NRD-40

DOT HS-802 488

A COMPARISON OF DRUG USE IN DRIVER FATALITIES AND SIMILARLY EXPOSED DRIVERS

Contract No. DOT-HS-4-00941

July 1977

Final Report

PREPARED FOR:

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
WASHINGTON, D.C. 20590

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT HS-802 488		

4. Title and Subtitle	5. Report Date
A COMPARISON OF DRUG USE IN DRIVER FATALITIES AND SIMILARLY EXPOSED DRIVERS	July 1977
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Robert R. Blackburn, Edward J. Woodhouse	3963-D
9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Midwest Research Institute 425 Volker Boulevard Kansas City, Missouri 64110	11. Contract or Grant No. DOT-HS-4-00941
	13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Washington, D.C. 20590	28 June 1974-25 March 1977 Final Report
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

Crash information, urine, blood and bile samples from 900 fatally injured drivers were collected by medical examiners in 22 areas of the country. Randomly selected living drivers were interviewed at times and places of recent fatal crashes in Dallas, Texas, and Memphis, Tennessee and breath, urine, and blood samples were obtained. Of 1,196 drivers, 91.6% cooperated with the interview, and nearly all of those interviewed provided a breath sample. A total of 75% provided a usable urine sample, and 70.9% of those asked provided a sufficient quantity of blood.

Of all the fatally injured drivers examined, 14.3% had used one or more of the 43 drugs tested before the crash. The drugs detected most frequently were antihistamines/decongestants, narcotics, and stimulants. The findings were not geographically dependent. Of the living drivers examined, 7.9% had been using one or more drugs prior to the interview, most frequently antihistamines/decongestants and sedatives. These findings were not site- or city-dependent.

Users of drugs are about two times as likely to be fatally injured in a vehicular crash as non-users. The relative risk is greatest for drivers using narcotic analgesics, sedatives/hypnotics, and nicotine, respectively.

17. Key Words		18. Distribution Statement
Accidents	Fatalities	Document is available to the public through the National Technical Information Service, Springfield, Virginia 22161
Alcohol	Marijuana	
Driver	Risk	
Drugs	Roadside Surveys	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
UNCLASSIFIED	UNCLASSIFIED	203	

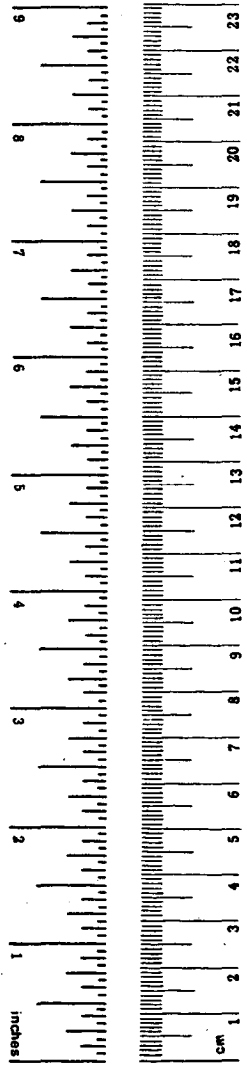
Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

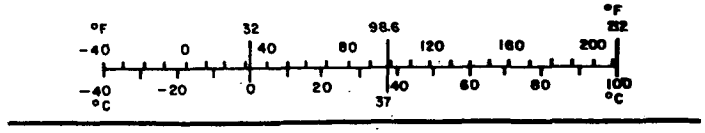
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



PREFACE

This report was prepared under Contract No. DOT-HS-4-00941 for the Department of Transportation, National Highway Traffic Safety Administration. The authors gratefully acknowledge the assistance provided by Mr. Peter Ziegler and Dr. Marvin Levy, NHTSA, the Contract Technical Managers. The discussions and suggestions provided by Drs. Monroe Snyder and Fred Benjamin, NHTSA were also much appreciated.

Mr. Robert Blackburn, Manager, Driver and Environment Programs, and Dr. Edward J. Woodhouse, Principal Chemist were the the Principal Investigators. Mr. Blackburn was responsible for securing the cooperation of city officials, the planning and operation of the roadside surveys and the analysis of all data. Dr. Woodhouse was responsible for securing the cooperation of medical examiners, the collection of specimens of fatally injured drivers and the chemical analysis of all specimens. The principal investigators were assisted throughout the project by Dr. William D. Glauz, Manager, Transportation Systems Section and by Dr. Florence I. Metz, Director of the Chemical Sciences Division and Dr. Sophia S. Fotopoulos, Head, Behavioral Sciences Laboratory.

Many other MRI staff members played a key role in this project. Mr. S. W. Graves, Ms. K. Haskins, Ms. P. Emily and Mr. J. Windels conducted the chemical analysis of blood, urine and bile specimens.

The roadside surveys were supervised by the first author, Dr. L. Bruce McDonald and Messrs. Douglas Harwood, Jerry Graham, and Robert Paulsen. They were assisted by Messrs. Ahmed Morsi, Patrick Heenan, and Barry Sanders.

Statistical analysis and related activities were the responsibility of Mr. Michael Sharp assisted by Ms. Rosemary Moran. Mr. Barry Sanders was responsible for all computer programming operations.

The collection of specimens from fatally injured drivers would not have been possible without the cooperation of the medical examiners involved in this project. Their assistance is gratefully acknowledged.

The roadside surveys would not have been possible without the cooperation of many public officials from the cities of Dallas, Texas and Memphis, Tennessee. In particular, their assistance was invaluable in arranging press conferences, providing traffic control personnel, and in locating registered nurses who assisted in the survey.

Finally, the authors wish to publicly thank the 1,255 motorists who participated in the survey, donating their time and the necessary specimens. Their cooperation was extremely high - a very necessary factor contributing to the successful performance of this project.

Approved for:

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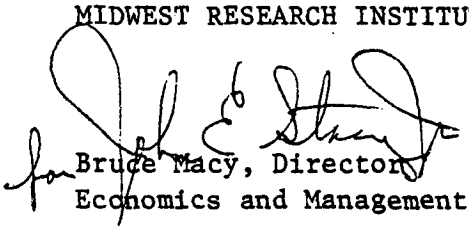

Bruce Macy, Director
Economics and Management Science Division

ADDENDUM

NHTSA Order 170-2 regarding technical reports (November 5, 1976) indicates that the responsible Associate Administrator or his designee is allowed two weeks for review of the final report and development of an addendum if one is necessary. Because of the current staff shortage, it has not been possible to review this report adequately within the permitted time. Therefore, this report is being published prior to a thorough internal review. It is clear, however, that before the results of this report can be interpreted appropriately or conclusions drawn regarding future action (e.g., further research), a number of points--pertaining to the nature of the data collected, chemical analyses performed, drug-driver interaction, etc.--warrant careful review and analysis. After this review, it is expected that a substantive "addendum" will be prepared and made available to readers on request.

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SUMMARY

A study was undertaken to determine whether or not particular drugs or drug types are over-involved in fatal crashes. The primary objectives of the study were the collection and chemical analysis of body fluid samples from fatally injured drivers and from a sample of living drivers similarly exposed. The chemically analyzed data from the living drivers were compared with the data from the fatally injured drivers to determine the relationship between drug usage by drivers and highway fatalities. The objectives of the study were met through a five-task research plan involving: (1) obtaining cooperation and development of procedures; (2) collection of samples from fatally injured drivers; (3) collection of samples from exposed drivers; (4) laboratory analysis of specimens; and (5) statistical analysis and interpretation of data.

The fatally injured driver data were collected by medical examiners in 22 areas of the country, each consisting of one or more counties. The data fell into two categories: (1) crash data information describing the circumstances of the fatal accidents; and (2) urine, blood and bile samples which were chemically analyzed for drugs. Finger and lip swabs were also collected (for detection of marijuana) but were not chemically analyzed.

The collection of fatally injured driver data began in November 1974 and was completed on December 16, 1975, in all areas except in the Cities of Dallas, Texas and Memphis, Tennessee. The collection in Dallas and Memphis continued through September 5 and August 27, 1976, respectively, to provide an adequate fatally injured driver sample in those two communities for subsequent comparisons with living drivers.

A total of 994 fatally injured driver specimen kits were received during the collection period of which 900 were chemically analyzed. The following fluids were supplied in adequate amounts: 637 (70.8%) urine, 825 (91.7%) blood, 492 (54.7%) bile, 587 (65.2%) both blood and urine, 326 (36.2%) all three fluid samples, and 832 (92.4%) complete set of swabs. Crash data were provided in all 900 cases.

Two communities, Dallas, Texas, and Memphis, Tennessee, cooperated with MRI in the conduct of roadside surveys to determine drug use among similarly exposed (living) drivers. Eleven surveys were conducted in Dallas between May 30, 1975, and September 13, 1976; eight surveys were conducted in Memphis between November 11, 1975, and September 2, 1976. The surveys were conducted at sites at which a driver was fatally injured (died with 4-1/2 hr of the crash) and for whom fluid specimens were submitted by the community medical examiner. Surveys were also

conducted at some fatally injured driver crash sites at which it was later determined that the medical examiner had failed to collect the required specimens. A total of 105 sampling sites were used in the study: 73 sites in Dallas and 32 in Memphis. The survey procedure consisted of stopping randomly selected male motorists at the time of day and day of week of the fatal crash, conducting the interview, and requesting breath, urine and blood samples. Lip and finger swab samples were also collected for detection of marijuana, but they were not chemically analyzed. An average of one dozen interviews were performed at each crash site.

Of 1,255 motorists stopped during the surveys, data from 1,196 drivers at acceptable sites were retained for subsequent analyses--759 drivers in Dallas and 437 drivers in Memphis. Of these 1,196 motorists, 91.6% cooperated with the interview, and breath samples were obtained from nearly all of those interviewed. Likewise, nearly all consented to give a urine sample, but only 67.2% of the drivers were able to produce a sufficient urine quantity on demand.* Also, of the motorists asked, 70.9% were able to provide a sufficient blood quantity.

The drivers encountered in the two communities had very similar demographic characteristics, and only small differences between the motorists from the two areas were noted. For instance, whereas the Memphis motorists were either white or black, the Dallas sample included many Mexican Americans as well. More blacks were interviewed, on a percent basis, in Memphis than in Dallas. The Dallas drivers tended to be less educated and younger than the Memphis drivers. The Memphis drivers interviewed tended to live mainly in Memphis; the Dallas drivers tended to be from Dallas as well as towns within the county.

Quantitative tests were performed on the living and fatally injured driver fluid specimens for 43 drugs, which were classified into seven drug groups: (1) sedatives and hypnotics, (2) tranquilizers, (3) stimulants and antidepressants, (4) antihistamines and decongestants, (5) narcotic analgesics, (6) hallucinogens, and (7) miscellaneous. Quantitative tests for the hallucinogen, LSD, were performed using only the urine samples collected from the fatally injured drivers. In addition, quantitative determinations of the blood alcohol content were performed on both breath and blood samples obtained from the living drivers and on the blood samples collected from the fatally injured drivers. Qualitative tests were also performed for nicotine (evidence of tobacco smoking) and salicylates (evidence of aspirin) using the living and fatally injured driver fluid specimens collected.

The total chemical analysis scheme involved: the preparation of specimens, including hydrolysis of glucuronides and sulfate ether,

* The total sample was increased to 75% by means of a "mail-back" procedure.

and extraction of the hydrolyzed specimens using a nonionic resin; the qualitative examination of the extracts by thin layer chromatography; and finally the quantitative confirmation of thin layer findings by gas chromatography. The statistical analysis of the fluid sample findings included findings confirmed by gas chromatography and quantitated at any level of concentration. The concentration of the drug in the fluid sample was not utilized as a parameter. Blood alcohol was determined using a gas chromatographic technique on blood head-space. LSD was assayed using radioimmunassay techniques.

The findings in fatally injured drivers were analyzed in 10 categories: each of the seven drug groups; one or more drugs, regardless of the drug group; nicotine; and salicylates. Moreover, five possible fluid sample combinations were considered: (1) urine separately, (2) blood separately, (3) bile separately, (4) urine and blood, and (5) urine, blood and bile. The incidences of drugs in the 22 submission areas, including Dallas and Memphis, were also examined but it was determined that the incidences did not differ significantly from area to area.

For cases in which both urine and blood findings from fatally injured drivers were available, the incidence of one or more drugs was about 12% (with a 95% confidence interval of $\pm$8.4%) in Dallas, about 24% ($\pm$14.6%) in Memphis, and 14.3% ($\pm$2.8%) overall. The most commonly detected drug was the antihistamine and decongestant, phenylpropanolamine, with the sedative, phenobarbital, second. Another antihistamine and decongestant, chlorpheniramine, the narcotic, codeine, and the stimulant, amphetamine, were also frequently encountered.

Nicotine was found in 64.7% ($\pm$3.9%) of the fatally injured drivers and salicylates were found in 17.4% ($\pm$3.1%). LSD was found in 1.2% (8/669) of the fatally injured drivers. All of these drivers evidencing LSD were males, 25 years old or less. Five of the eight (62.5%) were judged to be culpable, which is not significantly different from the total fatally injured driver population.

The incidences of drugs in the living drivers were examined in a manner similar to that used for the fatally injured drivers. These incidences were also compared by site within each survey community and between the two communities of Dallas and Memphis. The incidences were found not to differ significantly between sites or between cities. For cases for which both urine and blood findings were available, the incidence of one or more drugs was about 8.6% ($\pm$2.6%) in Dallas, and 6.7% ($\pm$2.9%) in Memphis, or about 7.9% ($\pm$1.9%) overall. The number of living drivers involved was relatively small in that only 40 out of 463 Dallas drivers and 19 out of 282 Memphis drivers evidenced one or more drugs.

As with the fatally injured drivers, the most commonly detected drug among the living drivers was the antihistamine and decongestant, phenylpropanolamine with the sedative, phenobarbital second. Another antihistamine and decongestant, chlorpheniramine was also found to be prevalent, more among the Dallas living drivers than among Memphis drivers.

About 56% ($\pm$3.6%) of the living drivers has been smoking tobacco while 19.2% ($\pm$2.8%) of the drivers had been using salicylates.

All but one of the 59 living driver drug detections resulted from the urine samples, rather than the blood samples. This is almost the same situation as that found for the fatally injured drivers, in which all but five of the drug detections resulted from the urine samples.

The incidences of drugs in fatally injured and living drivers were compared, to yield relative risks of being fatally injured as a driver in a crash. This was done separately for Dallas, Memphis, and the combination of the two communities. The relative risks were also determined by comparing the incidences of drugs in <u>all</u> fatally injured drivers with the incidence of drugs in <u>all</u> living drivers. The totality of the fatally injured driver data is statistically homogeneous and therefore serves as a description of the incidence of drug use among such drivers. The same is true about the totality of living driver data. Thus, the totality of all drug findings for both fatally injured and living drivers is the statistically preferred estimator for the incidence of drug usage for <u>any</u> location. From a statistical perspective, the relative risks based on all the data collected are to be preferred over the risks calculated for Dallas or Memphis alone since the increased sample size results in a more precise estimate of the relative risk. Also, there is no statistical evidence to indicate drug usage among living drivers was any different at crash sites for which fluid samples were available from the fatally injured driver than at those crash sites for which fluid samples were not available.

The comparisons of the relative incidences of drugs in all fatally injured drivers with those in all living drivers indicate that fatally injured drivers are significantly more likely to have been using drugs than similarly exposed (living) drivers. The comparisons imply that drivers using drugs have a relative risk of about 1.8 (with a 95% confidence interval of 1.3 to 2.5). The danger is greatest with narcotic analgesics with a relative risk of about 19 (with a 95% confidence interval of 5.1 to infinity); followed by sedatives and hypnotics with a relative risk of about 1.9 (with a 95% confidence interval of 1.1 to 3.5); and nicotine at 1.2 (with a 95% confidence interval of 1.1 to 1.3).

The relative risks for the other drug groups were all greater than unity, but the data samples are not large enough to make very powerful statements regarding their significance. (The lower confidence limits on the relative risk for these latter drug groups were all less than unity.)

The study reconfirmed alcohol as the most abused drug among drivers; it plays the leading role among drugs as a causative factor in fatal crashes. Drivers who would be legally intoxicated in most states (BAC of 0.10% or more) were found to be far more likely to be fatally injured in a crash than sober drivers. The relative risks were 3.27, 10.41, and 30.31 for BAC ranges of 0.05 to 0.09, 0.10 to 0.14, and 0.15 to 0.19, respectively (with attendant confidence intervals).

In further confirmation of previous findings, alcohol usage depends strongly on time of day for both the fatally injured drivers (at time of crash) and the living drivers (at time of interview). For both sets of drivers, the majority of all the drunk drivers was detected in the late evening and early morning hours. The only significant finding between time of day and other drug usage was that antihistamines and decongestants were over-involved in the morning and late afternoon to early evening hours among living drivers. Drug usage among the fatally injured drivers was mildly dependent on time of day, but in an opposite sense to that found for alcohol usage. However, the relationships between time of day and drug usage were not statistically significant.

Among the fatally injured drivers, the use of antihistamines and decongestants, and one or more drugs, were found to be significantly related, in a negative sense, with alcohol usage. Of those evidencing one or more drugs, 57.1% also had positive BAC's (0.01+), whereas a significantly higher percentage (68.4%) of the fatally injured drivers not using drugs had positive BAC's. The same negative association was found between alcohol usage and the other drug groups (except the miscellaneous group), but these drug incidence levels were too small to detect statistical significance. There is no statistical evidence to indicate that alcohol and drug usage are related among living drivers.

A number of fatally injured and living driver factors were compared with drug usage and examined for statistical importance. The use of antihistamines and decongestants was significantly related to season of the year among fatally injured drivers but not among living drivers. Fatally injured drivers had used these drugs relatively more frequently in the fall and less in the summer. For living drivers, however, season of the year was significantly related to the use of salicylates and the category "one or more drugs." Salicylates were over-involved in the

summer and fall and under-involved in the other seasons. The use of one or more drugs was over-represented in the fall and winter and under-represented in the spring and summer.

Culpability of the fatally injured drivers was not found to be related to drug usage. Neither was race significantly related to drug usage.

The age and sex of the fatally injured drivers were significantly related to usage of one or more drugs. Drivers 50 years and older were more likely to have been using one or more drugs while very young (19 years or less) and middle aged drivers (30 through 49) were less likely to have been using one or more drugs. A total of 23.1% of the fatally injured female drivers were using one or more drugs, compared to only 13.0% of the fatally injured male drivers. However, the 14.3% incidence of one or more drugs found for all fatally injured drivers is distorted by only 1.3% by the inclusion of fatally injured females, because they constituted only a small portion of the sample (13.3%).

The high incidence of drug usage among female fatalities prompted a correction of the relative risks by including only males in the calculations. The corrected relative risks are lower for each drug group (except for analgesics/narcotics and miscellaneous) than the risks determined from a combination of male and female fatally injured drivers. The greatest changes in risk were for sedatives and hypnotics, which decreased from 1.90 for all drivers to 1.61 for males only. (In addition, the lower confidence limit went below unity.) The risk for other drugs changed as follows: 1.69 to 0.97 for tranquilizers; 1.27 to 1.04 for antihistamines and decongestants; 2.54 to 2.93 for miscellaneous drugs; 1.81 to 1.64 for one or more drugs.

Finally, an analysis was conducted to determine the incidence of individual drug groups among living drivers at drug-involved fatal crash sites. Only two living drivers were found to have any drug in their system at the drug-involved fatal crash sites. The drugs detected in these two drivers did not match the drugs found in the drivers fatally injured at those sites. This shows the extremely low probability (zero in this study) of finding a given drug among living drivers at a fatal crash site where the same drug was found in the dead driver.

I. INTRODUCTION

This report describes a study to compare drug use in driver fatalities and living drivers exposed to the same driving environment. The high incidence of both prescription and illegal drug use, and the knowledge that a particular drug--alcohol--is over-involved in traffic fatalities, has raised suspicion that other drug use may be an important traffic safety problem.

Research was needed to determine if particular drugs were over-involved in traffic fatalities. Such research must give particular attention to the sampling of fatally injured drivers and to the sampling of a comparison group of "similarly exposed but not involved" drivers. Thus, the research study presented in this document was designed to determine whether or not particular drugs are over-involved in fatal crashes within a defined geographic area. The study accomplished this objective by determining the absolute incidence of drug involvement in driver fatalities, and the incidence relative to drivers similarly exposed but not involved.

The study was a logical extension of the Midwest Research Institute studies recently completed for the National Highway Traffic Safety Administration. These studies, "The Incidence of Drugs in Fatally Injured Drivers" (DOT Contracts Nos. DOT-HS-119-1-173 and DOT-HS-119-3-627) and "Drug Use Among Drivers" (DOT Contract No. DOT-HS-119-2-440), developed new analytical techniques, devised collection techniques for fatally injured and living driver specimens, and applied these techniques to an initial study of the incidence of drugs in fatally injured and living drivers. While the results of these studies indicated that certain drugs may indeed be a highway safety problem, the data were not sufficient to reliably determine the relative risk of a driver becoming involved in a fatal crash when he has one or more drugs in his system. Further data needed to be generated in which particular attention was paid to the sampling of both fatally injured drivers and "similarly exposed but not involved" drivers. The objectives of the study were met through a five-task research plan involving: (1) obtaining community cooperation and development of procedures; (2) collection of samples from fatally injured drivers; (3) collection of samples from living drivers; (4) laboratory analysis of specimens; and (5) statistical analysis and interpretation of data.

Section II of this report presents the research approach and methodology used in the study. His subdivisions describe how each of the above tasks were accomplished. The next section describes the screening of the fatally injured driver specimens, the analysis of the crash data, the nature of the living driver respondents and their cooperation, drugs found in both fatally injured and living driver samples, the relationship between the fatally injured and living driver findings, results relative to alcohol, and an analysis of the comparison between driver factors and drug usage.

The report ends with conclusions and recommendations, followed by the appendices which contain backup material.

II. RESEARCH APPROACH AND METHODOLOGY

This section of the report describes the approaches taken to accomplish each of the five tasks of the research plan. Subsection A deals with the selection of communities to provide the fatally injured driver specimens and data. Subsection B discusses the development of procedures for the collection of the fatally injured driver data while the collection of the specimens and data from the fatally injured drivers is presented in Subsection C. The selection of the communities for the exposed (living) driver surveys is discussed in Subsection D. Subsection E describes the survey plan for collecting fluid samples from living drivers while Subsection F discusses the field survey procedures used. Subsection G discusses the development of the chemical analysis methods and their application to the driver specimens collected. Finally, Subsection H briefly describes the data used and statistical analyses performed in the study.

A. Community Selection for Fatally Injured Driver Specimens and Data

The goal of this portion of the study was to select communities within the contiguous United States that would provide fluid specimens and data from 900 fatally injured drivers in a 10-month period. In addition, the selection would include two major communities from which samples from 150 fatally injured drivers would be obtained in the 10-month period and approximately 25 other smaller communities from which samples from 750 fatally injured drivers would be obtained in the same time period. The fatally injured drivers from the two large communities would be compared with living drivers, similarly exposed, obtained from the same two communities.

These requirements for fatally injured driver specimen and data collection were not possible to meet in the proposed 10-month period. Instead, two large communities were selected for survey for perods of 20 and 22 months in order to collect sufficient driver specimens and data. For the remaining 750 drivers, 22 smaller areas were selected to provide this number of fatally injured drivers over a period of 14 months. The factors influencing our selection of these communities are listed below.

1. Selection of two large communities: The selection of two large communities capable of providing a combined 150 fatally injured drivers in a 10-month period was complicated by two major factors:

a. Obtaining the cooperation of the medical examiner;

b. Obtaining cooperation of the city officials to allow a survey of living, similarly exposed drivers.

The latter factor was necessary because it was the objective of this program to compare drug incidences in fatally injured drivers and living drivers in the two major communities studied.

Several large communities were contacted by letter and telephone requesting cooperation for the collection of fatally injured drivers. The medical examiners of these communities were advised of the goals and requirements of the program and asked to reply if they were able and willing to cooperate. A sum of $20 would be paid to the cooperating medical examiner for each set of fatally injured driver specimens and data received during the study. Expressions of willingness to cooperate were received from the medical examiners in nine major areas; Dallas, Texas; Detroit, Michigan; Houston, Texas; Miami, Florida; Jacksonville, Florida; Oakland, California; Atlanta, Georgia; Tampa, Florida; and Memphis, Tennessee. Other large communities were unable to cooperate because of legal problems or medical examiners' lack of time, interest, or funds.

Of these nine areas, only two areas were also willing to cooperate in allowing concurrent surveys for living, similarly exposed drivers. These areas were Dallas, Texas, and Memphis, Tennessee (see Section II-D). The other seven large communities refused to cooperate or were unable to cooperate because of legal problems.

Thus, Dallas, Texas, and Memphis, Tennessee, were selected as the two major communities in this program for collection of 150 total fatally injured drivers, and for the living driver surveys.

2. Selection of the other communities: The selection of up to 25 other (smaller) communities to provide fluid specimens and data from 750 fatally injured drivers was dependent for the most part on the willingness of medical examiners to cooperate in supplying specimens and data from fatally injured drivers. Over 40 communities were contacted by letter and telephone, advised of the program goals and requirements and asked to reply if they were able and willing to cooperate. As with the larger communities, a sum of $20 would be paid for every set of fatally injured driver specimens and data received during the study. Thirteen communities expressed willingness to cooperate in the program;

these 13 communities were then combined with the seven larger communities which had already expressed willingness to cooperate in collection of fatally injured drivers for a total of 20 communities. These communities were:

Detroit, Michigan
Houston, Texas
Miami, Florida
Jacksonville, Florida
Oakland, California
Atlanta, Georgia
Tampa, Florida
Orlando, Florida
Kansas City, Missouri
Portland, Oregon
Wheaton, Illinois
Albuquerque, New Mexico
Las Vegas, Nevada
Minneapolis, Minnesota
Everett, Washington
Butler, Pennsylvania
Daytona Beach, Florida
Appleton, Wisconsin
Chester, Illinois
Eau Claire, Wisconsin

A listing of the medical examiners cooperating in this study is given in Appendix A, Table A-1.

The above list of communities is used here and elsewhere as an abbreviation for the areas submitting fatally injured driver samples. Each of the collection areas consisted of one or more counties in addition to at least part of the referenced community. A list of the extent of each submitting area is discussed in Section III-B.

B. Development of Procedures for the Collection of Fatally Injured Driver Specimens and Data

The procedures for the collection of fatally injured driver specimens and data were identical in all of the 22 areas involved in the study (20 areas to supply 750 drivers, 2 areas to supply 150 drivers).

The medical examiners in all 22 areas were, upon indicating willingness to cooperate, advised in detail of the driver specimen and data collection requirements. Medical examiners were requested to provide data and physiological specimens from every driver fatally injured in their jurisdictions during the collection period. An additional requirement was imposed that the driver must have died within 4-1/2 hr of the accident. This additional requirement was designed to reduce the problems associated with the administration of drugs between the time of crash and time of death, and consequent confounding of the drug analysis data. If it was not possible for the medical examiner to collect physiological specimens (e.g., if the driver was incinerated at the accident site) crash data were still requested to be forwarded to MRI. If the medical examiner was not able to furnish all the physiological specimens required, he was asked to provide written information as to the reason for this. Described below are the collection requirements imposed for the collection of fatally injured driver data and specimens for this program.

1. Data requirements: To collect data regarding the crash victim and the circumstances surrounding the crash, a crash data form was provided in duplicate with the crash collection kit. This form was to be completed by the medical examiner for each accident and supported, if possible, by the police accident report. The data to be included on this form consisted of the date and time of the accident, the date and time of victim's death, the date and time the samples were taken, the samples taken, the reasons why any samples were not taken, the drugs known administered between the time of accident and death, the location of the crash, the type and number of vehicles involved and the type of crash, other people involved in the crash, conditions most likely contributing to the crash, and finally, the age and sex of the victims. One copy of the completed crash data form was sent to MRI; the other was retained by the medical examiner for his records. A copy of the crash data form is shown in Appendix A, Figure A-1.

2. Physiological specimen requirements: The medical examiners were requested to provide from each eligible fatally injured driver the following specimens:

Blood, 60 ml for alcohol and drug analysis
Urine, 45 ml for drug analysis
Bile, 25 ml for drug analysis
Swabs of the hands, lips and palate for evidence of marijuana contact

Five ml of blood were required to be preserved with oxalate and fluoride for blood alcohol analysis. The remaining blood was preserved with oxalate only. Urine and bile specimens were not chemically preserved. Shipment and storage were under refrigerated conditions. The procedures for physically accomplishing the collection of data and specimens are described below.

3. Collection procedures: In order to collect the previously mentioned data and specimens, MRI provided the medical examiners with collection kits. These specimen and data collection kits specifically consisted of the following items.

a. An insulated mailer container of polyurethane foam and cardboard with MRI return address and airmail postage paid.

b. A kit I.D. card in duplicate.

c. A crash data form in duplicate, with prepaid return envelope.

d. A urine collection bottle, 50 ml size, with superior quality screw cap seal totally constructed of shatter-proof polypropylene.

e. A bile collection bottle, 30 ml size, similar to the urine bottle.

f. A blood collection bottle, 80 ml size, similar to the urine bottle but containing potassium oxalate as an anticoagulent. Vacutainers, needles, and vacutainer holder for blood collection.

g. A 7 ml vacutainer containing oxalate and fluoride for blood alcohol analysis.

h. A hands, lip and palate swab sub-kit consisting of four cotton swabs, four glass tubes with tight fitting screw caps, and a vial of 70% ethanol.

i. Instructions for use of the kit.

j. Artificial ice bags to refrigerate the samples in shipment.

The medical examiners were requested to ship back the refrigerated specimens as soon as possible. The crash data forms could be mailed back at a later, more convenient date. Copies of the collection kit instruction sheet and I.D. card are shown in Appendix A, Figures A-2 and A-3, respectively.

C. Collection of Fatally Injured Driver Specimens and Data

Using the procedures described earlier, data and specimens were collected from medical examiners in 22 communities. A total of 1,121 kits were dispatched and 994 kits were received back at MRI with data and specimens. The kits from Dallas, Texas, and Memphis, Tennessee were collected over a period of 22 and 20 months, respectively. In all other areas, the kits were collected over a 14-month period.

Of the 994 kits received, 900 were chemically analyzed and retained for further investigations. The remaining kits were rejected because they did not meet the rigid requirements for the program. Reasons for rejecting kits included:

Fatally injured person was not a driver
Driver lived for more than 4-1/2 hr after crash
Crash was out of the medical examiners jurisdiction

More is said in Section III-A about the screening of the fatally injured driver data.

Table 1 shows the number of kits dispatched to each area, and those collected and analyzed.

It was not possible in all cases for the medical examiner to supply all the requested specimens. Out of the total of 900 drivers kits meeting the requirements of the program, 637 (70.8%) supplied urine, 825 (91.7%) supplied blood, 492 (54.7%) supplied bile, 587 (65.2%) supplied both blood and urine, 326 (36.2%) supplied all three fluid samples, and 832 (92.4%) supplied a complete set of swabs. Crash data were provided in all cases.

D. Community Selection for Exposed (Living) Driver Surveys

One of the major tasks of the contract was to survey and collect fluid samples from 1,200 exposed (living) drivers at the time and

TABLE 1

KITS DISPATCHED AND COLLECTED

Area	Kits Dispatched	Kits Collected	
		Total	Analyzed
Dallas, Texas	168	164	123
Detroit, Michigan	100	88	86
Houston, Texas	82	73	69
Miami, Florida	80	73	68
Jacksonville, Florida	80	73	63
Oakland, California	60	57	56
Atlanta, Georgia	62	55	52
Memphis, Tennessee	69	53	47
Tampa, Florida	50	45	45
Orlando, Florida	49	45	43
Kansas City, Missouri	46	40	40
Portland, Oregon	39	39	39
Wheaton, Illinois	51	40	36
Albuquerque, New Mexico	43	39	26
Las Vegas, Nevada	28	27	26
Minneapolis, Minnesota	24	20	19
Everett, Washington	20	19	18
Butler, Pennsylvania	16	14	14
Daytona Beach, Florida	19	13	13
Appleton, Wisconsin	18	11	11
Chester, Illinois	8	3	3
Eau Claire, Wisconsin	9	3	3
Total	1,121	994	900

places of fatal crashes. In the initial conception of the program it was anticipated that the living driver surveys would be conducted in two metropolitan areas that usually each experience about 80 suitable driver fatalities (or a total of 150 driver fatalities) in a 10-month period. In order for a fatality to be of use in the study, it must be that of a driver who dies within 4-1/2 hr of the crash.

