after taking thioridazine, chlorpromazine and a placebo. Alcohol was also administered to the patients to test the interaction with the major tranquilizers. Milner and Landauer reported that "the results clearly show that alcohol, chlorpromazine and thioridazine affect performance on motor skill tests. The phenothiazines tended to slow reaction times, chlorpromazine being most potent."<sup>11</sup> The researchers also warned that drinking alcohol while undergoing treatment with these drugs could be hazardous, as both major tranquilizers added to the sedative and motor skill inhibiting effects of alcohol.

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<sup>9</sup>N. S. Kline and J. M. Davis, op. cit., p. 57.

<sup>10</sup>C. Milner and A. A. Landauer, "Alcohol, Thioridazine, and Chlorpromazine Effects on Skills Related to Driving Behavior," British Journal of Psychiatry, 118, No. 544 (March 1971), pp. 351-352.

<sup>11</sup>Ibid., p. 352.

TABLE 1  
ANTIPSYCHOTIC SIDE EFFECTS

Type	Comment
Central nervous system	
Parkinsonian type	
1) Parkinsonian syndrome	Reduce dose, use antiparkinsonian drugs
2) Dystonia reaction	Use parenteral antiparkinsonian drugs
3) Akathisia (restlessness)	Use antiparkinsonian drugs
Tardive dyskinesia	Late-appearing drug syndrome
Seizure (rare)	Dose-related
Sedation	Usually rapid onset; patient develops tolerance
Behavioral toxicity	Reduce dose
Autonomic	
Orthostatic hypotension	Warn patient
Anticholinergic	
Dry mouth	
Tachycardia, aggravation of glaucoma, blurred vision, impaired bowel or bladder function	
Inhibition of ejaculation	Generally occurs with thioridazine
Allergic	
Cholestatic jaundice	Preceded by flu-like syndrome in first month of treatment
Agranulocytosis	Often present as sore throat and high fever in first three months of treatment
Eosinophilia	Occurs early in treatment, benign
Contact dermatitis	
Photosensitivity	Occurs most frequently with chlorpromazine

(CONTINUED)



TABLE 1 (continued)

Type	Comment
Metabolic	
Weight gain	
Edema	
Lactation, gynecomastia	
Menstrual irregularities	
Skin and eye	
Pigmentary retinopathy	Occurs with high doses of thioridazine
Pigmentation of skin and eye (cornea and lens)	Long-term, high dose of chlorpromazine

FROM: N. S. Kline and J. M. Davis, "Psychotropic Drugs," American Journal of Nursing, 73, No. 1 (1973), pp. 54-63.

Betts, Clayton and Mackay also have recognized that psychotropic medication is of concern in relation to driving safety.<sup>12</sup> One hundred volunteers (50 males and 50 females) were screened for medical and psychiatric problems. Four psychotropic drugs plus a placebo were administered to five equal groups of subjects. Three low-speed vehicle-handling tests were given to subjects after the medication was taken by subjects in regular doses over a 36-hour period. This was an effort to reproduce realistic usage by patients. Trifluoperazine (stelazine) and haloperidal (seranace), two of the drugs tested and both major tranquilizers, produced effects on driving ability. Betts, Clayton and Mackay reported that trifluoperazine affected performance in speed vehicle-handling tests. The results also showed that haloperidal had a significant depressant effect when combined with alcohol, and trifluoperazine interacted to a significant extent with alcohol to produce euphoria. The researchers state that "physicians should inform patients of the potential dangers involved and warn against driving at least during the first few days if taking psychotropic medication."<sup>13</sup>

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<sup>12</sup>T. Betts, A. Clayton and G. Mackay, "Effects of Four Commonly Used Drugs on Low-Speed Driving Performance Tests," British Medical Journal, 4, No. 5840 (1972), pp. 580-584.

<sup>13</sup>Ibid., p. 584.

## MINOR TRANQUILIZERS

The minor tranquilizers vary considerably in chemical structure and exert their main effect on the cerebral cortex and have a lesser effect on lower brain centers. The minor tranquilizers are used mainly to relieve the less severe manifestations of anxiety and tension in normal individuals who react adversely to environmental stresses and also for treatment of the symptoms of psychoneurosis. The appropriate and common term for these agents is antianxiety agents. The therapeutic effects of the antianxiety agents or minor tranquilizers include muscle relaxing properties, anti-convulsive effects, calming and tranquilizing actions and anxiety decrements. In addition to these calming effects, they produce anti-nausea and anti-histaminic effects and decrease action of the minor stomach muscle. Some of the most commonly used minor tranquilizers are meprobamate (equanil, miltown), diazepam (valium) and chlordiazepoxide (librium).

Grant states that unwanted side effects of anti-anxiety agents may include drowsiness, loss of coordination, dizziness, headache, gastrointestinal discomfort, nausea and vomiting, rash, chills and fever.<sup>14</sup> Chapman and Almeida also mention loss of intellectual and emotional control as a potential side effect of lesser overdoses.<sup>15</sup> Physical addiction to the minor tranquilizers over long periods of time is a possibility. Abrupt withdrawal of the drug from the addicted person precipitates a withdrawal syndrome. The danger of suicide attempts by patients using these drugs should also be kept in mind.

Most psychiatrists feel that the minor tranquilizers are not effective for patients exhibiting psychotic symptoms. Many psychiatrists and pharmacologists feel that there is little difference between the anti-anxiety agents and the sedative-hypnotics. Since the minor tranquilizers remove only a part

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<sup>14</sup>N. Grant, op. cit., pp. 1-19.

