

J. C. Garriott,¹ Ph.D. and N. Latman,² M.S.

Drug Detection in Cases of "Driving Under the Influence"

The role of ethyl alcohol as a significant factor in traffic arrests and accidents has been established through numerous studies [1], while that of other drugs and their incidence in the driving population is less clear. Several studies have, however, demonstrated a high incidence of drugs in "intoxicated drivers" by questioning or urine analysis [2-4]. Finkle et al [3] reported 21% of arrested, drinking drivers indicated on routine questioning some kind of concurrent drug use.

The present study is the result of analyses of blood samples of drivers arrested in Dallas County for "driving under the influence of drugs" (DUID) in a 1½-year period.

Methods

Samples

In Dallas County, individuals arrested for driving under the influence are tested for alcohol intoxication by breath analysis using the Breathalyzer® [5]. When results of this test are lower than the apparent degree of intoxication or when evidence of drug use is apparent from questioning, symptoms, or drug samples found in the individual's possession, the subject is asked to submit a blood sample and is charged with driving under the influence of drugs. Customarily, two 12-ml samples of blood are drawn in tubes, each containing 14 mg of potassium oxalate and 17.5 mg of sodium fluoride, and are submitted to this laboratory within a few days of collection. The samples are stored at 4°C (39°F) until analyzed.

At the breath test station, the arresting officer completes an arrest report including a questionnaire in which the circumstances of arrest are noted and the individual's symptoms, using a code (see Table 1), are described. All cases submitted for analysis in 1974 (71) and after 1 July 1973 (64) were included in this study.

Drug Analysis

Two screening procedures, requiring a total of 10 ml of blood, were utilized for the detection of drugs in the blood sample. Another 5-ml aliquot was used for quantitation

Received for publication 6 May 1975; revised manuscript received 25 July 1975; accepted for publication 28 July 1975.

¹Chief toxicologist, Southwestern Institute of Forensic Sciences, and instructor, Departments of Pharmacology and Pathology, University of Texas Southwestern Medical School at Dallas, Dallas, Tex.

²Predoctoral student, Department of Physiology, Oklahoma State University School of Veterinary Medicine, Stillwater, Okla.; formerly, Toxicological chemist, Southwestern Institute of Forensic Sciences, Dallas, Tex.

TABLE 1—*Observations code information.*

A. Alcohol odor on breath		
1) none	3) moderate	
2) faint	4) strong	
B. Attitude		
1) profanity	5) carefree	9) hilarious
2) polite	6) cocky	10) indifferent
3) sleepy	7) talkative	11) excited
4) cooperative	8) insulting	12) combative
C. Unusual actions		
1) laughing	4) vomiting	
2) crying	5) belching	
3) fighting	6) hiccoughing	
D. Speech		
1) confused	5) slurred	9) not understandable
2) good	6) accent	10) thick-tongued
3) mush-mouthed	7) mumbled	
4) fair	8) stuttered	
E. Balance		
1) sure	3) swaying	5) needed support
2) unsure	4) wobbling	6) falling
F. Walking		
1) sure	3) swaying	5) staggering
2) unsure	4) stumbling	6) falling
G. Turning		
1) sure	3) swaying	5) staggering
2) unsure	4) hesitant	6) falling

of weak bases (diazepam and methaqualone) when these were found to be present by the initial screening procedure. One millilitre of sample was also used for alcohol determination.

Alkaline Drug Screening Procedure (Gas Chromatographic) [6]—To 5 ml of blood in a 15-ml glass stoppered centrifuge tube are added 2 drops of concentrated NH_4OH and 5 ml of *n*-butyl chloride [4]. The sample is extracted by gentle inversion by hand for about 5 min. The organic solvent layer is removed to a second 15-ml centrifuge tube and the process repeated. To the combined layers are added 5 ml of 0.2*N* HCl. After shaking, 4 ml of the acid layer is removed and placed in a 5-ml centrifuge tube. Seventy-five microlitres of chloroform are added and the aqueous phase is made basic by addition of eight drops of concentrated NH_4OH . The mixture is extracted by vigorous shaking, then centrifuged. Aliquots of the chloroform layer are used for injection into the gas chromatograph. Four microlitres are injected into columns (a) and (c) under the conditions described in the next paragraph. If drugs are detected, columns (b) and (d) are used for confirmation. Quantitation is accomplished by comparing peak heights with those from blood samples to which known concentrations of the drug have been added and carried through the procedure as described. Weaker bases (diazepam and methaqualone) were quantitated by the above procedure but with 1.0*N* HCl substituted for 0.2*N* HCl.

The gas chromatographs used were Hewlett-Packard 5700A models equipped with dual

columns, flame ionization detector, linear temperature programmer, and recorder (Hewlett-Packard 127A). The columns were 6 ft (1.8 m) by 2 mm inside diameter packed as follows:

- (a) 3% OV-1 on 80/100 mesh Chromosorb W, A/W, DMCS;
- (b) 3% OV-17 on 80/100 mesh Chromosorb W, A/W, DMCS;
- (c) 5% Apiezon L, 5% KOH on 80/100 mesh Chromosorb G, A/W, DMCS; and
- (d) 2.5% SE-30 on 80/100 mesh Chromosorb G, A/W, DMCS.

The gas flow rates were, for nitrogen (carrier gas), 30 ml/min; for hydrogen, 30 ml/min; and for air, 240 ml/min.