The requirements on the survey communities were very demanding and certainly beyond the control of the study. From an initial study of accident statistics only four cities satisfied the requirements: New York, Los Angeles, Chicago and Detroit. The likelihood of obtaining the cooperation for living driver surveys in one or two of these communities was doubtful, and in some cases impossible. Therefore, an alternate plan was developed using three communities providing a total of 150 driver fatalities in a 10-month, or longer period.

A major effort was undertaken to locate three potential survey communities that would satisfy the following set of sampling requirements:

1. The community must provide a sufficient sample size of fatally injured drivers. Approximately 50 driver fatalities were needed from each community in a 10-month period.

2. The medical examiner of the community must be willing to cooperate by submitting all appropriate driver fatality fluid samples along with complete fatal crash data.

3. The police department of the community must be willing to cooperate in the conduct of the roadside surveys.

4. The mayor (or equivalent) of the community must be in agreement with the surveys.

5. The legal authorities of the community must not have any legal objections to the surveys.

6. NHTSA must approve the community selection.

If any one of these requirements could not be met, the survey process could not take place in the given community. Yet, each requirement was a major hurdle. It was understood from the beginning of the search that if three communities could not be found satisfying all six of the requirements, some concessions would be necessary.

A list of 26 potential sampling areas was developed from driver fatality data obtained from numerous medical examiners, from telephone contacts with various city police departments and from data on motor-vehicle traffic deaths collected by the National Safety Council. These areas are given in Table 2. Communities with less than 50 driver fatalities in a 10-month period were included in the list for consideration in case one or two communities with greater than 50 driver fatalities could be found to cooperate with the study.

MRI personally contacted a number of communities to solicit their cooperation in the study. NHTSA in Washington sent letters to the regional administrators of NHTSA describing the project and asking for their assistance in contacting some of the communities. The balance of the communities not contacted by MRI were contacted by representatives from the NHTSA regional offices. It was soon determined that possibly only one or two communities on the list would satisfy all of the requirements. Dade County, Florida was interested in the study but the police participation needed was somewhat doubtful. The willingness of Las Vegas and Clark County, Nevada (and several other areas) to cooperate in the study was never determined. The Nevada area was subsequently ruled out because of the operational difficulties posed by the need to conduct roadside surveys in a county wide, predominately rural area.

Some of the responses to the inquiries expressed legal objections, some said that the police could not cooperate, and some said the political environment would not allow the surveys to be conducted. At the time of the inquiry, there was serious doubt that the roadside surveys could be legally conducted in west coast states because of state regulations. Five favorable replies, however, were obtained from those initially contacted. These communities were Dallas, Texas; Memphis, Tennessee; Houston, Texas; Tampa, Florida; and Atlanta, Georgia.

Visits were made to each of these five communities to describe the objectives of the program and to present some of the details of the planned survey. Meetings in each community were held between MRI, representatives of NHTSA, and various city/county officials. The community officials involved in most of the meetings included representatives from the Mayor's office, Governor's or City Traffic Safety Offices, Police, Traffic, Health and Legal Departments. A brochure describing the roadside drug usage survey was distributed before the meetings. This document gave the background for the survey, objectives of the program, procedures to be followed in the survey, and the need for the community cooperation.

TABLE 2

LIST OF POTENTIAL SAMPLING AREAS

Area	Estimated Number of Driver Fatalities in a 10-Month Period (Based on 1973 Data Except Where Noted)	Willingness to to Cooperate with Roadside Surveys
New York, New York	296*	No
Los Angeles, California	144*	No
Miami and Dade County, Florida	113	Possibly
Chicago, Illinois	100	No
Oakland and Alameda County, California	99	No
Detroit, Michigan	75	No
Philadelphia, Pennsylvania	70*	No
Tampa and Hillsborough County, Florida	66	No
Las Vegas and Clark County, Nevada	51	Unknown
Dallas, Texas	46	Yes
Jacksonville, Florida	45	No
Orlando, Orange and Osceola Counties, Florida	39	Unknown
Houston, Texas	38	No
Phoenix, Arizona	36	Unknown
Atlanta, Georgia	33*	No
Wheaton, Illinois and DuPage County, Illinois	33	Unknown
Kansas City, Missouri	32*	No
Memphis, Tennessee	31	Yes
Albuquerque and Bernalillo County, New Mexico	31	Unknown
Nashville, Tennessee	30*	No
Portland, Oregon	27*	No
Everett and Snohomish County, Washington	23	No
Columbus, Ohio	23	No
Minneapolis, Minnesota	17	Unknown
Denver, Colorado	17	No
Indianapolis, Indiana	16	No

* 1972 Accident Data.

In these meetings it was stressed that MRI would coordinate all survey planning and activities. Also, the assistance of the various governmental agencies was discussed. The assistance of the police and traffic departments was required in selecting safe and suitable sampling locations. Police officers would be needed to provide traffic control and perform the act of stopping vehicles for sampling, under the direction of survey personnel. The assistance from the Health Department was needed in publicly backing the survey, approving of the fluid sampling procedures and helping arrange for registered nurses to be assigned to the survey. The Legal Department's help was sought in answering any legal problems.

As a result of these meetings, both Dallas and Memphis agreed to cooperate in the surveys. The extension of cooperation by the various agencies within these two cities came relatively quick after the initial meetings. Such was not the case in the other three communities. The decisions by Houston, Tampa, and Atlanta not to cooperate in the study came after considerable time delay. Their decisions were based upon legal, political and police objections.

At this point in the search for survey communities, only two communities had been found from a list of 26 potential survey areas. However, neither of these two satisfied the first requirement. Thus, it was obvious that a relaxation of the community requirements must be made. The first requirement was modified.

It was decided between MRI and NHTSA that surveys would only be conducted in two communities--Dallas and Memphis--and that these surveys would be conducted over a 16-month period instead of a 10-month period as was originally planned. Using the most recent fatal accident data from these two areas it was estimated that a sum of 132 driver fatalities would be recorded in these areas in this period of time. This was considered a suitable substitution for the 150 driver fatalities originally sought.

E. Survey Plan for Collecting Fluid Samples from Living Drivers

A survey sampling plan was developed after Dallas and Memphis were selected as the survey communities. The sampling in both communities was to be conducted during the same time of day, day of week and at locations of previous crashes wherein a driver(s) was fatally injured.

The traffic moving on the same street and in the same direction as the fatally injured driver was to be sampled. The fatal crash sites used were to be those for which the fatally injured driver died within 4-1/2 hr of the crash and for which specimens were obtained and analyzed for drugs. There are several reasons for establishing a time limitation on the collection of fluid samples from the fatally injured drivers. First, the time lapse between the time of the crash and death will influence the estimate of the drivers condition at the time of the crash. This time effect is well known for alcohol, but not for other drugs. Clearly, the change in the body condition will be dependent on the specific drug in question. It is therefore important that fluid samples collected represent the state-of-the-body as close to the time of the fatal crash as possible. Secondly, the body fluids will be modified by medications, transfusions and the like that occur as part of the emergency medical procedures. The longer a driver survives, the greater effect these procedures would have upon the laboratory analysis.

Finally, there is the practical consideration regarding the point of diminishing returns. One must balance the loss of precision in the data attendant with longer lapse times against the gain of only a small increase in the sample size.

A 4-hr time limitation has been used in alcohol studies. From a cumulative distribution of survival times for a sample of fatally injured drivers it was found that a limit of 4 to 4-1/2 hr included about 85% of the cases. Moreover, no appreciable increase in sample size would occur unless the limit were increased to over 10 hr. Based upon these data and others discussed in Section III-A, it was decided to establish a 4-1/2 hr time lapse between the time of the crash and death as a reasonable limit.

At the beginning of the study, it was envisioned that two survey trips would be made to each community in a 10-month period. This meant that the time lapse between a fatal crash and a living driver survey at the scene of that crash would vary from 1 or 2 weeks to 5 months. As the study progressed, and before the surveys had commenced, NHTSA expressed concern that, in 5 months, conditions at the scene of the fatal crash might change to such an extent that the living drivers sampled might not be representative of the drivers on the road at the time of the fatal crash. These changes could be due to a number of factors including traffic, seasonality, etc. Therefore, NHTSA suggested that sampling at intervals more frequent than 5 months would be necessary. At this point, a number of survey plans, each incorporating different sampling intervals, were developed.

The most reliable way to survey motorists at the scene of a fatal crash and to control the conditions surrounding the crash is to center the survey around the exact time of the crash. In other words, be at the crash scene before and after the accident. Obviously, this is impossible. The next best approach would be to survey the motorists at the crash scene exactly 1 week after the accident. This is feasible, but is a very expensive approach. A compromise was established between the 5-month and the 1-week sampling interval in that the living drivers surveyed at a fatal crash site would be surveyed within 6 weeks of the exact time of the accident. NHTSA felt that the living drivers sampled within this 6 week period would be representative of the drivers on the road at the time of the fatal crash.

Based upon an estimated 132 driver fatalities from both communities in a 16-month period, it was decided to conduct 10 surveys in Dallas and 8 in Memphis. The surveys in each community were to be conducted roughly at 6-week intervals, depending, of course, upon the timing of the driver fatalities. This schedule was established to provide the 1,200 living driver samples required by the contract. One extra survey was conducted in Dallas (giving a total of 11 for that community). This was done to increase the sample size of dead and living drivers from Dallas when it was determined that the number of dead drivers usable for living driver surveys from both communities would be less than 132. Some fatally injured driver data were received from both communities before the living driver sampling plan was approved by NHTSA. By the time the plan was approved these driver fatalities were over 6 weeks old and could not be used in the planning of the living driver surveys. The time delay in starting the surveys later required the fatally injured driver sample collection time in Dallas and Memphis to be increased from 16 months to 22 and 20 months, respectively.

Early in the study, arrangements were made with both the Dallas and Memphis Police Departments to send us, on a weekly basis, a listing of the number of fatalities plus hard copies of the accident reports for the fatal driver accidents. These data were assembled and when the 5th week anniversary of the oldest driver fatality was observed, a survey schedule for the community was developed. The schedule finally developed included crash locations where drivers had been killed between 1 and 6 weeks previous to the planned starting date of the survey. The medical examiners office was contacted during the survey planning to determine if the appropriate fluid specimens had been collected from the fatally injured drivers. The timing of some of the surveys was such that many times the fluid samples from the medical examiners office did not arrive at MRI for chemical analysis until after the survey had been conducted.

Once the survey schedule was established, the police accident reports were studied and a personal inspection of each driver fatality crash site was made. A survey location close to the crash site was selected utilizing all safety requirements. In some cases the interview location selected was on private property. A signed statement was then obtained from the property owner of the site granting permission to use their off-street parking areas for the motorist's interviews.

The time of sampling at a given site was matched perfectly as far as time of day and day of week was concerned. The sampling at each site in Memphis was done over a 3-hr interval centered as near as possible at the time of the previous crash. Initially, a 2-hr sampling period was used at each site in Dallas. This was later changed to a 2-1/2 hr period to provide an adequate sample for Dallas. The longer sampling period was chosen for Memphis to help equalize the number of living drivers surveyed from each community. (Memphis was expected to have fewer driver fatalities than Dallas.)

Every effort was made to use every fatally injured driver crash site. However, some slight shift in site locations was necessary. There are valid reasons for making these changes and reasonable guidelines for doing so. For instance, no sampling was done on freeway facilities or under conditions where speed, congestion, or both might create traffic congestion and/or an accident situation. The sampling site for a freeway crash was located at the end of the first downstream exit ramp from the crash location. Two-way walkie-talkies were used among the survey crew sometimes when working these off-ramp sites to ensure that the motorists interviewed had passed the fatal crash scene. In some cases, the sampling site on a non-freeway-type highway was moved a few hundred feet upstream or downstream of the site of the crash where an area of enforced reduced speed was available. Likewise, when a crash occurred in an urban setting at an intersection, the sampling point was sometimes moved a block or two upstream of the intersection where a more suitable location for placing the mobile laboratory could be found.

Sampling was not generally restricted because of anticipated low traffic volumes. At a couple of survey sites only two to three motorists were interviewed. However, one survey site was omitted from consideration when it was discovered we would be surveying motorists at 3 AM coming out of a dead end street which contained only four residences. Under these conditions we did not expect any traffic.

MRI, in accordance with the Department of Health, Education and Welfare's (DHEW's) regulations on "Protection of Human Subjects," (45 CFR 46 as ammended) has established a Human Subjects Committee. This committee consists of several technical and administrative representatives from MRI, several physicians, a professor of psychology from a state university, a lawyer, several representatives of civic organizations, and a housewife. This committee reviews research proposals prior to submission and research plans after acceptance for compliance with DHEW and MRI policy regarding the protection of rights of human subjects. In all programs involving human subjects, the research plan must contain a protocol that informs the subjects of the risks and benefits of the research and requires their informed consent for participation. If at any time the Chairman of the Human Subjects Committee determines that the human subjects are being placed at greater risk than approved by the committee, he can order the research stopped pending review and approval by the committee.

A protocol for the living driver surveys was developed early in the study and submitted to the MRI Human Subjects Committee for approval. This was a voluntary action and one not required by the contract. The protocol was approved by the committee before the surveys were begun. The committee regularly reviewed the project throughout the period the surveys were conducted. A surveillance form (see Appendix B, Table B-1) was submitted quarterly to the Human Subjects Committee. In addition, briefing reviews were held semi-annually with a subcommittee to ensure that the rights of the living drivers stopped during the surveys were being protected and that the approved protocol was being followed. The minutes of these semi-annual briefing reviews were then submitted to the Human Subjects Committee for review and action, if necessary. Excerpts from minutes of several of the Human Subjects Committee Meetings dealing with the review of the study are presented in Appendix B, Table B-2. At no time during the study did the committee consider the protocol violated, nor the rights of the living drivers compromised.

F. In-Field Survey Procedure

A press briefing was held in each community 1 day prior to the start of the first survey period in that community. The briefings were held in municipal buildings and were presided over by the Director of the Health Department and a representative from MRI. Reporters from

local newspapers, radio and TV stations attended the meetings and gave us excellent mass media publicity. The favorable survey publicity helped to give us a higher-than-expected cooperation rate from the motorists.

The roadside survey procedure was patterned after that used previously in another study of drug use among drivers.* A major item of equipment used during the survey was a mobile laboratory. This was a rented motor home which contained heating, cooling, refrigeration and sanitary facilities together with counter and storage space capabilities and necessary seating arrangements for effective interviewing. The unit contained its own power generating equipment for both internal and external lighting. Four flood lamps were placed on the roof of the motor home to provide lighting of the immediate parking area. A sign describing the nature and backing of the survey was placed on the side of the motor home, in view of the motorist. A portable, diamond-shaped sign alerting motorists to the roadside survey was mounted on its own support and placed on the curb upstream of the survey site.

The sampling crew consisted of an MRI field supervisor, an MRI assistant, a locally hired registered nurse for drawing blood, and a police officer to direct traffic and intercept randomly selected vehicles. When possible, particularly late a night, a locally hired driver was used to assist intoxicated motorists to their next destination. The police officers were a necessary and integral part of the survey. They were effective at stopping motorists and undoubtedly contributed considerably to the high degree of motorist cooperation achieved.

The survey procedure was as follows. When another interviewee was needed, the supervisor would draw a number from a table of random numbers, wait the number of seconds corresponding to the number selected and then notify the police officer. The latter would then stop the next male motorist (who could reasonably be stopped safely) and direct him to the survey supervisor. The supervisor would introduce himself to the motorist and explain that he was conducting a drug survey for the U.S. Department of Transportation. He assured the motorists that his cooperation was voluntary and anonymous, and that nothing we found could be used against him. The motorist was given a letter from the Traffic Safety Coordinator (in Dallas) or the Director of the Memphis and Shelby

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* Glauz, W. D., R. R. Blackburn, "Drug Use Among Drivers," Contract No. DOT-HS-119-2-440 (MRI Project 3668-E), Midwest Research Institute Final Report, February 1975 (DOT-HS-801411).

County Traffic Safety Coordinating Committee (in Memphis) requesting his cooperation (see Appendix C). The motorist was then asked to enter the van to answer some questions.

Once in the van, the driver was asked a series of questions about his age, health and what medication, if any, he was taking. A Breathalyzer test was administered by the assistant. The driver was then given a standard urine sample bottle and asked to step into the restroom and give us a urine sample.

When he returned, we asked him for a blood sample. Each driver asked for a blood sample was also offered $10 in order to maximize the willingness of the motorist to donate the sample. The registered nurse withdrew a 20 to 30 ml sample using standard Vacutainers. Blood samples were not requested from motorists who were under the legal age of consent or who, in the opinion of the nurse, had chronic health problems.

The final sample requested of the motorist were finger and lip swabs (for detection of marijuana). A Q-tip dipped in ethanol was rolled around the lips to pick up residue of marijuana. A separate Q-tip, also dipped in ethanol, was used to swab the digits of each finger on the right hand. The same process was repeated for the left hand using a third Q-tip. The three Q-tip samples were then placed in separate screw top glass tubes. It was later decided not to chemically analyze the swabs and they were discarded.

After each fluid and swab sample was collected, it was coded with the corresponding interview number. The samples were then refrigerated until they were shipped by air to MRI, where they were refrigerated until chemically analyzed.

At the end of the survey the motorist was given the Breathalyzer result, some literature, and an opportunity to ask questions. We used all reasonable means to prevent the driver from continuing to drive if his blood alcohol concentration (BAC) was at or above the local legal presumptive limit. This included encouraging him to let a sober passenger do the rest of the driving, or requesting that someone else, such as our part-time driver, drive him to his local destination.

A number of motorists consented to give a urine sample but could not produce a specimen at the time, or gave an inadequate amount (less than 20 ml). These motorists were asked to place a urine sample in a coded specimen bottle furnished for that purpose, within the next

several hours. The drivers were requested to write on the label the date and time of the sample, and place it in the furnished, self-addressed, stamped mailer.

In most instances, the motorist interviews were conducted within the van. However, when a motorist was reluctant to leave his car, every attempt was made to conduct the interview at the car. This approach permitted the reluctant motorist to take a more favorable attitude toward the survey and enabled us to obtain the interview and breath sample at the car. At the conclusion of the outside interview we asked for a urine and blood sample with the offer to pay $10 for the samples. Many times the offer of payment was sufficient to get the motorist out of his car, into the van, and to provide the necessary fluid samples.

G. Development of Chemical Analysis Methods and their Application to Driver Specimens

The physiological specimens collected from both fatally injured drivers (FID) and similarly exposed living drivers (SELD) were analyzed for drugs and alcohol as follows:

Blood (FID and SELD), alcohol and drugs
Urine (FID), drugs, including LSD
Urine (SELD), drugs
Bile (FID), drugs

In addition, small samples of all blood specimens were reserved for marijuana analysis by radioimmunoassay. This assay was not conducted on this project--1,669 1 ml plasma specimens were shipped to White Memorial Medical Center, Los Angeles, California for analysis on a separate project. The alcohol swabs of the hands, lips and palate, collected for marijuana contact analysis, were not analyzed on this project.

This section describes the experimental methodology developed for the analysis of these specimens. Plasma, bile, and urine were examined for 43 drugs which were quantitatively analyzed (these drugs are given in Table 3). In addition, nicotine and salicylates were analyzed qualitatively, and alcohol determinations were conducted on blood samples. LSD analyses were conducted on fatally injured driver urine specimens.

TABLE 3

DRUGS AND DRUG GROUPS INCLUDED IN THE ANALYTICAL SCREEN

Sedatives and Hypnotics

Phenobarbital (Luminal)
Pentobarbital (Nembutal)
Amobarbital (Amytal)
Secobarbital (Seconal)
Butabarbital (Butisol)
Butobarbital (Butethal)
Diphenylhydantoin (Dilantin)
Glutethimide (Doriden)
Methaqualone (Quaalude)

Tranquilizers

Meprobamate (Miltown)
Chlordiazepoxide (Librium)
Diazepam (Valium)
Chlorpromazine (Thorazine)
Promazine (Sparine)
Thioridazine (Mellaril)
Trifluoperazine (Stelazine)
Oxazepam

Stimulants and Antidepressants

Methylphenidate (Ritalin)
Imipramine (Tofranil)
Amitriptyline (Elavil)
Amphetamine (Dexedrine)
Methamphetamine (Desoxyn)

Antihistamines and Decongestants

Chlorpheniramine
Diphenhydramine
Tripelennamine
Methapyriline
Phenylpropanolamine

Narcotic Analgesics

Nalorphine (Nalline)
Morphine
Codeine
Meperidine (Demerol)
Cocaine
Methadone (Dolophine)
Hydromorphone (Dilaudid)
Propoxyphene (Darvon)

Hallucinogens

Dimethyltryptamine (DMT)
Diethyltryptamine (DET)
Mescaline
2,5-dimethoxy-4-methylamphetamine (STP)

Miscellaneous

Phendimetrazine
Procaine
Lobeline
Quinine

An analytical methodology was developed based on prior methodologies used for analysis of drugs in driver specimens.*

The total analytical scheme involves: the preparation of specimens, including hydrolysis of glucuronides and sulfate ethers, and extraction of the hydrolyzed specimens using a nonionic resin; the qualitative examination of the extracts by thin-layer chromatography; and finally the quantitative confirmation of thin-layer findings by gas chromatography. Blood alcohol was determined using a gas chromatographic technique on blood head-space. LSD was assayed using radioimmunoassay techniques. Figure 1 depicts the total analytical scheme.

The methodologies were developed and evaluated using blood, urine and bile specimens spiked with known levels of the drugs of interest. Continuous inclusion of standards and controls throughout the development and application of these methods ensured quality control.

Described below are the following pertinent descriptions of the analytical methodology.

Preparation of specimens for analysis of drugs.
Analysis of plasma, urine and bile.
Analysis of fatally injured driver urine for LSD.
Analysis of blood for alcohol.
Supplies and reagents for analyses.

1. Preparation of specimens for analysis of drugs: Upon receipt, specimens were refrigerated until preparation. Storage was overnight only. The amounts of material received were measured and logged in. The unpreserved blood was centrifuged to produce plasma. Fifteen milliliters of plasma, 10 ml of bile, and 20 ml of urine were removed for analysis and remaining fluids were stored frozen to await marijuana and LSD analysis. If the amounts mentioned above were not available, then 1 ml was frozen for future use and the remaining fluid (measured) was used in the analysis described in this document. Five milliliters of whole fluoridated blood was refrigerated to await blood alcohol analysis.

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* Woodhouse, E. J., "The Incidence of Drugs in Fatally Injured Drivers," Contract No. DOT-HS-119-3-627 (MRI Project 3747-C) Midwest Research Institute Final Report, October 1973.

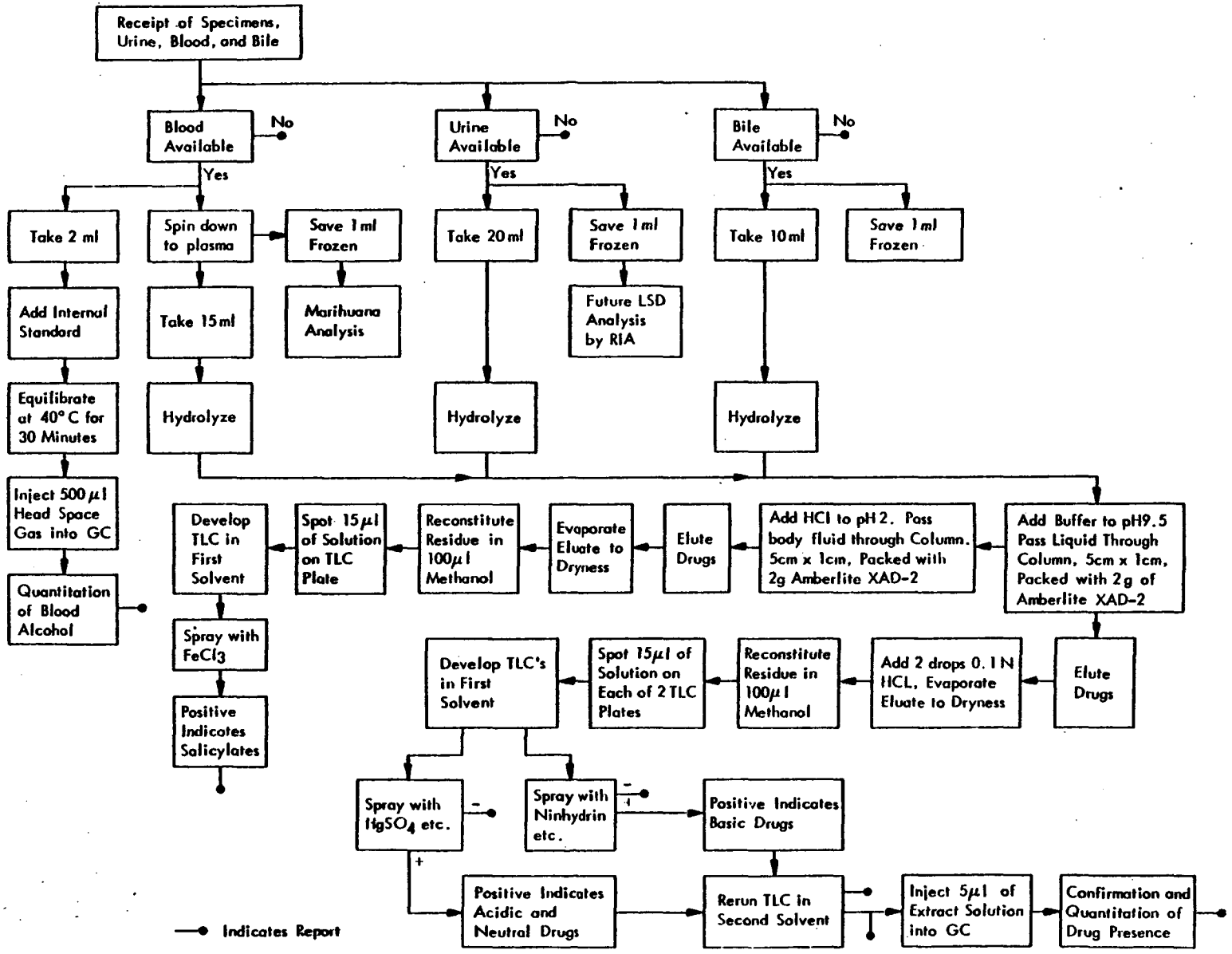

Figure 1 - Analytical Screen for Determination of Drugs in Body Fluids of Drivers

2. Analysis of plasma, urine and bile for drugs: Plasma and urine samples from fatally injured and living drivers and bile samples from fatally injured drivers were analyzed for 45 drugs--all those shown in Table 3 plus salicylates and nicotine. All analyses were quantitated except those for salicylates and nicotine. Described below are the hydrolysis and extraction, thin-layer chromatographic and gas chromatographic analysis steps.

a. Hydrolysis and extraction: The analysis involved hydrolysis of the fluids to free any drugs present from conjugates. Drugs in body fluids are often largely present as conjugates with glucuronic acid and as ethereal sulfates. When present as such, they are not extracted and detected in an analytical scheme such as presented here. Liberation of glucuronides and sulfates was accomplished using a mixture of glucuronidase and sulfatase enzymes as follows. To prepare the enzyme solution, 6.8 g of sodium acetate trihydrate was dissolved in 250 ml distilled water. To this solution was added 600 mg of sulfatase (Type H-1, Sigma) containing glucuronidase. Five milliliters of this solution was added to 20 ml of urine, 10 ml per 15 ml of plasma, and 10 ml per 10 ml of bile. The body fluids were then adjusted to pH 5.0 with 6N hydrochloric acid and incubated in covered containers at 37°C for 24 hr. After incubation, all specimens were filtered and prepared for extraction.

Extraction of drugs from all body fluids was accomplished using a nonionic resin, Amberlite XAD-2, available from Rhom and Haas, Inc. The resin used was as provided by Brinkmann Instruments, Inc., for its "Drug Skreen" system. The body fluid was buffered and passed through a column of the resin. The drugs were retained on the column and then eluted with an organic solvent. The detailed process was as described below.

The absorbent cartridges, as shown in Figure 2, were placed in aspirator racks without the filter cartridges. Each adsorbent cartridge contained a 5 cm column of 2 g of resin.

The absorbent cartridges were moistened with 5 ml of distilled water. The filtered, hydrolyzed body fluids were taken to pH 7 with sodium hydroxide and then buffered at pH 9.5 by the addition of 3 ml of a buffer consisting of a mixture of saturated sodium bicarbonate with saturated sodium carbonate added to adjust the pH to 9.5. The body fluids were then passed through the adsorbent cartridges. The fluid passing through the cartridge was retained for further use in salicylate determination.

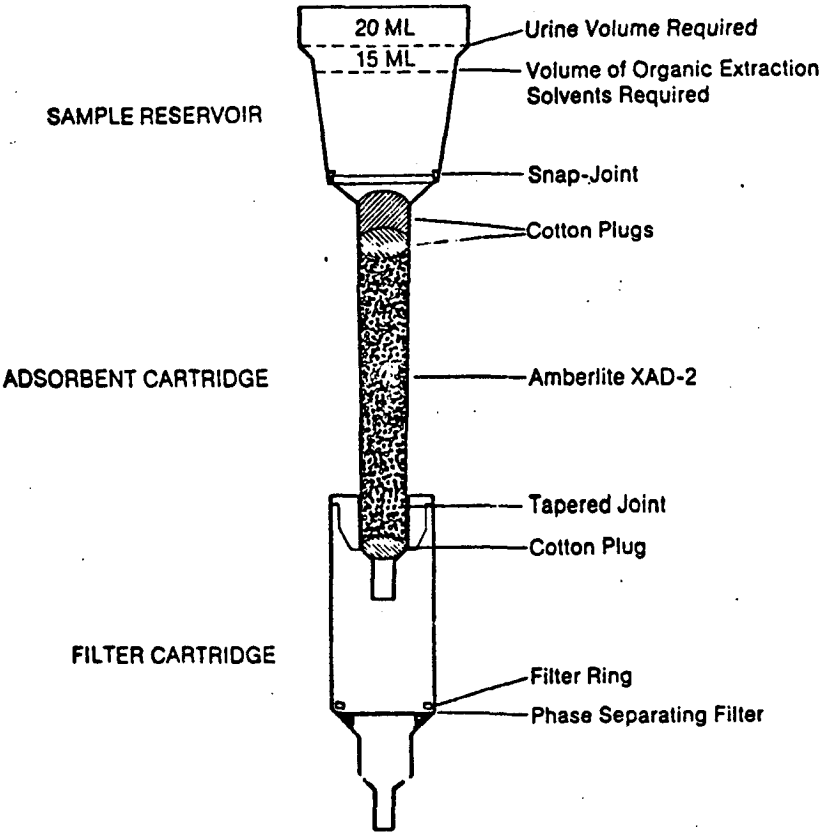

Figure 2 - Extraction Assembly

The adsorbent cartridges were aspirated for 20 min to remove water, and then placed in the filter cartridges for elution. The cotton plugs were removed from the top of the adsorbent cartridge, the phase separating paper was wet with elution solvent (1,2-dichloroethane/ethyl acetate, 4:6) and 15 ml of elution solvent passed through the adsorbent cartridge in three 5 ml batches. The eluate was collected in a glass conical evaporation vessel, acidified with 2 drops of 0.1 N hydrochloric acid and evaporated to dryness at 45°C in a water bath under ventilation. This eluate contained all barbiturates, neutral and basic drugs. The original body fluids were then adjusted to pH 2 with hydrochloric acid and passed through fresh adsorbent cartridges to retain the salicylates which were then eluted with 15 ml of elution solvent (1,2-dichloroethane/ethyl acetate, 4:6) and evaporated to dryness at 45°C in a water bath under ventilation.

Thus, two extract residues resulted from each body fluid, one containing all drugs of interest except salicylates; the other containing the salicylates. These extract residues were reconstituted in 0.5 ml methanol, transferred to 1/2 dram glass vials, evaporated to dryness at room temperature, capped tightly and stored frozen to await analysis. Control specimens of urine and plasma spiked with drugs were run with every batch of driver specimens to monitor the extraction performance.

b. Thin-layer chromatographic analysis for drugs: Extract residues from blood, urine, and bile were examined for the presence of drugs using thin-layer chromatography. Both residues were examined; the salicylates residue, and the residue containing all other drugs of interest.