<sup>15</sup>A. H. Chapman and E. Almeida, The Interpersonal Basis of Psychiatric Nursing, (New York: G. P. Putnam's Sons, 1972).

of the patient's anxiety, it is recommended that their use be accompanied by therapy to resolve the patient's basic emotional and psychological problems. The adverse side effects mentioned have been a concern to researchers because of their possible effect on driving safety.

Linnoila and Mattila divided 90 military men into groups.<sup>16</sup> They were given drugs double blind in identical capsules: 10 mg. of diazepam (valium), 25 mg. of codeine phosphate, or 750 mg. of isoliazid. Drugs were administered in combination with a placebo or a similar alcoholic bitter drink. In addition to having their ability measured on an automatic simulator device (Sim-L-Car), the subjects were asked to assess their capacity of performance and the quality of their drug and drink. Linnoila and Mattila state that "alcohol alone increased the collision frequency and made the subjects prone to ignore instructions and safety rules. Diazepam (valium, a minor tranquilizer) alone increased the collision frequency...Diazepam given in combination with alcohol resulted in a further increase in the number of collisions and negligence of the rules, but a new phenomenon was serious steering errors."<sup>17</sup> As a side light, codeine also increased collision frequency and interacted with alcohol in the same way as diazepam.

Landauer, Laurie and Milner tested the effects of benzoctamine (tacitin), a newer minor tranquilizer, on driving skill by giving 33 subjects a battery of motor skill tests and questionnaires both before and after alcohol intoxication.<sup>18</sup> The subjects were divided in three equal groups of 11 subjects each, receiving 40 mg, 20 mg, and 0 mg of benzoctamine (tacitin) respectively. No differences in driving skills were found after benzoctamine alone was administered; however, three out of five performance variables decreased

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<sup>16</sup>M. Linnoila and M. J. Mattila, "Interaction of Alcohol and Drugs on Psychomotor Skills as Demonstrated by a Driving Simulator," British Journal of Pharmacology, 47, No. 3 (1973), pp. 671-672.

<sup>17</sup>Ibid., p. 671.

<sup>18</sup>A. A. Landauer, W. Laurie and G. Milner, "The Effect of Benzoctamine and Alcohol on Motor Skills Used in Car Driving," Forensic Science, 2 (1973), pp. 275-283.

significantly ( $p < .001$ ) after only alcohol was consumed. The authors conclude that there is no evidence that benzoctamine interacts in either a synergistic or antagonistic manner with alcohol. Thus, this study indicates no effect on driving performance with use of benzoctamine.

Schroeder, Ewing, Rause, Ball and Allen tested 30 male undergraduate volunteers for the effects of chlordiazepoxide (librium) and an antihistamine (methpyrilene hydrochloride) with and without the combination of alcohol on driving skills.<sup>19</sup> Eye movements were recorded while the subjects watched a training film. A driving simulator was also used to measure performance. The authors conclude that "the results of this exploratory experiment supported the contention that the use of alcohol in combination with other drugs, even a single dose at low blood concentrations, is significantly related to degradation of selective components of driving performance. The present study also suggests that different types of responses involved in driving are differentially affected by drugs."<sup>20</sup> Schroeder, et al. go on to emphasize that their results indicate that "low concentrations of alcohol, methapyrilene and chlordiazepoxide have significant effects alone and in combination on selective components of driving behavior."<sup>21</sup>

Although few studies have been performed that measure the effects of the minor tranquilizers on driving skills either alone or in combination with alcohol, it appears justifiable to caution patients to limit their driving as much as possible and avoid drinking alcohol while taking the anti-anxiety agents. Further research is certainly needed in this area.

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<sup>19</sup> S. R. Schroeder, et al., Synergistic Effects of Alcohol, Methapyrilene and Chlordiazepoxide on Drivers' Eye Movements and Tracking Errors in Simulated Dangerous Situations (Chapel Hill, North Carolina: Highway Safety Research Center, 1972).

<sup>20</sup> Ibid., p. 13.

<sup>21</sup> Ibid., p. 16

## ANTIDEPRESSANT DRUGS

Depression is the most common psychiatric disorder, is usually episodic and tends toward spontaneous improvement. Kline and Davis report that statistical studies indicate that about 40 percent of depressed patients recover spontaneously within three to four weeks after the onset of depression.<sup>22</sup> Drugs are usually prescribed for patients who have a severe depression lasting from several weeks to one year, especially if the patient has strong feelings of guilt and worthlessness, is physically slowed down, has lost interest in activities and has lost weight. The tricyclic drugs, one group of antidepressants, include imipramine hydrochloride (tofranil), amitriptyline (elavil), nortriptyline (aventyl) among others. The tricyclic drugs produce marked improvement in about 70 percent of depressed patients, as compared with 40 percent improvement with a placebo. Kline and Davis go on to state that "many of the 30 percent who do not improve with a placebo, but do improve under drugs, would if untreated, go on to have protracted depressions, entailing prolonged hospitalization. Some might have committed suicide."<sup>23</sup>

The monoamine oxidase (MAO) inhibitors, another main group of antidepressants, are mainly limited to hospital environments due to the danger involved in dosage regulation and the frequent and serious side effects.

The amphetamines and other short-acting stimulants are also occasionally used for mild depressions. Other measures are also used to aid the depressive patients. Supportive therapy, reduction in environmental stresses and improvement in the social setting are often used as an adjunct to prescribing antidepressant agents.

Since the tricyclic antidepressants are most commonly used for outpatients, research conducted on the effects of antidepressants on driving

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<sup>22</sup> N. S. Kline and J. M. Davis, op. cit., pp. 54-62.