The temperature for columns (a) and (b) were raised by 8 deg per min from 150°C (302°F) to 270°C (518°F) and held at 270°C for 2 min. Column (c) was programmed to rise 8 deg per min from 110 to 190°C (230 to 374°F); the initial temperature was held for 2 min and the final temperature, for 4 min. The initial temperature of 130°C (266°F) for column (d) was held for 4 min; the temperature was then raised by 8 deg per min to 190°C (374°F), which was held for 4 min.

Screening Procedure for Acidic, Basic, and Neutral Drugs (Ultraviolet Spectrophotometric)—Five millilitres of blood, to which 20 mg potassium biphosphate have been added, are extracted with 100 ml of chloroform. The chloroform layer is removed, then successively shaken with 5 ml of 0.2N H₂SO₄ and 5 ml of 0.45N NaOH. Barbiturates are detected and quantitated in the NaOH extract by the procedure of Goldbaum [7]. The barbiturate derivative is determined by gas chromatography (GC). The H₂SO₄ extract is scanned in the ultraviolet range from 340 to 220 nm for detection of basic drugs. The remaining chloroform layer is divided into three portions. After evaporating to a residue, one portion is used for detection of glutethimide by the procedure of Goldbaum [8]. Another is applied to a thin-layer plate and sprayed with furfural, followed by concentrated HCl, for detection of carbamates. The third is evaporated to a residue, then dissolved in 5 ml of 0.2N H₂SO₄ and scanned in the ultraviolet range for the detection of weak bases (such as methaqualone, diazepam, caffeine).

Gas Chromatographic Procedure for Alcohols—Ethyl alcohol was detected and quantitated by the procedure of Jain [9].

Detection Limits of Methods

The lower limits of detection for some representative drugs in blood are as follows: barbiturates, 0.200 mg/dl; diazepam, 0.010 mg/dl; propoxyphene, 0.005 mg/dl; methaqualone, 0.010 mg/dl; amphetamine, 0.010 mg/dl; and methadone, 0.005 mg/dl. These are within the usual therapeutic range of blood concentrations for all drugs, excepting amphetamines (plasma concentration after 15-mg oral dose, 0.004 mg/dl) [10] and slightly above the one 65-mg dose blood concentration for propoxyphene [11].

Results

Appendixes A and B list the individual cases, drugs found, blood concentrations, age, race, and sex of the individual, the observations of the officer concerning the individual's behavior, and the circumstances surrounding the arrest. Table 1 explains the codes used to describe the observations.

It will be noted that a certain number of individuals in each year had blood ethanol concentrations above the presumed limit for driving while intoxicated (0.10% w/v). It is not immediately apparent why these were submitted for DUID, but it is assumed that there was some evidence of drug use as well as alcohol intoxication. Complete information was not always available on each case. Those below this limit showed signs of intoxication that could not be explained by the quantity of alcohol present. The cases with positive findings are arranged according to the number of drugs detected, with the maximum

number of four drugs found in each of the years being the last entry (Appendixes A and B). In Table 2, each of the drugs detected during the two years is listed in its order of

TABLE 2—*Frequency of detection of individual drugs.*

1973 (64 Total)			1974 (71 Total)		
Drug	Occurrences, no.	Frequency, %	Drug	Occurrences, no.	Frequency, %
Ethanol	21	32.8	Ethanol	34	48.0
Methaqualone	18	28.2	Diazepam	16	22.5
Secobarbital	11	17.2	Methaqualone	12	17.0
Amo- + Secobarbital	10	15.6	Amo- + Secobarbital	13	18.3
Diazepam	4	6.2	Pentobarbital	7	9.9
Butobarbital	3	4.7	Secobarbital	5	7.1
Chlordiazepoxide	3	4.7	Phenobarbital	4	5.6
Meprobamate	3	4.7	Diphenylhydantoin	2	2.8
Pentobarbital	2	3.1	Amobarbital	1	1.4
Phenobarbital	2	3.1	Barbital	1	1.4
Amobarbital	1	1.5	Butobarbital	1	1.4
Methamphetamine	1	1.5	Butalbital	1	1.4
Butalbital	1	1.5	Methadone	1	1.4
Amphetamine	1	1.5	Chlordiazepoxide	1	1.4
Negative results	10	15.6	Phenmetrazine	1	1.4
			Negative results	7	9.9

frequency. The five most frequently detected drugs in each year were ethanol, methaqualone, diazepam, the barbiturate mixture amobarbital and secobarbital,³ and one of the individual barbiturates, secobarbital or pentobarbital. In 1974, diazepam replaced methaqualone as the most frequently encountered drug other than ethanol, appearing in 22.5% of all cases, and methaqualone in 17%. Methaqualone had appeared in 28.2% and diazepam in only 6.2% of all cases in 1973.

Barbiturates, as a group, were found in 42.2% of all cases in 1973 and in 39.4% of all cases in 1974.

A large number of individuals were intoxicated with more than one drug (Table 3).

TABLE 3—*Frequency of cases of intoxication with more than one drug.^a*

Drugs Detected Per Case, no.	1973 Cases, no.	1974 Cases, no.
1	31 (8)	37 (13)
2	20 (11)	19 (15)
3	2 (1)	6 (4)
4	1 (1)	2 (2)
Negative results	10	7
Total cases	64	71

^aNumbers in parentheses are the number of cases in which one of the drugs detected was ethyl alcohol.

³This mixture is assumed to come from a single medication (Tuinal®), as indicated by Dallas County Criminal Investigation Laboratory statistics and was, consequently, counted as a single drug.

Most of these had also ingested alcoholic beverages. A total of twelve subjects in each year had more than one drug substance besides ethanol detected by the screening procedures.