(1) Salicylates residue: The salicylates residues were reconstituted in 0.1 ml of methanol and 15 μl spotted onto thin-layer chromatographic plates (20 by 20 cm, 250 μ Silica Gel G) along with standards of aspirin and salicylic acid. The plates were developed for 15 cm in a saturated tank containing ethyl acetate/methanol/ammonia, 85:10:5. After development, the plates were dried in air at room temperature and sprayed with ferric chloride (5 g ferric chloride in 100 ml distilled water) to visualize the salicylates. The salicylates (aspirin and salicylic acid) appear as purple spots on a tan background with an R_f 0.07. Detection sensitivity is 1 μg on the plate and in the range of 1 to 2 μg 1 ml in body fluids. Confirmation could be achieved by using a second solvent (benzene/methanol/acetic acid, 45:8:4) in which salicylates exhibited a mobility of 0.68.

(2) Other drug residue: These residues were reconstituted in 0.1 ml of methanol and 15 µl was spotted on each of two thin-layer chromatographic plates (20 by 20 cm, 250 µ Silica Gel G). Up to 10 specimens and 8 group drug standards were spotted per plate. Both of the plates were developed in a saturated tank containing ethyl acetate/methanol/ammonia, 85:10:5. The plates were then air-dried at room temperature. One plate was examined for acidic and neutral drugs (sedatives and hypnotics), the other plate examined for basic drugs (opiates, amphetamines, tranquilizers, etc.).

c. Acidic and neutral drugs: The thin-layer chromatographic plate was visualized by spraying with mercuric sulfate, diphenyl carbazone and vanillin successively, noting all color formation between and after sprays. Mercuric sulfate ($HgSO_4$) spray consisted of a solution of 5 g of mercuric oxide in 100 ml water to which 20 ml of concentrated sulfuric acid was added, and the whole solution diluted to 250 ml with distilled water. Diphenyl carbazone (DPC) spray consisted of 100 mg diphenyl carbazone dissolved in 50 ml chloroform and stored in a dark bottle. The vanillin spray consisted of 5 g of vanillin dissolved in 100 ml concentrated sulfuric acid. This latter spray was stored, refrigerated, and made up fresh weekly.

The thin-layer chromatographic characteristics of the acidic and neutral drugs are shown in Table 4. If tentative positives were found in the body fluid extracts using the first solvent, they were rerun using the second developing solvent (chloroform/acetone, 90:10, unsaturated tank).

d. Basic drugs: The thin-layer chromatographic plate was visualized by spraying with ninhydrin (500 mg in 100 ml 1-butanol) and warming the plate under ultraviolet light. This was followed by spraying the cooled plate with iodoplatinate (IOP) spray and noting all color formation between and after sprays. Ninhydrin spray was stored refrigerated. Iodoplatinate spray was prepared by dissolving 1 g of platinum tetrachloride in 100 ml of water and mixing this solution with 300 ml of water containing 10 g of potassium iodide. This solution was refrigerated and diluted 1:1 with 2N hydrochloric acid prior to use. The thin-layer characteristics of the basic drugs are shown in Table 5. If tentative positives were found in the body fluid extracts using the first solvent, they were rerun using the second developing solvent (Benzene/methanol/ethyl acetate/ammonia, 75.5:13.0:10.0:1.5, saturated tank).

TABLE 4

THIN-LAYER CHROMATOGRAPHIC CHARACTERISTICS
OF ACIDIC AND NEUTRAL DRUGS

Group Standard	Drug	Sensitivity Limit of Standard on Plate (μg)	R_f First Solvent	R_f Second Solvent	Colors $HgSO_4$	Colors DPC	Colors Vanillin
1	Glutethimide	2	0.77	0.70	White	Red	-
	Secobarbital	0.5	0.46	0.56	White	Blue	-
	Amobarbital	0.5	0.42	0.50	White	Violet	-
2	Meprobamate	2	0.58	0.05	-	-	Blue/green
	Pentobarbital	0.5	0.46	0.51	White	Violet	-
	Butobarbital	0.5	0.39	0.45	White	Violet	-
3	Diphenylhydantoin	1	0.44	0.28	White	Violet	-
	Butabarbital	0.5	0.42	0.45	White	Violet	-
	Phenobarbital	1	0.23	0.39	White	Violet	-

Note: The sensitivity limit for detection in body fluids is in the range of 0.25 to 0.5 μg/ml for barbiturates and diphenylhydantoin, and 1 μg/ml for glutethimide and meprobamate.

TABLE 5

THIN-LAYER CHARACTERISTICS OF BASIC DRUGS

Group Standard	Drug	Sensitivity Limit of Standard on Plate (µg)	R_f First Solvent	R_f Second Solvent	Colors: Ninhydrin	Colors: IOP
4	Propoxyphene	2	0.79	0.68	Blue	Red/brown
	Diazepam	2	0.74	0.61	-	Purple/brown
	Thioridazine	1	0.70	0.51	Yellow	Blue/black
	Trifluoperazine	1	0.61	0.39	Yellow	Blue/black
	Dimethyltryptamine	1	0.50	0.20	Blue/green	Purple
5	Lobeline	1	0.73	0.54	-	Purple
	Methylphenidate	8	0.66	0.49	Blue	Purple
	Promazine	1	0.63	0.40	Yellow	Blue/black
	Amphetamine	2	0.44	0.22	Red/brown	Red/brown
	Phenylpropanolamine	2	0.33	0.15	Brown	Red
6	Chlorpromazine	1	0.69	0.51	Yellow	Brown/black
	Diphenhydramine	1	0.67	0.48	Blue	Blue/purple
	Phendimetrazine	4	0.61	0.44	-	Purple
	Codeine	1	0.29	0.18	-	Purple
	Morphine	2	0.14	0.11	Gray	Blue
7	Methaqualone	2	0.73	0.66	-	Purple
	Imipramine	1	0.66	0.43	Blue	Purple
	Methapyrilene	1	0.66	0.41	Blue	Blue/purple
	Methamphetamine	4	0.38	0.19	Blue	Blue
	Hydromorphone	1	0.14	0.12	Blue	Purple
8	Amitryptilene	1	0.71	0.48	Blue	Purple
	Meperidine	1	0.63	0.37	-	Purple
	Diethyltryptamine	1	0.63	0.23	Blue/gray	Purple
	Quinine	1	0.44	0.19	White	Blue
9	Cocaine	1	0.73	0.62	Blue	Purple
	Procaine	2	0.68	0.60	Blue	Purple
	Chlordiazepoxide	1	0.48	0.34	Yellow	Purple/red
	2,5-dimethoxy-4 methylamphetamine	2	0.43	0.18	Red/brown	Brown
10	Methadone	1	0.75	0.46	Blue	Purple
	Tripelennamine	1	0.70	0.40	Blue	Blue/purple
	Chlorpheniramine	1	0.56	0.28	-	Purple
	Nalorphine	1	0.29	0.16	Blue	Blue
	Nicotine	1	0.60	0.43	-	Blue

Note: The sensitivity limit for detection of the basic drugs in body fluids is in the range of 0.5 to 1 µg/ml for all drugs except the following: methylphenidate ~ 4 µg/ml; phendimetrazine ~ 2 µg/ml; and methamphetamine ~ 2 µg/ml.

It should be stressed at this point that the thin-layer chromatographic findings on the body fluids were not taken as conclusive evidence of a drug or drugs except in the case of nicotine and the salicylates. In screening for more than 40 drugs, it was not possible to achieve complete separation of all drugs in any one developing solvent. The use of two developing solvents resolved this problem to a significant degree but even so, the thin-layer results were still regarded as tentative except in the case of nicotine and salicylates which were recorded in a large percentage of the body fluids with definitive thin-layer chromatographic characteristics.

Body fluid extracts yielding tentative positives for the drugs of interest (excepting nicotine and salicylates) were subjected to gas chromatographic confirmation and quantitation as described in the next section.

e. Gas chromatographic analysis for drugs: Gas chromatographic analysis was performed on those body fluid extracts indicating positives for drugs on the thin-layer chromatographic screen. The extracts, as used for the thin-layer work, were dosed with a known amount of internal standard and examined on a Tracor Model MT220 gas chromatograph. Two columns were employed in this investigation: (1) a 6 ft x 4 mm glass column with 3% OV-1 on 80-100 Supelcoport; and (2) a 3 ft x 4 mm glass column with 1% CHMDS on 100-120 Gas Chrom Q. The carrier gas was nitrogen at a flow rate of 60 ml/min, detector (flame ionization) temperature was 260°C, injector port temperature was 240°C. The column temperature was varied. One to five microliters of the extract was injected onto the column. Table 6 shows the columns, conditions, and the internal standard, absolute, and relative retention times for the drugs of interest on these columns. Pure standards with internal standards were injected immediately before each run. The resulting gas chromatograms yielded the amount of drugs present (if confirmed) in the extract. The internal standards were used as a check on both the retention time and peak height data.

In order to calculate the amount of drug present in the original body fluids, extraction efficiencies were obtained for each drug found in the body fluids and confirmed by gas chromatography. Specimens of human urine and plasma were spiked with pure drugs at levels of 1, 2, 5 and 10 μg/ml in duplicate. These specimens were hydrolyzed, extracted and reconstituted in exactly the same manner as the driver body fluids. Gas chromatography then revealed the amount extracted and thus the extraction efficiency. Extraction efficiencies determined in the program

TABLE 6

GAS CHROMATOGRAPHIC CONDITIONS, INTERNAL STANDARDS, AND ABSOLUTE AND RELATIVE RETENTION TIMES

Drug	Temperature °C		Internal Standard	Drug Retention Times			
				Absolute (min)		Relative	
	Column 1	Column 2		Column 1	Column 2	Column 1	Column 2
Amphetamine	140	120	Phenylpropanolamine	1.7	0.8	0.71	1.33
Methamphetamine	140	120	Phenylpropanolamine	2.1	0.8	0.88	1.33
Phenylpropanolamine	140	120	Amphetamine	2.4	0.6	1.41	0.75
Pentobarbital*	180	150	Phenobarbital	3.3	2.0	0.42	0.36
Amobarbital*	180	150	Phenobarbital	3.0	2.8	0.38	0.51
Secobarbital*	180	150	Phenobarbital	3.8	3.4	0.48	0.62
Butabarbital*	180	150	Phenobarbital	2.5	2.3	0.32	0.42
Butobarbital*	180	150	Phenobarbital	2.5	2.2	0.32	0.40
Phenobarbital*	180	150	Pentobarbital	7.9	5.5	2.39	2.75
Glutethimide	200	190	Procaine	1.4	5.5	0.52	1.57
Diphenylhydantoin*	200	-	Methadone	7.9	-	2.08	-
Tripelennamine	200	190	Amitriptyline	2.1	2.4	0.47	0.47
Methapyrilene	200	190	Amitriptyline	2.2	2.9	0.49	0.57
Diphenhydramine	200	190	Amitriptyline	1.4	1.3	0.31	0.25
Chlorpheniramine	200	190	Amitriptyline	2.6	2.7	0.58	0.53
Imipramine	200	190	Amitriptyline	5.3	6.4	1.18	1.25
Amitriptyline	200	190	Imipramine	4.5	5.1	0.85	0.80
Methylphenidate	200	190	STP	0.9	0.8	1.50	1.00
Meperidine	200	190	STP	0.9	0.7	1.50	1.40
Phendimetrazine	200	-	STP	0.4	-	0.67	-
Dimethyltryptamine	200	190	Amitriptyline	1.1	3.8	0.24	0.75
Diethyltryptamine	200	190	Amitriptyline	1.9	4.4	0.42	0.86
2,5-Dimethoxy-4-methylamphetamine (STP)	200	190	Meperidine	0.6	0.5	0.67	0.71
Meprobamate	-	190	Procaine	-	2.2	-	0.63
Methaqualone	200	190	Procaine	3.8	11.4	1.41	3.26
Lobeline	200	190	Methadone	1.3	2.2	0.34	1.83
Propoxyphene	200	190	Methadone	4.4	3.1	1.16	2.58
Methadone	200	210	Procaine	3.8	1.2	1.41	0.34
Cocaine	200	210	Methadone	4.9	3.0	1.29	2.50
Procaine	200	210	Methadone	2.7	3.5	0.71	2.92
Chlorpromazine	250	240	Promazine	2.7	2.7	1.59	1.69
Promazine	250	240	Chlorpromazine	1.7	1.6	0.63	0.59
Trifluoperazine	250	240	Chlorpromazine	2.9	3.7	1.07	1.37
Thioridazine	250	-	Chlorpromazine	8.1	-	3.00	-
Chlordiazepoxide	250	240	Chlorpromazine	1.9	7.6	0.70	2.81
Diazepam	250	240	Chlorpromazine	1.6	4.6	0.59	1.70
Codeine	250	240	Nalorphine	1.5	-	0.71	-
Morphine*	250	240	Nalorphine	1.5	-	0.71	-
Nalorphine	250	-	Codeine	2.1	-	1.40	-
Hydromorphone*	250	-	Nalorphine	1.8	-	0.86	-
Quinine	250	-	Chlorpromazine	3.9	-	1.44	-

* Methyl derivatives: produced by on-column methylation using 0.2 M trimethylanilinium hydroxide (Meth-Elute); 1 µg of Meth-Elute per 3 µg of drug.

are listed in Table 7. There is no significant difference in extraction efficiencies run at different spiking levels or between plasma and urine except in the cases noted in Table 7. Bile was not available in sufficient quantities to run extraction efficiency experiments; it was assumed that the extraction efficiencies from bile would be the same as from plasma and urine.

3. Analysis of fatally injured driver urine for LSD: Urine samples from 669 fatally injured drivers were assayed for LSD using radioimmunoassay. Samples were run in batches of 30 to 40 with standards for calibration of each run and control samples to check accuracy and reproducibility. Tritiated LSD was mixed with the samples in a buffered solution, anti-LSD antiserum was added, and the mixture incubated overnight at 0°C. Charcoal was then added to remove unbound LSD, the mixture centrifuged and the supernatant containing bound LSD was removed for scintillation counting. The more LSD present in the original urine, the less tritiated LSD was present in the supernatant which was counted. Quantitation was effected using calibration curves. All samples were tested in duplicate. All positive findings were verified by diluting the urine and reassaying. Such diluted samples were required to stay on the standard curve for verification. The sensitivity limit of this methodology for LSD in urine was 100 pg/ml. Specific details for the RIA methodology are as follows:

Reagents

Phosphate buffer: 0.01 M sodium phosphate plus 0.15 M sodium chloride titrated to pH 7.4 with 4 N sodium hydroxide.

Tritiated LSD: New England Nuclear: diluted to appropriate activity with ethanol and ascorbic acid. Lyophilized before use and reconstituted in phosphate buffer.

Antiserum: Collaborative Research LSD antiserum: diluted to appropriate concentration with phosphate buffer.

Scintillation medium: 6 g "Omnifluor" per liter of toluene/"Triton X-100" (2:1).

Procedure

In a typical run, 0.3 ml phosphate buffer is added to a glass test tube (20 ml). An 0.1 ml antiserum is added, followed by 0.1 ml of the test sample (urine, control or standard). An 0.1 ml of tracer solution is added and the mixture incubated at 0°C for 24 hr. The 0.2 ml of

TABLE 7

EXTRACTION EFFICIENCIES FOR DRUGS FOUND IN DRIVER SPECIMENS

Drug	Extraction Efficiency
Phenobarbital	32 ± 11%
Phenylpropanolamine	6 ± 2%
Chloropheniramine	54 ± 11%
Pentobarbital	40 ± 7%
Methaqualone	64 ± 5%
Amphetamine	50 ± 7%
Quinine	48 ± 7%
Methapyrilene	64 ± 6%
Meprobamate	54 ± 6%
Secobarbital	51 ± 7%
Propoxyphene (Urine)	75 ± 6%
Propoxyphene (Plasma)	31 ± 7%
Amitriptyline (Urine)	54 ± 8%
Amitriptyline (Plasma)	33 ± 11%
Amobarbital	41 ± 8%
Diphenylhydantoin	46 ± 11%
Phendimetrazine	58 ± 10%
Cocaine	49 ± 11%
Methadone	45 ± 9%
Promazine	35 ± 8%
Tripelennamine	54 ± 7%
Butabarbital (Urine)	43 ± 5%
Butabarbital (Plasma)	28 ± 4%
Diphenhydramine	51 ± 15%
Thioridazine	17 ± 5%

a 1% suspension of charcoal in phosphate buffer is added, the mixture shaken on a "Vortex" and left to stand for 20 min in ice. The mixture was then centrifuged at 1,800 rpm for 10 min, and the supernatant immediately transferred to scintillation vials containing 10 ml of a mixture of toluene/"Triton-X100" (2:1) containing "Omnifluor." The vials were then counted in a liquid scintillation counter. The radioactivity of the supernatant is inversely proportional to the amount of LSD present in the unknown, standard or control sample. LSD concentrations in unknowns are calculated from standard curves prepared in each run of 40 samples.

4. Analysis of blood for alcohol: Blood specimens obtained from drivers were assayed for blood alcohol using gas chromatography of the head-space above the blood. The blood was preserved with fluoride to prevent in-situ formation of alcohol after collection.

Blood (2 ml) was placed in a 20 ml serum bottle and acetonitrile (1 ml of a 1:300 acetonitrile/water solution) added. The bottle was sealed with a rubber septum and placed in a water bath at 40°C for 30 min. The vapor above the blood (500 μl) was injected into a 100/120 mesh Porapak Q column, 2 ft x 1/8 in. stainless steel. The column temperature was 110°C and the carrier gas nitrogen flow was 50 cc/min.

These conditions yielded good peak shape and separation for ethyl alcohol and acetonitrile (internal standard). A standard curve was prepared over the concentration range 0.050 to 0.500% blood alcohol by spiking blood at these levels and adding a known amount of acetonitrile. The ratio of ethyl alcohol to acetonitrile peak was plotted aginst percent alcohol and this curve employed to determine the alcohol concentration in driver blood samples.

5. Supplies and reagents

a. Sample preparation

- Enzyme; Sulfatase, Type H1, contains sulfatase and β-glucuronidase, Product No. 59626, Sigma Chemical Co.
- Extraction equipment; "Drug Skreen System," Brinkmann Instruments, Inc.
- Solvents and chemicals; Reagent grade, dried, if appropriate, over molecular sieve.

b. Thin-layer chromatography

- TLC tanks; glass, to hold 20 x 20 cm plates, Product No. 3500-021-6, Brinkmann Instruments, Inc.
- TLC plates; 20 x 20 cm glass with 250 μ thick Silica Gel G, Product No. "SILPLATE 22," Brinkmann Instruments, Inc.
- Micropipettes; 5, 10, 20 μl from Drummond Scientific.
- Hot plates; Corning Model PC35, Matheson Scientific.
- Solvents and spray reagents; Reagent grade.
- Drug Standards; from Applied Science, Inc., and USP.

c. Gas chromatography

- Columns; glass, from Altech Associates, Inc., and Analabs, Inc. Stainless steel columns from Analabs, Inc.
- Column materials; Supelco, Inc.
- GC Syringes; Hamilton 5 and 10 μl, from Supelco, Inc.
- "Meth-Elute" methylating agent, from Pierce Chemical Co., Product No. 49300.
- Solvents, Reagent-grade, dried over molecular sieve.

d. Radioimmunoassay

- LSD Antiserum; Collaborative Research, Inc., Catalog No. Z-10.
- Tritiated LSD; New England Nuclear: Catalog No. NET-447, 0.25 mCi (0.0038 mg) in 0.25 ml ethanol with 0.25% ascorbic acid.

- "Omnifluor;" New England Nuclear: Catalog No. NEF-906.
- Toluene; scintillation grade, Fisher Scientific, Catalog No. T-313.
- "Triton X-100;" Packard Instrument Company, Catalog No. 6008084.
- Other reagents and solvents; reagent grade.

H. Data Used and Statistical Analysis Performed

The data analyzed in this study came from both fatally injured and living drivers. The data provided by the 22 medical examiners on fatally injured drivers fell into two categories: (1) crash data information describing the circumstances of the fatal accidents (see Appendix A), and (2) urine, blood and bile samples which were chemically analyzed for drugs. Finger and lip swabs were also collected (for detection of marijuana) but were not chemically analyzed. The bile findings were analyzed only for the fatally injured drivers because they are not directly comparable to any data obtained from the living drivers.

The data collected from living drivers fell into two main categories: (1) motorists' answers to the survey questionnaire (see Appendix B), and (2) breath, urine and blood samples which were chemically analyzed for drugs. Lip and finger swab samples were also collected for detection of marijuana but were not chemically analyzed.

The four types of data collected (crash data and analytical results on the fatally injured driver specimens; and interview data and analytical results on the living driver specimens) were encoded for computer analysis. A listing of the information encoded for each data type is presented in Appendix C along with the format used to keypunch the data. A series of computer programs were written which accepted these data. The output of these programs were used with selected programs from the Statistical Package for the Social Sciences (SPSS) to perform the various statistical tabulations. Chi-square analyses were performed to determine the level of significance of the findings. Relative frequency tabulations were also made of the data collected. The data from Dallas, Texas, and Memphis, Tennessee, were analyzed independently and in combination.

The statistical analysis of the fluid sample findings considered drug findings confirmed by gas chromatography and quantitated in any body fluid at any level of concentration. The concentration of the drug in the fluid sample was not utilized as a parameter. The findings in fatally injured drivers were examined for each of the seven drug groups, one or more drugs, nicotine and salicylates. Moreover, five possible fluid sample combinations were considered: (1) urine separately, (2) blood separately, (3) bile separately, (4) urine and blood, and (5) urine, blood and bile. The incidence of LSD was examined considering only the urine samples. The incidences of drugs were also examined by submission area including Dallas and Memphis.

The incidences of drugs in the living drivers were examined in a manner similar to that used for the fatally injured drivers. These incidences were also compared by site within each survey community and between the two communities of Dallas and Memphis.

The relative incidence of drugs in the living drivers was compared with the relative incidence of drugs in fatally injured drivers. This was done separately for Dallas and Memphis and for the combination of the two communities, considering only those living driver samples collected at fatal crash sites for which fluid specimens were obtained from the fatally injured driver and analyzed for drugs. The relative risks were also determined by comparing the incidence of drugs in all fatally injured drivers with the incidence of drugs in all living drivers.

The relationship between alcohol usage and various factors and between alcohol usage and drug usage were examined for both the fatally injured and living drivers. In addition, a number of dead and living driver factors were compared with drug usage and examined for statistical importance. Finally, an analysis was conducted to determine the incidence of individual drug groups among living drivers at drug-involved fatal crash sites.

III. RESEARCH FINDINGS AND INTERPRETATION OF THE DATA

A large amount of data was obtained during this project. Those data, the results from the statistical analyses of those data, and the appropriate interpretations of the analyses are brought together in this section.

Subsection A deals with the collection of the fatally injured driver data. It discusses the screening of the fatally injured driver data received. Subsection B describes the analyses of the fatally injured driver crash data. Subsection C deals with the living drivers. It describes their acceptance of the survey and their demographic characteristics.

Subsection D presents the detailed drug findings for the drivers. The fatally injured driver drug findings are presented first followed by a description of the drugs found in the living drivers. The fatally injured and living driver drug findings are compared in Subsection E. It is within this section that the relative risk of being fatally injured in an automobile crash after ingestion of drugs is discussed.

The results concerning alcohol usage, by itself, and in combination with drug usage are presented in Subsection F. A number of fatally injured and living driver factors are compared with drug usage in Subsection G. Finally, the incidence of drugs in living drivers at drug-involved fatal crash sites is discussed in Subsection H.

A. Screening of the Fatally Injured Driver Data

A total of 994 fatally injured driver specimen kits, each including a crash data form, were returned to MRI from medical examiners in the 22 communities listed in Section II. These victims were tentatively selected by those medical examiners as meeting the criteria set by MRI to be included in the study. The crash data and body fluids associated with these 994 fatally injured drivers were subjected to numerous examinations to remove nonqualifying subjects from the study.

The first screening of the fatally injured driver data involved a manual examination of the crash data forms and the specimen kits received. The times recorded between crash and death were not considered in this examination. The first screening eliminated 85 victims, leaving body fluids from 909 fatally injured drivers to be chemically analyzed and retained for further analyses. The reasons for the exclusion of these 85 victims include:

1. The crash occurred outside the jurisdiction of the respective medical examiner.

2. The victim was a passenger instead of the driver.

3. The fatality was a nontraffic fatality.

4. The kit was a duplicate of one already received.

5. The kit was returned but unused.

6. The kit was received after the deadline set as cutoff time for data collection.

7. Combinations of two or more of the above reasons.

The data from the remaining 909 fatally injured drivers were further investigated to determine whether any drugs had been administered to the drivers before they died and, if so, whether the results would confound our analytical results. This second screening was performed in two stages, one manually and one by computer, after the chemical analysis results (and crash data) from the 909 victims had been converted to punched cards.

In the first stage of the second screening, seven of the 43 drugs in the screen of the fatally injured driver fluid specimens (see Table 3) were determined to be likely candidates as drugs which might be administered at the crash scene, in an ambulance, or at the hospital to relieve pain, stabilize body functions, or otherwise maintain the life of the victim. The seven drugs were determined from personal communications with a number of medical examiners and from a knowledge of the functions of each drug. The seven drugs are as follows:

1. Hydromorphine
2. Morphine
3. Procaine
4. Diphenylhydantoin
5. Amitriptylene
6. Diazepam
7. Methylphenidate

Next, all 909 crash data forms were scanned to determine which of the seven medications, if any, were reported by the medical examiners as having been administered to the victims after their crashes. A list of all the drugs reported by the medical examiners is included in Table 8 along with the number of times each drug was reported. Three of the medications listed in Table 8, and marked with an asterisk, were also included in the drug screen.

1. Methylphenidate
2. Diazepam
3. Amitriptylene

In the second stage of the second screening, all analytical results from the 909 fatally injured drivers were screened by computer for incidences of the above seven drugs in any fluid sample. Twelve cases were found with one or more of these drugs in a body fluid. One of the findings was collaborated by the medical examiner's comments on that victim's crash data form. A further search was undertaken for each of the remaining 11 victims to determine whether the drugs detected had been administered after the crash. The appropriate medical examiner was contacted for each case and asked to reinvestigate all available records including ambulance reports. Only one of the 11 fatally injured drivers was found to have had drugs administered after the crash. The remaining 10 cases showed no evidence of the detected drugs being administered after the crash. The medical examiners reported that 5 of the remaining 10 victims showed evidence that they were drug users.

The two victims identified as having drugs administered after their crash were deleted from the analysis, reducing the number of fatally injured drivers to 907. One of the two drivers eliminated died about 5 hr after the crash; the other driver was DOA at the hospital. This shows that an arbitrary time interval between time of crash and death (say 4 or 4 1/2 hr) cannot be used to totally rule out victims who had drugs administered to them after the crash. The analytical results must be compared with medical examiner records to determine invalid specimens.

TABLE 8

DRUGS REPORTED ON CRASH DATA FORMS AS BEING ADMINISTERED TO VICTIMS AFTER THE CRASH

Drugs Reported	Number of Times Reported
Sodium bicarbonate	25
Lactate	12
Atropine	10
Calcium chloride	7
Isometheptene	4
Adrenaline	4
Saline	3
Isoprenaline	3
Lidocaine	3
Methylphenidate*	2
Diazepam*	2
Amitriptyline*	2
Perphenazine	2
Phenazone	2
Chloral hydrate	2
Acetominophen	2
Cortizone	2
Dextran	2
Normosal	2
Dexamethasone	2
Mannitol	2
Procaine amide	1
Noradrenaline	1
Metariminol	1
Cephalothin	1
Diazoxide	1

* Medications included in the drug screen.

The only question to be answered at this point was which of the 907 remaining samples should be discarded from a time-after-crash to time-of-death consideration. Early in the data collection stage of the study, a determination was made not to consider fatal cases where the victim lived beyond 4 hr after the crash. This information was conveyed to the medical examiners, but it was suspected that they could not follow the guidelines too closely.

A final screening of the crash data associated with the remaining 907 fatally injured drivers was also conducted by computer. This screening was performed to identify those drivers that lived longer than 4 hr after the crash. A total of 16 drivers were identified in this final edit. The interval between the time of crash and time of death for these 16 cases ranged from 4 hr 3 min to 23 hr 10 min.

The 16 cases cited above exemplify the degree of inconsistency that emerged between areas and even within individual areas regarding the samples that were submitted. One of the problems faced by the medical examiners was the difficulty in determining the exact time of crash and/or death of victims. Missing or conflicting information frequently gave the medical examiner only a vague idea of the time between crash and death.

Table 9 shows the distribution of the intervals between crash and death for the 907 fatally injured drivers. Table 9 also depicts the frequency of positive drug findings (in any fluid at any level of concentration) within each time interval. There is no evidence that drug incidence increased as time between crash and death increased (the absolute numbers in the 5+ hr time interval are too small to place any significance upon the drug incidence in this time interval). No drivers who died between 4 and 4.5 hr or between 4.51 and 4.99 hr after their crash had any detectable drugs in their body fluids.

The inability of the medical examiners to accurately determine the time of crash and the time of death lead to a premise that a variation of $\pm$ 15 min for fixation of time of crash and for time of death should be accepted. For that reason, it was decided to alter the time limit between crash and death from 4 hr to 4-1/2 hr. This extension permitted retention of all but seven of the 907 (a total of 900) fatally injured drivers in the analyses. (It also allowed the inclusion of three "otherwise valid" living driver surveys which had been performed at sites where the driver had lived between 4 and 4-1/2 hr.)

TABLE 9

DISTRIBUTION OF 907 FATALLY INJURED DRIVERS BY TIME INTERVAL BETWEEN CRASH AND DEATH

Time Between Crash to Death (Hr)	Number of Fatally Injured Drivers	Number of Drivers With Positive Drug Findings	Drug Incidence (%)
Dead on arrival (DOA)	459	60	13.1
0 to 0.99	259	26	10.0
1 to 1.99	111	12	10.8
2 to 2.99	36	6	16.7
3 to 3.99	16	1	6.3
4 to 4.5	9	0	0.0
4.51 to 4.99	2	0	0.0
5+ Hr	5	1	20.0
Unknown	10	1	10.0
Total	907	107	11.8

Chapter II discussed the fact that not all of the 900 analyzed crash victims had all fluids returned in the kits. Of the 900 fatally injured drivers determined to be valid crash victims, 637 (70.8%) supplied urine, 825 (91.7%) supplied blood, 492 (54.7%) supplied bile, 587 (65.2%) supplied both blood and urine, 326 (36.2%) supplied all three fluid samples, and 832 (92.4%) supplied a complete set of swabs.

B. Fatally Injured Driver Crash Data

Relative frequency tabulations were made of the crash data collected for the 900 fatally injured drivers. The tabulations are presented in Appendix F, Tables F-1 through F-15, for the following items:

1. Number of fatally injured drivers by collection area;
2. Number of fatal crashes by year;
3. Number of fatal crashes by month of year;
4. Time of day of the fatal crash;
5. Day of week of the fatal crash;
6. Area type of the fatal crash location;
7. Number of vehicles involved in the fatal crashes;
8. Number of people in the fatally injured drivers vehicles;
9. Type of accident;
10. Fatally injured drivers vehicle type;
11. Sex of the fatally injured drivers;
12. Age group of the fatally injured drivers;
13. Culpability of the fatally injured drivers;
14. Total number of fatalities in all vehicles involved in the fatal crashes; and

15. Total number of nonfatal injuries in all vehicles involved in the fatal crashes.

No tests for statistical significance were applied to the crash data, however, some observations of the data were made.

The medical examiner from Dallas County, Texas, submitted the largest number of fatally injured driver specimens that were analyzed--a total of 123 drivers (81 from the City of Dallas and 42 from Dallas County, excluding the City of Dallas). The area submitting the next largest number of fatally injured driver specimens that were analyzed (86) was Wayne County, Michigan (including parts of Detroit). A total of 45 fatally injured driver specimens (analyzed) were submitted from the City of Memphis, Tennessee, while two were submitted from Shelby County, Tennessee (excluding Memphis).