<sup>23</sup> Ibid., p. 58.

skills is primarily limited to this group. The tricyclic antidepressants are closely related to the phenothiazine, antipsychotic agents and most of the unwanted side effects are the same. Table 2 lists the side effects for antidepressant drugs.<sup>24</sup>

Patman, Landauer and Milner gave 24 volunteers psychomotor tests measuring driving skills to determine the combined effect of alcohol and amitriptyline (elanie).<sup>25</sup> Although no positive joint drug reaction under the experimental conditions was found, the authors conclude, "nonetheless, it is probably best to warn all patients being given amitriptyline that the drug may add to the dangers of alcohol consumption and that at no time should they drink even a small amount and drive."<sup>26</sup>

Milner found that amitriptyline, when administered to albino mice in combination with alcohol, increased the toxicity of alcohol.<sup>27</sup> Although doses were high, Milner feels that patients should be warned of drinking alcohol while taking amitriptyline. He states, "drug effects represent a complex interaction between the individual patient, the chemical component and the environment."<sup>28</sup>

Again, research with the antidepressants is minimal; however, researchers continue to warn against driving, particularly in combination with alcohol.

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<sup>24</sup>Ibid., p. 59.

<sup>25</sup>J. Patman, A. A. Landauer, and G. Milner, "The Combined Effect of Alcohol and Amitriptyline on Skills Similar to Motor Car Driving." Medical Journal of Australia, 2 (1969), pp. 946-949.

<sup>26</sup>Ibid., p. 949.

<sup>27</sup>G. Milner, "Cumulative Lethal Dose of Alcohol in Mice Given Amitriptyline." Journal of Pharmaceutical Sciences, 57, No. 11 (1968), pp. 2005-2006.

<sup>28</sup>Ibid., p. 2006.

TABLE 2  
ANTIDEPRESSANT SIDE EFFECTS

Type	Comment
<b>Tricyclic Antidepressants</b>	
1. Behavioral Aggravation of psychosis Shift of depression to mania	Unusual
2. Central nervous system Tremor	
3. Autonomic Dry mouth, aggravation of glaucoma, bowel and bladder paralysis, edema EKG changes	Arrhythmia can be severe in overdose
4. Allergic Cholestatic jaundice Agranulocytosis	Rare Rare
<b>MAO Inhibitors</b>	
1. Behavioral Same as above plus - Excitement	
2. Central nervous system Same as above plus - Hypertensive crisis Intracerebral hemorrhage Hyperpyrexia Peripheral neuropathy	MAO inhibitors withdrawn Avoid cheese or other foods with high tyramine or pressor amine, such as amphetamine, cold remedies Avoid MAO inhibitors with tricyclic drugs
3. Autonomic Same as above	
4. Allergic Same as above plus - Hepatocellular jaundice	Very rare (not proven to be causative)

FROM: N. S. Kline and J. M. Davis, "Psychotropic Drugs," American Journal of Nursing, 73, No. 1 (1973), pp. 54-63.



## OTHER PRESCRIPTION DRUGS

Various prescription drugs have been cited as potential causes of elevated accident rates. Barbituates, often used as sleeping aides, depress the central nervous system. Effects of barbituates range from mild sedation with small doses to anaesthesia with large doses. Von Felsinger, Lasagna and Beecher found that visual perception, attention and computation were impaired up to eight hours after ingestion of sodium pentobarbital.<sup>29</sup> Reaction time studies have also shown that many barbituates slow down responsiveness.<sup>30,31</sup> Psychomotor and perceptual skills were also found to be impaired by therapeutic doses of barbituates.<sup>32,33</sup> The main effects of the barbituates certainly indicate that driving skills could be impaired, particularly among those people dependent on or addicted to them.

Amphetamines are generally used to increase mental and physical activity; however, these drugs have been found to create tremulousness, restlessness, agitation, impatience and aggressiveness. Smart, Schmidt and Bateman examined the accident rates of 30 psychoactive drug users who were patients of psychiatric hospitals in Toronto and had been diagnosed as addicted or dependent on some psychoactive drug prior to being in the study.<sup>34</sup> The authors found

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<sup>29</sup>Von Felsinger, L. Lasagna and H. K. Beecher. "The Persistence of Mental Impairment Following a Hypnotic Dose of a Barbituate." Journal of Pharmacology, 109, (1953), pp. 284-291.

<sup>30</sup>R. E. Goodnow, et al., "Physiological Performance Following a Hypnotic Dose of a Barbituate," Journal of Pharmacology, 102 (1951), pp. 55-61.

<sup>31</sup>H. E. Hill, and R. E. Belleville, "Effects of Chronic Barbituate Intoxication on Motivation and Muscular Coordination," American Medical Association Archives of Neurological Psychiatry, 70, (1953) pp. 180-188.

<sup>32</sup>G. A. Tallard, and G. C. Quarton, "Methamphetamine and Penobarbital Effects on Human Motor Performance." Psychopharmacologia, 8 (1968), pp. 241-250.

<sup>33</sup>W. Pare, "The Effect of Caffeine and Seconal on a Visual Discrimination Task," Journal of Comparative and Physiological Psychology, 54 (1961), pp. 506-509.

<sup>34</sup>R. G. Smart, W. Schmidt and K. Bateman. "Psychoactive Drugs and Traffic Accidents." Journal of Safety Research, 1, No. 2 (June 1969), pp. 67-73.

that the subjects had accident rates about twice as high as would be expected for their age, sex and driving exposure. Most of the excess of accidents was contributed by those addicted to amphetamines. Users of amphetamines, alone or in combination with other drugs, had a 3.7 times higher accident rate than would be expected.

Smart, Schmidt and Bateman also found that those subjects using alcohol and barbituates, barbituates only or tranquilizers only had fewer accidents than expected. Those dependent on alcohol and tranquilizers, with or without barbituates, however, had elevated accident rates.