A certain number of drug categories would have gone undetected. Notably, these were volatile substances not eluting under conditions used for detecting ethanol, (freons, high alcohols, trichloroethanol, benzene derivatives, and others), hard narcotics (opiates), and certain hallucinogenic substances (lysergic acid derivatives, cannabis components, mescaline). No attempt was made to detect substances in these categories because of limited quantity of blood sample available. The presence of these substances would have been detected only through observations by the arresting officer and these are noted in the tables. Also, as no urine samples were taken for analysis, some drugs present in the body may have been missed in the screening of blood samples due either to the ingestion of low doses or to the presence of very low quantities in the blood.

Discussion

An obvious decrease in actual cases submitted for DUID occurred between the two years sampled (from 128 in 1973 to 71 in 1974). This resulted from a change in police procedures and a greater reluctance of the officer to file on this charge rather than any decrease in the probable number of drivers believed to be driving under the influence of drugs. It should also be recognized that a minimum number of these charges are filed in comparison with DWI (driving while intoxicated-alcohol) due to the additional time required in processing forms and in procuring a blood sample. Data relating to arrest statistics for DWI and DUID are shown in Table 4.⁴

TABLE 4—*Data on arrest statistics for cases of driving while intoxicated-alcohol (DWI) and driving under the influence of drugs (DUID).*

	DWI Total Arrests	DUID Total Arrests
1973	6865	128
1974	6047	71
Average age of arrestees, years	37	26.6
Sex, %		
Male	93	85
Female	7	15

The age range of arrestees for DUID was 17 to 56 years and the average age was 26.6, whereas those arrested for DWI averaged about 37 years. This would seem to imply a greater incidence of drug use other than alcohol in the younger age groups. The ratio of females to males in the DUID group was more than twice as high as the same ratio for the DWI group. From the limited sample of those in this study found to have only alcohol in their blood, only 5% were women, which agrees closely with 7% in the overall DWI statistics (Table 4).

It is apparent from the data that sedative-hypnotic drugs account for almost all of the drugs detected in each year. The exceptions were one instance each of amphetamine, methamphetamine, and phenmetrazine. It was not possible to determine what percentage of the cases represented drug usage from illicit preparations, but it is safe to assume

Personal communication with P. A. Lewis, Director, Alcohol Safety Action Program, Southern Methodist University, Dallas, Tex., 14 April 1975.

from the blood concentrations obtained in most cases that the drugs were being taken in doses greater than therapeutic ones and, if obtained by legitimate prescription, were not taken as prescribed. For example, a high therapeutic blood concentration after a sedative dose of secobarbital is approximately 0.20 to 0.30 mg/dl [12]. All of the subjects with this drug alone had concentrations exceeding this amount. In addition, the high incidence of drugs found in combination with alcohol tends to point toward abuse, as the additive effects of sedative drug medication with alcohol are well known [13].

The most outstanding difference in drug use patterns between the two years was the shift in incidence of diazepam and methaqualone (Table 2). Methaqualone was the most frequently detected drug in 1973, being involved in 28.2% of cases, whereas diazepam became the most frequently detected drug in 1974 (found in 22.5% of all cases). This could have resulted from an increase in illicit use of diazepam, a change in the drug of choice prescribed by physicians for similar purposes, an increase in availability (production and sale) of the latter substance, or any combination of these factors. No data were available from other sources for further interpretation of this observation.

Of the seven cases reported as negative by toxicologic analysis and included in Appendix B, drugs or intoxicants were implicated in all by circumstances. They included *Cannabis* and paint fumes, substances not detected by the procedures used. *Cannabis* was mentioned in arrest reports in 12.7% of all cases in 1974 and 14% of cases in 1973 (indicated by signs of its recent use in those cases). Inhalation of paint fumes or paint thinner as the intoxicating substance was indicated in three cases in 1974.

In view of the relatively high incidence of positive toxicologic findings in this study (87.5% drugs or alcohol, or both; 72.0% drugs) and the implication of other intoxicants in most of the remainder, it is suggested that drugs may play a larger role in the intoxicated driver population than previously recognized. Although the number of drivers arrested on this charge is low compared to those arrested for DWI (alcohol), the incidence of drug use among drivers is believed to be actually higher, but detection is infrequent due to difficulties in implementing and enforcing a DUID program.

Acknowledgments

The authors thank Lt. John Day, Lt. James Woods, and Sgt. Ira Scott of the Dallas Police Department for their cooperation in making police records and statistics available for this study. Mrs. Susan Jones of the Institute of Forensic Sciences provided able technical assistance in blood analyses.