A large percentage (81.3%) of the fatal crashes analyzed occurred during 1975. About 52% of the fatal crashes occurred between 8 PM and 4 AM, and 38% occurred on Saturday or Sunday. Slightly over half of the crashes (51.4%) were single vehicle accidents and 71.5% of the fatally injured drivers were alone in the crash. About 66% of the single vehicle crashes involved fixed objects, and 87% of the multiple vehicle crashes were either head-on or angle type accidents. About 75% of the fatally injured drivers were driving passenger cars and 12.7% were driving motorcycles. Females accounted for 16.3% of the fatally injured drivers, and 54.8% of all the dead drivers were 29 years old or less with 22% between the ages of 20 and 24. About 72% of the fatally injured drivers were judged to be culpable. The driver was determined as being culpable if: (1) the crash was a single vehicle accident, or (2) the victims condition or behavior most likely contributed to the crash, as determined from police and medical examiners comments.

C. Description of Survey Respondents

1. Driver acceptance: Two communities, Dallas, Texas, and Memphis, Tennessee, cooperated with MRI in the conduct of roadside surveys to determine drug use among similarly exposed (living) drivers. Eleven surveys were conducted in Dallas between May 30, 1975, and September 13, 1976; eight surveys were conducted in Memphis between November 11, 1975, and September 2, 1976. The surveys were conducted at sites within each community at which a driver was fatally injured (died within 4-1/2 hr of the crash) and for whom fluid specimens were

submitted by the Dallas or Shelby County medical examiners. Surveys were also conducted at some fatally injured driver crash sites at which it was later determined that the medical examiner had failed to collect the required specimens. A total of 105 sampling sites were used in the study; 73 sites in Dallas and 32 in Memphis. The survey procedure consisted of stopping randomly selected male motorists at the time of day and day of week of the fatal crash, conducting the interview, and requesting breath, urine and blood samples. Lip and finger swab samples were also collected for detection of marijuana, but they were not chemically analyzed. An average of about one dozen interviews were performed at each crash site.

A total of 1,255 motorists were stopped during the 11 survey periods in Dallas and eight survey periods in Memphis. Data from 1,196 drivers at acceptable sites were retained for subsequent analyses--759 drivers in Dallas and 437 drivers in Memphis. The number of people in Dallas and Memphis who agreed to the interview and to other requests are given in Tables 10 and 11, respectively. Acceptance of the interview was very similar between the two communities. However, the motorists in Memphis tended to be slightly more cooperative than those in Dallas. Of the 1,196 motorists stopped, 90.5% in Dallas and 93.4% in Memphis cooperated with the interview, giving an overall cooperation rate of 91.6% (see Table 12). Breath samples (for BAC determintion) were obtained from 87.0% in Dallas, 91.5% in Memphis and 88.6% overall, meaning nearly all of those interviewed provided a breath sample. Likewise, nearly all consented to give a urine sample: 87.0% in Dallas; 92.0% in Memphis and 88.8% overall. All motorists were not asked for a blood sample, for reasons of age or health. Of those from whom a blood sample was requested, 75.7% consented. The motorists in the two communities had about the same cooperation rate for the blood sample request: 76.1% of the people asked in Dallas and 75.1% asked in Memphis agreed to provide a blood sample.

Overall, about 89% of the motorists stopped agreed to provide either the urine or blood sample. This remarkably high degree of cooperation resulted from many factors, one of which was the offer of $10 for the blood sample or a combination of the urine and blood samples.

Table 13 gives additional information on the obtainment of fluid samples. Although 1,062 motorists consented to give a urine sample, only 511 (67.3) of the drivers in Dallas and 293 (67.0%) in Memphis--804 and 67.2% overall--were able to produce a sufficient urine quantity ($\geq$ 20 ml) on demand. Those who were unable to provide the amount needed at the time of the interview were given a preposted mailer and instructed in its use. Many people did cooperate with the mail-back procedure so

TABLE 10

SUMMARY OF DALLAS DRUG SURVEYS

Survey Number	Number Motorists Stopped	Number Motorists Interviewed	Number BAC's Obtained	Number Consented to Give Urine	Number Motorists Asked For Blood	Number Consented to Give Blood
1	133	95	93	94	125	82
2	103	84	81	82	100	74
3	70	70	65	66	65	50
4	60	59	57	56	58	52
5	73	72	68	69	71	56
6	67	65	60	57	66	50
7	53	50	48	47	52	38
8	22	22	22	22	22	20
9	56	55	52	52	52	37
10	34	30	29	29	32	22
11	88	85	85	86	84	72
Total	759	687	660	660	727	553

TABLE 11

SUMMARY OF MEMPHIS DRUG SURVEYS

Survey Number	Number Motorists Stopped	Number Motorists Interviewed	Number BAC's Obtained	Number Consented to Give Urine	Number Motorists Asked For Blood	Number Consented to Give Blood
1	67	62	61	61	65	57
2	28	26	25	25	28	20
3	79	71	70	70	79	48
4	33	32	32	32	33	30
5	39	37	37	37	36	32
6	90	88	85	85	86	64
7	42	37	38	37	40	29
8	59	55	52	55	59	40
Total	437	408	400	402	426	320

TABLE 12

SUMMARY OF ALL DRUG SURVEYS

Survey Area	Number of Surveys	Number Motorists Stopped	Number Motorists Interviewed	Number BAC's Obtained	Number Consented To Give Urine	Number Motorists Asked For Blood	Number Consented To Give Blood
Dallas	11	759	687 (90.5%)	660 (87.0%)	660 (87.0%)	727 (95.8%)	553 (76.1%)
Memphis	8	437	408 (93.4%)	400 (91.5%)	402 (92.0%)	426 (97.5%)	320 (75.1%)
Total	19	1,196	1,095 (91.6%)	1,060 (88.6%)	1,062 (88.8%)	1,153 (96.4%)	873 (75.7%)

TABLE 13

SUMMARY OF LIVING DRIVER SAMPLES ANALYZED FOR DRUGS

Survey Area	Number Motorists Stopped	Number Motorists Accepted Interviews	Number Urine Samples Analyzed for Drugs			Number Blood Samples Analyzed For Drugs
			Collected On Site	Returned Through Mail	Total	
Dallas	759	687 (90.5%)	511 (67.3%)	57 (7.5%)	568 (74.8%)	509 (70.0%)
Memphis	437	408 (93.4%)	293 (67.0%)	36 (8.2%)	329 (75.3%)	308 (72.3%)
Total	1,196	1,095 (91.6%)	804 (67.2%)	93 (7.8%)	897 (75.0%)	817 (70.9%)

that, as a result, urine samples were obtained from 75% (897/1,196) of the motorists stopped. Of the number of mailers given out, 26.9% (93/346) were returned with suffucient quantity for use in the analysis.

Although 873 motorists consented to give a blood sample (see Table 12), samples were obtained and analyzed for only 817 (70.9% of motorists asked for a sample--see Table 13). Several factors contributed to this, but the major reason for this difference was that the nurse was unable to locate a suitable vein.

The overall cooperation rate of the motorists in providing either a urine or blood sample is higher than the cooperation rates for each fluid sample, taken one at a time. For example, 81.4% of all motorists stopped, were able to produce either a urine or blood sample in sufficient quantity for chemical analysis. However, it was estimated that 83% of the motorists stopped provided either a urine or blood sample irrespective of the amount.

2. Demographic characteristics: The drivers encountered in the two communities had very similar demographic characteristics, and only small differences between the motorists from the two areas were noted. Their answers to the demographic questions are included in Appendix G. Of particular interest are questions 29, 33, 36 through 38 and 42. Responses to those questions are repeated here in Table 14.

The Memphis motorists were either white or black, whereas the Dallas sample included many Mexican Americans as well. More blacks were interviewed, on a percent basis, in Memphis than in Dallas. The Memphis drivers interviewed tended to live mainly in Memphis; the Dallas drivers tended to be from Dallas as well as towns within the county. The Dallas drivers tended to be younger than the Memphis drivers in that a larger fraction of drivers 19 years and younger were stopped in Dallas. The age group, 30 to 39, contained the largest percentage of motorists stopped in each community.

The income distributions for each community are quite similar. There was a larger fraction of motorists in Dallas in the lower income bracket ($\leq$ \$2,499) and in the upper income bracket (\$30,000 +) than in Memphis. However, a larger fraction of Memphis drivers were found in the middle income range (\$10,000 to \$20,000) than in Dallas. The Dallas drivers tended to have somewhat less education, with about 34% having less than a high school education compared to 31% in Memphis.

A large fraction of motorists in each community were coming from their own home, with the percentage being greatest in Memphis. However, a large fraction of Dallas drivers were coming from work, school or a sport/recreation facility.

No tests for significance were performed on any of the motorists responses displayed in Table 14 nor in Appendix G. It is unlikely that many of the differences between the two communities could be shown to be significantly different at the $\alpha < 0.05$ level.

Information about the vehicle being driven was recorded for all motorists stopped, regardless of whether or not they cooperated. Those findings are displayed in Table 15. There was very little difference between the populations found in the vehicles in the two communities. In comparing the number of people in the living driver's vehicles with the distribution found in the fatally injured driver's vehicles (Table F-8) it was found that the living driver's vehicles tended to be more highly populated. For instance, 71.5% of the fatally injured drivers were alone at the time of the crash, but between 58.0% and 59.7% of the living drivers were alone in the car at the time of the interview.

Finally, the Dallas living drivers tended to drive relatively new family and sporty cars and pickups; while Memphis living drivers drove relatively new family cars and pickups.

3. Motorists responses concerning the use of drugs and medications: Each driver inerviewed was asked a series of questions concerning his use of drugs and medications. First, he was asked if he was currently taking any medicine, pills, or drugs and if so, how often, how recently, whether it is a prescription or not and the name of the drug. Answers to these questions were recorded in questions 43 through 72 on the survey instrument in Appendix D.

During the editing of the survey quesionnaires, each drug mentioned by the motorists was classified into one of 25 groups. The names of the drugs mentioned are shown in Appendix H by drug groups. The large range of prescription and nonprescription drug types, coupled with the relatively common response that the driver did not know exactly what drug he was taking, made impractical an analysis of significance for the different drug groups. However, it was noted that aspirin was the most commonly mentioned drug (71 drivers), followed by multiple vitamins (49), and high blood pressure medication (32). Eleven drivers mentioned they were taking valium.

TABLE 14

DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

	Percentage of Motorists	
	Dallas	Memphis
Race		
White	61.1%	57.0%
Black	31.3	42.3
Latin	7.2	0.2
Other	0.4	0.5
City or Town of Residence		
Dallas, Texas	71.9	0.0
Memphis, Tennessee	0.0	82.4
Nearby towns in county	18.8	5.3
Rural areas in county	1.1	0.2
Adjacent counties	3.7	1.5
Outstate	2.5	2.4
Other state	1.4	8.2
Part time resident	0.3	0.0
Age		
16-17	4.8	2.7
18-19	6.0	4.4
20-24	16.6	20.4
25-29	18.2	15.5
30-39	22.8	23.5
40-49	14.9	16.8
50-59	10.6	10.2
60-69	5.2	4.9
70+	0.8	1.7
Income		
Less than $1,000	2.8	1.6
1,000 - 2,499	3.6	3.0
2,500 - 4,999	7.0	6.4
5,000 - 7,499	13.0	14.0
7,500 - 9,999	13.6	10.5
10,000 - 14,999	21.7	27.9
15,000 - 19,999	12.8	15.3
20,000 - 29,999	10.1	9.8
30,000+	5.4	3.0
Unknown	10.0	8.5

TABLE 14 (Concluded)

	Percentage of Motorists	
	Dallas	Memphis
Education		
6th Grade or less	6.8	6.6
7-9th Grade	9.9	10.5
High school - incomplete	16.8	13.9
High school graduate	23.4	27.7
Special training	6.0	6.1
College - incomplete	24.0	22.4
College graduate	8.2	7.5
Year or more graduate	4.9	5.4
Where Coming From		
Own Home	25.9	30.7
Friend or relative home	18.4	19.2
Work or school	22.9	20.2
Appointment	12.5	11.7
Sport or recreation facility	5.6	2.9
Restaurant	5.2	4.4
Bar, tavern, private club	4.0	4.4
Just driving around	2.7	2.0
Other	2.7	4.6

TABLE 15

OTHER OBSERVED CHARACTERISTICS OF RESPONDENTS

	Percentage of Motorists	
	Dallas	Memphis
Number People in Car		
1	58.0%	59.7%
2	26.6	23.6
3	8.6	10.2
4	3.9	3.0
5+	2.9	3.5
Car Model		
Family car (sedan, station wagon, etc.)	55.5	72.8
Sporty	12.1	5.3
Car-pickup	2.7	1.8
Compact	6.9	4.6
Foreign compact	4.5	3.0
Minibus	1.5	0.2
Truck-pickup	14.2	10.4
Motorcycle	0.9	0.2
Other	1.7	1.6
Vehicle Age-Condition		
0-3 - excellent	37.3	36.9
0-3 - fair	11.0	7.6
0-3 - poor	0.8	0.0
4-9 - excellant	9.4	13.1
4-9 - fair	26.3	29.4
4-9 - poor	3.2	2.8
>10 - excellant	1.2	1.4
>10 - fair	7.0	4.6
>10 - poor	3.9	4.4

D. Driver Drug Findings

The urine, blood and bile samples collected from the fatally injured drivers by the medical examiners in the 22 areas (including Dallas and Memphis) and the urine and blood samples obtained from the living drivers stopped in the Dallas and Memphis surveys were analyzed to detect drug incidence. Quantitative tests were performed on these fluid specimens for 43 drugs (see Table 3) which were classified into seven drug groups: (1) sedatives and hypnotics, (2) tranquilizers, (3) stimulants and antidepressants, (4) antihistamines and decongestants, (5) narcotic analgesics, (6) hallucinogens, and (7) miscellaneous. Quantitative tests for the hallucinogen, LSD, were performed using only the urine samples collected from the fatally injured drivers. In addition, quantitative determinations of the blood alcohol content were performed on the blood samples collected from the fatally injured drivers and on both breath and blood samples obtained from the living drivers. Qualitative tests were also performed for nicotine (evidence of tobacco smoking) and salicylates (evidence of aspirin) using the living driver and fatally injured driver fluid specimens collected.

The total chemical analysis scheme involved: the preparation of specimens, including hydrolysis of glucuronides and sulfate ethers, and extraction of the hydrolyzed specimens using a nonionic resin; the qualitative examination of the extracts by thin-layer chromatography; and finally the quantitative confirmation of thin-layer findings by gas chromatography. Blood alcochol was determined using a gas chromatographic technique on blood head-space. LSD was assayed using radioimmunoassay techniques.

The statistical analysis of the fluid sample findings considered drug findings confirmed by gas chromatography and quantitated in any body fluid at any level of concentration. The concentration of the drug in the fluid sample was not utilized as a response.

A discussion is presented in Appendix I of the positive drug findings in blood samples from both fatally injured and living drivers. Four levels of concentration are considered there: trace amounts, therapeutic, toxic and lethal concentration. These data are presented for informaion only and were not used in any of the subsequent analysis.

1. Fatally injured driver drug findings: The incidences of drugs other than alcohol in fatally injured drivers are presented in Tables 16 through 20 for five fluid sample combinations: (1) urine separately, (2) blood separately, (3) bile separately, (4) blood and urine, and (5) blood, urine and bile, respectively. The findings are described for each of the seven drug groups (sedatives/hypnotics, tranquilizers, stimulants/antidepressants, antihistamines/decongestants, narcotic analgesics, hallucinogens, and miscellaneous) one or more drugs, nicotine and salicylates. The drug incidences for each fluid combination are also presented separately for the City of Dallas, the City of Memphis, and the total of all the areas submitting fatally injured driver specimens. The 95% confidence interval for each incidence is also displayed in the drug incidence tables.

Table 21 presents the incidences of quantitated drugs (by individual drugs and drug groups) in all of the 587 fatally injured drivers for whom both blood and urine samples were available. The findings are listed for urine and blood individually and for the combination of the two fluids.

For cases in which both urine and blood findings were available (see Table 20), it was determined that the incidence of one or more drugs was about 12% (with a 95% confidence interval of $\pm$ 8.4%) for Dallas fatally injured drivers, about 24% ($\pm$ 14.6%) for Memphis fatally injured drivers, and 14.3% ($\pm$ 2.8%) overall. Table 21 shows that the most commonly detected drug was the antihistamine and decongestant phenylpropanolamine, with the sedative phenobarbital second. Another antihistamine and decongestant, chlorpheniramine, the narcotic codine and the stimulant, amphetamine, were also frequently encountered.

The above drug findings are comparable to the results reported in an earlier study concerned with drug use among drivers.* In that study, 17.69% of the fatally injured drivers, for whom both blood and urine smaples were available, evidence one or more drugs. Also, almost two-thirds of the drugs found in the earlier study were of the sedative/hyponotic type with phenobarbital the single drug most commonly detected. The second most frequently detected drug was phenylpropanolamine. In addition to these two drugs, the stimulants, amphetamine and metamphetamine, were also commonly encountered.

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* Glauz, W. D., and R. R. Blackburn, "Drug Use Among Drivers," Contract No. DOT-HS-119-2-440, (MRI Project 3668-E), Midwest Research Institute Final Report, February 1975. (DOT-HS-801411).

TABLE 16

INCIDENCE OF DRUGS IN FATALLY INJURED DRIVERS
FOR WHOM URINE SAMPLES WERE AVAILABLE

Type of Drug	Dallas (63 Drivers)			Memphis (33 Drivers)			All Fatally Injured Drivers (637 Drivers)		
	No.	Percent	95% Confidence Interval	No.	Percent	95% Confidence Interval	No.	Percent	95% Confidence Interval
Sedatives and Hypnotics	3	4.76	±5.25	2	6.06	±8.13	31	4.87	±1.67
Tranquilizers	1	1.59	±3.10	0	0.00	a/	4	0.63	±0.61
Stimulants and Antidepressants	1	1.59	±3.10	0	0.00	a/	9	1.41	±0.92
Antihistamines and Decongestants	1	1.59	±3.10	5	15.15	±12.23	34	5.34	±1.75
Narcotic Analgesics	2	3.17	±4.33	1	3.03	±5.84	16	2.51	±1.22
Hallucinogens	0	0.00	a/	0	0.00	a/	0	0.00	a/
Miscellaneous	0	0.00	a/	0	0.00	a/	6	0.94	±0.75
Total Drivers With Any One or More Drugs	7	11.11	±7.76	7	21.21	±13.96	86	13.50	±2.65
Nicotine	40	63.49	±11.90	22	66.67	±16.09	413	64.84	±3.71
Salicylates	11	17.46	±9.37	7	21.21	±13.96	105	16.48	±2.88

a/ Indeterminable from the data collected.

TABLE 17

INCIDENCE OF DRUGS IN FATALLY INJURED DRIVERS
FOR WHOM BLOOD SAMPLES WERE AVAILABLE

Type of Drug	Dallas (76 Drivers) No.	Dallas (76 Drivers) Percent	Dallas (76 Drivers) 95% Confidence Interval	Memphis (45 Drivers) No.	Memphis (45 Drivers) Percent	Memphis (45 Drivers) 95% Confidence Interval	All Fatally Injured Drivers (825 Drivers) No.	All Fatally Injured Drivers (825 Drivers) Percent	All Fatally Injured Drivers (825 Drivers) 95% Confidence Interval
Sedatives and Hypnotics	2	2.63	±3.61	2	4.44	±6.12	37	4.48	±1.41
Tranquilizers	1	1.32	±2.57	1	2.22	±4.31	4	0.48	±0.47
Stimulants and Antidepressants	1	1.32	±2.57	0	0.00	a/	2	0.24	±0.34
Antihistamines and Decongestants	0	0.00	a/	2	4.44	±6.12	2	0.24	±0.34
Narcotic Analgesics	0	0.00	a/	0	0.00	a/	4	0.48	±0.47
Hallucinogens	0	0.00	a/	0	0.00	a/	0	0.00	a/
Miscellaneous	0	0.00	a/	0	0.00	a/	1	0.12	±0.24
Total Drivers With One or More Drugs	4	5.26	±5.02	5	11.11	±9.17	50	6.06	±1.63
Nicotine	12	15.79	±8.19	8	17.78	±11.17	113	13.70	±2.35
Salicylates	10	13.16	±7.60	6	13.33	±9.94	78	9.45	±2.00

a/ Indeterminable from the data collected.

TABLE 18

INCIDENCES OF DRUGS IN FATALLY INJURED DRIVERS FOR WHOM BILE SAMPLES WERE AVAILABLE

Type of Drug	Dallas (62 Drivers) No.	Dallas (62 Drivers) Percent	Dallas (62 Drivers) 95% Confidence Interval	Memphis (5 Drivers) No.	Memphis (5 Drivers) Percent	Memphis (5 Drivers) 95% Confidence Interval	All Fatally Injured Drivers (492 Drivers) No.	All Fatally Injured Drivers (492 Drivers) Percent	All Fatally Injured Drivers (492 Drivers) 95% Confidence Interval
Sedatives and Hypnotics	2	3.23	±4.41	0	0.00	a/	16	3.25	±1.57
Tranquilizers	0	0.00	a/	0	0.00	a/	1	0.20	±0.40
Stimulants and Antidepressants	1	1.61	±3.14	0	0.00	a/	1	0.20	±0.40
Antihistamines and Decongestants	0	0.00	a/	0	0.00	a/	5	1.02	±0.89
Narcotic Analgesics	1	1.61	±3.14	0	0.00	a/	7	1.42	±1.05
Hallucinogens	0	0.00	a/	0	0.00	a/	0	0.00	a/
Miscellaneous	0	0.00	a/	0	0.00	a/	1	0.20	±0.40
Total Drivers With One or More Drugs	4	6.45	±6.12	0	0.00	a/	28	5.69	±2.05
Nicotine	10	16.13	±9.15	0	0.00	a/	76	15.45	±3.19
Salicylates	8	12.90	±8.35	1	20.00	±35.06	32	6.50	±2.18

a/ Indeterminable from the data collected.

TABLE 19

INCIDENCES OF DRUGS IN FATALLY INJURED DRIVERS
FOR WHOM BOTH BLOOD AND URINE SAMPLES WERE AVAILABLE

Type of Drug	Dallas (58 Drivers) No.	Dallas (58 Drivers) Percent	Dallas (58 Drivers) 95% Confidence Interval	Memphis (33 Drivers) No.	Memphis (33 Drivers) Percent	Memphis (33 Drivers) 95% Confidence Interval	All Fatally Injured Drivers (587 Drivers) No.	All Fatally Injured Drivers (587 Drivers) Percent	All Fatally Injured Drivers (587 Drivers) 95% Confidence Interval
Sedatives and Hypnotics	3	5.17	±5.71	2	6.06	±8.13	30	5.11	±1.78
Tranquilizers	1	1.72	±3.35	1	3.03	±5.84	4	0.68	±0.67
Stimulants and Antidepressants	1	1.72	±3.35	0	0.0	a/	7	1.19	±0.88
Antihistamines and Decongestants	1	1.72	±3.35	5	15.15	±12.23	31	5.28	±1.81
Narcotic Analgesics	2	3.45	±4.70	1	3.03	±5.84	15	2.56	±1.28
Hallucinogens	0	0.0	a/	0	0.0	a/	0	0.0	a/
Miscellaneous	0	0.0	a/	0	0.0	a/	6	1.02	±0.81
Total Drivers With One or More Drugs	7	12.06	±8.39	8	24.24	±14.62	84	14.31	±2.83
Nicotine	37	63.79	±12.37	22	66.67	±16.09	380	64.74	±3.87
Salicylates	11	18.97	±10.09	7	21.21	±13.96	102	17.38	±3.07

a/ Indeterminable from the data collected.

TABLE 20

INCIDENCES OF DRUGS IN FATALLY INJURED DRIVERS
FOR WHOM BLOOD, URINE AND BILE SAMPLES WERE AVAILABLE

Type of Drug	Dallas (44 Drivers) No.	Percent	95% Confidence Interval	Memphis (5 Drivers) No.	Percent	95% Confidence Interval	All Fatally Injured Drivers (326 Drivers) No.	Percent	95% Confidence Interval
Sedatives and Hypnotics	3	6.82	±7.45	0	0.00	a/	18	5.52	±2.48
Tranquilizers	1	2.27	±4.41	1	20.00	±35.06	4	1.23	±1.20
Stimulants and Antidepressants	1	2.27	±4.41	0	0.00	a/	7	2.15	±5.17
Antihistamines and Decongestants	1	2.27	±4.41	0	0.00	a/	21	6.44	±2.67
Narcotic Analgesics	1	2.27	±4.41	0	0.00	a/	9	2.76	±1.78
Hallucinogens	0	0.00	a/	0	0.00	a/	0	0.00	a/
Miscellaneous	0	0.00	a/	0	0.00	a/	5	1.53	±1.34
Total Drivers With One or More Drugs	6	13.64	±10.13	1	20.00	±35.06	57	17.48	±4.12
Nicotine	29	65.91	±14.01	4	80.00	±35.06	219	67.18	±5.10
Salicylates	9	20.45	±11.92	1	20.00	±35.06	63	19.33	±4.29

a/ Indeterminable from the data collected.

TABLE 21

QUANTITATED DRUGS IN 587 FATALLY INJURED DRIVERS FOR WHOM BOTH BLOOD AND URINE SAMPLES WERE AVAILABLE

Drug	Urine		Blood		Total Drivers	
	Number	Percent	Number	Percent	Number	Percent
Amobarbital	3	0.51	3	0.51	3	0.51
Diphenylhydantoin	0	0.00	1	0.17	1	0.17
Methaqualone	1	0.17	3	0.51	3	0.51
Pentobarbital	4	0.68	3	0.51	4	0.68
Phenobarbital	18	3.07	14	2.39	18	3.07
Secobarbital	1	0.17	1	0.17	1	0.17
Sedatives and Hypnotics	27	4.60	25	4.26	30	5.11
Chlorpromazine	1	0.17	2	0.34	2	0.34
Meprobamate	1	0.17	2	0.34	2	0.34
Tranquilizers	2	0.34	4	0.68	4	0.68
Amitriptyline	1	0.17	1	0.17	1	0.17
Amphetamine	6	1.02	1	0.17	6	1.02
Stimulants and Antidepressants	7	1.19	2	0.34	7	1.19
Chlorpheniramine	11	1.87	1	0.17	11	1.87
Diphenhydramine	2	0.34	1	0.17	2	0.34
Methapyriline	3	0.51	0	0.00	3	0.51
Phenylpropanolamine	23	3.92	0	0.00	23	3.92
Antihistamines and Decongestants	31	5.28	2	0.34	31	5.28
Cocaine	1	0.17	0	0.00	1	0.17
Codeine	7	1.19	1	0.17	7	1.19
Methadone	1	0.17	0	0.00	1	0.17
Morphine	5	0.85	3	0.51	5	0.85
Propoxyphene	2	0.34	0	0.00	2	0.34
Narcotic Analgesics	15	2.56	4	0.68	15	2.56
Hallucinogens	0	0.00	0	0.00	0	0.00
Phendimetrazine	2	0.34	0	0.00	2	0.34
Procaine	1	0.17	0	0.00	1	0.17
Quinine	3	0.51	1	0.17	3	0.51
Miscellaneous	6	1.02	1	0.17	6	1.02
Total Drivers	80	13.63	38	6.47	84	14.31

Nicotine was found in 64.7% (± 3.9%) of the fatally injured drivers and salicylates were found in 17.4% (± 3.1%) of the dead drivers.

The incidence of LSD in fatally injured drivers was examined considering only the urine samples. LSD was found in 1.2% (8/669) of the fatally injured drivers. All of the dead drivers evidencing LSD were males, 25 years old or less. Five of the eight (62.5%) were judged to be culpable, which is not significantly different from the total fatally injured driver population. The eight drivers evidencing LSD were from the following areas:

Wayne County, Michigan (2 drivers)
Fulton and Cobb County, Georgia
City of Dallas, Texas
Clark County, Nevada
Dupage County, Illinois
Multnomah, Clackamas, or Washington County, Oregon
Dade County, Florida

No other analysis of the LSD findings was performed.

2. Living driver drug incidences: The incidences of drugs other than alcohol in living drivers were examined in a manner similar to that used for the fatally injured drivers. The findings are presented in Tables 22 through 24 for three fluid sample combinations: (1) urine separately, (2) blood separately, and (3) blood and urine, respectively. The results are presented for each of the seven drug groups, one or more drugs, nicotine and salicylates. The drug incidences for each fluid combination are also presented separately for the City of Dallas, the City of Memphis, and the sum from both cities. The 95% confidence interval for each incidence is also displayed in the tables.

Table 25 displays the incidences of individual drugs (and drug groups) found in living drivers for whom both blood and urine samples were available. The findings are listed for Dallas and Memphis individually and for the combination of both cities.

For cases for which both urine and blood findings were available (see Table 24) the incidence of one or more drugs was about 8.6% (± 2.6%) for the Dallas living drivers and 6.7% (± 2.9%) for the Memphis living drivers for about 7.9% (± 1.9%) overall. The number of living drivers involved was relatively small; only 40 out of 463 Dallas drivers and 19 out of 282 Memphis drivers evidenced one or more drugs.

TABLE 22

INCIDENCE OF DRUGS IN LIVING DRIVERS
FOR WHOM URINE SAMPLES WERE AVAILABLE

Type of Drug	Dallas (568 Drivers)			Memphis (329 Drivers)			All Living Drivers (897 Drivers)		
	No.	Percent	95% Confidence Interval	No.	Percent	95% Confidence Interval	No.	Percent	95% Confidence Interval
Sedatives and Hypnotics	16	2.82	±1.36	6	1.82	±1.45	22	2.45	±1.01
Tranquilizers	3	0.53	±0.60	0	0.00	a/	3	0.33	±0.38
Stimulants and Antidepressants	7	1.23	±0.91	0	0.00	a/	7	0.78	±1.52
Antihistamines and Decongestants	19	3.35	±1.48	13	3.95	±2.11	32	3.57	±1.21
Narcotic Analgesics	3	0.53	±0.60	0	0.00	a/	3	0.33	±0.38
Hallucinogens	0	0.00	a/	0	0.00	a/	0	0.00	a/
Miscellaneous	1	0.18	±0.34	1	0.30	±0.59	2	0.22	±0.31
Total Drivers with One or More Drugs	47	8.27	±2.27	19	5.78	±2.52	66	7.38	±1.71
Nicotine	297	52.29	±4.11	183	55.62	±5.37	480	53.51	±3.26
Salicylates	109	19.19	±3.24	53	16.11	±3.97	162	18.06	±2.52

a/ Indeterminable from the data collected.

TABLE 23

INCIDENCE OF DRUGS IN LIVING DRIVERS
FOR WHOM BLOOD SAMPLES WERE AVAILABLE

Type of Drug	Dallas (509 Drivers)			Memphis (308 Drivers)			All Living Drivers (817 Drivers)		
	No.	Percent	95% Confidence Interval	No.	Percent	95% Confidence Interval	No.	Percent	95% Confidence Interval
Sedatives and Hypnotics	8	1.57	±1.09	5	1.62	±1.41	13	1.59	±0.86
Tranquilizers	0	0.00	a/	0	0.00	a/	0	0.00	a/
Stimulants and Antidepressants	0	0.00	a/	0	0.00	a/	0	0.00	a/
Antihistamines and Decongestants	0	0.00	a/	0	0.00	a/	0	0.00	a/
Narcotic Analgesics	0	0.00	a/	0	0.00	a/	0	0.00	a/
Hallucinogens	0	0.00	a/	0	0.00	a/	0	0.00	a/
Miscellaneous	0	0.00	a/	1	0.32	±0.64	1	0.12	±0.24
Total Drivers With One or More Drugs	8	1.57	±1.09	6	1.95	±1.54	14	1.71	±0.89
Nicotine	1	0.20	±0.38	1	0.32	±0.64	2	0.24	±0.34
Salicylates	58	11.39	±2.76	29	9.42	±3.26	87	10.65	±2.12

a/ Indeterminable from the data collected.

TABLE 24

INCIDENCE OF DRUGS IN LIVING DRIVERS
FOR WHOM BOTH BLOOD AND URINE SAMPLES WERE AVAILABLE

Type of Drug	Dallas (463 Drivers)			Memphis (282 Drivers)			All Living Drivers (745 Drivers)		
	No.	Percent	95% Confidence Interval	No.	Percent	95% Confidence Interval	No.	Percent	95% Confidence Interval
Sedatives and Hypnotics	13	2.81	±1.52	6	2.13	±1.68	20	2.68	±1.20
Tranquilizers	3	0.65	±0.73	0	0.0	a/	3	0.40	±0.45
Stimulants and Antidepressants	4	0.86	±0.84	0	0.0	a/	4	0.54	±0.52
Antihistamines and Decongestants	18	3.89	±1.76	13	4.61	±2.45	31	4.16	±1.43
Natcotic Analgesics	2	0.43	±0.60	0	0.0	a/	1	0.13	±0.26
Hallucinogens	0	0.0	a/	0	0.0	a/	0	0.0	a/
Miscellaneous	1	0.22	±0.42	2	0.71	±0.98	3	0.40	±0.45
Total Drivers With One or More Drugs	40	8.65	±2.56	19	6.74	±2.93	59	7.92	±1.94
Nicotine	252	54.43	±4.54	165	58.51	±5.75	417	55.97	±3.56
Salicylates	95	20.52	±3.68	48	17.02	±4.39	143	19.19	±2.83

a/ Indeterminable from the data collected.