The authors suggest as a possible explanation of the results: "Amphetamines characteristically raise activity levels and this alone could make driving after ingestion a common event, whereas tranquilizers and especially barbituates tend to make people sleepy, lethargic and perhaps inhibit driving."<sup>35</sup>

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<sup>35</sup>Ibid., p. 72.

## SUMMARY

There is tentative evidence that psychotropic drugs may impair driving ability and result in traffic accidents. There is certainly evidence that extensive research must be made to determine how the physiological and psychological effects of the psychotropic agents affect driving skills. Milner studied patients of general practitioners out-patient clinics and psychiatrists and admissions to an early treatment psychiatric hospital.<sup>36</sup> Milner found that psychotropic drugs were prescribed for 73.5 percent of the 564 patients attending psychiatrists and for 8.5 percent of the 4,020 general practice patients. The author also found that 57 percent of the males and 35 percent of the females given psychotropic drugs may drink and drive. Phenothiazines (major tranquilizers) and other tranquilizers were prescribed for 45 percent of the patients. Barbituates and other sedatives were next most common. More than one drug was prescribed for 33 percent of the patients.

These statistics, alone, indicate the prevalence of psychotropic drug use. The primary function of these drugs are prescribed to alter mood and aide in changing behavior which may affect driving ability. Unwanted side effects may further decrease driving performance. It is essential that thorough research be performed to determine whether psychotropic drug use has an effect on driving safety. The psychotropic agents in combination with alcohol may have additional risks to the driver of a vehicle. Milner states, "As psychotropic drugs are long lasting and generally taken over lengthy periods, inappropriate and dangerous driving behavior may result from their interactions with alcohol. Warning patients of the possible dangers of drinking and driving while on psychotropic drugs, avoiding casual prescribing of polypharmacy, prolonged treatment and excessive dosage, should reduce the risks associated with drug therapy."<sup>37</sup>

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<sup>36</sup>G. Milner, "Drinking and Driving in 753 General Practice and Psychiatric Patients on Psychotropic Drugs," British Journal of Psychiatry, 115, No. 518 (1969), pp. 99-100.

<sup>37</sup>Ibid., p. 99.

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### III. "STREET" DRUGS

Marijuana, the hallucinogens and other illegal and illegally obtained drugs are commonly referred to as "street drugs." The use of these drugs has continued to increase over the last decade in the United States to the extent that they are available to most high school students and some junior high school students. Since these drugs are not regulated for impurities and their effect, dose-response relationship and side effects have not been adequately determined through thorough research, there is great concern for the well being of the users of marijuana, the hallucinogens and other "street drugs." Short-term and long-term effects of the use of these drugs are unpredictable.

In addition to the direct concern for individuals regularly using "street drugs" for their pleasant effects there is the concern for the effect on traffic safety. The deleterious effects of alcohol on driving performance are well documented.<sup>38</sup> It is probable that other drugs which produce intoxicating effects also decrease driving performance and cause a decrease in driving skills.

<sup>38</sup>M. Young, D. Valentine, and R. Williams, op. cit.

## MARIJUANA

Marijuana is a preparation of flowering tops, leaves, stems and seeds of the Indian hemp, *cannabis sativa*. The sticky resin exuded by the tops of the plants, contains the intoxicating substance. The male plants produce a minimal amount of resin and are mainly grown for hemp fiber. The resin when prepared for smoking or eating is called "hashish." Marijuana is commonly smoked and the potency varies, depending on the amount of resin present. Tri trans-tetrahydro-cannabinol (THC) is the fraction of the resin which is active. Synthetic THC is now available for research purposes and as an illegal "street drug."

Marijuana was used therapeutically in the United States since the 19th Century; however, more widespread use caused societal concern in the 1920's and severe legal penalties were imposed in the 1930's. The increase of its use in the 1960's, particularly on college campuses, and its now common usage in secondary schools by all social classes has stimulated research and is a cause of great concern.

Research has been performed on the effects of cannabis which indicates impaired performance on simple intellectual and psychomotor tests;<sup>39</sup> inferior performance on both manipulative and coordination skills,<sup>40</sup> verbal learning impairments<sup>41</sup> as well as some other indications of decreased performance. Other studies have found no significant impairment.

There is no doubt, however, that inhaling marijuana smoke or ingesting marijuana does produce intoxicating effects, known as a "high." Marijuana

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<sup>39</sup>A. T. Weil, N. E. Zinberg, and J. M. Nelsen, "Clinical and Psychological Effects of Marijuana in Man," Science, 162 (December 13, 1968), 1234-1242.

<sup>40</sup>G. Salvendy and G. P. McCabe, Jr., "Marijuana and Human Performance," Human Factors, 17, No. 3 (1975), pp. 229-235.

<sup>41</sup>W. Rickles, et al., "Marijuana Induced State-Dependent Verbal Learning " Psychopharmacologia, 30, No. 4 (1973), pp. 349-354.

usage produces divergent emotional responses. Blackbourne and Davis state, "It is with this drug that one may observe great confusion between the terms abuse and use. The facts are that moderate use under restricted circumstances by stable individuals leads to no problems. On the other hand, accessibility to the unstable person or drug dependent personality can lead easily to abuse in terms of excessive frequency of use as well as judgment impairment where judgment is needed, especially upon the highway."<sup>42</sup>