APPENDIX A

1973 DUID Cases

Case	Drug (s)	Blood Concentration	Age	Race/Sex	Observations	Behavior and Additional Information
73C3518	alcohol	0.01%	33	w/m	E3,5; F3,5; G3,4; A2; B3,5,7; D1,5,9,10	vehicle accident; mental confusion; epileptic taking Dilantin®
73C4116	alcohol	0.07%	52	b/m	A1; B3,4; D1,10; E1; F1; G1	sleepy, dazed, confused state; eyes would not dilate
73C3509	alcohol	0.09%	43	w/m	A2, F3	glassy, bloodshot eyes; appeared drunk
73C4614	alcohol	0.09%	17	w/m	A2; B3,9; D5,10; E2; F2; G2	driving 50 mph in 30 mph zone, appeared intoxicated, needed support to stand; glue odor in vehicle
73C4774	alcohol	0.10%	22	w/m	B1,6,7,8,12; D1,5; E4; F4; G4	belligerent, irrational, ran two stop signs
73C4025	alcohol	0.14%	31	b/m	A1; B3; D3,7,10; E2; F2; G2	accident; incoherent, continually fell asleep
73C4612	alcohol	0.20%	24	w/m	A4; B3,5,7; D5,7; E2,3,4; F2,3,4,5; G2,3,4,5	vehicle weaving; uncooperative (possible marijuana present)
73C4030	alcohol	0.23%	23	w/m	A3; B7; D5; E3; F3; G4	driving wrong way on one-way street, mental confusion
73C2865	amphetamine	0.02 mg/dl	39	w/m	B2,3,4,7; D1,3,5,10; E2; F2,5; G2	ran red light, incoherent, mental confusion, wore sunglasses at night
73C4026	diazepam	0.13 mg/dl	48	w/m	B10; D5,10; E5; F3; G3	mental confusion, erratic driving
73C4613	diazepam	0.23 mg/dl	23	w/m	B1,7; C2; D9; E6; F6; G6	vehicle accident; uncooperative
73C3290	meprobamate	2.60 mg/dl	49	w/f	B10; D5; E3; F3,5; G3	mental confusion; slow, erratic driving
73C4028	meprobamate	4.30 mg/dl	43	w/m	B2; D3,5; E4,5; F5; G5	faulty judgment
73C2887	methaqualone	0.23 mg/dl	22	w/m	B2,3,4,5; D3,5,8; E2; F2; G2	driving weaving and erratic, pupils dilated, smoking marijuana
73C2452	methaqualone	0.24 mg/dl	19	w/m	B4,5,7; C1; D2; E3; F3; G3	vehicle accident; eyes glazed and watery, possible marijuana use
73C3091	methaqualone	0.30 mg/dl	21	w/m	B5; D10; E4; F3; G4	vehicle speeding; lost control of vehicle
73C4491	methaqualone	0.30 mg/dl	23	b/m	B3,7; D1,3,5,7; E2,3; F3,5; G3	vehicle weaving; eyes bloodshot
73C4561	methaqualone	0.60 mg/dl	19	w/m	B3,4; D3,5; E3; F5; G5	uncooperative; vehicle accident
73C3288	methaqualone	0.65 mg/dl	25	b/m	B3; D10; E5; F5; G5	uncooperative; vehicle accident
73C3696	pentobarbital	0.80 mg/dl	29	w/m	B2,4; D-Slow,5; E3; F3; G3	erratic driving, multiple accidents, lack of responsible action

73C0002	pentobarbital	1.26 mg/dl	24	b/m	B1,4,5,7,11; D1,5; E2; F1; G2	methadone patient, bad perception; vehicle accident; excited
73C3203	phenobarbital	5.41 mg/dl	35	w/m	B3; D9,10; E5; F4,5; G5	erratic driving, mental confusion, possible epileptic, equilibrium upset
73C2453	secobarbital	0.53 mg/dl	24	w/f	D5,9; E5; F5	incoherent, no sense of direction, possible marijuana use
73C3643	secobarbital	0.58 mg/dl	21	w/m	B5,7; C1; D3,5; E2; F2,5; G2	dilated, cooperative, poor coordination
73C3510	secobarbital	0.71 mg/dl	17	b/m	B3; D1,7; E3,5; F4; G4	vehicle accident
73C3507	secobarbital	0.74 mg/dl	21	b/m	D5	erratic driving, had been awake more than 24 hours
73C3806	secobarbital	1.05 mg/dl	18	w/m	B10; D1,3,5,10; E2,3,4; F2,3,4,5; G2,3,4,5	vehicle accident; disoriented
73C2652	chlordiazepoxide	2.63 mg/dl	21	w/m	B3,5,7; D1,3,7,10; E4,5,6; F5; G5	vehicle accident; uncoordinated, mental confusion
73C3199	amobarbital and secobarbital	0.20 mg/dl	27	b/m	B3,9; D1,3; E5,6; F6; G6	vehicle accident; glassy-eyed, listless, incoherent, possible marihuana use
73C4550	amobarbital and secobarbital	0.48 mg/dl	24	b/m	B4,7; D1,5,7; E3; F3; G2,3	possible marijuana complication
73C2864	amobarbital and secobarbital	1.71 mg/dl	23	w/m	B1,7; C1; D4; E3; F3; G3	vehicle accident; poor perception, mental confusion, watery eyes
Two Drugs						
73C3517	alcohol	0.03%	47	w/m	A4; B8; D3,5,10; E3,5; F3; G4	vehicle weaving; mental confusion
73C4591	chlordiazepoxide	1.70 mg/dl	37	w/m	A3; B3; D5; E3,4; F3,5; G3	incoherent, mental confusion, uncoordinated
73C4392	diazepam	0.05%	21	b/m	A3; B10; D8; E4; F4; G3	constricted pupils, "had the shakes," erratic driving
73C3644	methaqualone	0.24 mg/dl	20	w/m	A3; B3,10; D3,5,7,10; E2,3,4,5; F2,3; G2,3,5	erratic driving; uncooperative, marijuana also used
73C4395	alcohol	0.49 mg/dl	21	b/m	A2; B4,5; D5,10; E2,3; F2,3; G4,5	erratic driving; cooperative
73C3093	alcohol	0.04%	20	w/m	A2; B11; D10; E5; F5; G5	vehicle accident (multiple); resisted arrest; erratic driving
73C2454	alcohol	0.35 mg/dl	18	b/m	A3; B3; D9; E5; F5; G4	erratic driving, mental confusion, possible marijuana use also
73C2269	alcohol	0.59 mg/dl	20	b/m	A4; D10; C5; D8,10; E5; F5; G5	hit and run accident; mental confusion
	alcohol	0.09%				
	secobarbital	0.28 mg/dl				