TABLE 25

INCIDENCE OF SPECIFIC DRUGS FOUND IN LIVING DRIVERS FOR WHOM BOTH BLOOD AND URINE SAMPLES WERE AVAILABLE

Type of Drug	Dallas (463 Drivers) Number	Dallas (463 Drivers) Percent	Memphis (282 Drivers) Number	Memphis (282 Drivers) Percent	Both Cities (745 Drivers) Number	Both Cities (745 Drivers) Percent
Butabarbital	1	0.22	0	0.00	1	0.13
Diphenylhydantoin	1	0.22	0	0.00	1	0.13
Phenobarbital	12	2.59	6	2.13	18	2.42
Sedatives and Hypnotics	13	2.81	6	2.13	19	2.55
Meprobamate	1	0.22	0	0.00	1	0.13
Qxazepam	1	0.22	0	0.00	1	0.13
Thioridazine	1	0.22	0	0.00	1	0.13
Tranquilizers	3	0.65	0	0.00	3	0.40
Amphetamine	4	0.86	0	0.00	4	0.54
Stimulants and Antidepressants	4	0.86	0	0.00	4	0.54
Chlorpheniramine	8	1.73	2	0.71	10	1.34
Diphenhydramine	0	0.00	1	0.35	1	0.13
Phenylpropanolamine	16	3.46	12	4.26	28	3.76
Antihistamines and Decongestants	18	3.89	13	4.61	31	4.16
Morphine	1	0.22	0	0.00	1	0.13
Propoxyphene	1	0.22	0	0.00	1	0.13
Narcotic Analgesics	2	0.43	0	0.00	2	0.27
Hallucinogens	0	0.00	0	0.00	0	0.00
Quinine	1	0.22	2	0.71	3	0.40
Miscellaneous	1	0.22	2	0.71	3	0.40
Total Drivers With One or More Drugs	40	8.64	19	6.74	59	7.92
Nicotine	252	54.4	165	58.5	417	56.0
Salicylates	95	20.5	48	17.0	143	19.2

As with the fatally injured drivers, the most commonly detected drug among the living drivers was the antihistamine and decongestant, phenylpropanolamine, with the sedative, phenobarbital, second (see Table 25). Another antihistamine and decongestant, chlorpheniramine, was also found to be prevalent, more among the Dallas living drivers than among Memphis drivers.

These drug findings were compared with those in a recent study on drug use among drivers.* In that study, 4.19% of the living drivers, for whom both blood and urine samples were avilable, evidenced one or more drugs in his system. This is much lower than that found in the current study (7.92%). The preponderance of drugs found in the previous study were of the sedative/hypnotic type (generally phenobarbital). With the exception of the tranquilizer, meprobamate, no other drug or drug group was detected in more than a few individuals. Antihistamines and decongestants were not common at all, contrary to the current findings.

About 56% ($\pm$ 3.6%) of the living drivers had been smoking tobacco while 19.2% ($\pm$ 2.8%) of the drivers had been using salicylates.

Almost all of the drugs found in drivers for whom both blood and urine samples were available were detected either from the urine samples or were found in both the urine and blood samples. Only one of the living driver drug detections resulted solely from the blood samples. This is almost the same situation for the drugs detected from the fatally injured drivers. Here, only five of the fatally injured driver drug detections resulted solely from the blood samples.

3. Statistical importance of the drug findings: The statistical survey design for the fatal incidences is a stratified cluster framework. The 24 submission areas (including the Cities of Dallas and Memphis) represent clusters of data which are classifiable by geography. The mathematical structure of the living driver data is the same, with the survey locations (sites) within each city representing clusters of data and the two cities being the "strata." The fatally injured and living driver drug incidences and their variances were calculated using

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* Glauz, W. D., and R. R. Blackburn, "Drug Use Among Drivers," Contract No. DOT-HS-119-2-440, (MRI Project 3668-E), Midwest Research Institute Final report, February 1975 (DOT-HS-801411).

the equations in Appendix J. The variance equations were used to describe the precision of the observed incidences in Tables 16 through 20 and in Tables 22 through 24. The intracluster correlation for either the living or fatally injured driver data was not significantly different from zero (via Barlett's test). The fatally injured driver drug incidences for any particular fluid sample combinations did not differ significantly from area to area including Dallas and Memphis. The incidences of drugs in the living drivers were also compared by site within each survey community and between the two communities of Dallas and Memphis. The incidences were found not to differ significantly between survey locations or between cities.

Twenty of the 32 survey sites in Memphis were fatal crash sites for which fluid specimens were obtained from the fatally injured driver and analyzed for drugs. These 20 sites are referred to as "matched" sites. In addition living driver surveys were conducted at 12 sites ("unmatched") in Memphis for which no comparable fatally injured driver specimens were available for analysis. In Dallas, 43 of the 73 survey sites were matched, so that 63 of the total 105 survey sites used in the study were matched.

A statistical comparison of the drug usage in the matched and unmatched data sets revealed no matching "effect." In other words, there is no statistical evidence that association with a fatal fluid specimen(s) influences the living driver drug incidences for three drug groups ($\chi^2(1) = 1.37$ for the sedative/hypnotic drug group, $\chi^2(1) = 0$ for the antihistamine/decongestants drug group, and $\chi^2(1) = 0.82$ for the group, one or more drugs). The other drug groups contained insufficient sample sizes to make any statistical statement. All subsequent drug finding results presented in this report are given for the totality of living or fatally injured driver data.

E. Relative Risk of a Fatal Accident Involvement

The relative incidence of drugs in fatally injured drivers was compared with the relative incidence of drugs in living drivers. The results of that comparison are presented in this subsection. From these comparisons one is able to make certain inferences about the relative chances, or risks, of being fatally injured while driving a motor vehicle after having injected various drugs. The comparisons were made separately for Dallas and Memphis, and for the combination of the two communities. The relative risks were also determined by comparing the incidences of drugs in all fatally injured drivers with the incidence of drugs in all living drivers.

Comparative data for Dallas living and fatally injured drivers evidencing drugs, other than alcohol, at any level of concentration are presented in Tables 26 through 28 for three fluid sample combinations: (1) urine separately, (2) blood separately, and (3) blood and urine, respectively. The findings are described for each of the seven drug groups, one or more drugs, nicotine and salicylates. The 95% confidence interval for each incidence is also displayed in the tables. The same comparative data are given in Tables 29 through 31 for Memphis drivers, in Tables 32 through 34 for Memphis plus Dallas drivers, and in Tables 35 through 37. for all living and all fatally injured driver data collected.

The relative chance, or risk, of being fatally injured if having ingested a specific drug is evaluated by simply dividing the percentage of fatally injured drivers having evidences of that drug by the corresponding percentage of living drivers. This relative risk is displayed in the third to last column of Tables 26 through 37. The next to the last and last columns in these tables present the lower and upper 95% confidence limits, respectively, for each relative risk value. The confidence limits were evaluated using the equation given in Appendix J for the variance of the relative risk.

The totality of the fatally injured driver data is statistically homogeneous and therefore serves as a description of the incidence of drug use among dead drivers. The same is true about the totality of living driver data. Thus, the totality of all drug findings for both fatally injured and living drivers is the statistically preferred estimator for the incidence of drug usage for <u>any</u> location. From a statistical perspective, the relative risks based on all the data collected are to be preferred over the risks calculated for Dallas or Memphis alone since the increased sample size results in a more precise estimate of the relative risk. Insufficient data are available for Dallas or Memphis alone upon which to draw statistically valid conclusions about the risks of a drug involved fatal crash in each community. Also, there is no statistical evidence to indicate drug usage among living drivers was any different at crash sites for which fluid samples were available from the dead driver than at those crash sites for which fluid samples were not available.

The comparisons of the relative incidences of drugs in all fatally injured drivers wth the relative incidences of drugs in all the living drivers indicate that fatally injured drivers are significantly more likely to have been using drugs than the similarly exposed (living) drivers.

TABLE 26

COMPARATIVE DATA FOR DALLAS DRIVERS EVIDENCING DRUGS AND FOR WHOM URINE SAMPLES WERE AVAILABLE

Type of Drug	Living Drivers			Fatally Injured Drivers			Relative Risk of Being Fatally Injured		
	No.	Percent	95% Confidence Interval	No.	Percent	95% Confidence Interval	No.	95% Confidence Limits Lower	Upper
Sedatives and Hypnotics	16	2.82	±1.36	3	4.76	±5.25	1.688	0.259	4.634
Tranquilizers	3	0.53	±0.60	1	1.59	±3.10	3.000	0.000	38.576
Stimulants and Antidepressants	7	1.23	±0.91	1	1.59	±3.10	1.293	0.000	6.630
Antihistamines and Decongestants	19	3.35	±1.48	1	1.59	±3.10	0.475	0.000	1.671
Narcotic Analgesics	3	0.53	±0.60	2	3.17	±4.33	5.981	0.059	63.465
Hallucinogens	0	0.00	a/	0	0.00	a/	a/	a/	a/
Miscellaneous	1	0.18	±0.34	0	0.00	a/	0.000	a/	a/
One or More Drugs	47	8.27	±2.27	7	11.11	±7.76	1.343	0.559	2.514
Nicotine	297	52.29	±4.11	40	63.49	±11.90	1.214	0.994	1.460
Salicylates	109	19.19	±3.24	11	17.46	±9.37	0.910	0.498	1.435
Sample Size	568			63					

a/ Indeterminable from the data collected.

TABLE 27

COMPARATIVE DATA FOR DALLAS DRIVERS EVIDENCING DRUGS AND FOR WHOM BLOOD SAMPLES WERE AVAILABLE

Type of Drug	Living Drivers			Fatally Injured Drivers			Relative Risk of Being Fatally Injured		
								95% Confidence Limits	
	No.	Percent	95% Confidence Interval	No.	Percent	95% Confidence Interval	No.	Lower	Upper
Sedatives and Hypnotics	8	1.57	±1.09	2	2.63	±3.61	1.675	0.015	6.649
Tranquilizers	0	0.00	a/	1	1.32	±2.57	∞	a/	a/
Stimulants and Antidepressants	0	0.00	a/	1	1.32	±2.57	∞	a/	a/
Antihistamines and Decongestants	0	0.00	a/	0	0.00	a/	a/	a/	a/
Narcotic Analgesics	0	0.00	a/	0	0.00	a/	a/	a/	a/
Hallucinogens	0	0.00	a/	0	0.00	a/	a/	a/	a/
Miscellaneous	0	0.00	a/	0	0.00	a/	a/	a/	a/
One or More Drugs	8	1.57	±1.09	4	5.26	±5.02	3.350	0.701	11.284
Nicotine	1	0.20	±0.38	12	15.79	±8.19	78.95	20.932	∞
Salicylates	58	11.39	±2.76	10	13.16	±7.60	1.55	0.596	1.980
Sample Size	509			76					

a/ Indeterminable from the data collected.

TABLE 28

COMPARATIVE DATA FOR DALLAS DRIVERS EVIDENCING DRUGS AND FOR WHOM BOTH BLOOD AND URINE SAMPLES WERE AVAILABLE

Type of Drug	Living Drivers			Fatally Injured Drivers			Relative Risk of Being Fatally Injured		
			95% Confidence			95% Confidence		95% Confidence Limits	
	No.	Percent	Interval	No.	Percent	Interval	No.	Lower	Upper
Sedatives and Hypnotics	13	2.81	±1.51	3	5.17	±5.71	1.712	0.257	4.887
Tranquilizers	3	0.65	±0.73	1	1.72	±3.35	2.646	0.0	33.032
Stimulants and Antidepressants	4	0.86	±0.84	1	1.72	±3.35	2.000	0.0	16.129
Antihistamines and Decongestants	18	3.89	±1.76	1	1.72	±3.35	0.442	0.0	1.573
Narcotic Analgesics	2	0.43	±0.60	2	3.45	±4.70	15.682	0.135	∞
Hallucinogens	0	0.0	a/	0	0.0	a/	a/	a/	a/
Miscellaneous	1	0.22	±0.42	0	0.0	a/	0.0	a/	a/
One or More Drugs	40	8.64	±2.56	7	12.06	±8.39	1.396	0.575	2.661
Nicotine	252	54.43	±4.54	37	63.79	±12.37	1.172	0.952	1.421
Salicylates	95	20.52	±3.68	11	18.97	±10.09	0.924	0.506	1.467
Sample Size	463			58					

a/ Indeterminable from the data collected.

TABLE 29

COMPARATIVE DATA FOR MEMPHIS DRIVERS EVIDENCING DRUGS AND FOR WHOM URINE SAMPLES WERE AVAILABLE

Type of Drug	Living Drivers			Fatally Injured Drivers			Relative Risk of Being Fatally Injured		
			95% Confidence			95% Confidence		95% Confidence Limits	
	No.	Percent	Interval	No.	Percent	Interval	No.	Lower	Upper
Sedatives and Hypnotics	6	1.82	±1.45	2	6.06	±8.13	3.333	0.075	15.323
Tranquilizers	0	0.00	a/	0	0.00	a/	a/	a/	a/
Stimulants and Antidepressants	0	0.00	a/	0	0.00	a/	a/	a/	a/
Antihistamines and Decongestants	13	3.95	±2.11	5	15.15	±12.23	3.836	1.163	9.842
Narcotic Analgesics	0	0.00	a/	1	3.03	±5.84	∞	a/	a/
Hallucinogens	0	0.00	a/	0	0.00	a/	a/	a/	a/
Miscellaneous	1	0.30	±0.59	0	0.00	a/	0.0	a/	a/
One or More Drugs	19	5.78	±2.52	7	21.21	±13.96	3.670	1.472	7.875
Nicotine	183	55.62	±5.37	22	66.67	±16.09	1.199	0.926	1.512
Salicylates	53	16.11	±3.97	7	21.21	±13.96	1.317	0.589	2.357
Sample Size	329			33					

a/ Indeterminable from the data collected.

TABLE 30

COMPARATIVE DATA FOR MEMPHIS DRIVERS EVIDENCING DRUGS AND FOR WHOM BLOOD SAMPLES WERE AVAILABLE

Type of Drug	Living Drivers			Fatally Injured Drivers			Relative Risk of Being Fatally Injured		
								95% Confidence Limits	
	No.	Percent	95% Confidence Interval	No.	Percent	95% Confidence Interval	No.	Lower	Upper
Sedatives and Hypnotics	5	1.62	±1.41	2	4.44	±6.12	2.743	0.017	14.594
Tranquilizers	0	0.00	a/	1	2.22	±4.31	∞	a/	a/
Stimulants and Antidepressants	0	0.00	a/	0	0.00	a/	a/	a/	a/
Antihistamines and Decongestants	0	0.00	a/	2	4.44	±6.12	∞	a/	a/
Narcotic Analgesics	0	0.00	a/	0	0.00	a/	a/	a/	a/
Hallucinogens	0	0.00	a/	0	0.00	a/	a/	a/	a/
Miscellaneous	1	0.32	±0.64	0	0.00	a/	0.0	a/	a/
One or More Drugs	6	1.95	±1.54	5	11.11	±9.17	5.698	1.478	21.001
Nicotine	1	0.32	±0.64	8	17.78	±11.17	55.556	12.496	∞
Salicylates	29	9.42	±3.26	6	13.33	±9.94	1.415	0.526	2.894
Sample Size	308			45					

a/ Indeterminable from the data collected.

TABLE 31

COMPARATIVE DATA FOR MEMPHIS DRIVERS EVIDENCING DRUGS AND FOR WHOM BOTH BLOOD AND URINE SAMPLES WERE AVAILABLE

Type of Drug	Living Drivers			Fatally Injured Drivers			Relative Risk of Being Fatally Injured		
			95% Confidence			95% Confidence		95% Confidence Limits	
	No.	Percent	Interval	No.	Percent	Interval	No.	Lower	Upper
Sedatives and Hypnotics	6	2.13	±1.68	2	6.06	±8.13	2.845	0.064	12.912
Tranquilizers	0	0.0	a/	1	3.03	±5.84	∞	a/	a/
Stimulants and Antidepressants	0	0.0	a/	0	0.0	a/	a/	a/	a/
Antihistamines and Decongestants	13	4.61	±2.45	5	15.15	±12.23	3.286	0.998	8.407
Narcotic Analgesics	0	0.0	a/	1	3.03	±5.84	∞	a/	a/
Hallucinogens	0	0.0	a/	0	0.0	a/	a/	a/	a/
Miscellaneous	2	0.71	±0.98	0	0.0	a/	0.0	a/	a/
One or More Drugs	19	6.74	±2.93	8	24.24	±14.60	3.596	1.552	7.501
Nicotine	165	58.51	±5.75	22	66.67	±16.09	1.139	0.880	1.439
Salicylates	48	17.02	±4.39	7	21.21	±13.96	1.246	0.554	2.254
Sample Size	282			33					

a/ Indeterminable from the data collected.

TABLE 32

COMPARATIVE DATA FOR MEMPHIS PLUS DALLAS DRIVERS EVIDENCING DRUGS AND FOR WHOM URINE SAMPLES WERE AVAILABLE

Type of Drug	Living Drivers			Fatally Injured Drivers			Relative Risk of Being Fatally Injured		
								95% Confidence Limits	
	No.	Percent	95% Confidence Interval	No.	Percent	95% Confidence Interval	No.	Lower	Upper
Sedatives and Hypnotics	22	2.45	±1.01	5	5.21	±4.44	2.127	0.635	4.874
Tranquilizers	3	0.33	±0.38	1	1.04	±2.03	3.152	0.000	44.007
Stimulants and Antidepressants	7	0.78	±1.52	0	0.00	a/	0.000	a/	a/
Antihistamines and Decongestants	32	3.57	±1.21	6	6.25	±4.84	1.751	0.624	3.604
Narcotic Analgesics	3	0.33	±0.38	3	3.13	±3.48	9.485	1.041	99.155
Hallucinogens	0	0.00	a/	0	0.00	a/	a/	a/	a/
Miscellaneous	2	0.22	±0.31	0	0.00	a/	0.000	a/	a/
One or More Drugs	66	7.38	±1.71	14	14.58	±7.06	1.976	1.104	3.196
Nicotine	480	53.51	±3.26	62	64.58	±9.57	1.207	1.033	1.397
Salicylates	162	18.06	±2.52	18	18.75	±7.81	1.038	0.661	1.500
Sample Size	897			96					

a/ Indeterminable from the data collected.

TABLE 33

COMPARATIVE DATA FOR MEMPHIS PLUS DALLAS DRIVERS EVIDENCING DRUGS AND FOR WHOM BLOOD SAMPLES WERE AVAILABLE

Type of Drug	Living Drivers			Fatally Injured Drivers			Relative Risk of Being Fatally Injured		
	No.	Percent	95% Confidence Interval	No.	Percent	95% Confidence Interval	No.	95% Confidence Limits Lower	Upper
Sedatives and Hypnotics	13	1.59	±0.86	4	3.31	±3.19	2.077	0.460	5.753
Tranquilizers	0	0.00	a/	2	1.65	±2.27	∞	a/	a/
Stimulants and Antidepressants	0	0.00	a/	1	0.83	±1.61	∞	a/	a/
Antihistamines and Decongestants	0	0.00	a/	2	1.65	±2.27	∞	a/	a/
Narcotic Analgesics	0	0.00	a/	0	0.00	a/	a/	a/	a/
Hallucinogens	0	0.00	a/	0	0.00	a/	a/	a/	a/
Miscellaneous	1	0.12	±0.24	0	0.00	a/	0	a/	a/
One or More Drugs	14	1.71	±0.89	9	7.44	±4.68	4.342	1.731	10.065
Nicotine	2	0.24	±0.34	20	16.53	±6.62	67.525	24.089	∞
Salicylates	87	10.65	±2.12	16	13.22	±6.04	7.241	0.729	1.924
Sample Size	817			121					

a/ Indeterminable from the data collected.

TABLE 34

COMPARATIVE DATA FOR MEMPHIS PLUS DALLAS DRIVERS EVIDENCING DRUGS AND FOR WHOM BOTH BLOOD AND URINE SAMPLES WERE AVAILABLE

Type of Drug	Living Drivers			Fatally Injured Drivers			Relative Risk of Being Fatally Injured		
	No.	Percent	95% Confidence Interval	No.	Percent	95% Confidence Interval	No.	95% Confidence Limits Lower	Upper
Sedatives and Hypnotics	20	2.68	±1.20	5	5.49	±4.68	2.045	0.599	4.865
Tranquilizers	3	0.40	±0.45	2	2.20	±3.01	5.463	0.049	57.728
Stimulants and Antidepressants	4	0.54	±0.52	1	1.10	±2.14	2.049	0.000	16.554
Antihistamines and Decongestants	31	4.16	±1.43	6	6.59	±5.10	1.584	0.563	3.277
Narcotic Analgesics	1	0.13	±0.26	3	3.30	±3.67	24.590	1.860	∞
Hallucinogens	0	0.00	a/	0	0.00	a/	a/	a/	a/
Miscellaneous	3	0.40	±0.45	0	0.00	a/	0.000	a/	a/
One or More Drugs	59	7.92	±1.94	15	16.48	±7.62	2.081	1.181	3.366
Nicotine	417	55.97	±3.56	59	64.84	±9.81	1.158	0.987	1.346
Salicylates	143	19.19	±2.83	18	19.78	±8.18	1.031	0.655	1.496
Sample Size	745			91					

a/ Indeterminable from the data collected.

TABLE 35

COMPARATIVE DATA FOR ALL DRIVERS EVIDENCING DRUGS AND FOR WHOM URINE SAMPLES WERE AVAILABLE

Type of Drug	Living Drivers			Fatally Injured Drivers			Relative Risk of Being Fatally Injured		
								95% Confidence Limits	
	No.	Percent	95% Confidence Interval	No.	Percent	95% Confidence Interval	No.	Lower	Upper
Sedatives and Hypnotics	22	2.45	±1.01	31	4.87	±1.67	1.984	1.152	3.519
Tranquilizers	3	0.33	±0.38	4	0.63	±0.61	1.878	0.308	17.080
Stimulants and Antidepressants	7	0.78	±1.52	9	1.41	±0.92	1.810	0.403	∞
Antihistamines and Decongestants	32	3.57	±1.21	34	5.34	±1.75	1.496	0.919	2.447
Narcotic Analgesics	3	0.33	±0.38	16	2.51	±1.22	7.511	2.701	54.089
Hallucinogens	0	0.00	a/	0	0.00	a/	a/	a/	a/
Miscellaneous	2	0.22	±0.31	6	0.94	±0.75	4.224	0.904	∞
One or More Drugs	66	7.38	±1.71	86	13.50	±2.65	1.835	1.350	2.514
Nicotine	480	53.51	±3.26	413	64.84	±3.71	1.212	1.113	1.319
Salicylates	162	18.06	±2.52	105	16.48	±2.88	0.913	0.725	1.142
Sample Size	897			637					

a/ Indeterminable from the data collected.

TABLE 36

COMPARATIVE DATA FOR ALL DRIVERS EVIDENCING DRUGS AND FOR WHOM BLOOD SAMPLES WERE AVAILABLE

Type of Drug	Living Drivers			Fatally Injured Drivers			Relative Risk of Being Fatally Injured		
	No.	Percent	95% Confidence Interval	No.	Percent	95% Confidence Interval	No.	95% Confidence Limits Lower	Upper
Sedatives and Hypnotics	13	1.59	±0.86	37	4.48	±1.41	2.819	1.571	5.648
Tranquilizers	0	0.00	a/	4	0.48	±0.47	∞	a/	a/
Stimulants and Antidepressants	0	0.00	a/	2	0.24	±0.34	∞	a/	a/
Antihistamines and Decongestants	0	0.00	a/	2	0.24	±0.34	∞	a/	a/
Narcotic Analgesics	0	0.00	a/	4	0.48	±0.47	∞	a/	a/
Hallucinogens	0	0.00	a/	0	0.00	a/	a/	a/	a/
Miscellaneous	1	0.12	±0.24	1	0.12	±0.24	0.990	0.000	∞
One or More Drugs	14	1.71	±0.89	50	6.06	±1.63	3.537	2.077	6.737
Nicotine	2	0.24	±0.34	113	13.70	±2.35	55.952	24.579	∞
Salicylates	87	10.65	±2.12	78	9.45	±2.00	0.888	0.659	1.193
Sample Size	817			825					

a/ Indeterminable from the data collected.

TABLE 37

COMPARATIVE DATA FOR ALL DRIVERS EVIDENCING DRUGS AND FOR WHOM BOTH BLOOD AND URINE SAMPLES WERE AVAILABLE

Type of Drug	Living Drivers			Fatally Injured Drivers			Relative Risk of Being Fatally Injured		
			95% Confidence			95% Confidence		95% Confidence Limits	
	No.	Percent	Interval	No.	Percent	Interval	No.	Lower	Upper
Sedatives and Hypnotics	20	2.68	±1.20	30	5.11	±1.78	1.904	1.079	3.512
Tranquilizers	3	0.40	±0.45	4	0.68	±0.67	1.692	0.278	15.349
Stimulants and Antidepressants	4	0.54	±0.52	7	1.19	±0.88	2.221	0.613	11.444
Antihistamines and Decongestants	31	4.16	±1.43	31	5.28	±1.81	1.269	0.766	2.103
Narcotic Analgesics	1	0.13	±0.26	15	2.56	±1.28	19.042	5.064	∞
Hallucinogens	0	0.0	a/	0	0.0	a/	a/	a/	a/
Miscellaneous	3	0.40	±0.45	6	1.02	±0.81	2.538	0.599	21.268
One or More Drugs	59	7.92	±1.94	84	14.31	±2.83	1.807	1.318	2.506
Nicotine	417	55.97	±3.56	380	64.74	±3.87	1.210	1.059	1.264
Salicylates	143	19.19	±2.83	102	17.38	±3.07	0.906	0.715	1.142
Sample Size	745			587					

a/ Indeterminable from the data collected.

The comparisons in Table 37 imply that drivers usine one or more drugs have a greater chance of being fatally injured in a vehicular crash than similarly exposed drivers not using drugs--they have a relative risk of about 1.8 (with a 95% confidence interval of 1.3 to 2.5). The danger may be greatest with narcotic analgesics with a relative risk of about 19 (with a 95% confidence interval of 5.1 to infinity); followed by sedatives and hypnotics with a relative risk of about 1.9 (with a 95% confidence interval of 1.1 to 3.5); and nicotine at 1.2 (with a 95% confidence interval of 1.1 to 1.3). The relative risks for the other drug groups (tranquilizers, stimulants and antidepressants, antihistamines and decongestants, and miscellaneous) were all greater than unity, but data samples are not large enough to make very powerful statements regarding their significance. (The lower confidence limits on the relative risk for these latter drug groups were all less than unity.)

The relative risk estimates for nicotine drawn from the blood findings only are very large (see Tables 30, 33, 36 and 39). The associated 95% confidence limits for these risks are also extremely large. The reasons for these conditions are that nicotine was found in the blood of only two living drivers (one each in Dallas and Memphis); it was more prevalently found in the blood of the fatally injured drivers. The significance of these findings suggest that the fatally injured drivers were smoking shortly before or at the time of the crash. Living drivers were not smoking from the time they were stopped until sometime after the blood samples were drawn, perhaps a time lapse of about 10 to 15 min in most cases.

The relative risk data in Table 37 were compared with similar data obtained in a previous study.* The comparative data from the previous study are repeated here in Table 38 for completeness. The results in the two tables are quite different. In the past study, the relative risk of being fatally injured and using one or more drugs was 4.22. This is almost twice the risk found in the current study (Table 37). In addition, both the magnitude of the relative risk for individual drug types and the order of drug types in terms of decreasing risks are different in the two tables.

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* Glauz, W. D., R. R. Blackburn, "Drug Use Among Drivers," Contract No. DOT-HS-119-2-440, (MRI Project 3668-E) Midwest Research Institute Final Report, February 1975 (DOT-HS-801-411).

TABLE 38

COMPARATIVE DATA FOR DRIVERS EVIDENCING DRUGS AT ANY LEVEL*

Drug Type	Living Drivers		Fatally Injured Drivers		Relative Chance of Being Fatally Injured
	No.	Percent	No.	Percent	
Sedatives and Hypnotics	19	2.49	56	11.13	4.47
Stimulants and Antidepressants	1	0.13	27	5.37	40.99
Antihistamines and Decongestants	2	0.26	17	3.38	12.90
Tranquilizers	10	1.31	17	3.38	2.58
Narcotic Analgesics	2	0.26	7	1.39	5.31
Miscellaneous	0	0.00	8	1.59	-
One or more Drugs	32	4.19	89	17.69	4.22
Sample Size	763		503		

* Glauz, W. D., R. R. Blackburn, "Drug Use Among Drivers," Contract No. DOT-HS-119-2-440, February 1975 (DOT-HS-801-411).

F. Alcohol Usage Among Drivers

1. Usage of alcohol dependent of other drugs: The study reconfirmed the fact that alcohol is the most abused drug among driver, and it plays the leading role among drugs as a causative factor in fatal crashes. Comparative data for alcohol considering all living and all fatally injured driver data are presented in Table 39. The blood alcohol concentration (BAC) data shown were determined from blood samples and are presented for different levels of BAC including the categories "negative" and any positive BAC. The 95% confidence interval for each relative incidence is also displayed in the table.

Overall, 16.5% of the living drivers stopped and interviewed had been drinking and 4.5% could be presumed drunk, on the basis of a BAC of 0.10 or more. The site-by-site BAC findings are displayed in Appendix K for both Dallas and Memphis. The BAC results in Appendix K were determined from the breathalyzer tests administered to the motorists during the interviews. There is little evidence that any of the sites in either city is statistically more likely to have produced drunk drivers than the others.

As shown in Table 41, 65.7% of the fatally injured drivers had consumed some alcohol. Most of these, or 53.6%, had enough alcohol to be presumed intoxicated in most states (BAC 0.10).

Table 39 also displays the relative risk of being fatally injured if having ingested alcohol. The alcohol data are grouped according to BAC level. The last three columns are a restatement of the relative risk columns but normalized to 1.00 for sober drivers, in agreement with standard practice. The lower and upper 95% confidence limits for both the relative risk and the normalized relative risk are also shown in Table 41.

From Table 41 it is seen that drivers who would be intoxicated in most states (BAC of 0.10% or more) were found to be far more likely to be fatally injured in a crash than sober drivers. In agreement with previous findings, the relative chance increased drastically with BAC, being 3.27 in the BAC range 0.05% to 0.09% (with a 95% confidence interval of 2.13 to 5.03); 10.41 in the BAC range 0.10% to 0.14% (with a 95% confidence interval of 6.55 to 17.86); 30.31 in the BAC range 0.15% to 0.19% (with a 95% confidence interval of 17.17 to 69.07); and an uncertain but extremely high figure at greater BAC's.

TABLE 39

COMPARATIVE DATA FOR ALCOHOL CONSIDERING ALL DRIVERS FOR WHOM BOTH BLOOD AND URINE SAMPLES WERE AVAILABLE

	Living Drivers (729 Drivers)			Fatally Injured Drivers (556 Drivers)			Relative Risk of Being Fatally Injured			Normalized Relative Risk of Being Fatally Injured[a/]		
			95% Confidence			95% Confidence		95% Confidence Limits			95% Confidence Limits	
Alcohol BAC Level	No.	Percent	Interval	No.	Percent	Interval	No.	Lower	Upper	No.	Lower	Upper
Negative	609	83.54	±2.69	191	34.35	±3.95	0.411	0.369	0.456	1.000	0.898	1.109
0.01 - 0.04	46	6.31	±1.77	25	4.50	±1.73	0.713	0.429	1.140	1.735	1.044	2.774
0.05 - 0.09	41	5.62	±1.67	42	7.55	±2.20	1.343	0.875	2.067	3.268	2.129	5.029
0.10 - 0.14	19	2.61	±1.16	62	11.15	±2.62	4.278	2.690	7.339	10.409	6.545	17.856
0.15 - 0.19	8	1.10	±0.76	76	13.67	±2.86	12.456	7.056	28.386	30.307	17.168	69.066
0.20 - 0.24	4	0.55	±0.54	81	14.57	±2.93	26.551	13.287	102.944	64.601	32.328	250.472
0.25+	2	0.27	±0.38	79	14.21	±2.90	51.790	22.166	16,295.0	126.010	53.932	39,647.0
Any Positive BAC	120	16.46	±2.69	365	65.65	±3.95	3.988	3.415	4.715	9.703	8.309	11.472

a/ Relative risk is normalized to 1.000 for "negative" BAC.