The effect of marijuana intoxication on driving skills and highway safety is of great concern to accident researchers. Much of the available research compares the effects of marijuana with those of alcohol. Sterling-Smith and Graham found in their interviews with 393 marijuana smokers (each smoked marijuana three or more times in the year prior to the study) that the experienced marijuana users reported in the majority when under the influence of marijuana "it was more difficult to concentrate on a job or project (i.e., a driving task), that it was considerably easier to be distracted (i.e., from the driving task), that they found it more difficult to make sudden decisions (i.e., in response to danger signals, traffic lights, etc.), that they found it easier to make foolish or impulsive decisions (i.e., wrong decisions for danger signals), that they found it more difficult to make sudden physical movements (i.e., braking, turning) and that they found it harder to remember things (i.e., highway directions, vehicle instrumentation, etc.)."<sup>43</sup>

Crancer, Dille, Delay, Wallace and Haykin compared the effects of a marijuana high, alcohol intoxication and no treatment on simulated driving performance.<sup>44</sup> Thirty-six subjects were screened and the experiment was

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<sup>42</sup>B. D. Blackbourne and J. H. Davis, "Drug Abuse Problems," Journal of Drug Issues, 1, No. 1 (January 1971), p. 88.

<sup>43</sup>R. S. Sterling-Smith and D. D. Graham, Marijuana and Driver Behavior: Historic and Social Observations Among Fatal Accident Operators and a Control Sample, (Washington, D. C.: National Highway Traffic Safety Administration, May, 1976), p.89

<sup>44</sup>A. Crancer, et al., "Comparison of the Effects of Marijuana and Alcohol on Simulated Driving Performance," Science, 164 (May 1969), pp.851-854.

conducted over a six-week period. The researchers concluded from their results that marijuana-wise subjects under the influence of marijuana had significantly more speedometer errors. There was no significant difference in accelerator, brake, signal, steering and total errors on the simulator than under control conditions. The same subjects intoxicated from alcohol, however, were found to have significantly more accelerator, brake, signal, speedometer, and total errors than under control conditions. Crancer, et al., suggested that impairment in the simulated driving performance is not a function of increased marijuana dosage or inexperience with the drug.<sup>45</sup>

In another study, Smart gave questionnaires to 246 college students in Canada who held drivers' licenses the previous year.<sup>46</sup> Based on self-reports regarding accident and traffic violation incidents, "the results suggest that for this population marijuana use contributes to very few accidents and charges, only about one third of those for alcohol."<sup>47</sup> Smart mentioned, however, that driving after a marijuana high may occur much less often than after alcohol usage and suggests that the legalization of marijuana may increase the number of marijuana influenced drivers, thus affecting traffic safety.<sup>48</sup> The frequency of driving within an hour after marijuana or alcohol use during the past year is represented in Table 3.<sup>49</sup>

The incidences of driving immediately following marijuana intoxication are certainly lower than for those individuals driving under the influence of alcohol. However, it is apparent that many individuals do drive while "high" on marijuana, indicating the need for traffic research in the area.

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<sup>45</sup>Crancer, et al., op. cit., pp. 851-854.

<sup>46</sup>R. Smart, "Marijuana and Driving Risk Among College Students," Journal of Safety Research, 6, No. 4 (December 1974), pp. 155-159.

<sup>47</sup>Ibid., p. 158.

<sup>48</sup>Ibid., pp. 155-159.

<sup>49</sup>Ibid., p. 157.



TABLE 3

FREQUENCY OF DRIVING WITHIN  
AN HOUR AFTER MARIJUANA OR  
ALCOHOL USE IN PAST YEAR

Number of Driving Occasions	Number of Drivers	
	After Marijuana	After Alcohol
0	186	65
1	15	17
2	5	26
3	5	29
4	2	8
5	4	8
6	1	9
7	0	3
8	3	3
9	1	1
10+	24	68
No reply	0	0
Total	246	246

FROM: R. Smart, "Marijuana and Driving Risk Among College Students," Journal of Safety Research, 6, No. 4 (December 1974), p. 157.

Waller, Lamborne and Steffenhagen investigated the use of marijuana and alcohol among 1271 Vermont college students. Almost one-half of the students (N=626) had used marijuana.<sup>50</sup> Sixty percent of this group combined it with alcohol at least occasionally, 39 percent did so at least half of the time they used marijuana and 14 percent combined the two drugs at least once a week. More than 90 percent of the marijuana users drove automobiles. The authors reported that 25 percent of the impaired driving among users occurred while they were high on both marijuana and alcohol.

Again, the research suggests that there exists a substantial population of drivers who are under the influence of marijuana and/or marijuana coupled with alcohol. Sterling-Smith and Graham established within a sample of 267 drivers who were most responsible for a traffic fatality that "43 (16 percent) were clinically evaluated with a reliable degree of certainty to have been under the influence of marijuana at the time of their respective fatal accident."<sup>51</sup> Among the 43 marijuana influenced operators, 13 (30 percent) had not been using alcohol or any other drug. The remaining 30 (70 percent) had been smoking marijuana and drinking alcohol.

The authors also administered a human factor stress questionnaire to the 43 operators with focal accident marijuana influence. Table 4 lists the human factor stress items and the number and percentage of drivers who reported such stresses.<sup>52</sup>

Additional research tends to confirm the decreased driving performance of individuals under the influence of marijuana. Maskowitz, Sharma and McGlothlin specifically tested for the effect of marijuana on peripheral vision.<sup>53</sup> Twelve subjects (21-32 years old) were given four different treatment levels of smoked marijuana (0, 50, 100 and 200 micrograms of THC per kg

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<sup>50</sup>J. A. Waller , K. R. Lamborne and R. A. Steffenhagen , Marijuana and Driving Among Teenagers: Use of Marijuana and Other Drugs, (Burlington, Vermont: University of Vermont, 1973).

<sup>51</sup>R. S. Sterling-Smith, op. cit., p. 74.

<sup>52</sup>Ibid., p. 154.