1973 DUI/D Cases

Case	Drug (s)	Blood Concentration	Age	Race/Sex	Observations	Behavior and Additional Information
73C3151	alcohol amobarbital and secobarbital	0.02% 0.95 mg/dl	19	w/m	A4; B8,12; C3; D5; E3; F3; G3	hit and run accident; watery, bloodshot eyes, resisted arrest, mental confusion
74C0001	alcohol amobarbital and secobarbital	0.05% trace	23	w/m	not available	appeared in sober condition
73C4117	alcohol amobarbital and secobarbital	0.10% 1.29 mg/dl	17	w/m	A3; B1,6,8,12; D1,5,7; E5; F3,4; G3,5	vehicle accident; erratic driving; mental confusion, poor coordination
73C2863	butabarbital butalbital	total barb- iturate, 1.16 mg/dl	41	w/f	B12; D3,5,7,10; E3; F2; G2	driving 55 mph in 35 mph zone, faulty judgment, taking medication
73C4027	chlordiazepoxide secobarbital	1.17 mg/dl 1.56 mg/dl	42	w/m	B2,3,4,10; D1,3,5,6; E5; F5; G5	very erratic driving; reduced sensory perception, reduced coordination
73C3688	meprobamate phenobarbital	2.80 mg/dl 1.01 mg/dl	42	b/m	B3; D9,10; E6; F5; G5	multiple severe accidents; dizzy, light-headed, incoherent, unable to answer simple questions
73C2270	methaqualone secobarbital	0.51 mg/dl 0.22 mg/dl	19	b/m	B3; D7,10; E6; F6; G6	erratic driving
73C4394	methaqualone amobarbital and secobarbital	0.04 mg/dl 0.45 mg/dl	18	b/m	B3,5; D5; E3; F3; G3	vehicle accident; erratic driving; dazed, dilated pupils; sleeping and extremely hard to awaken
73C3695	methaqualone amobarbital and secobarbital	0.14 mg/dl 1.12 mg/dl	23	b/m	B10; D3,5; E4; F5; G5	vehicle accident; incoherent, resisted arrest
73C3200	methaqualone amobarbital and secobarbital	0.16 mg/dl 0.53 mg/dl	19	b/f	B3; C1; D5; E5; F5; G2	erratic driving; uncooperative
73C4551	methaqualone amobarbital and secobarbital	0.48 mg/dl 0.26 mg/dl	24	b/f	B3; C2; D1; E2,3,4,5; F2,3,4,5; G2,3,4,5	weaving, erratic driving; "talked in circles," appeared nervous
73C3094	secobarbital butabarbital	0.89 mg/dl trace	21	b/m	B3; D9; E3,4; F4; G5	poor judgment, appeared drunk, kept trying to fall asleep, could not answer simple questions

Three Drugs

73C2889	alcohol methaqualone secobarbital	0.01% 0.20 mg/dl 0.33 mg/dl	20	b/m	A2; B3,6,10; D1,5,9,10; E3, 5,6; F4,5; G3,4,5	multiple vehicle accidents; incoherent, appeared intoxicated, fell asleep enroute to jail, mental confusion, poor co- ordination vehicle accident; eyes appeared glassy, slow reactions
73C2888	diazepam methamphetamine methaqualone	0.02 mg/dl 0.04 mg/dl 0.36 mg/dl	27	w/m	B3; D3,5,10; E4,5; F3; G5	

Four Drugs

73C3289	alcohol amobarbital butabarbital methaqualone	0.04% trace 0.48 mg/dl 0.17 mg/dl	22	w/m	A2; B10; D1,7; E4; F4; G4	multiple accidents; bloodshot eyes, appeared intoxicated, some mental confusion
---------	--	--	----	-----	---------------------------	---

APPENDIX B

1974 DUID Cases

Case	Drug (s)	Blood Concentration	Age	Race/Sex	Observations	Behavior and Additional Information
74C0247	alcohol	0.05%	20	w/m	A3; B10; D10; E4; F4; G4	speeding; poor coordination, incoherent, trouble understanding
74C1381	alcohol	0.10%	32	w/m	A4; B4; D7; E5; F5; G4	speeding; ran stop sign, uncooperative, eyes bloodshot, "appeared drunk"
74C2096	alcohol	0.18%	25	b/m	B3; D1,5,7,10; E2; F2; G2	driving wrong way on one-way street; eyes glassy, bloodshot; slow to answer questions
74C4773	alcohol	0.19%	38	b/f	...	erratic driving, accident with fixed object, lost control of vehicle
74C0997	alcohol	0.08%	18	b/m	...	"appeared drunk," "eyes glazed," incoherent, appeared light-headed and indifferent
74C1879	alcohol	0.04%	42	w/m	A4; B1,12; D5; E3; F5; G4	vehicle weaving; bloodshot eyes, incoherent
74C2631	alcohol	0.29%	...	...	...	...
74C3516	alcohol	0.07%	20	b/m	A4; B10; D3; E3; F4; G4	one-car accident; slow in actions; bloodshot eyes; difficulty walking, talking, and controlling body motions; needle puncture marks on arms
74C3572	alcohol	0.05%	25	w/m	A3; B8,12; C3; D10; F5; G5	weaving in traffic; burned tires; lost control of truck, slumped in seat, couldn't stand, resisted arrest; "taking drugs for venereal infection"
74C3820	alcohol	0.05%	22	w/m	...	driving wrong way on one-way street; confused speech, bloodshot eyes; marijuana and pills found in the car
74C3970	alcohol	0.22%	25	w/m	...	...
74C4256	alcohol	0.05%	19	w/m	A3; B3,10; D3; E2,4; F2,3; G2,3	ran red light and collided with another car; speech slurred, confused, unsteady, appeared drunk