TABLE 40

TIME OF DAY VERSUS PERCENTAGE OF DRINKING AND DRIVING FOR FATALLY INJURED DRIVERS

	Blood Alcohol Concentration Level								
Time	0.00	0.01-0.04	0.05-0.09	0.10-0.14	0.15-0.19	0.20+	Any Positive (0.01+)	0.10+	Sample Size
0001-0400	13.64	2.84	9.09	15.34	17.61	41.48	86.36	74.43	176
0401-0800	46.43	1.79	1.79	16.07	17.86	16.07	53.57	50.00	56
0801-1200	61.70	8.51	8.51	2.13	6.38	12.77	38.30	21.28	47
1201-1600	67.92	7.55	3.77	5.66	5.66	9.43	32.08	20.75	53
1601-2000	46.99	4.82	9.64	6.02	4.82	27.71	53.01	38.55	83
2001-2400	26.24	4.96	7.80	12.06	17.73	31.21	73.76	60.99	141
Total	34.35	4.50	7.55	11.15	13.67	28.78	65.65	53.60	556

TABLE 41

TIME OF DAY VERSUS PERCENTAGE OF DRINKING AND DRIVING FOR LIVING DRIVERS

Time	Blood Alcohol Concentration Level								Sample Size
	0.00	0.01-0.04	0.05-0.09	0.10-0.14	0.15-0.19	0.20+	Any Positive (0.01+)	0.10+	
0001-0400	68.48	9.70	12.73	4.85	2.42	1.82	31.52	9.09	165
0401-0800	79.63	7.41	5.56	5.56	1.85	0.0	20.37	7.41	54
0801-1200	94.06	1.98	0.99	1.98	0.99	0.0	5.94	2.97	101
1201-1600	94.21	3.31	0.83	1.65	0.0	0.0	5.79	1.65	121
1601-2000	86.71	4.90	6.29	0.70	0.70	0.70	13.29	2.10	143
2001-2400	82.52	9.09	4.20	2.10	0.70	1.40	17.48	4.20	143
Total	83.49	6.33	5.64	2.61	1.10	0.83	16.51	4.54	727

Data on the time of day versus the percentage of drinking and driving for fatally injured and living drivers are shown in Tables 40 and 41, respectively. In further confirmation of previous findings, alcohol usage depends strongly on time of day for both the fatally injured drivers (at time of crash) and the living drivers (at time of interview). For both sets of drivers, the majority of all the drunk drivers was detected in the late evening and early morning hours.

2. Usage of alcohol in combination with other drugs: The relationships between alcohol usage and drug usage were examined for both the fatally injured and living drivers. Table 42 presents the drug groups found in combination with alcohol in the fatally injured drivers. Table 43 presents the same information but for the living drivers Among the fatally injured drivers, the use of antihistamines and decongestants and one or more drugs were found to be significantly related, in a negative sense, with alcohol usage. Of the fatally injured drivers evidencing one or more drugs, 57.1% also had positive BAC's (0.01% +). A significantly higher percentage (68.4%) of the dead drivers not using drugs had positive BAC's. The same negative association was found between alcohol usage and the other drug groups, except the miscellaneous group, but these drug incidence levels were too small for any statistical significance. There is no statistical evidence to indicate that alcohol and drug usage are related among living drivers.

G. Fatally Injured and Living Driver Factors Compared with Drug Usage

The finding that alcohol usage depends strongly on time of day for both the fatally injured and living drivers prompted a similar investigation for other drugs. The relationship between time of day and drug usage was examined for the seven drug groups and the cateogry, one or more drugs for both the fatally injured and living drivers. The only significant finding was that antihistamines and decongestants were over-involved in the morning and late afternoon to early evening hours among living drivers. Drug usage among the fatally injured drivers was mildly dependant on time of day, but in an opposite sense to that found for alcohol usage. However, the relationships between time of day and drug usage were not statistically significant.

A number of other fatally injured and living driver factors were compared with drug usage and examined for statistical importance. Fatally injured driver factors included area type, number of vehicles involved,

TABLE 42

DRUGS COMBINED WITH ALCOHOL IN FATALLY INJURED DRIVERS

Type of Drivers	BAC's 0.00	0.01-0.09	0.10+	Sample Size
All Drivers	33.2%	11.9%	54.9%	587
Non-Drug Users	31.6%	10.5%	57.9%	503
Drivers Evidencing:				
Sedatives and Hypnotics	36.7%	23.3%	40.0%	30
Tranquilizers	75.0%	25.0%	0.0%	4
Stimulants and Antidepressants	28.6%	42.8%	28.6%	7
Antihistamines and Decongestants	58.1%	12.9%	29.0%	31
Narcotic Analgesics	40.0%	26.7%	33.3%	15
Hallucinogens	a/	a/	a/	0
Miscellaneous	0.0%	16.7%	83.3%	6
One or More Drugs	42.9%	20.2%	36.9%	84

a/ Indeterminable from the data collected.

TABLE 43

DRUGS COMBINED WITH ALCOHOL IN LIVING DRIVERS

Type of Drivers	BAC's 0.00	0.01-0.09	0.10+	Sample Size
All Drivers	81.7%	11.7%	6.6%	745
Non-Drug Users	81.9%	11.4%	6.7%	686
Drivers Evidencing:				
Sedatives and Hypnotics	90.0%	10.0%	0.0%	20
Tranquilizers	66.7%	33.3%	0.0%	3
Stimulants and Antidepressants	25.0%	25.0%	50.0%	4
Antihistamines and Decongestants	87.1%	9.7%	3.2%	31
Narcotic Analgesics	100.0%	0.0%	0.0%	1
Hallucinogens	a/	a/	a/	0
Miscellaneous	33.3%	66.7%	0.0%	3
One or More Drugs	79.7%	15.2%	5.1%	59

a/ Indeterminable from the data collected.

accident type, vehicle type, number of people in vehicle, season of the year, sex, age and culpability of the driver. The results of the fatally injured driver comparisons are given in Table 44. Living driver factors examined were vehicle age and condition, income, marital status, sex, race, and season of the year. The results of the living driver comparisons are given in Table 45. The use of antihistamines and decongestants was significantly related to season among fatally injured drivers but not among living drivers. Fatally injured drivers had used these drugs relatively more frequently in the fall and less in the summer. For living drivers, however, season of the year was significantly related to the use of salicylates and the category "one or more drugs." Salicylates were over-involved in the summer and fall and under-involved in the other seasons. The use of one or more drugs was over-represented in the fall and winter and under-represented in the spring and summer.

The age of the fatally injured drivers were significantly related to usage of one or more drugs. Older drivers (50 years and older) were more likely to have been using one or more drugs while very young (19 years or less) and middle aged drivers (30 through 49) were less likely to have been using one or more drugs.

Culpability of the fatally injured drivers was not found to be related to drug usage.

Fatally injured female drivers were over-involved in usage of one or more drugs. A total of 23.1% of the fatally injured female drivers were using one or more drugs, compared to only 13.0% of the fatally injured male drivers. The 14.3% incidence of one or more drugs found for all fatally injured drivers is distorted by only 1.3% by the inclusion of fatally injured females, because they constituted only a small portion of the sample (13.3%).

The high incidence of drug usage among female fatalities prompted a reexamination of the relative risks by including only males in the calculations. The relative risks of a fatal accident, considering males only, are given in Table 46. The risks are lower for each drug group (except for narcotic analgesics and miscellaneous) than the risks determined from a combination of male and female fatally injured drivers. The greatest changes in risk were for sedatives and hypnotics, which decreased from 1.90 for all drivers to 1.61 for males only (in addition the lower confidence limit went below unity); the risk for tranquilizers decreased from

TABLE 44

CORRELATES TO DRUG USAGE AND DRIVING
AMONG FATALLY INJURED DRIVERS

Comparison[a/]	Confidence Level of Relationship
Area Type	Not significant
Number Vehicles Involved	Not significant
Accident Type	Not significant
Vehicle Type of Driver	Not significant
Number People in Vehicle	Not significant
Season of Year	Not significant
Season of Year with Use of Antihistamines/Decongestants	$p < 0.025$
Season of Year with Use of Salicylates	Not significant
Time of Day of Crash	Not significant
Time of Day of Crash with Use of Sedatives/Hypnotics	Not significant
Time of Day of Crash with Use of Antihistamines/ Decongestants	Not significant
Sex of Driver	$p < 0.05$
Age of Driver	$p < 0.10$
Culpability of Driver	Not significant
Culpability of Driver with Use of Sedatives/Hypnotics	Not significant
Culpability of Driver with Use of Antihistamines/ Decongestants	Not significant
Culpability of Driver with Use of Analgesics/Narcotics	Not significant

a/ The comparisons listed are with the use of one or more drugs unless otherwise noted.

TABLE 45

CORRELATES TO DRUG USAGE AND DRIVING AMONG LIVING DRIVERS

Comparison[a/]	Confidence Level of Relationship
Vehicle Age	Not significant
Vehicle Condition	Not significant
Driver Age	Not significant
Driver Income	Not significant
Driver Marital Status	Not significant
Season of Year	$p < 0.10$
Season of Year with Use of Sedatives/Hypnotics	Not significant
Season of Year with Use of Salicylates	$p < 0.01$
Season of Year with Use of Antihistamines/Decongestants	Not significant
Time of Day	Not significant
Time of Day with Use of Sedatives/Hypnotics	Not significant
Time of Day with Use of Antihistamines/Decongestants	$p < 0.025$
Race of Driver	Not significant

a/ The comparisons listed are with the use of one or more drugs unless otherwise noted.

TABLE 46

COMPARATIVE DATA FOR MALE ONLY DRIVERS EVIDENCING DRUGS AND FOR WHOM BOTH BLOOD AND URINE SAMPLES WERE AVAILABLE

Type of Drug	Living Drivers			Fatally Injured Drivers			Relative Risk of Being Fatally Injured		
	No.	Percent	95% Confidence Interval	No.	Percent	95% Confidence Interval	No.	95% Confidence Limits Lower	Upper
Sedatives and Hypnotics	20	2.68	±1.20	22	4.33	±1.77	1.613	0.861	3.079
Tranquilizers	3	0.40	±0.45	2	0.39	±0.54	0.968	0.003	10.291
Stimulants and Antidepressants	4	0.54	±0.52	6	1.18	±0.94	2.198	0.552	10.138
Antihistamines and Decongestants	31	4.16	±1.43	22	4.33	±1.77	1.041	0.589	1.790
Narcotic Analgesics	1	0.13	±0.26	13	2.56	±1.37	19.076	4.872	∞
Hallucinogens	0	0.0	a/	0	0.0	a/	a/	a/	a/
Miscellaneous	3	0.40	±0.45	6	1.18	±0.94	2.930	0.691	21.376
One or More Drugs	59	7.92	±1.94	66	12.99	±2.92	1.641	1.081	2.439
Sample Size	745			508					

a/ Indeterminable from the data collected.

1.69 to 0.97; the risks for antihistamines and decongestants decreased from 1.27 to 1.04; the risks for miscellaneous drugs increased from 2.54 to 2.93; and the risk for one or more drugs decreased from 1.81 to 1.64.

H. Other Findings

There is, in general, no site effect on drug incidences among drivers, as indicated by the insignificant ($\simeq 0$) value of the intracluster correlation coefficient. Nevertheless, an analysis was conducted to compare the drug incidences of living drivers at drug-involved fatal crash sites with those at nondrug-involved fatal crash sites. Such comparisons were made within Memphis alone, Dallas alone, and the sum of both cities. These comparisons resulted in no statistically significant difference in living driver drug incidence according to whether or not the survey site corresponded to a drug-invovled fatal crash site. The chi-square test results are given in Table 47 for three drug groups and the three sets of drivers. Statistically significant conclusions could not be made for the other drug groups because of insufficient sample sizes.

From the above results it can be said that the drug incidences among living drivers are not over-represented at drug-involved fatal crash sites. It should be remembered, however, that the very small sample sizes involved do not allow powerful distinctions of this type to be made.

The small samples involved in determining the incidence of individual drug groups among living drivers at drug-involved fatal crash sites can be seen from Figure 3. The information displayed in this figure shows the progression of the sample size screening effects for both the fatally injured and living driver data to arrive at a final "match" of the two sets of data. Considering the blood plus urine drug findings, it is seen that only two living drivers were found to have any drug in their system at the drug-involved fatal crash sites. The drugs detected in these two living drivers did not match the drugs found in the fatally injured drivers. This shows the extremely low probability (zero in this study) of finding a given drug among living drivers at a fatal crash site where the same drug was found in the fatally injured driver.

TABLE 47

CHI-SQUARE TEST RESULTS FOR THREE DRUG GROUPS

Drivers	Drug Groups: Sedatives/ Hypnotics	Drug Groups: Antihistamines/ Decongestants	Drug Groups: One or More Drugs
Memphis	0.20	1.73	0.64
Dallas	1.10	1.20	1.77
Memphis and Dallas	0.31	1.03	1.72

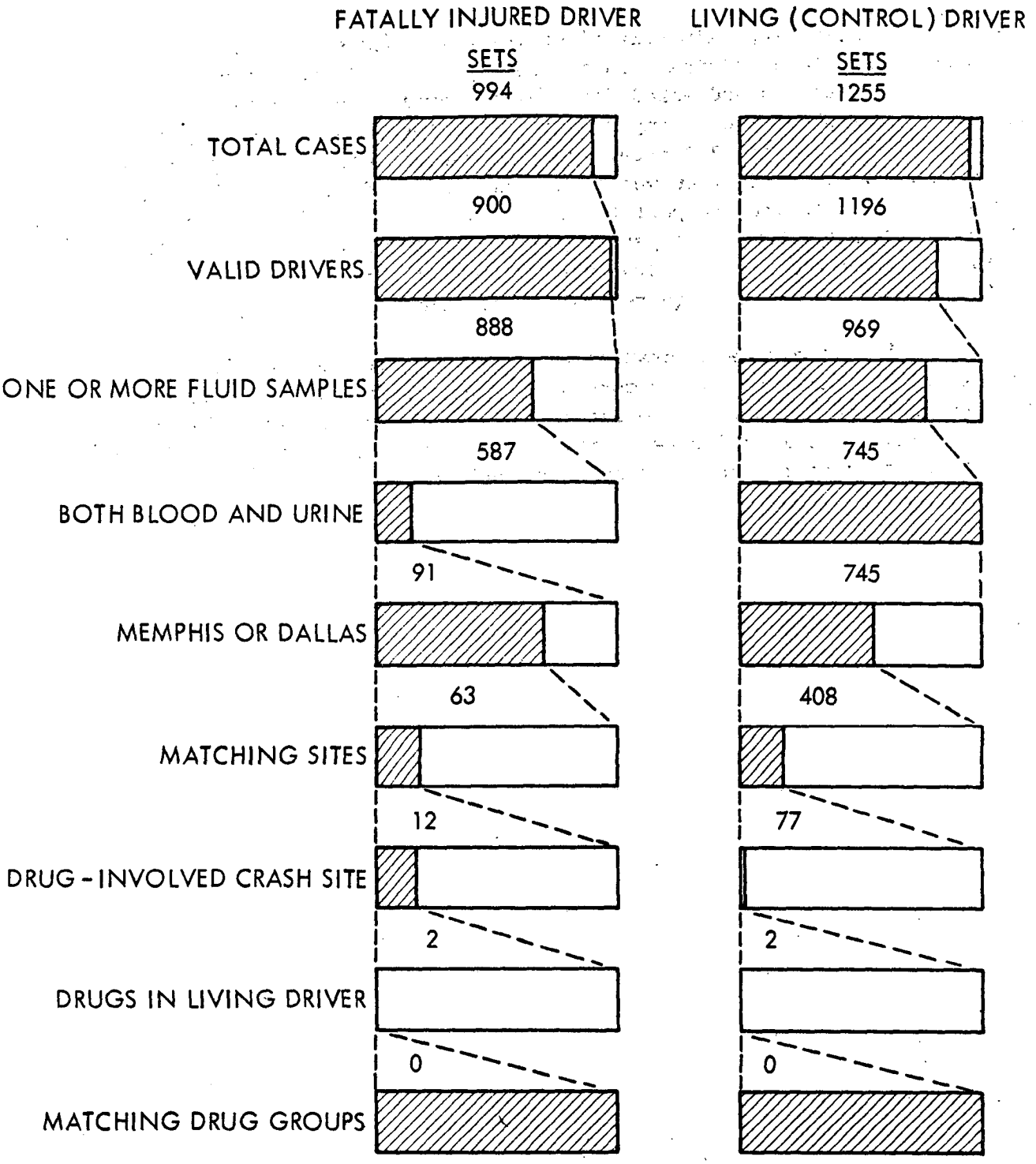

Figure 3 - Sample Size Screening Effects

Finally, approximately 8% of the motorists stopped at random would not agree to participate in the survey. In addition, abut 24% of the motorists stopped and asked for a blood sample would not agree to provide the sample. The living drivers who refused to provide a blood sample (and a resultant BAC determination) were compared to cooperators for whom a BAC determination was made from the blood sample. The comparisons were made with respect to time of day ($\chi^2(5) = 7.33$), location - Dallas separately, Memphis separately, and Dallas plus Memphis ($\chi^2(3) = 2.89$) and where known, other drug usage - one or more drugs ($\chi^2(1) = 0.28$). None of these chi-square tests were significant.

Thus, there is no statistical evidence that refuses differ from cooperators in terms of one or more drug usage, location, or temporal patterns. Although no direct evidence, by definition, is available for ascertaining refusal influence on the study, indirectly, the refusals do not appear to distort the research findings.

IV. CONCLUSIONS AND RECOMMENDATIONS

Several conclusions can be drawn from the results reported upon herein. First of all, it is possible to obtain cooperation from medical examiners to provide fluid specimens from fatally injured drivers for analysis of drugs. This cooperation is enhanced by paying the medical examiners for their service. Secondly, legal and political concerns make it difficult to select communities for living driver surveys. One cannot go to a given community and start to conduct roadside surveys without the consent and assistance of community officials. Many times the decision of a community not to cooperate in a survey is based upon political pressure.

Thirdly, once community approval for the survey is obtained, it is possible to stop motorists randomly and secure the voluntary cooperation of most of them in providing fluid samples for drug analysis The motorists' cooperation is also enhanced by paying them for their blood (and urine) samples. In general, the procedures developed for collecting the fluid samples from both fatally injured and living drivers proved to be very satisfactory. An exception to this is the marijuana sampling procedure which employed the use of swabs. This technique is not yet efficient enough to use for reliable results.

The incidence of drug usage among fatally injured drivers is not geographically dependent. Of all the fatally injured drivers examined, 14.3% were found to have used one or more drugs before the crash. The most frequently detected drugs among the fatally injured drivers are antihistamines/decongestants, narcotics, and stimulants.

The incidence of drug usage among living drivers is not significantly variable from site-to-site and from city-to-city. Of the living drivers examined, 7.9% were found to be using one or more drugs prior to the interview. The most frequently detected drugs among the living drivers are antihistamines/decongestants and sedatives.

The results of the drug analysis indicate that fatally injured drivers are significantly more likely to use drugs than similarly exposed (living) drivers. The relative risk of being involved in a fatal crash is the greatest for drivers using narcotic analgesics, sedatives/hypnotics, one or more drugs, and nicotine, respectively. The relative risk is about 1.8 for the group of 43 drugs tested as a whole. The change of being involved in a fatal crash for drivers who smoke is about 1.2 times as great as for the drivers who do not smoke.

The age and sex of the fatally injured drivers are significantly related to the usage of one or more drugs. Older drivers (50 years and older) are more likely to use one or more drugs while the very young (19 years or less) and middle aged drivers (30 through 49) are less likely to use one or more drugs. Fatally injured female drivers are more likely to have been using one or more drugs than male drivers.

No positive relationship was found between alcohol and drug usage. And, finally, the results reconfirmed that alcohol is by far the most abused drug.

The conclusions drawn from this study contain the basis for a primary recommendation: NHTSA must determine the extent to which they wish to pursue the problem of drug use among drivers. The problem is definitely not as significant as that of alcohol. Only 14.3% of the fatally injured drivers were found to have used one or more drugs, compared to 65.7% that had a positive BAC or 53.6% that had a BAC of 0.10% or more. Although it is true that fatally injured drivers are significantly more likely to have been using drugs than similarly exposed (living) drivers, the relative risk of 1.8 for the group of 43 drugs tested as a whole certainly does not compare with the relative risk of 10.4 or greater for drivers with BACs of 0.10% or more.

The benefits to be received, in terms of lives saved, pursuing the drug/driver problem must be realistically assessed. They must be balanced not only against the costs of research yet to be performed, but the cost and effectiveness of countermeasures against the problem. Then, these benefits and costs must be weighed against those of alternate traffic safety problems, such as drinking and driving.

If a decision is made to continue to investigate drug use among drivers, certain further secondary recommendations are warranted. First, the results obtained in this study need to be verified by collecting additional living and fatally injured driver data. However, more sensitive chemical analysis procedures need to be used for the drug detections. For example, some of the tranquilizers investigated are suspected to be frequently used, but the sensitivity level of the chemical analysis procedures employed precludes detections of most of these except at mid-to-high therapeutic levels and above. The same is true for many of the drugs in the other drug groups investigated.

Secondly, although the techniques for some other drugs were sufficiently sensitive, the drugs were not detected. Such drugs should

be omitted from drug screens in future studies. The funds that would otherwise be spent in screening for unused drugs could be more effectively spent in the detection of more prevalently used (or suspected to be used) drugs.

It is not advisable in future drug use studies to collect blood samples from the motorists if the same chemical analyses procedures, as were used herein, are used for drug detection. Very little information about drug incidence in both living and fatally injured drivers was learned from the blood samples collected. However, if more sensitive chemical analyses techniques were used for drug detection, the blood sample would be the recommended fluid sample collected from drivers for two reasons. First, the blood sample is no more difficult to obtain from drivers, especially living drivers, than the urine sample. Secondly, the blood findings can be logically divided into levels of concentration (trace, therapeutic, toxic, and lethal) for a determination of the condition "under the influence" once that category is defined.

In addition, it is recommended that females be included in future living driver sample population. Since fatally injured female drivers were far more likely to have been using one or more drugs than male drivers, it is important to determine if the associated risks of a fatal crash are greater for female than male drivers.

It is further recommended that future drug use studies not be overly concerned with obtaining a perfect match between the fatally injured and living driver samples. It is unduly costly and unnecessary to use only those living driver samples collected at fatal crash sites for which fluid specimens were obtained from the fatally injured driver and analyzed for drugs. This study showed that drug usage among fatally injured drivers is not geographically dependent and that drug usage among living drivers is not significantly variable from site-to-site or from city-to-city. Therefore, a more simplistic and economical matching criteria can be used to compare drug usage between fatally injured and living drivers.

Finally, the procedures for marijuana sampling and chemical analysis of this drug should be improved. One milliliter plasma specimens were extracted from the blood samples collected and shipped to White Memorial Medical Center in Los Angeles, California, for marijuana analysis. When these results become available they should be incorporated with the data presented herein.

APPENDIX A

ACQUISITION OF DRIVER SPECIMENS AND DATA

TABLE A-1

MEDICAL EXAMINES COOPERATING IN PROGRAM

Dr. Werner U. Spitz
Office of Chief Medical Examiner,
Wayne County
400 East Lafayette
Detroit, Michigan 48226

Dr. Robert R. Stivers
Chief Medical Examiner
62 Butler Street, S.E.
Atlanta, Georgia 30303

Dr. Charles S. Petty
Dallas County Medical Examiner
P.O. Box 35728
Dallas, Texas 75235

Mr. R. W. Prahl, Chief Investigator
Coroner's Office
480 Fourth Street
Oakland, California 94607

Ferrin B. Moreland, Ph.D.
Chief Toxicologist
Office of the Medical Examiner
of Harris County
1502 Taub Loop
Houston, Texas 77025

Dr. John Coe
Medical Examiner
Hennepin County Medical Examiner's
Office
510 Park Avenue
Minneapolis, Minnesota 55415

Peter Lipkovic, M.D.
Duval County Coroner
2100 Jefferson Street
Jacksonville, Florida 32206

Richard Mayne, Chief Deputy Coroner
District Health Office
625 Shadow Lane, Box 4426
Las Vegas, Nevada 89106

Dr. T. F. Hegert
Medical Examiner, District 9,
1416 South Orange Aveune
Orlando, Florida 32800

Dr. Bonita J. Peterson
Jackson County Medical Examiner
General Hospital, Room 13H
24th and Cherry
Kansas City, Missouri 64108

Robert K. Matthews
Coroner of DuPage County
421 North County Farm Road
Wheaton, Illinois 60187

Dr. Arthur Schwartz, District Medical
Examiner
Room 303
Volusia County Courthouse Annex
Daytona Beach, Florida 32015

Dr. James T. Weston
Chief State Medical Investigator
Basic Sciences Building
University of New Mexico
915 Stanford Drive, N.E.
Albuquerque, New Mexico 87131

Dr. Larry V. Lewman
301 N.E. Knott
Portland, Oregon 97212

Robert H. Phillips
Snohomish County Coroner
Room B 20
Court House
Everett, Washington 98201

Bernard Kemps, Coroner
Outagamie County
1412 West Franklin Street
Appleton, Wisconsin 54911

TABLE A-1 (Concluded)

William F. Young, Jr.
County Coroner
137 West Jefferson Street
Butler, Pennsylvania 16001

Gary L. McClure
Randolph County Coroner
1019 State Street
Chester, Illinois 62233

Dr. James K. Martin
206 Fifth Avenue
Eau Claire, Wisconsin 54701

Dr. Stafford
Toxicology Laboratory
University of Tennessee
3 North Dunlap
Memphis, Tennessee 38163

Dr. Ronald K. Wright
Assistant Medical Examiner
1700 N.W. 10th Avenue
Miami, Florida 33136

Dr. John R. Feegel
Chief Medical Examiner, District 13
3407 Bay to Bay Blvd.
Tampa, Florida 33609

CRASH DATA INFORMATION FORM

NHTSA Contract No. DOT-HS-4-00941

All information on this form is for research purposes only and is strictly confidential. Please complete either Part A and Part B or Part A only and enclose a copy of the police accident report. This report is to be filled out for each fatally injured driver within your jurisdiction. (This includes those for whom no physiological samples are provided.)

PART A

Coroner or Medical Examiner NAME: _____

TITLE: _____

ADDRESS: _____

_____

Coroner or Medical Examiner Case No.: _____

Date of Crash: _____

Time of Crash: _____

Day of Week of Crash: _____

Date of Death: _____

Time of Death: _____

Date Sample Taken: _____

Time Sample Taken: _____

Sample(s) Provided:
Blood _____ Bile _____ Urine _____ Swabs _____

Reason Any of Above Samples Not Provided:

(Blood) _____

(Bile) _____

(Urine) _____

(Swabs) _____

List of Drugs and Amounts Administered Between Time of Accident and Death

1. _____

2. _____

3. _____

To Be Filled Out by MRI

MRI Code 1 _____
1 2 3 4 5

Area Code ___
6 7

Crash Date _____
8 9 10 11 12 13
Mon Day Yr

Crash Time _____
14 15:16 17
(24-hr clock)

Crash Day ___
18

Death Date _____
19 20 21 22 23 24

Death Time _____
25 26:27 28

Sample Date _____
29 30 31 32 33 34

Sample Time _____
35 36:37 38

Samples _____
39 40 41 42

Reasons
(Blood) ___
43 44
(Bile) ___
45 46
(Urine) ___
47 48
(Swabs) ___
49 50

Drugs and Amounts _____
51 52 53 54
_____
55 56 57 58
_____
59 60 61 62

(OVER)

Figure A-1 - Crash Data Form for Fatally Injured Drivers

To Be Filled Out By MRI

MRI Code 2 | 1 2 3 4 5 (key punch new card)

PART B

Location of Crash: CITY _____ City ___ (6 7)

STATE _____ State ___ (8 9)

COUNTY _____ County ___ (10)

STREET ADDRESS _____

Area Type: 1. Rural _____ 2. Suburban _____ 3. Urban _____ Area Type ___ (11)

Number Vehicles Involved: _____ No. Vehicle ___ (12)

Type of Accident (check one applicable): Type Accident ___ (13 14)

1. Head-On _____ 5. Run Off Road _____
2. Rear-End _____ 6. Overturn _____
3. Angle _____ 7. Other (specify) _____
4. Fixed Object _____ _____

Type Vehicles Involved (passenger car, truck, motorcycles, train, etc.)

Vehicle (1) _____ Type Vehicle (1) ___ (15)

Vehicle (2) _____ (2) ___ (16)

Vehicle (3) _____ (3) ___ (17)

Other Vehicles _____ (Other) ___ (18-23)

Which Vehicle (1, 2, 3, etc., above) was Driven by the Fatally Injured Driver: _____ Fatal Vehicle ___ (24)

	Number People In	Number People Killed In	Number People Injured In	
Vehicle (1)				Vehicle (1) ___ (25 26 27)
Vehicle (2)				Vehicle (2) ___ (28 29 30)
Vehicle (3)				Vehicle (3) ___ (31 32 33)
Vehicle (All Others)				Other Vehicles ___ (34 35 36)

Check Condition(s) That Most Likely Contributed to the Crash

1. Victim's Condition or Behavior: _____ Condition ___ (37 38)
2. Other Driver's Condition or Behavior: _____
3. Other (Specify): _____

_____

_____

Sex of Victim: Male _____ Female _____ Sex ___ (39)

Age of Victim: _____ Age ___ (40 41)

Please describe any further information available concerning this crash and the victim.

DOT Contract No. DOT-HS-4-00941

SPECIMEN COLLECTION FROM

FATALLY INJURED DRIVERS

Requirements

The following specimens, if possible, from fatally injured drivers who are dead within four hours of the crash: (1)blood; (2) urine; (3) bile; and (4) alcohol washings of the fingers and face. Please fill out the enclosed ID cards in duplicate. Return one to MRI with the specimens, the other should be kept in your files. Please complete the Crash Data Forms as soon as possible. Also please provide, on the Crash Data Forms, a written explanation if all specimens cannot be provided.

Instructions

1. Blood collection: The kit contains two foam cartons, each containing five red-top vacutainers, and one foam carton containing one gray-top vacutainer. Also included in the kit is a "Monoject" double needle in a pink plastic case, a plastic vacutainer tube-and-needle-holder and plastic bottle marked "Blood" on a red label.

Blood samples should be obtained from the femoral artery if possible. If this is not possible, please state source of blood on the ID card. Disinfect the area with an aqueous disinfectant before taking the blood sample.

To collect blood, screw needle into end of tube-and-needle-holder and remove plastic sheath to expose needle. Place a vacutainer tube (rubber end first) into the tube holder and contact the rubber with the end of the inner needle. Do not puncture the seal at this point. Holding the tube-and-needle-holder with tube inserted, insert the outer needle into blood vessel--be careful not to push on the tube or else the seal will be broken prematurely. When blood vessel is punctured, slowly push the tube over the inner needle and puncture the seal. The vacuum in the tube will draw in the blood. Remove the tube of blood and, keeping the needle in the blood vessel, push another empty tube over the inner needle. Repeat this to produce 11 vacutainer tubes of blood (10 red-top tubes of blood and one gray-top tube of blood). Please fill the gray-top tube last. Discard the needle and holder. Place the gray-top vacutainer of blood back into its foam carton and card sheath. Place the contents of the 10 red-top vacutainers into the plastic screw-top bottle marked "Blood", and tighten firmly. Discard the empty vacutainers and their two foam containers.

Figure A-2 - Specimen Collection Kit Instruction Sheet

OVER

2. Urine collection: The kit contains a plastic screw cap bottle with yellow label, "urine." Place as much urine in the bottle as possible (50 ml), screw the cap back on firmly. No preservative is necessary.