<sup>53</sup>H. Maskowitz , S. Sharma and W. McGlothlin, "Effect of Marijuana Upon Peripheral Vision as a Function of the Information Processing Demands in Central Vision," Perceptual and Motor Skills, 35, No. 3 (1972), pp. 875-882.

TABLE 4

HUMAN FACTOR STRESS ITEMS KNOWN TO HAVE BEEN INFLUENCING  
THE 43 OPERATORS WITH FOCAL ACCIDENT MARIJUANA INFLUENCE

<u>HUMAN FACTOR STRESS ITEM</u>	<u>OPERATORS INFLUENCED</u>
1. To let off steam or after an argument	34 (79%)
2. After drinking a little (BAC .01 to .04 gm/100ml % or a similar clinical evaluation)	3 (7%)
3. After drinking too much (BAC greater than or equal to .05 gm/100ml % or a similar clinical evaluation)	30 (70%)
4. After using street or entertainment drugs	3 * (7%)
5. Early in the evening (6:00 to 10:00 PM)	13 (30%)
6. Late at night (10:00 PM and following)	21 (49%)
7. Driving alone	17 (40%)
8. When late for an appointment/tardiness	13 (30%)
9. When tired or fatigued	16 (37%)
10. Driving on an unfamiliar road	7 (16%)
11. Driving an unfamiliar vehicle	11 (26%)

\* 5 operators were using "other drugs" including 2 with pharmaceuticals that had been prescribed and 3 with street or entertainment drugs

FROM: R. S. Sterling-Smith and D. D. Graham, Marijuana and Driver Behavior: Historic and Social Observations Among Fatal Accident Operators and a Control Sample, (Washington, D. C.: National Highway Traffic Safety Administration, May 1976), p. 154.

of body weight) and were tested for visual performance under complex visual and attentional situations. The authors' results indicated that "peripheral vision is impaired progressively by increased doses of marijuana, as shown by increased failure of light detections. In addition, there is a concomitant failure to handle information presented to vision, as shown by increased errors in counting the central light blinks."<sup>54</sup>

Also, they suggested that alcohol impairment of peripheral vision was observed only when there was a division of attention between central visual tasks and peripheral vision tasks, whereas marijuana impaired peripheral vision even when no central visual tasks demanded attention.

Klonoff sought to determine the effects of low and high doses of marijuana on driving performance in an on-the-road test.<sup>55</sup> Sixty-four subjects (19-31 years old) were asked to drive in a restricted, traffic-free area, as well as on streets of a downtown area, during peak hours of traffic flow after inhalation of low dosage and high doses of marijuana and after a placebo. Results indicated that smoking marijuana had a significant detrimental effect ( $p < .05$ ) on driving skill and performance, with no difference with regard to sex, driving experience or experience with driving under the influence of marijuana. Some of the common errors among marijuana influenced subjects included loss of discrimination between course markers, driving off course, insufficient caution, preoccupation with traffic signals and lack of response to green lights.

In a laboratory controlled, light board test which measured the time required to hold a circle in a ring for a full second, Binder found that marijuana smoking produced a decrement in that component of performance in 20 subjects (19-25 years old) who were matched against a control group.<sup>56</sup>

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<sup>54</sup>

H. Maskowitz, op. cit., p. 881.

<sup>55</sup>

H. Klonoff, "Marijuana and Driving in Real-Life Situations," Science, 186, No. 4161 (October 1974).

<sup>56</sup>

A. Binder, "An Experimental Approach to Driver Evaluation Using Alcohol Drinkers and Marijuana Smokers," Accident Analysis and Prevention, 3 (1971), pp.237-256.

These results support earlier research with regard to delayed action. Whether the light board reliably reflects driving skills is questionable, however.

Bech<sup>57</sup> and Rafaelson<sup>58</sup> reported in two independent studies that the similarities between the effects of marijuana and alcohol were more similar than different. Bech measured eight young volunteers on driving simulators and with psychological tests and reported that "in the behavioral part of our simulator study, we found that the similarities between the effects of cannabis and alcohol were more dominant than the differences. The results show that, phenomenologically, cannabis differs from alcohol in having a profound effect on the subjective estimations of time and distance."<sup>59</sup> Rafaelson found similar results in his study of eight subjects, adding that both cannabis and alcohol increased the time required to brake and start, whereas alcohol increased while marijuana decreased the number of gear changes. Rafaelson reported that a marijuana dose relationship was not found.<sup>60</sup>

Manno, Kiplinger, Scholz, Fanney and Haines gave twelve subjects three different doses of THC (0 mg, 2.5 mg and 5 mg) with and without alcohol concentrations of .05 percent and tested the subjects on motor performance, mental performance and subjective effects.<sup>61</sup> The authors reported significantly decreased performance after a 5 mg dose of THC, compared to the placebo

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<sup>57</sup>P. Bech, "Cannabis and Alcohol: Effects on Estimation of Time and Distance," Psychopharmacologia, 32, No. 4 (1973), pp. 373-381.

<sup>58</sup>O. J. Rafaelson, "Cannabis and Alcohol: Effects on Simulate Car Driving," Science, 197 (March 2, 1973), pp. 920-923.

<sup>59</sup>P. Bech, op. cit., p. 380.

<sup>60</sup>O. J. Rafaelson, op. cit., pp. 920-923.

<sup>61</sup>J. E. Manno, et al., "The Influence of Alcohol and Marijuana on Motor and Mental Performance," Clinical Pharmacology and Therapeutics, 12 (1971), p. 208.

condition, both with and without alcohol. Interestingly, they reported that the combination of alcohol and THC generally produced an additive decrement in performance. They stated that "the decrement produced by the combination of alcohol and marijuana was significantly greater than alcohol alone or marijuana alone."<sup>62</sup>

Although the equipment used may not have been capable of demonstrating a dose-response phenomenon, Manno, et al., found no difference between the two doses of THC in any of the tests.