74C4554	alcohol	0.21%	25	w/m	A4; B2,4,5,6,7,9,10	ran red light, went to officer's car; "took Valium® two days ago"
74C2907	barbital	6.27 mg/dl	31	w/m	A1; B3; D1,10; E2; F2; G2	vehicle accident; drove away, vehicle weaving; heavy speech, staggering walk, bloodshot eyes, unable to maintain balance; occupation, lab technician
74C1635	diazepam	0.33 mg/dl	29	w/f	B2,3,5; D5,10; E3; F3; G3	vehicle accident; bloodshot eyes, glassy stare, distorted perceptions
74C2261	diazepam	0.40 mg/dl	19	b/m	B3,4; D1,7,10; E2,3,6; F2,3,4,6; G2,4,6	vehicle weaving, accident; slowed reactions, bloodshot eyes, mental confusion; "drank beer and smoking marijuana"
74C3571	diazepam	0.04 mg/dl	40	b/m	A1; B3; D7,10; E6; F6; G6	vehicle accident; could not stand, "taking meds for back pain"
74C3822	diazepam demethyl-diazepam ^a	<0.01 mg/dl <0.01 mg/dl	44	w/m	A1; B10; D4; E5; F2,3; G5	vehicle weaving, accident caused by another car swerving to avoid him; said had taken Valium® 12 hours previously as prescribed by dentist
74C4553	diazepam	0.21 mg/dl	18	w/m	...	...
74C2751	demethyl-diazepam diazepam	0.03 mg/dl 0.08 mg/dl	26	w/m	...	...
74C1282	methaqualone	0.19 mg/dl	...	...	...	vehicle weaving; could not stand unaided; staggered, dazed; marihuana cigarette found in car plus 50 "Roche 6" Valium® tablets
74C1508	methaqualone	0.51 mg/dl	25	b/f	B4; D5; E3; F3; G3	driving on wrong side of road; "appeared intoxicated"
74C1840	methaqualone	0.55 mg/dl	21	b/m	B3,4; D3,5,7,10; E2,3,4,5; F2,3,4,5	"appeared confused;" needed support to stand
74C0169	methaqualone	0.55 mg/dl	45	w/m	...	vehicle accident; fell on ground
74C1509	methaqualone	0.83 mg/dl	23	w/m	...	vehicle accidents (multiple); fled scene, possible marihuana use
74C2799	methaqualone (insufficient sample for complete screen)	0.86 mg/dl	19	w/f	...	vehicle weaving; uncoordinated; vehicle accident; poor perception, appeared drunk minor accident; could hardly walk, had to use car for support; crying, stated had taken pills

1973 DUID Cases

Case	Drug (s)	Blood Concentration	Age	Race/Sex	Observations	Behavior and Additional Information
74C4029	methaqualone	0.60 mg/dl	22	w/m	A1; B7; D5; E4; F4; G5	vehicle accident; almost fell when getting out of car, stated had taken "quaaludin"
74C2372	pentobarbital	0.72 mg/dl	21	w/m	...	vehicle swerved, jumped curb, knocked down street sign, and proceeded to hit stopped vehicle; jumped out and began swearing
74C3235	pentobarbital	0.49 mg/dl	21	w/m	...	...
74C3890	pentobarbital	0.98 mg/dl	18	w/m	A1; B12; D1; E6; F6; G6	speeding; stopped and tried to get away on foot; incoherent, could not stand unaided nor answer simple questions
74C0249	secobarbital	0.78 mg/dl	...	.../f	...	vehicle accident (rear end); pupils very small, difficulty talking and walking
74C0248	amobarbital and secobarbital	0.85 mg/dl	56	w/m	B2,3,10; D1,3; E3,5,6; F4,5; G4,6	vehicle accident; fled scene, resisted arrest, "appeared intoxicated"
74C0691	amobarbital and secobarbital	1.36 mg/dl	79	w/m	B4; D5; E3; F3; G3	vehicle multiple accident; possessed Deronil [®] , Macroductin [®] , Isordil Tem-bids [®] , and kaolin
74C2373	amobarbital and secobarbital	0.84 mg/dl	29	b/m	A2; B3,4; D7; E5; F5; G3,4	vehicle accident; six pills in prescription bottle in pocket
74C2752	amobarbital and secobarbital	0.88 mg/dl	18	w/m	B3; D3,7; E3; F3; G3	vehicle accident; drove away, struck street sign; swayed; slurred speech; trouble staying awake; took "pain pills"
74C3208	amobarbital and secobarbital	0.82 mg/dl	25	b/m	A2; B2,4; D3; E1; F2; G2	speeding and weaving; capsules believed to be heroin along with marijuana found in car
74C3799	amobarbital and secobarbital	0.94 mg/dl	17	w/m	A1; B4; D4; E2; F2; G2	major accident; fled scene, hit embankment; incoherent, staggered; water pipe in car, syringes, needle marks, admitted "taking a pill"