3. Bile collection: The kit contains a plastic screw cap bottle with a green label "bile." Place as much bile as possible in the bottle (30 ml), and screw the cap back on firmly. No preservative is necessary.

4. Alcohol washings of the fingers and face: The kit contains a foam carton containing four glass tubes with swabs and one glass tube with 70% alcohol solution. The swab tubes are marked "left hand," "right hand," "lips" and "palate." Remove the appropriate swab from the swab tube, dip in the alcohol and swab the appropriate area. For the two hands, swab the thumb and tips of the fingers. For the palate, swab the roof of the mouth behind the front teeth. For the lips, swab the fleshy part of the lips, where a cigarette would normally contact the lips. Place the moist swabs back in their respective tubes, screw the caps on firmly and replace in the foam container and card sheath. Discard the alcohol bottle.

PLEASE PLACE ALL THE SPECIMENS IN A REFRIGERATOR UNTIL READY TO MAIL. (DO NOT FREEZE). Place two "blue ice" bags in the freezer to cool for shipment. These bags must be frozen before shipment.

5. Complete the Identification Card in duplicate. Place one copy in the plastic bag provided and place in the kit box. Retain the other copy for your files.

6. Place all the refrigerated specimens (and the ID card) in the foam kit box with the alcohol swab kit uppermost. Place the two frozen "blue ice" bags on the top of the specimens. Place the foam box in the cardboard box, seal the box with tape and mail back to Midwest Research Institute by Air Mail Special Delivery, C.O.D.--do not pay for the postage--MRI will assume all postage fees at the destination in Kansas City. Please mail out the specimens on Mondays and Tuesdays only; this will ensure that we will receive the specimens without a weekend delay.

7. Please complete the Crash Data Forms as soon as possible. Always complete Part A; complete Part B if police accident report is not available. File one copy safely and mail the other copy to MRI, along with the police accident report, if available, in the envelope provided.

Thank you

Please feel free to call us at (816) 561-0202, Ext. 242 if you have any questions

NHTSA Contract No. DOT-HS-4-00941, MRI Project No. 3963-E(2)
ACCIDENT IDENTIFICATION CARD - FATALLY INJURED DRIVER MRI Code _____

Name of Driver_____ Coroner's Case No. _____

Location of Crash: State _____ County _____

Address (Crash) _____

Date of Crash _____ Time of Crash _____

Time of Death _____ Time of Sample _____

Name of Coroner _____

Site of Blood Sample: Femoral artery ☐ Other (detail) _____

_____

Known drugs administered between time of accident and death:

Drug _____ Amount _____

Drug _____ Amount _____

Figure A-3 - Specimen Collection Kit ID Card

APPENDIX B

STUDY SURVEILLANCE BY THE MRI HUMAN SUBJECTS COMMITTEE

TABLE B-1

MIDWEST RESEARCH INSTITUTE
Human Subjects Committee

Surveillance Form

During the three-month period from_____to_____

I certify that:

A. _____ 1. I did no research involving humans.

_____ 2. I did research involving human volunteers, and the plan has been approved by the Human Subjects Committee and no change has been made in experimental procedure or in the method of obtaining patient consent.

_____ 3. I have made changes in the experimental procedure and/or in the method of obtaining consent, and these changes have received the approval of the Human Subjects Committee.

_____ 4. I plan to make changes in the experimental procedure and/or in the method of obtaining consent, and the Human Subjects Committee has been notified of these changes.

B. _____ For all research involving humans, I have obtained a signed statement of consent from every subject.

C. _____ I did observational research only. (The manipulation of an independent variable was not involved.)

D. _____ I did research involving human material, and this has been approved by the Human Subjects Committee.

E. _____ I did research involving confidential information from human subjects, and this has been approved by the Human Subjects Committee.

_____	_____	_____
PROJECT NUMBER	SIGNATURE	DATE

THIS COMPLETED FORM SHALL BE RETURNED TO THE CHAIRMAN OF THE MONITORING SUBCOMMITTEE WITHIN ONE WEEK OF THE COMPLETION OF EACH QUARTER OF THE WORK ON THE CONTRACT OR GRANT.

TABLE B-2

1. Excerpts from the Minutes of the Human Subjects Committee Meeting, May 21, 1975.

MRI Proposal E-2136, "A Comparison of Drug Use in Driver Fatalities and Similarly Exposed Drivers," submitted by Mr. Blackburn, co-principal investigator. Dr. Glauz was also present to answer questions. Mr. Blackburn explained that the program will involve roadside surveys and the collection of breath, urine, blood, and lip-swab samples. A local police officer, registered nurse, or medical technician and others will assist the MRI team at the site. Only male subjects will be accepted, and they will be rewarded by a small monetary fee after they have voluntarily consented to participate. Consent will be gained informally after the MRI team member has explained the survey and the subject has read a letter written by the town's mayor endorsing the survey. Typescripts of the project explanation and the request for a blood sample were presented to the Committee. Anonimity of the data will be preserved by not identifying the subjects. Blood samples will not be taken from minors, and care will be taken to determine that subjects giving blood have gained majority under local law. A potential risk to the subjects, other than the taking of their blood, includes the possibility of arrest, should the driver be found to be under the influence of alcohol or drugs. Such drivers will not be identified and the field supervisor will determine if aid is required in getting the person home. The police officer will be committed not to file charges against these individuals. The project team has adopted procedural steps to minimize the risk of making the survey in a traffic situation.

It was determined that the potential benefits from identifying significant factors contributing to highway deaths outweigh risks to the subjects, and that these risks have been minimized by the principal investigators. Mr. Dinwiddie moved that the proposal be approved. Dr. Castles seconded the motion, which was passed unanimously by those present and voting (Dr. Castles, Mr. Coburn, Mr. Dinwiddie Dr. House, Dr. McKeel, and Mr. Breed). Dr. House accepted the appointment of chairman of the monitoring subcommittee. He will advise the chairman of his choice of subcommittee members.

TABLE B-2 (Concluded)

2. Excerpts from the Minutes of the Human Subjects Committee Meeting, August 25, 1975.

MRI Project 3963-E, "A Comparison of Drug Use in Driver Fatalities and Similarly Exposed Drivers." The subcommittee report was submitted for information only. There were no comments.

3. Excerpts from the Minutes of the Human Subjects Committee Meeting, February 18, 1977.

MRI Project 3963-E, "A Comparison of Drug Use in Driver Fatalities and Similarly Exposed Drivers." Dr. House presented the final subcommittee review of the program, which involved 1,218 living subjects and 942 fatally injured subjects. There were no infections incurred in taking blood samples, no instances of subjects fainting, no problems in subjects volunteering their names, or other emergent problems. Mrs. Park moved that the report be approved. Dr. Graham seconded and the motion passed unanimously with Mr. Breed, Dr. Castles, Dr. Graham, Dr. House, Mrs. Park and Mr. Thronberry present and voting.

APPENDIX C

LETTERS OF INTRODUCTION GIVEN TO THE MOTORISTS REQUESTING THEIR VOLUNTARY COOPERATION IN THE SURVEY

CITY OF DALLAS

Dear Motorist:

You have been selected to participate in a Highway Safety Roadside Drug Usage Survey -- a study necessary for the benefit of the public at large to determine the incidence of drugs in a sample of the Dallas, Texas, driving population.

This survey is a crucial part of a highway safety research program and is being conducted by a research team from the Midwest Research Institute of Kansas City, Missouri. The funds were provided by the U. S. Department of Transportation.

This survey has the full support of City officials.

We are inviting you to assist Dallas and the National Highway Traffic Safety Administration in this study. Answers to any questions asked you and any fluid samples collected will be confidential. No identifying information such as name, address or drivers license number will be associated with the data collected. Under no circumstances will any information given to the survey staff be used against you or anyone else.

You are being offered this unique opportunity to participate in a meaningful program on traffic safety. However, you are under no obligation to do so. The information you give is a matter of your own conscience and free decision.

Thank you for your cooperation in this survey.

Sincerely,

John H. Pickett
Traffic Safety Coordinator

MEMPHIS & SHELBY COUNTY
TRAFFIC SAFETY COORDINATING COMMITTEE

SHELBY COUNTY COURT HOUSE 140 ADAMS
ROOM 304 TELEPHONE 528-3068
MEMPHIS, TENNESSEE 38103

RON MARSHAK
Executive Director

GEORGE FLETCHER
Alcohol Safety
Project/Coordinator

JACK HALEY
Pedestrian Safety
Project/Coordinator

GENERAL SESSIONS CT.
OF SHELBY COUNTY

TRAFFIC COURTS
CITY OF MEMPHIS

MEMPHIS POLICE DEPT.
CITY OF MEMPHIS

SHERIFF'S DEPARTMENT
SHELBY COUNTY

TRAFFIC ADVISORY COMM.
CITY OF MEMPHIS

TRAFFIC ADVISORY COMM.
SHELBY COUNTY

SAFETY COUNCIL
MEMPHIS & SHELBY CO.

TRAFFIC ENGINEER
CITY OF MEMPHIS

TRAFFIC ENGINEER
SHELBY COUNTY

BOARD OF EDUCATION
CITY OF MEMPHIS

BOARD OF EDUCATION
SHELBY COUNTY

SAFETY DIRECTOR
SHELBY COUNTY

HEALTH DEPARTMENT
MEMPHIS & SHELBY CO.

PLANNING COMMISSION
MEMPHIS & SHELBY CO.

VEHICLE INSPECTION
CITY OF MEMPHIS

HIGHWAY PATROL
STATE OF TENN.

Dear Motorist:

You have been selected to participate in a Traffic Safety Roadside Drug Usage Survey -- a study necessary for the benefit of the public at large to determine the incidence of drugs in a sample of the Memphis, Tennessee, driving population.

This survey is a crucial part of a traffic safety research program and is being conducted by a research team from Midwest Research Institute of Kansas City, Missouri. The funds were provided by the National Highway Traffic Safety Administration of the U. S. Department of Transportation.

This survey has my full support as well as that of other city officials.

We are inviting you to assist Memphis and the National Highway Traffic Safety Administration in this study. No record of the identity of persons participating in or refusing to participate in the survey shall be kept. Answers to any questions asked you and any fluid samples collected will be confidential and completely anonymous since no identifying information such as name, address, or drivers license number will be requested. Under no circumstances will any information given to the survey staff be used against you or anyone else.

You are being offered this unique opportunity to participate in a meaningful program on traffic safety. However, you are under no obligation to do so. The information you give is a matter of your own conscience and free decision.

Thank you very much for your cooperation in this survey.

Sincerely,

Ron Marshak

Ron Marshak
Director

RM/dg

APPENDIX D

SURVEY INSTRUMENT, SURVEY SITE IDENTIFIER SHEET, AND OCCUPATION CHECK LIST

ROADSIDE DRUG USAGE SURVEY

1. Sample Number 1 ___ ___ ___ ___
   (1) (2) (3) (4) (5)
   (Column "2" is Community Number)

2. Sampling Period ___
   (6)

3. Location Number ___ ___
   (7) (8)

Duplicate Items 9 through 15 from Identifier Sheet.

16. Day of Week (on which survey began)
   1( ) Monday
   2( ) Tuesday
   3( ) Wednesday
   4( ) Thursday
   5( ) Friday
   6( ) Saturday
   7( ) Sunday

17. Date ___ ___ ___ ___ ___ ___
   (17) (18) (19) (20) (21) (22)
   day month year

---

23. Interview
   1( ) Accepted, willing
   2( ) Accepted, unwilling
   3( ) Refused, excuse or polite
   4( ) Refused, belligerent

24. Time Interview Began ___ ___ : ___ ___
   (24-hour clock) (24) (25) (26) (27)
   (Code midnight as 00:00)

28. Estimate of Impairment
   1( ) None
   2( ) A little
   3( ) A lot
   4( ) Don't know
   If impaired, why_____

   _____

29. Race
   1( ) White
   2( ) Black
   3( ) Latin
   4( ) Oriental
   5( ) American Indian
   6( ) Other (specify)_____

30. Number of people in car ____

31. Car Model
   1( ) Family car (sedan, station wagon, etc.)
   2( ) Sporty and high performance (hot rods, sport cars)
   3( ) Car-Pickup (El Camino, Ranchero)
   4( ) Compacts (Pinto, Maverick, etc.)
   5( ) Foreign Compacts (VW, Renault, etc.)
   6( ) Minibus
   7( ) Truck Pickup
   8( ) Motorcycle
   9( ) Other_____

32. Vehicle Age and Condition
   1( ) 0-3 - Excellent
   2( ) - Fair
   3( ) - Poor
   4( ) 4-9 - Excellent
   5( ) - Fair
   6( ) - Poor
   7( ) ≥10 - Excellent
   8( ) - Fair
   9( ) - Poor

_____
Supervisor

_____
Nurse

_____
Recorder

33. What city or town do you live in, and what county?
1( ) Dallas, Texas
2( ) Memphis, Tennessee
3( ) Third Community
4( ) Surrounding towns in county
5( ) Other rural areas in the county
6( ) Adjacent counties
7( ) Outstate
8( ) Other state
9( ) Part time resident of survey community

34. What is your marital status?
1( ) Married
2( ) Married with children
3( ) Divorced
4( ) Separated
5( ) Widowed
6( ) Single (never married)

35. (If not married) With whom do you live?
1( ) Alone
2( ) Parent
3( ) Other relative
4( ) A friend
5( ) A group (Halfway House, Salvation Army, commune, etc.) > 4 people
6( ) Military
7( ) Other (specify)_____

36. In what age group do you fall? (Show Card 1)
1( ) 16-17
2( ) 18-19
3( ) 20-24
4( ) 25-29
5( ) 30-39
6( ) 40-49
7( ) 50-59
8( ) 60-69
9( ) 70 or over

37. What is the total annual income for your or your family? (Show Card 1)
1( ) Less than $1,000
2( ) $1,000 - $2,499
3( ) $2,500 - $4,999
4( ) $5,000 - $7,499
5( ) $7,500 - $9,999
6( ) $10,000 - $14,999
7( ) $15,000 - $19,999
8( ) $20,000 - $29,999
9( ) $30,000 or more

38. What is the highest educational level you've attained?
1( ) 6th grade or less
2( ) 7 - 9th grade
3( ) High school, incomplete
4( ) High school graduate
5( ) Special, non-college training (i.e., business, trade, technical, etc.)
6( ) College, incomplete
7( ) College graduate
8( ) 1 Year or more graduate work

39. What is your present employment status?
1( ) Unemployed, not looking for work
2( ) Unemployed, looking for work
3( ) Retired
4( ) Full-time student
5( ) Working full-time
6( ) Part-time employed
7( ) Part-time student
8( ) Other (specify)_____
9( ) Refused to answer

40. What kind of work do you do? (Probe and refer to occupation check list)
01( ) Professional
02( ) Semi-professional
03( ) Manager, Proprietor or Executive
04( ) Farm Owner
05( ) Sales
06( ) Farm Manager
07( ) Craftsman or Foreman
08( ) Clerical Worker
09( ) Operatives
10( ) Service or Protective
11( ) Farm Labor or Farm Foreman
12( ) Laborer (except farm)
13( ) Other (specify)_____
14( ) Does not apply
15( ) Refused to answer

42. Where were you coming from when we stopped you?
1( ) Own home
2( ) Friend's or relative's home
3( ) Work or school
4( ) Appointment (meeting, shopping, business)
5( ) Sport or recreational facility
6( ) Restaurant
7( ) Bar, tavern or private club
8( ) Just driving around
9( ) Other (specify)_____

43. Are you currently taking any medicines, pills, drugs or anything of that sort? (If so,) How long has it been since you took the medication? (Probe)

Would you please tell us the type or name of the medication	Times/Day (1 for once/day or less) (9 for as needed)	Hours Since Last Took	Prescription?
___ ___ _____ 43 44 Write in	___ 45	___ ___ 46 47	( ) 48
___ ___ _____ 49 50 Write in	___ 51	___ ___ 52 53	( ) 54
___ ___ _____ 55 56 Write in	___ 57	___ ___ 58 59	( ) 60
___ ___ _____ 61 62 Write in	___ 63	___ ___ 64 65	( ) 66
___ ___ _____ 67 68 Write in	___ 69	___ ___ 70 71	( ) 72

73. Drinking is an accepted part of business and social activity for many people. Do you ever drink alcoholic beverages? (If "yes" ask -- How many drinks have you had in the last 4 hours?)

XX ____ Enter number
98( ) None
99( ) Don't drink Go to Question 78

75. How long ago did you finish your last drink?
1( ) Less than 4 hours ago
2( ) Less than 3 hours ago
3( ) Less than 2 hours ago
4( ) Less than 1 hour ago
5( ) Less than 30 minutes ago
6( ) Less than 15 minutes ago
7( ) Was drinking when stopped

76. Now, I'd like you to blow into this tube. This is part of the procedure for gathering data for this survey.

XX ___ ___ (Enter BAC)
76 77
97( ) Negative or zero reading
98( ) Refused
99( ) Equipment or operator problem

78. This completes the questioning. The results of the Breathalyzer test will be available in about 2 minutes. While you are waiting for the results, I would like you to give us a urine sample. We have a toilet facility in this van for your convenience.
1( ) Accepted, willing
2( ) Accepted, unwilling
3( ) Accepted to mail
4( ) Accepted, small sample and mailer
5( ) Refused, excuse or polite
6( ) Refused, belligerent

79. Blood sample
1( ) Given, willing
2( ) Given, unwilling
3( ) Refused, excuse or polite
4( ) Refused, belligerent
5( ) Not requested-under age
6( ) Not requested-health reason
7( ) Could not locate vein

80. Some medications leave residues on the lips and fingers. As a final part of the interview, I would like for you to let us collect three swab samples from you.

Samples
1( ) All three swabs
2( ) Both hands
3( ) Lips
4( ) Lips and left hand
5( ) Lips and right hand
6( ) Left hand
7( ) Right hand
8( ) Refused, excuse or polite
9( ) Refused, belligerent
Explanations_____

Thank you very much for your cooperation and for your time.

SITE IDENTIFIER SHEET

1. Sampling Period ___

2. Location Number ___ ___

3. Date ___ ___ ___ ___ ___ ___
   day month year

9. Area Type
   1( ) Rural
   2( ) Suburban
   3( ) Urban

10. Road Type
   1( ) Freeway Exit
   2( ) City Street - One Way
   3( ) City Street - Two Way - 4 or more Lanes
   4( ) City Street - Two Way - 2 or 3 Lanes
   5( ) Highway - Divided
   6( ) Highway - Two Way - 4 or more Lanes
   7( ) Highway - Two Way - 2 or 3 Lanes

11. Relative Traffic Volume
   1( ) Low
   2( ) Medium
   3( ) High

12. 1-Hour, 1-Way Traffic Count ___ ___ ___ ___
   12 13 14 15

16. At this site:
   Last Sample Number ___ ___ ___ ___
   First Sample Number ___ ___ ___ ___

17. Comments:_____

_____

_____

OCCUPATION CHECK LIST

Code	
01	Professional: clergyman, dentist, physician, engineer, lawyer, professor, teacher, scientist, etc.
02	Semi-professional: accountant, actor, pilot, armed forces officer, artist, draftsman, librarian, musician, medical technician, etc.
03	Manager, proprietor, or executive: sales manager, store manager, factory supervisor, owner of own business, contractor, banker, government official, manufacturer, etc.
04	Farm Owner
05	Sales: life insurance, real estate, industrial or farm goods, etc.
06	Farm Manager
07	Craftsman or foreman: baker, carpenter, plumber, tailor, factory foreman, etc.
08	Clerical worker: sales clerk, office clerk, bookkeeper, ticket agent, etc.
09	Operatives: bus driver, chauffeur, deliveryman, route man, taxicab driver, truck or trailer-truck driver, etc.
10	Service or protective: armed-forces enlisted man, barber, beautician, policeman, waiter, fireman, etc.
11	Farm Laborer or Farm Foreman
12	Laborer (except farm): carpenter's helper, fisherman, garage laborer, gardener, longshoreman, truck driver's helper, warehouseman, etc.
13	Other
14	Refuse to Answer

APPENDIX E

DATA TYPE AND CODING FORMAT

I. Card Types

Type 1: Living Driver Interviews

Type 2: Living Driver Lab Results

Type 3: Fatally Injured Driver Lab Results

Type 4: Crash Data Form

II. Coding of Living Driver Interview

Code directly from interview form.

III. Coding of Chemical Analysis Data (Dead Drivers and Living Drivers)

Col. 1: Card Type (3 = Dead driver, 2 = Living driver)

Col. 2-5: Last four digits of MRI Sample Code. (Ignore "A" designation at this point)

Col. 6-7: Area Code (city or community)

Col. 8-9: Location number, Dallas or Memphis only. (Leave blank for other communities)

Col. 10-12: BAC, No decimal point. Special codes as follows:

* : 999 (no sample)

- : blank (negative)

>.30 : 301

trace: 001

Col. 13-18: Nicotine and Salicylate incidence; 1 means present, blank means not present or no sample. Colums are:

13 Urine, N

14 Urine, S

15 Blood, N

16 Blood, S

17 Bile, N Blank for Living Driver

18 Bile, S Blank for Living Driver

Cols. 19-24: First drug data set (detailed below)

Cols. 25-30, 31-36, 37-42, 43-48, 49-54, 44-60, 61-66, 67-72, 73-78:

Successive drug data sets, defined as for cols. 19-24 (see below)

Drug Data Set Coding:

The six digit fields accomplish 3 main purposes:

1. They indicate amount and type of drug detected;

2. They indicate when no fluid sample was available;

3. They indicate, for living drivers, when the urine sample was via a mailing tube.

The six digits are as follows:

1. Fluid type: 1 = Urine
2 = Blood
3 = Bile
4 = Urine Mailer (see below)

2-3. Drug type: 01 - 43: existing drug codes
99 = * (no sample)

4-6. Drug amount: XX.X
↑ understood decimal point, not punched

999: ≥100.0
000: trace

Punch one field for every drug confirmed by G. C.

If same drug confirmed for 2 fluids, punch 2 fields.

Punch one field for every fluid missing (shown as *) (No special field for bile for living drivers)

Punch an extra field for living drivers for whom urine sample was by a mailer (indicated by an "A" designation with the sample code.) The field will simply be a "4" followed by 5 blanks.
Note: Ignore the mailed sample if the associated regular sample (same sample code, without the A) included a urine sample which was analyzed, even if the results were different.

IV. Coding of Crash Data

Col. 1: Card Type (4)

Col. 2-5: Last 4 digits of MRI Sample Code.

Col. 6-7: Area Code (city or community).

Col. 8-9: Location number, Dallas or Memphis only. (Leave blank for other communities)

Col. 10-15: Date of Crash (Day, month, year; rather than as shown on information form).

Col. 16-19: Time of Crash (24 hr clock).

Col. 20-23: Time of Death (24 hr clock).

Col. 24: Day of Crash (1-7; Monday = 1).

Col. 25-28: Samples provided: 1 = yes, blank = no.

25: Blood
26: Bile
27: Urine
28: Swabs

Col. 29: Area Type (1 = Rural, 2 = Suburban, 3 = Urban).

Col. 30: Number of Vehicles Involved.

Col. 31: Type of Accident (1-7, See information form).

Col. 32: Vehicle Type of victim (1 = car, 2 = pickup truck, 3 = other truck, 4 = motorcycle, 5 = other).

Col. 33: Number of people in victim's vehicle.

Col. 34: Total number of fatalities, all vehicles.

Col. 35: Total number of injuries, all vehicles.

Col. 36: Victim culpability (1 = yes, blank = no).
Code as a "1" (culpable) if:

a) Single vehicle accident, or

b) victim's condition or behavior most likely contributed to the crash, or

c) Medical examiner's comments strongly implicate the victim--for example, victim going wrong way, at excessive speed, through red light, etc.

Col. 37: Sex of Victim (1 = male, 2 = female).

Col. 38-39: Age of Victim.

APPENDIX F

FREQUENCY TABULATIONS OF FATALLY INJURED DRIVER CRASH DATA

TABLE F-1

NUMBER OF FATALLY INJURED DRIVERS BY COLLECTION AREA

Collection Areas	Number	Percent
Wayne County, Michigan (including parts of Detroit	86	9.6
Fulton and Cobb Counties, Georgia (including parts of Atlanta)	52	5.8
Dallas County, Texas (excluding Dallas)	42	4.7
City of Dallas, Texas	81	9.0
Alameda County, California (including Oakland)	56	6.2
Harris County, Texas (including parts of Houston)	69	7.7
Hennepin County, Minnesota (including Minneapolis)	19	2.1
Duval, Clay and Nassau Counties, Florida (including Jacksonville)	63	7.0
Clark County, Nevada (including Las Vegas)	26	2.9
Orange and Osceola Counties, Florida (including Orlando)	44	4.9
Jackson County, Missouri (including Kansas City)	40	4.4
DuPage County, Illinois (including Wheaton)	36	4.0
Volusia, Putnam and Ilagler Counties, Florida (including Daytona Beach)	13	1.4
Bernalillo County, New Mexico (including Albuquerque)	26	2.9
Multnomah, Clackamas and Washington Counties, Oregon (including Portland)	39	4.3
Snohomish County, Washington (including Everett)	18	2.0
Outagamie County, Wisconsin (including Appleton)	11	1.2
Butler County, Pennsylvania (including Butler)	14	1.6
Randolph County, Illinois (including Chester)	3	0.3
Eau Claire and Jackson Counties, Wisconsin (including Eau Claire)	3	0.3
Shelby County, Tennessee (excluding Memphis)	2	0.2
City of Memphis, Tennessee	45	5.0
Dade County, Florida (including Miami)	68	7.6
Hillsborough County, Florida (including Tampa)	44	4.9
Total	900	100.0

TABLE F-2

YEAR OF FATAL CRASH

Year	Number	Percent
1974	117	13.0
1975	732	81.3
1976	51	5.7
Total	900	100.0

TABLE F-3

MONTH OF YEAR OF FATAL CRASH

Month	Number	Percent
January	80	8.9
February	71	7.9
March	68	7.6
April	81	9.0
May	79	8.8
June	84	9.3
July	76	8.5
August	63	7.0
September	53	5.9
October	56	6.2
November	91	10.1
December	97	10.8
Total	899	100.0

TABLE F-4

TIME OF DAY OF THE FATAL CRASH

Time Interval	Number	Percent
0001 - 0400	255	29.3
0401 - 0800	90	10.3
0801 - 1200	91	10.4
1201 - 1600	107	12.3
1601 - 2000	130	14.9
2001 - 2400	199	22.8
Total	872	100.0

TABLE F-5

DAY OF WEEK OF THE FATAL CRASH

Day of Week	Number	Percent
Monday	125	13.9
Tuesday	107	11.9
Wednesday	113	12.6
Thursday	92	10.2
Friday	124	13.8
Saturday	180	20.0
Sunday	159	17.7
Total	900	100.0

TABLE F-6

AREA TYPE OF THE FATAL CRASH LOCATION

Area Type	Number	Percent
Rural	169	25.8
Suburban	225	34.4
Urban	260	39.8
Total	654	100.0

TABLE F-7

NUMBER OF VEHICLES INVOLVED IN THE FATAL CRASH

Number of Vehicles	Number of Crashes	Percent
1	454	51.4
2	387	43.8
3	34	3.8
4	9	1.0
Total	884	100.0

Total Number of Known Vehicles in the Crashes = 1,366

TABLE F-8

NUMBER OF PEOPLE IN FATALLY INJURED DRIVERS' VEHICLE

Number of People	Number of Crashes	Percent
1	524	71.5
2	148	20.2
3	33	4.5
4	20	2.7
5	5	0.7
6	0	0.0
7	2	0.3
8	1	0.1
Total	733	100.0

Total Number of Known People in the Crashes = 1,046

TABLE F-9

TYPE OF ACCIDENT

Type of Accident	Number	Percent
Head On	166	18.7
Rear End	61	6.9
Angle	233	26.3
Fixed Object	283	31.9
Ran Off Road	63	7.1
Overturn	58	6.5
Other	23	2.6
Total	887	100.0

TABLE F-10

FATALLY INJURED DRIVERS' VEHICLE TYPE

Vehicle Type	Number	Percent
Car	670	74.8
Pickup Truck	74	8.3
Other Truck	28	3.1
Motorcycle	114	12.7
Other	10	1.1
Total	896	100.0

TABLE F-11

SEX OF THE FATALLY INJURED DRIVERS

Sex	Number	Percent
Male	751	83.7
Female	146	16.3
Total	897	100.0

TABLE F-12

AGE OF THE FATALLY INJURED DRIVERS

Age Group	Number	Percent	Cumulative Percent
Less than 16	9	1.0	1.0
16 - 17	49	5.6	6.6
18 - 19	86	9.7	16.3
20 - 24	194	22.0	38.3
25 - 29	146	16.5	54.8
30 - 39	148	16.8	71.6
40 - 49	75	8.5	80.1
50 - 59	86	9.7	89.8
60 - 69	50	5.7	95.5
70 and Over	40	4.5	100.0
Total	883	100.0	

TABLE F-13

CULPABILITY OF THE FATALLY INJURED DRIVERS

Culpability	Number	Percent
Not Culpable	254	28.2
Culpable	646	71.8
Total	900	100.0

TABLE F-14

TOTAL NUMBER OF FATALITIES IN ALL VEHICLES INVOLVED IN THE FATAL CRASHES

Number of Fatalities	Number of Crashes	Percent
1	789	89.3
2	78	8.8
3	15	1.7
4	0	0.0
5	2	0.2
Total	884	100.0

Total number of known fatalities in the crashes = 1,000.

TABLE F-15

TOTAL NUMBER OF NON-FATAL INJURIES IN ALL VEHICLES INVOLVED IN THE FATAL CRASHES

Number of Non-Fatal Injuries	Number of Crashes	Percent
0	669	74.3
1	138	15.3
2	46	5.1
3	27	3.0
4	12	1.3
5	3	0.3
6	4	0.4
7	1	0.1
Total	231	100.0

Total number of non-fatal injuries in the crash = 405.