Sterling-Smith and Graham report that "marijuana continues to be the second most commonly used drug in contemporary society preceded only by commercial alcohol."<sup>63</sup> Very little, however, is known about the behavioral effects of marijuana, particularly as it relates to driving ability. Problems in marijuana research are numerous. Marijuana is an illegal drug, and subjects are reluctant to cooperate with researchers. It is also difficult to readily determine if a driver is under the influence of marijuana. Typically only young subjects are used in experimentation and doses per individual are difficult to control. In spite of these difficulties, the investigation of the effects of marijuana on highway safety must be continued.

Klein states, "Unless adequate research is extended in this direction, we may assume that marijuana related traffic crashes of abnormal behavior shall remain unreported."<sup>64</sup> As long as marijuana related traffic incidents remain unreported and extensive research is not completed, the effects of marijuana on driving safety will remain elusive.

The research reviewed does provide indications of the relationship between driving skills and the effects of marijuana. Further research in

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<sup>62</sup>J. E. Manno, et al., op. cit., p. 208.

<sup>63</sup>R. S. Sterling-Smith, op. cit., p. 90.

<sup>64</sup>A. W. Klein, J. H. Davis, and B. D. Blackbourne, "Marijuana and Automobile Crashes," Journal of Drug Issues, 4 (January 1971), pp. 18-26.

the direction of marijuana's relationship with traffic safety may include peripheral vision, effects on time and distance, distractability and delayed action.

The marijuana user is also more prone to the use of other drugs. Klein, Davis and Blackbourne surveyed 571 individuals from various colleges and professional schools with regard to drug use.<sup>65</sup> Table 5 indicates that the marijuana user is more likely to use or experiment with other drugs.<sup>66</sup>

This multi drug use compounds the problems of research as well as elevates the risk from drivers who may be under the influence of marijuana and another drug.

It is wise to caution individuals who use marijuana, even at this state in research, that driving under the influence of marijuana is not recommended.

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<sup>65</sup> Ibid. , p. 18-26.

<sup>66</sup> Ibid., p. 25.

TABLE 5

## MARIJUANA USE AND OTHER DRUGS

<u>Marijuana Use</u>	<u>Number*</u>	<u>Percent of Group Which Use or Used</u>			
		<u>Alcohol</u>	<u>Tobacco</u>	<u>LSD</u>	<u>Heroin</u>
Non-Users	247	22%	27%	0%	0%
Former Users	72	21%	51%	9%	0%
Infrequent Users (less than 4 times per month)	38	50%	50%	21%	5%
Weekly Users (4 to 8 per times per month)	46	50%	46%	41%	11%
Chronic Users (more than 8 times per month)	100	47%	69%	64%	19%

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\*Out of 571 replies there were 68 which did not indicate frequency of use.

FROM: A. W. Klein, J. H. Davis, and B. D. Blackbourne, "Marijuana and Automobile Crashes," Journal of Drug Issues, 4 (January 1971), pp. 18-26.



## HALLUCINOGENS

The group of hallucinogenic drugs includes lysergic acid diethylamide (LSD), mescaline and psilocybin, as well as cannabis, which has already been discussed. Very little research had been conducted which measures the effects of LSD, mescaline and psilocybin despite their frequency of use. These drugs have similar effects but vary widely in effective doses. LSD is the most powerful and is taken in milligrams. All of these drugs are illegal substances in the United States yet are relatively easy to obtain. LSD is laboratory manufactured, mescaline is found in one species of cactus and psilocybin is found in a species of mushroom. The effects of these drugs include "an increased sensitivity to all varieties of stimuli, hallucinations, a waxing and waning of the intensity of colors, prolonged afterimages, illusions, changes in depth perception, disturbances in body image, and alteration of cognition and judgement."<sup>67</sup> The ability of the hallucinogens to produce "flashbacks" or reoccurrences is not shared by other drugs, such as alcohol, barbiturates, amphetamines and other psychotropic drugs; thus, this drug group has an added risk for drivers as well as making it extremely difficult to research the effect on driving safety.

Woody discussed three case studies of individuals who were hallucinogenic drug users and had visual disturbances while driving.<sup>68</sup> The author concluded that "prolonged afterimages, visual hallucinations and alterations of cognition and judgment are three of the many acute effects of hallucinogens."<sup>69</sup>

Smart and Fejer surveyed 710 students from Toronto high schools who held drivers' licenses.<sup>70</sup> An anonymous questionnaire, was administered in a

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<sup>67</sup> G. W. Woody, "Visual Disturbances Experienced by Hallucinogenic Drug Abusers While Driving," American Journal of Psychiatry, 127, No. 5 (November 1970), p. 143.

<sup>68</sup> Ibid., pp. 143-146.

<sup>69</sup> Ibid., p. 145.