Two Drugs	alcohol diazepam	0.10%	37	b/m	A1; B3; D7,10; E5; F6; G5	vehicle accident; prescription for Valium®
74C0246	alcohol diazepam	0.12 mg/dl 0.03%	24	w/m	A2; B5,6,7; D2; E2,3; F2,3; G2,3	vehicle weaving; unsteady, eyes glassy, possible marihuana use
74C1881	methaqualone	0.48 mg/dl	27	w/m	A2; B1,5,10; D9; E5; F2,3; G2,3	vehicle accident; bloodshot eyes, hardly understandable speech
74C1702	alcohol methaqualone	0.07%	25	w/f	A3; B7; C2; D4; E2; F3; G4	vehicle weaving; marihuana use; ran red light, eyes bloodshot
74C0521	alcohol phenmetrazine	0.19%	25	b/m	...	vehicle accident; incoherent, pupils constricted, eyes bloodshot, mental confusion
73C4772	alcohol phenobarbital	0.41 mg/dl	23	w/m	A3; B6,7; D1; E2; F3; G3	erratic driving; speech confused
74C0692	alcohol amobarbital and secobarbital	0.03% 0.98 mg/dl	22	w/m	A3; B1,5,6,7,8; D3,5; E2; F2; G2	vehicle weaving; bloodshot eyes
74C0690	alcohol amobarbital and secobarbital	0.06% 0.66 mg/dl	21	w/m	...	ran red light, vehicle accident; bloodshot eyes, dilated pupils, incoherent; reflexes and reactions extremely slow and uncoordinated
74C0424	alcohol amobarbital and secobarbital	0.01% 1.89 mg/dl	19	b/m	A4; B3,6,10; C6; D3,10; E2,3; F2,3; G2,3,4	drove vehicle into intersection before stopping for red light, "appeared intoxicated"
74C1267	alcohol diazepam	0.04% 0.14 mg/dl	20	w/m	A1; B8,11; E2; D5; E5; F4; G4	vehicle accident; unstable in walk, had slurred speech and bloodshot eyes, admitted to taking Valium® and drinking
74C3461	diazepam alcohol	0.06 mg/dl 0.09%	28	w/f	A1; B10; D5,7; E3; F2,3; G2	multiple vehicle accidents; dazed, staggered; slurred speech; "took Valium® day before"
74C3879	diazepam demethyldiazepam	0.05 mg/dl 0.01 mg/dl	33	w/f	...	...
74C4026	alcohol diazepam demethyldiazepam	0.06% 0.05 mg/dl 0.08 mg/dl 0.24%	20	w/m	A4; B4; C4; D3,5; E3; F3; G3	vehicle weaving; appeared very intoxicated; had just left bar after "three beers," five hours of sleep previous night; "took a Valium®"

1974 DUJD Cases

Case	Drug (s)	Blood Concentration	Age	Race/Sex	Observations	Behavior and Additional Information
74C2262	chlordiazepoxide alcohol	0.92 mg/dl 0.21%	49	w/f	A1; B3; D5,7; E3; F3; G4	vehicle hit parked truck; swaying; speech slurred; "taking nerve pills"
74C3763	butabarbital alcohol	1.09 mg/dl 0.01%	23	w/f	B7; D3; E3; F3; G3	driving "all over road" and almost collided with other car; staggered; slurred speech; "took Valium® prescribed by dentist"
74C0170	pentobarbital and secobarbital	trace 1.05 mg/dl	32	w/m	B2,4; D3,5,7; E2,4; F2,3,5; G2,3,4,5	vehicle accident with fixed object; mental confusion
74C0168	pentobarbital amobarbital and secobarbital	1.12 mg/dl trace	22	w/m	B10; C2; D5; E5; F5; G3	vehicle accident with fixed object; "appeared drunk;" needle marks on arms, mental confusion, and uncooperative
74C4067	secobarbital diazepam	0.10 mg/dl positive (QNS for quantitation)	25	w/m	...	...
74C2798	secobarbital butabarbital	0.44 mg/dl	39	w/f	A1; B3; C2; D3; E3; F5; G4	vehicle accident; incoherent, much trouble staying awake; said had taken several Valium® tablets several hours earlier
Three Drugs						
74C2611	phenobarbital diphenylhydantoin alcohol	1.17 mg/dl 0.35 mg/dl 0.19%	28	b/m	A3; B6,12; D7; E3,5; F4,5; G5	minor accident; had bottle each of Dilantin®, phenobarbital, Valium®; "took two pills from each bottle"
74C3390	secobarbital diazepam alcohol	0.09 mg/dl 0.05 mg/dl 0.05%	28	w/m	A3; B3,4,7; D5; E3; F3; G3	minor accident; had been injured, stated had been taking Valium® and was drinking
74C3764	secobarbital alcohol methaqualone	0.24 mg/dl 0.01% 0.22 mg/dl	25	b/m	A4; B10; C5; D10; E5; F5; G5	vehicle traveling at low rate of speed, weaving in and out of traffic; speech slurred, could not walk without assistance