<sup>70</sup> R. G. Smart and D. Fejer, "Drug Use and Driving Risk Among High School Students," Accident Analysis and Prevention, 8, No. 1 (1976) pp. 33-38.

in a classroom situation. Table 6 indicates the number of individuals using various drugs and the percentage of these individuals who had at least one accident.<sup>71</sup> Table 7 indicates drug use and the percentage of individuals having at least one driving offense.<sup>72</sup> It is readily apparent that drivers using glue, opiates, speed, LSD and other hallucinogens had more accidents. Again, more traffic violations were found among users of hallucinogens as well as glue, and, other stimulants. Smart and Fejer state that "not-users of all drugs less frequently report accidents than do users. The significant differences are for users of tobacco, marijuana, opiates, speed, LSD and other hallucinogens."<sup>73</sup>

Crancer and Quiring studied 302 persons who were in the files of the Seattle Police Department as users of illegal drugs and were holders of current, valid Washington drivers' licenses.<sup>74</sup> The population included 100 narcotic users, 123 dangerous-drug users (amphetamines, barbituates and hallucinogens) and 79 marijuana users. Crancer and Quiring reported that all groups of illegal-drug users had higher rates of accidents than a corresponding control group. The accident rate for narcotics users was 29 percent higher; for dangerous-drug users, 57 percent higher; and for marijuana users, 39 percent higher. With respect to violation rates, each illegal drug group was statistically higher than the control group. The authors also report that only 10.8 percent of all illegal drug users who are male have clear accident records compared with 42.1 percent in the control group. The lowest percentage of clear records, 5.8 percent, is found for males in the dangerous drug group. Reckless driving, negligent driving, hit and run and defective equipment were the four types of violations found in higher proportion among illegal drug users than in the control group.

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<sup>71</sup>Ibid., p. 35.

<sup>72</sup>Ibid., p. 35.

<sup>73</sup>Ibid., p. 37.

<sup>74</sup>A. Crancer and D. L. Quiring, Driving Records of Persons Arrested for Illegal Drug Use: Report 011, (Washington Department of Motor Vehicles, May, 1968).

TABLE 6

DRUG USE AND DRIVING RISK AMONG HIGH SCHOOL STUDENTS:  
NUMBER AND PERCENT WITH CAR ACCIDENTS

	Non-Users		Users		Chi Square	p <
	Total Number	% with Accidents	Total Number	% with Accidents		
Tobacco	426	11.5	284	20.8	10.65	.001
Alcohol	52	11.5	658	15.5	.04	.80
Marijuana	439	11.4	271	21.4	13.01	.001
Glue	704	15.1	6	33.3	.43	.50
Solvents	695	15.0	15	26.7	.78	.30
Barbituates	579	14.0	131	20.6	3.13	.05
Opiates	685	14.2	25	44.0	14.41	.001
Speed	693	14.1	17	58.8	22.33	.001
Stimulants	670	14.6	40	25.0	2.39	.10
Tranquilizers	634	14.0	76	25.0	5.50	.02
LSD	681	13.8	29	48.3	23.02	.001
Other Hallucinogens	658	13.4	52	38.5	21.61	.001

FROM: R. G. Smart and D. Fejer, "Drug Use and Driving Risk Among High School Students," Accident Analysis and Prevention, 8, No. 1 (1976), pp. 33-38.

TABLE 7

DRUG USE AND DRIVING RISK AMONG HIGH SCHOOL STUDENTS:  
NUMBER AND PERCENT OF USERS AND NON-USERS OF DRUGS WITH DRIVING OFFENCES

	Non-Users		Users		Chi Square	p <
	Total Number	% with Offenses	Total Number	% with Offenses		
Tobacco	426	15.8	284	27.5	15.03	.001
Alcohol	52	13.5	658	20.4	1.14	.20
Marijuana	439	15.5	271	27.7	14.72	.001
Glue	704	20.0	6	33.3	.08	.70
Solvents	695	20.0	15	26.7	.09	.70
Barbituates	579	20.4	131	19.1	.48	.30
Opiates	685	19.6	25	36.0	.55	.30
Speed	693	19.9	17	29.4	1.61	.20
Stimulants	670	19.1	40	37.5	6.83	.001
Tranquilizers	634	19.6	76	25.0	.93	.70
LSD	681	19.7	29	31.0	1.57	.20
Other Hallocinogens	658	18.4	52	42.3	15.68	.001

FROM: R. G. Smart and D. Fejer, "Drug Use and Driving Risk Among High School Students," Accident Analysis and Prevention, 8, No. 1 (1976), pp. 33-38.

Although it is impossible to determine the reason for the poor driving records of the illegal drug groups in Crancer and Quiring's study, physiological impairment as the result of drug use certainly should be of primary consideration. The authors state that this study "indicates that further, more detailed inquiry into the relationship between illegal drug use and driving performance is warranted. Such studies should attempt to determine the reason for the observed deviation in driving performance."<sup>75</sup>

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<sup>75</sup>A. Crancer and D. L. Quiring, op. cit., p. 4.

## SUMMARY

The widespread use of illegal drugs, particularly among young people, definitely warrants further investigation into their behavioral, physiological and psychological effects. The use of marijuana and hallucinogens while driving certainly has an impact on driving safety. The unpredictable effects of these drugs, including flashbacks, plus their effects in combination with alcohol leads one to suspect that an individual's ability to perform the complex tasks of driving may be impaired.

Although research in this area is incomplete, the investigations reviewed indicate a relationship between decreased driving performance and illegal drug use.

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## BIOGRAPHICAL SKETCHES

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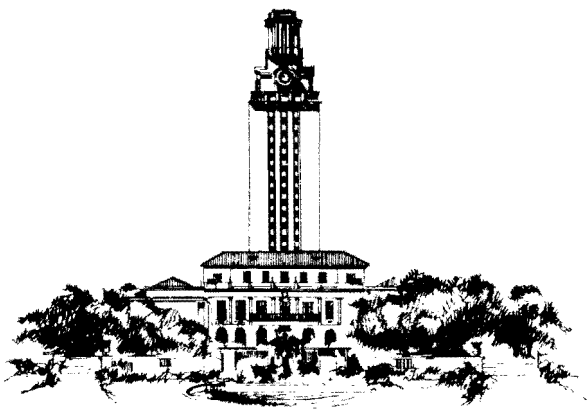
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