74C3819	phenobarbital	0.65 mg/dl	25	w/m	A1; B3; D1; E3; F3; G3	multiple vehicle accidents; confused speech, dilated pupils, swaying; "taking tranquilizers"	
74C0111	diphenhydantoin	1.27 mg/dl	19	w/m	B3,4,10; D1,7,9	vehicle accident; incoherent, "behaved in unorganized manner;" dazed, "passed out," unable to answer simple questions	
	demethyl-diazepam	0.03 mg/dl					
74C1715	amobarbital	1.17 mg/dl	28	b/m	A "sweet"; B4; D1; E3; F3; G3	minor accident; trouble with coordination; stated was on methadone; white powder found in car	
	diazepam	0.05 mg/dl					
	pentobarbital	trace					
	methadone	0.01 mg/dl					
	amobarbital and	0.55 mg/dl					
	secobarbital						
	alcohol	0.06 mg/dl					
Four Drugs							
74C0003	alcohol	0.06%	22	w/m	A3; B3,7,12; C2,3; D5,9,10; E5; F5; G5	driving 70 mph in 30 mph zone, erratic driving; impaired perception, possible marihuana use, "needle tracks on arm," uncooperative	
	methaqualone	0.09 mg/dl					
74C4027	pentobarbital	1.54 mg/dl	25	w/m	A4; B3,7,10; C5; D1,3,5,7,10; E4; F3,4	vehicle accident; "had 1½ drinks, took codeine for pain from tooth extraction"	
	secobarbital	trace					
	phenobarbital	0.43 mg/dl					
	butalbital	(as total barbiturate)					
	methaqualone	0.52 mg/dl					
	alcohol	0.04%					
Negative Toxicology							
74C1880	negative drugs	...	18	w/m	B10; D1,5; E4; F4; G4	"mental confusion," "paint odor on breath;" paint on subject's lips, face, hands	
	negative alcohol	...					
74C1703	negative drugs	...	22	w/m	B3,4,10; D1,3; E2; F2,3; G2	vehicle weaving; fled from police; marihuana and hashish found in car	
	negative alcohol	...					
74C1708	negative drugs	...	22	w/m	...	unable to answer questions; eyes dilated, in possession of codeine tablets and 3 unknown white tablets	
	negative alcohol	...					
74C1380	negative drugs	...	17	w/m	A4 (Paint); B12; D5; E4; F5; G4	vehicle speeding and weaving; strong odor of paint fumes on breath; silver paint on lips; bag containing rag soaked in silver paint found in car	
	negative alcohol	...					

1974 DUI/D Cases

Case	Drug (s)	Blood Concentration	Age	Race/Sex	Observations	Behavior and Additional Information
74C0834	negative drugs negative alcohol	... ...	17	w/f	A1; B4; D2; E1; F1; G1	vehicle accident; incoherent; marihuana found; believed to have been sniffing paint thinner
74C0425	negative drugs negative alcohol	... ...	23	w/m	B10; D1; E3; F2; G2	driving erratically, stated had popped some pills earlier for "thyroid, asthma, sinus"
74C2179	negative drugs negative alcohol	... ...	20	w/f	...	vehicle speeding; very happy, excited, eyes dilated; roach clip, marihuana seen in car; resisted arrest, kicked two officers

*Demethyl diazepam is the major metabolite of diazepam. In some cases it was detected and quantitated in the blood sample.

References

- [1] Fox, B. and Fox, J., Eds., "Alcohol and Traffic Safety," U.S. Dept. of Health, Education and Welfare, Bethesda, 1963, p. 34.
- [2] Davis, J. H., "Carbon Monoxide, Alcohol and Drugs in Fatal Automobile Accidents," *Clinical Toxicology*, Vol. 7, No. 6, 1974, pp. 597-613.
- [3] Finkle, B. S., Biasotti, A. A., and Bradford, C., "The Occurrence of Some Drugs and Toxic Agents Encountered in Drinking Driver Investigations," *Journal of Forensic Sciences*, Vol. 13, No. 2, 1968, pp. 236-245.
- [4] Midwest Research Institute Report, "The Incidence of Drugs in Fatally Injured Drivers," MRI Project No. 3747-E, E. J. Woodhouse, Project Leader, Kansas City, Mo., 1973.
- [5] Borkenstein, R. F., *Breath Tests to Determine Alcoholic Influence*, 2nd ed., Indiana State Police, Indianapolis, Ind., 1957.
- [6] Foerster, E. and Mason, M. F., "Preliminary Studies on the Use of *n*-Butyl Chloride as an Extractant in a Drug Screening Procedure," *Journal of Forensic Sciences*, Vol. 19, No. 1, 1974, pp. 155-162.
- [7] Goldbaum, L. R., "Determination of Barbiturates," *Analytical Chemistry*, Vol. 24, No. 10, 1952, pp. 1604-1607.
- [8] Goldbaum, L. R., Williams, M., and Johnston, E. H., "Determination and Distribution of Doriden," *Journal of Forensic Sciences*, Vol. 7, No. 4, 1962, pp. 449-503.
- [9] Jain, N. C., "Direct Blood Injection Method for Gas Chromatographic Determination of Alcohols and Other Volatile Compounds," *Clinical Chemistry*, Vol. 17, No. 2, 1971, pp. 82-85.
- [10] Beckett, A. H., Salmon, J. A., and Mitchard, M., "The Relation Between Blood Levels and Urinary Excretion of Amphetamines Under Controlled Acidic and Under Fluctuating Urinary pH Values Using (¹⁴C) Amphetamine," *Journal of Pharmacy and Pharmacology*, Vol. 21, 1969, pp. 251-258.
- [11] Baselt, R. C., Wright, J. A., and Cravey, R. H. "Therapeutic and Toxic Concentrations of More than 100 Toxicologically Significant Drugs in Blood, Plasma, or Serum: A Tabulation," *Clinical Chemistry*, Vol. 21, No. 1, 1975, pp. 44-62.
- [12] Parker, K. D., Elliott, H. W., Wright, J. A., Nomaf, N., and Hine, C. H., "Blood and Urine Concentrations of Subjects Receiving Barbiturates, Meprobamate, Glutethimide or Diphenylhydantoin," *Clinical Toxicology*, Vol. 3, No. 1, 1970, pp. 131-145.
- [13] Forney, R. B. and Hughes, F. W., *Combined Effects of Alcohol and Other Drugs*, Charles C Thomas, Springfield, Ill., 1968.

Southwestern Institute of Forensic Sciences
Criminal Investigation Laboratory
Drawer 35728
Dallas, Tex. 75235