APPENDIX G

RESPONSES FROM SURVEY INSTRUMENT

Question		Dallas		Memphis	
		Number	Percent	Number	Percent
1	LIVING DRIVER SURVEY				
9	AREA TYPE	759		437	
	RURAL	61	8.04	0	0.00
	SUBURBAN	415	54.68	174	39.82
	URBAN	283	37.29	263	60.18
10	ROAD TYPE	759		437	
	FREEWAY EXIT	112	14.76	78	17.85
	CITY ST ONE WAY	58	7.64	35	8.01
	CITY ST TWO WAY 4 LN	248	32.67	154	35.24
	CITY ST TWO WAY 2-3 LN	122	16.07	90	20.59
	HWY DIVIDED	93	12.25	46	10.53
	HWY TWO WAY 4 LN	108	14.23	17	3.89
	HWY TWO WAY 2-3 LN	18	2.37	17	3.89
11	TRAFFIC VOLUME	759		437	
	LOW	259	34.12	173	39.59
	MEDIUM	284	37.42	136	31.12
	HIGH	216	28.46	128	29.29
16	DAY OF WEEK	759		437	
	MON	99	13.04	61	13.96
	TUES	65	8.56	73	16.70
	WED	74	9.75	50	11.44
	THUR	112	14.76	61	13.96
	FRI	173	22.79	8	1.83
	SAT	119	15.68	53	12.13
	SUN	117	15.42	131	29.98
23	INTERVIEW PARTICIPATION	758		435	
	ACCEPTED-WILLING	612	80.74	361	82.99
	ACCEPTED-UNWILLING	75	9.89	47	10.80
	REFUSED-POLITE	63	8.31	26	5.98
	REFUSED-BELLIGERENT	8	1.06	1	.23
28	ESTIMATE OF IMPAIRMENT	754		435	
	NONE	673	89.26	406	93.33
	A LITTLE	76	10.08	24	5.52
	A LOT	4	.53	2	.46
	DON'T KNOW	1	.13	2	.46
29	RACE	753		435	
	WHITE	460	61.09	248	57.01
	BLACK	236	31.34	184	42.30
	LATIN	54	7.17	1	.23
	ORIENTAL	2	.27	2	.46
	AMERICAN INDIAN	0	0.00	0	0.00
	OTHER	1	.13	0	0.00

Question		Dallas		Memphis	
		Number	Percent	Number	Percent
30	NUMBER OF PEOPLE IN CAR	748		432	
	ONE	434	58.02	258	59.72
	TWO	199	26.60	102	23.61
	THREE	64	8.56	44	10.19
	FOUR	29	3.88	13	3.01
	FIVE	14	1.87	12	2.78
	SIX	3	.40	2	.46
	SEVEN	4	.53	0	0.00
	EIGHT	1	.13	1	.23
	NINE OR MORE	0	0.00	0	0.00
31	CAR MODEL	753		434	
	FAMILY CAR (SEDAN ETC)	418	55.51	316	72.81
	SPORTY	91	12.08	23	5.30
	CAR-PICKUP	20	2.66	8	1.84
	COMPACT (PINTO ETC)	52	6.91	20	4.61
	FOREIGN COMPACT	34	4.52	13	3.00
	MINIBUS	11	1.46	1	.23
	TRUCK-PICKUP	107	14.21	45	10.37
	MOTORCYCLE	7	.93	1	.23
	OTHER	13	1.73	7	1.61
32	VEHICLE AGE-CONDITION	754		436	
	0-3 - EXCELLENT	281	37.27	161	36.93
	0-3 - FAIR	83	11.01	33	7.57
	0-3 - POOR	6	.80	0	0.00
	4-9 - EXCELLENT	71	9.42	57	13.07
	4-9 - FAIR	198	26.25	128	29.36
	4-9 - POOR	24	3.18	12	2.75
	>10 - EXCELLENT	9	1.19	6	1.38
	>10 - FAIR	53	7.03	20	4.59
	>10 - POOR	29	3.85	19	4.36
33	CITY,TOWN OF RESIDENCE	708		414	
	DALLAS, TEXAS	509	71.89	0	0.00
	MEMPHIS,TENNESSEE	0	0.00	341	82.37
	THIRD SURVEY COMMUNITY	2	.28	0	0.00
	NEARBY TOWNS IN COUNTY	133	18.79	22	5.31
	RURAL AREAS IN COUNTY	8	1.13	1	.24
	ADJACENT COUNTIES	26	3.67	6	1.45
	OUTSTATE	18	2.54	10	2.42
	OTHER STATE	10	1.41	34	8.21
	PART TIME RESIDENT	2	.28	0	0.00
34	MARITAL STATUS	699		411	
	MARRIED	134	19.17	46	11.19
	MARRIED WITH CHILDREN	316	45.21	204	49.64
	DIVORCED	32	4.58	31	7.54
	SEPARATED	10	1.43	15	3.65
	WIDOWED	3	.43	5	1.22
	SINGLE (NEVER MARRIED)	204	29.18	110	26.76

Question		Dallas		Memphis	
		Number	Percent	Number	Percent
35	WITH WHOM DO YOU LIVE	245		151	
	ALONE	74	30.20	44	29.14
	PARENT	102	41.63	68	45.03
	OTHER RELATIVE	26	10.61	13	8.61
	FRIEND	42	17.14	21	13.91
	GROUP(HALFWAY HSE ETC)	1	.41	1	.66
	MILITARY	0	0.00	4	2.65
	OTHER	0	0.00	0	0.00
36	AGE GROUP	746		412	
	16-17	36	4.83	11	2.67
	18-19	45	6.03	18	4.37
	20-24	124	16.62	84	20.39
	25-29	136	18.23	64	15.53
	30-39	170	22.79	97	23.54
	40-49	111	14.88	69	16.75
	50-59	79	10.59	42	10.19
	60-69	39	5.23	20	4.85
	70 OR OLDER	6	.80	7	1.70
37	TOTAL ANNUAL INCOME	759		437	
	UNDER $1,000	21	2.77	7	1.60
	1,000-2,499	27	3.56	13	2.97
	2,500-4,999	53	6.98	28	6.41
	5,000-7,499	99	13.04	61	13.96
	7,500-9,999	103	13.57	46	10.53
	10,000-14,999	165	21.74	122	27.92
	15,000-19,999	97	12.78	67	15.33
	20,000-29,999	77	10.14	43	9.84
	30,000 OR MORE	41	5.40	13	2.97
	UNKNOWN	76	10.01	37	8.47
38	EDUCATION	696		411	
	6TH GRADE OR LESS	47	6.75	27	6.57
	7-9TH GRADE	69	9.91	43	10.46
	HIGH SCHOOL-INCOMPLETE	117	16.81	57	13.87
	HIGH SCHOOL GRADUATE	163	23.42	114	27.74
	SPECIAL TRAINING	42	6.03	25	6.08
	COLLEGE-INCOMPLETE	167	23.99	92	22.38
	COLLEGE GRADUATE	57	8.19	31	7.54
	YEAR OR MORE GRADUATE	34	4.89	22	5.35
39	EMPLOYMENT STATUS	696		411	
	UNEMPLOYED,NOT LOOKING	4	.57	6	1.46
	UNEMPLOYED,LOOKING	25	3.59	12	2.92
	RETIRED	19	2.73	16	3.89
	FULL-TIME STUDENT	50	7.18	30	7.30
	WORKING FULL-TIME	553	79.45	313	76.16
	PART-TIME EMPLOYED	29	4.17	23	5.60
	PART-TIME STUDENT	6	.86	1	.24
	OTHER	10	1.44	10	2.43
	REFUSED TO ANSWER	0	0.00	0	0.00

Question		Dallas		Memphis	
		Number	Percent	Number	Percent
40	KIND OF WORK	684		410	
	PROFESSIONAL	47	6.87	19	4.63
	SEMI-PROFESSIONAL	37	5.41	25	6.10
	MANAGER,EXECUTIVE ETC	80	11.70	33	8.05
	FARM OWNER	0	0.00	3	.73
	SALES	39	5.70	26	6.34
	FARM MANAGER	1	.15	0	0.00
	CRAFTSMAN OR FOREMAN	127	18.57	48	11.71
	CLERICAL WORKER	47	6.87	24	5.85
	OPERATIVES	65	9.50	56	13.66
	SERVICE OR PROTECTIVE	55	8.04	30	7.32
	FARM-LABOR OR FOREMAN	2	.29	0	0.00
	NON-FARM LABORER	119	17.40	81	19.76
	OTHER	27	3.95	13	3.17
	DOES NOT APPLY	38	5.56	52	12.68
	REFUSED TO ANSWER	0	0.00	0	0.00
42	WHERE COMING FROM	695		411	
	OWN HOME	180	25.90	126	30.66
	FRIEND OR RELATIVE HOME	128	18.42	79	19.22
	WORK OR SCHOOL	159	22.88	83	20.19
	APPOINTMENT	87	12.52	48	11.68
	SPORT OR REC. FACILITY	39	5.61	12	2.92
	RESTAURANT	36	5.18	18	4.38
	BAR,TAVERN,PRIVATE CLUB	28	4.03	18	4.38
	JUST DRIVING AROUND	19	2.73	8	1.95
	OTHER	19	2.73	19	4.62
43	TYPE OF 1ST PRESCRIPTION	119		57	
	TRANQUILIZERS	19	15.97	5	8.77
	ANALGESICS-ANTIPYRETICS	4	3.36	4	7.02
	STIMULANTS-ANORETICS	5	4.20	2	3.51
	HORMONES AND STEROIDS	0	0.00	1	1.75
	SEDATIVES AND HYPNOTICS	1	.84	0	0.00
	ANTI-INFECTIVE AGENTS	12	10.08	8	14.04
	VITAMINS AND MINERALS	2	1.68	0	0.00
	ANTIDIABETICS	6	5.04	3	5.26
	ANTIHISTAMINES	13	10.92	3	5.26
	ANTICOAGULANTS	0	0.00	1	1.75
	ANALGESIC NARCOTICS	1	.84	1	1.75
	ANTICHOLINERGICS	0	0.00	0	0.00
	DIURETICS-URICOSURICS	7	5.88	3	5.26
	ANTIASTHMATICS	2	1.68	2	3.51
	ANTIARTHRITICS	1	.84	1	1.75
	ANTISPASMODICS	2	1.68	1	1.75
	ANTACIDS-INTESTINAL ABS	1	.84	1	1.75
	LAXATIVES	0	0.00	0	0.00
	ANESTHETICS	0	0.00	0	0.00
	MARIJUANA	0	0.00	0	0.00
	LSD	0	0.00	0	0.00
	HASHISH	0	0.00	0	0.00
	MESCALINE	0	0.00	0	0.00
	MISCELLANEOUS	7	5.88	1	1.75
	UNKNOWN	36	30.25	20	35.09

Question		Dallas		Memphis	
		Number	Percent	Number	Percent
49	TYPE OF 2ND PRESCRIPTION	40		23	
	TRANQUILIZERS	8	20.00	3	13.04
	ANALGESICS-ANTIPYRETICS	2	5.00	1	4.35
	STIMULANTS-ANORETICS	0	0.00	0	0.00
	HORMONES AND STEROIDS	1	2.50	0	0.00
	SEDATIVES AND HYPNOTICS	0	0.00	0	0.00
	ANTI-INFECTIVE AGENTS	3	7.50	3	13.04
	VITAMINS AND MINERALS	0	0.00	1	4.35
	ANTIDIABETICS	1	2.50	1	4.35
	ANTIHISTAMINES	1	2.50	0	0.00
	ANTICOAGULANTS	1	2.50	0	0.00
	ANALGESIC NARCOTICS	0	0.00	0	0.00
	ANTICHOLINERGICS	0	0.00	0	0.00
	DIURETICS-URICOSURICS	0	0.00	1	4.35
	ANTIASTHMATICS	3	7.50	0	0.00
	ANTIARTHRITICS	0	0.00	0	0.00
	ANTISPASMODICS	0	0.00	0	0.00
	ANTACIDS-INTESTINAL ABS	1	2.50	0	0.00
	LAXATIVES	0	0.00	0	0.00
	ANESTHETICS	0	0.00	0	0.00
	MARIJUANA	0	0.00	0	0.00
	LSD	0	0.00	0	0.00
	HASHISH	0	0.00	0	0.00
	MESCALINE	0	0.00	0	0.00
	MISCELLANEOUS	6	15.00	0	0.00
	UNKNOWN	13	32.50	13	56.52
55	TYPE OF 3RD PRESCRIPTION	11		6	
	TRANQUILIZERS	1	9.09	0	0.00
	ANALGESICS-ANTIPYRETICS	0	0.00	0	0.00
	STIMULANTS-ANORETICS	0	0.00	1	16.67
	HORMONES AND STEROIDS	0	0.00	0	0.00
	SEDATIVES AND HYPNOTICS	0	0.00	0	0.00
	ANTI-INFECTIVE AGENTS	1	9.09	0	0.00
	VITAMINS AND MINERALS	2	18.18	0	0.00
	ANTIDIABETICS	1	9.09	1	16.67
	ANTIHISTAMINES	1	9.09	1	16.67
	ANTICOAGULANTS	0	0.00	0	0.00
	ANALGESIC NARCOTICS	0	0.00	0	0.00
	ANTICHOLINERGICS	0	0.00	0	0.00
	DIURETICS-URICOSURICS	1	9.09	1	16.67
	ANTIASTHMATICS	0	0.00	0	0.00
	ANTIARTHRITICS	0	0.00	0	0.00
	ANTISPASMODICS	0	0.00	1	16.67
	ANTACIDS-INTESTINAL ABS	0	0.00	0	0.00
	LAXATIVES	0	0.00	0	0.00
	ANESTHETICS	0	0.00	0	0.00
	MARIJUANA	0	0.00	0	0.00
	LSD	0	0.00	0	0.00
	HASHISH	0	0.00	0	0.00
	MESCALINE	0	0.00	0	0.00
	MISCELLANEOUS	0	0.00	0	0.00
	UNKNOWN	4	36.36	1	16.67

Question		Dallas		Memphis	
		Number	Percent	Number	Percent
61	TYPE OF 4TH PRESCRIPTION	5		2	
	TRANQUILIZERS	0	0.00	0	0.00
	ANALGESICS-ANTIPYRETICS	0	0.00	0	0.00
	STIMULANTS-ANORETICS	1	20.00	1	50.00
	HORMONES AND STEROIDS	0	0.00	0	0.00
	SEDATIVES AND HYPNOTICS	1	20.00	0	0.00
	ANTI-INFECTIVE AGENTS	0	0.00	0	0.00
	VITAMINS AND MINERALS	0	0.00	0	0.00
	ANTIDIABETICS	0	0.00	0	0.00
	ANTIHISTAMINES	1	20.00	0	0.00
	ANTICOAGULANTS	0	0.00	0	0.00
	ANALGESIC NARCOTICS	0	0.00	0	0.00
	ANTICHOLINERGICS	0	0.00	0	0.00
	DIURETICS-URICOSURICS	1	20.00	0	0.00
	ANTIASTHMATICS	0	0.00	0	0.00
	ANTIARTHRITICS	0	0.00	0	0.00
	ANTISPASMODICS	0	0.00	0	0.00
	ANTACIDS-INTESTINAL ABS	0	0.00	0	0.00
	LAXATIVES	0	0.00	0	0.00
	ANESTHETICS	0	0.00	0	0.00
	MARIJUANA	0	0.00	0	0.00
	LSD	0	0.00	0	0.00
	HASHISH	0	0.00	0	0.00
	MESCALINE	0	0.00	0	0.00
	MISCELLANEOUS	1	20.00	0	0.00
	UNKNOWN	0	0.00	1	50.00
67	TYPE OF 5TH PRESCRIPTION	2		1	
	TRANQUILIZERS	0	0.00	0	0.00
	ANALGESICS-ANTIPYRETICS	0	0.00	0	0.00
	STIMULANTS-ANORETICS	0	0.00	0	0.00
	HORMONES AND STEROIDS	0	0.00	0	0.00
	SEDATIVES AND HYPNOTICS	2	100.00	0	0.00
	ANTI-INFECTIVE AGENTS	0	0.00	0	0.00
	VITAMINS AND MINERALS	0	0.00	0	0.00
	ANTIDIABETICS	0	0.00	0	0.00
	ANTIHISTAMINES	0	0.00	0	0.00
	ANTICOAGULANTS	0	0.00	0	0.00
	ANALGESIC NARCOTICS	0	0.00	0	0.00
	ANTICHOLINERGICS	0	0.00	0	0.00
	DIURETICS-URICOSURICS	0	0.00	0	0.00
	ANTIASTHMATICS	0	0.00	0	0.00
	ANTIARTHRITICS	0	0.00	0	0.00
	ANTISPASMODICS	0	0.00	0	0.00
	ANTACIDS-INTESTINAL ABS	0	0.00	0	0.00
	LAXATIVES	0	0.00	0	0.00
	ANESTHETICS	0	0.00	0	0.00
	MARIJUANA	0	0.00	0	0.00
	LSD	0	0.00	0	0.00
	HASHISH	0	0.00	0	0.00
	MESCALINE	0	0.00	0	0.00
	MISCELLANEOUS	0	0.00	1	100.00
	UNKNOWN	0	0.00	0	0.00

Question		Dallas Number	Dallas Percent	Memphis Number	Memphis Percent
	HOW OFTEN 1ST-PRESCRIPTN				
45	NUMBER MOTORISTS ASKED	759		437	
	TAKING 1ST PRESCRIPTION	119	15.68	57	13.04
	ONCE A DAY	35	4.61	18	4.12
	2 TIMES A DAY	30	3.95	8	1.83
	3 TIMES A DAY	16	2.11	7	1.60
	4 TIMES A DAY	12	1.58	8	1.83
	5-6 TIMES A DAY	4	.53	4	.92
	7-8 TIMES A DAY	0	0.00	1	.23
	WHEN NEEDED	22	2.90	11	2.52
	NOT TAKING	640	84.32	380	86.96
	HOW OFTEN 2ND-PRESCRIPTN				
51	NUMBER MOTORISTS ASKED	759		437	
	TAKING 2ND PRESCRIPTION	40	5.27	23	5.26
	ONCE A DAY	17	2.24	8	1.83
	2 TIMES A DAY	7	.92	6	1.37
	3 TIMES A DAY	5	.66	2	.46
	4 TIMES A DAY	4	.53	2	.46
	5-6 TIMES A DAY	3	.40	1	.23
	7-8 TIMES A DAY	0	0.00	0	0.00
	WHEN NEEDED	4	.53	4	.92
	NOT TAKING	719	94.73	414	94.74
	HOW OFTEN 3RD-PRESCRIPTN				
57	NUMBER MOTORISTS ASKED	759		437	
	TAKING 3RD PRESCRIPTION	11	1.45	6	1.37
	ONCE A DAY	6	.79	0	0.00
	2 TIMES A DAY	2	.26	3	.69
	3 TIMES A DAY	2	.26	2	.46
	4 TIMES A DAY	0	0.00	0	0.00
	5-6 TIMES A DAY	0	0.00	0	0.00
	7-8 TIMES A DAY	0	0.00	0	0.00
	WHEN NEEDED	1	.13	1	.23
	NOT TAKING	748	98.55	431	98.63
	HOW OFTEN 4TH-PRESCRIPTN				
63	NUMBER MOTORISTS ASKED	759		437	
	TAKING 4TH PRESCRIPTION	5	.66	2	.46
	ONCE A DAY	3	.40	0	0.00
	2 TIMES A DAY	2	.26	0	0.00
	3 TIMES A DAY	0	0.00	1	.23
	4 TIMES A DAY	0	0.00	1	.23
	5-6 TIMES A DAY	0	0.00	0	0.00
	7-8 TIMES A DAY	0	0.00	0	0.00
	WHEN NEEDED	0	0.00	0	0.00
	NOT TAKING	754	99.34	435	99.54

Question		Dallas Number	Dallas Percent	Memphis Number	Memphis Percent
	HOW OFTEN 5TH-PRESCRIPTN				
69	NUMBER MOTORISTS ASKED	759		437	
	TAKING 5TH PRESCRIPTION	1	.13	1	.23
	ONCE A DAY	1	.13	0	0.00
	2 TIMES A DAY	0	0.00	1	.23
	3 TIMES A DAY	0	0.00	0	0.00
	4 TIMES A DAY	0	0.00	0	0.00
	5-6 TIMES A DAY	0	0.00	0	0.00
	7-8 TIMES A DAY	0	0.00	0	0.00
	WHEN NEEDED	0	0.00	0	0.00
	NOT TAKING	758	99.87	436	99.77
46	HOW LONG AGO-1ST PRESCPT	119		57	
	1 HOUR OR LESS	12	10.08	4	7.02
	1-2 HOURS	10	8.40	4	7.02
	2-3 HOURS	7	5.88	2	3.51
	3-4 HOURS	9	7.56	4	7.02
	4-8 HOURS	21	17.65	10	17.54
	8-12 HOURS	25	21.01	14	24.56
	12-24 HOURS	22	18.49	10	17.54
	24-36 HOURS	2	1.68	2	3.51
	36-48 HOURS	4	3.36	3	5.26
	2-4 DAYS	1	.84	0	0.00
	MORE THAN 4 DAYS AGO	6	5.04	4	7.02
52	HOW LONG AGO-2ND PRESCPT	40		23	
	1 HOUR OR LESS	4	10.00	3	13.04
	1-2 HOURS	4	10.00	2	8.70
	2-3 HOURS	2	5.00	0	0.00
	3-4 HOURS	2	5.00	0	0.00
	4-8 HOURS	6	15.00	2	8.70
	8-12 HOURS	8	20.00	7	30.43
	12-24 HOURS	9	22.50	5	21.74
	24-36 HOURS	0	0.00	1	4.35
	36-48 HOURS	2	5.00	1	4.35
	2-4 DAYS	2	5.00	2	8.70
	MORE THAN 4 DAYS	1	2.50	0	0.00
58	HOW LONG AGO-3RD PRESCPT	11		6	
	1 HOUR OR LESS	2	18.18	0	0.00
	1-2 HOURS	2	18.18	2	33.33
	2-3 HOURS	0	0.00	0	0.00
	3-4 HOURS	1	9.09	0	0.00
	4-8 HOURS	2	18.18	0	0.00
	8-12 HOURS	1	9.09	1	16.67
	12-24 HOURS	2	18.18	1	16.67
	24-36 HOURS	0	0.00	1	16.67
	36-48 HOURS	0	0.00	1	16.67
	2-4 DAYS	0	0.00	0	0.00
	MORE THAN 4 DAYS	1	9.09	0	0.00

Question		Dallas		Memphis	
		Number	Percent	Number	Percent
64	HOW LONG AGO-4TH PRESCPT	5		2	
	1 HOUR OR LESS	1	20.00	0	0.00
	1-2 HOURS	0	0.00	2	100.00
	2-3 HOURS	0	0.00	0	0.00
	3-4 HOURS	0	0.00	0	0.00
	4-8 HOURS	1	20.00	0	0.00
	8-12 HOURS	2	40.00	0	0.00
	12-24 HOURS	1	20.00	0	0.00
	24-36 HOURS	0	0.00	0	0.00
	36-48 HOURS	0	0.00	0	0.00
	2-4 DAYS	0	0.00	0	0.00
	MORE THAN 4 DAYS	0	0.00	0	0.00
70	HOW LONG AGO-5TH PRESCPT	2		1	
	1 HOUR OR LESS	0	0.00	0	0.00
	1-2 HOURS	0	0.00	1	100.00
	2-3 HOURS	0	0.00	0	0.00
	3-4 HOURS	0	0.00	0	0.00
	4-8 HOURS	0	0.00	0	0.00
	8-12 HOURS	0	0.00	0	0.00
	12-24 HOURS	2	100.00	0	0.00
	24-36 HOURS	0	0.00	0	0.00
	36-48 HOURS	0	0.00	0	0.00
	2-4 DAYS	0	0.00	0	0.00
	MORE THAN 4 DAYS	0	0.00	0	0.00
43	TYPE OF 1ST NON-PRESCRPT	112		69	
	TRANQUILIZERS	1	.89	2	2.90
	ANALGESICS-ANTIPYRETICS	44	39.29	33	47.83
	STIMULANTS-ANDRETICS	0	0.00	2	2.90
	HORMONES AND STEROIDS	0	0.00	0	0.00
	SEDATIVES AND HYPNOTICS	1	.89	0	0.00
	ANTI-INFECTIVE AGENTS	3	2.68	0	0.00
	VITAMINS AND MINERALS	33	29.46	14	20.29
	ANTIDIABETICS	0	0.00	1	1.45
	ANTIHISTAMINES	13	11.61	8	11.59
	ANTICOAGULANTS	0	0.00	0	0.00
	ANALGESIC NARCOTICS	0	0.00	0	0.00
	ANTICHOLINERGICS	0	0.00	0	0.00
	DIURETICS-URICOSURICS	0	0.00	0	0.00
	ANTIASTHMATICS	2	1.79	1	1.45
	ANTIARTHRITICS	0	0.00	0	0.00
	ANTISPASMODICS	0	0.00	0	0.00
	ANTACIDS-INTESTINAL ABS	4	3.57	5	7.25
	LAXATIVES	0	0.00	0	0.00
	ANESTHETICS	0	0.00	0	0.00
	MARIJUANA	6	5.36	1	1.45
	LSD	0	0.00	0	0.00
	HASHISH	0	0.00	0	0.00
	MESCALINE	0	0.00	0	0.00
	MISCELLANEOUS	4	3.57	0	0.00
	UNKNOWN	1	.89	2	2.90

Question		Dallas Number	Dallas Percent	Memphis Number	Memphis Percent
49	TYPE OF 2ND NON-PRESCRPT	28		16	
	TRANQUILIZERS	0	0.00	1	6.25
	ANALGESICS-ANTIPYRETICS	3	10.71	8	50.00
	STIMULANTS-ANORETICS	1	3.57	0	0.00
	HORMONES AND STEROIDS	0	0.00	0	0.00
	SEDATIVES AND HYPNOTICS	0	0.00	0	0.00
	ANTI-INFECTIVE AGENTS	0	0.00	0	0.00
	VITAMINS AND MINERALS	8	28.57	3	18.75
	ANTIDIABETICS	0	0.00	0	0.00
	ANTIHISTAMINES	5	17.86	1	6.25
	ANTICOAGULANTS	0	0.00	0	0.00
	ANALGESIC NARCOTICS	0	0.00	0	0.00
	ANTICHOLINERGICS	0	0.00	0	0.00
	DIURETICS-URICOSURICS	0	0.00	0	0.00
	ANTIASTHMATICS	2	7.14	0	0.00
	ANTIARTHRITICS	0	0.00	0	0.00
	ANTISPASMODICS	0	0.00	0	0.00
	ANTACIDS-INTESTINAL ABS	4	14.29	0	0.00
	LAXATIVES	0	0.00	0	0.00
	ANESTHETICS	0	0.00	0	0.00
	MARIJUANA	0	0.00	1	6.25
	LSD	0	0.00	0	0.00
	HASHISH	0	0.00	0	0.00
	MESCALINE	0	0.00	0	0.00
	MISCELLANEOUS	1	3.57	0	0.00
	UNKNOWN	4	14.29	2	12.50
55	TYPE OF 3RD NON-PRESCRPT	14		6	
	TRANQUILIZERS	0	0.00	0	0.00
	ANALGESICS-ANTIPYRETICS	3	21.43	2	33.33
	STIMULANTS-ANORETICS	0	0.00	0	0.00
	HORMONES AND STEROIDS	0	0.00	0	0.00
	SEDATIVES AND HYPNOTICS	0	0.00	0	0.00
	VITAMINS AND MINERALS	7	50.00	3	50.00
	ANTIDIABETICS	0	0.00	0	0.00
	ANTIHISTAMINES	1	7.14	0	0.00
	ANTICOAGULANTS	0	0.00	0	0.00
	ANALGESIC NARCOTICS	0	0.00	0	0.00
	ANTICHOLINERGICS	0	0.00	0	0.00
	DIURETICS-URICOSURICS	0	0.00	0	0.00
	ANTIASTHMATICS	2	14.29	0	0.00
	ANTIARTHRITICS	0	0.00	0	0.00
	ANTISPASMODICS	0	0.00	0	0.00
	ANTACIDS-INTESTINAL ABS	1	7.14	0	0.00
	LAXATIVES	0	0.00	0	0.00
	ANESTHETICS	0	0.00	0	0.00
	MARIJUANA	0	0.00	0	0.00
	LSD	0	0.00	0	0.00
	HASHISH	0	0.00	0	0.00
	MESCALINE	0	0.00	0	0.00
	MISCELLANEOUS	0	0.00	1	16.67
	UNKNOWN	0	0.00	0	0.00

Question		Dallas		Memphis	
		Number	Percent	Number	Percent
61	TYPE OF 4TH NON-PRESCRPT	1		2	
	TRANQUILIZERS	0	0.00	0	0.00
	ANALGESICS-ANTIPYRETICS	0	0.00	0	0.00
	STIMULANTS-ANORETICS	0	0.00	0	0.00
	HORMONES AND STEROIDS	0	0.00	0	0.00
	SEDATIVES AND HYPNOTICS	0	0.00	0	0.00
	ANTI-INFECTIVE AGENTS	0	0.00	0	0.00
	VITAMINS AND MINERALS	1	100.00	2	100.00
	ANTIDIABETICS	0	0.00	0	0.00
	ANTIHISTAMINES	0	0.00	0	0.00
	ANTICOAGULANTS	0	0.00	0	0.00
	ANALGESIC NARCOTICS	0	0.00	0	0.00
	ANTICHOLINERGICS	0	0.00	0	0.00
	DIURETICS-URICOSURICS	0	0.00	0	0.00
	ANTIASTHMATICS	0	0.00	0	0.00
	ANTIARTHRITICS	0	0.00	0	0.00
	ANTISPASMODICS	0	0.00	0	0.00
	ANTACIDS-INTESTINAL ABS	0	0.00	0	0.00
	LAXATIVES	0	0.00	0	0.00
	ANESTHETICS	0	0.00	0	0.00
	MARIJUANA	0	0.00	0	0.00
	LSD	0	0.00	0	0.00
	HASHISH	0	0.00	0	0.00
	MESCALINE	0	0.00	0	0.00
	MISCELLANEOUS	0	0.00	0	0.00
	UNKNOWN	0	0.00	0	0.00
67	TYPE OF 5TH NON-PRESCRPT	1		1	
	TRANQUILIZERS	0	0.00	0	0.00
	ANALGESICS-ANTIPYRETICS	0	0.00	1	100.00
	STIMULANTS-ANORETICS	0	0.00	0	0.00
	HORMONES AND STEROIDS	0	0.00	0	0.00
	SEDATIVES AND HYPNOTICS	0	0.00	0	0.00
	ANTI-INFECTIVE AGENTS	0	0.00	0	0.00
	VITAMINS AND MINERALS	1	100.00	0	0.00
	ANTIDIABETICS	0	0.00	0	0.00
	ANTIHISTAMINES	0	0.00	0	0.00
	ANTICOAGULANTS	0	0.00	0	0.00
	ANALGESIC NARCOTICS	0	0.00	0	0.00
	ANTICHOLINERGICS	0	0.00	0	0.00
	DIURETICS-URICOSURICS	0	0.00	0	0.00
	ANTIASTHMATICS	0	0.00	0	0.00
	ANTIARTHRITICS	0	0.00	0	0.00
	ANTISPASMODICS	0	0.00	0	0.00
	ANTACIDS-INTESTINAL ABS	0	0.00	0	0.00
	LAXATIVES	0	0.00	0	0.00
	ANESTHETICS	0	0.00	0	0.00
	MARIJUANA	0	0.00	0	0.00
	LSD	0	0.00	0	0.00
	HASHISH	0	0.00	0	0.00
	MESCALINE	0	0.00	0	0.00
	MISCELLANEOUS	0	0.00	0	0.00
	UNKNOWN	0	0.00	0	0.00

Question		Dallas Number	Dallas Percent	Memphis Number	Memphis Percent
	HOW OFTEN-1ST NON-PRSCPT				
45	NUMBER MOTORISTS ASKED	759		437	
	TAKING 1ST NON-PRSCPT	110	14.49	69	15.79
	ONCE A DAY	45	5.93	19	4.35
	2 TIMES A DAY	16	2.11	2	.46
	3 TIMES A DAY	2	.26	2	.46
	4 TIMES A DAY	2	.26	2	.46
	5-6 TIMES A DAY	2	.26	1	.23
	7-8 TIMES A DAY	0	0.00	0	0.00
	WHEN NEEDED	43	5.67	43	9.84
	NOT TAKING	649	85.51	368	84.21
	HOW OFTEN-2ND NON-PRSCPT				
51	NUMBER MOTORISTS ASKED	759		437	
	TAKING 2ND NON-PRSCPT	28	3.69	16	3.66
	ONCE A DAY	13	1.71	3	.69
	2 TIMES A DAY	4	.53	1	.23
	3 TIMES A DAY	1	.13	0	0.00
	4 TIMES A DAY	0	0.00	1	.23
	HOW OFTEN-2ND NON-PRSCPT	28	3.69	16	3.66
	ONCE A DAY	13	1.71	3	.69
	2 TIMES A DAY	4	.53	1	.23
	3 TIMES A DAY	1	.13	0	0.00
	4 TIMES A DAY	0	0.00	1	.23
	5-6 TIMES A DAY	0	0.00	0	0.00
	7-8 TIMES A DAY	0	0.00	0	0.00
	WHEN NEEDED	10	1.32	11	2.52
	NOT TAKING	731	96.31	421	96.34
	HOW OFTEN-3RD NON-PRSCPT				
57	NUMBER MOTORISTS ASKED-	759		437	
	TAKING 3RD NON-PRSCPT	14	1.84	6	1.37
	ONCE A DAY	6	.79	2	.46
	2 TIMES A DAY	0	0.00	0	0.00
	3 TIMES A DAY	2	.26	1	.23
	4 TIMES A DAY	0	0.00	0	0.00
	5-6 TIMES A DAY	1	.13	0	0.00
	7-8 TIMES A DAY	0	0.00	0	0.00
	WHEN NEEDED	5	.66	3	.69
	NOT TAKING	745	98.16	431	98.63
	HOW OFTEN-4TH NON-PRSCPT				
63	NUMBER MOTORISTS ASKED	759		437	
	TAKING 4TH NON-PRSCPT	1	.13	2	.46
	ONCE A DAY	1	.13	0	0.00
	2 TIMES A DAY	0	0.00	1	.23
	3 TIMES A DAY	0	0.00	0	0.00
	4 TIMES A DAY	0	0.00	0	0.00
	5-6 TIMES A DAY	0	0.00	0	0.00
	7-8 TIMES A DAY	0	0.00	0	0.00
	WHEN NEEDED	0	0.00	1	.23
	NOT TAKING	758	99.87	435	99.54

Question		Dallas Number	Dallas Percent	Memphis Number	Memphis Percent
	HOW OFTEN-5TH NON-PRSCPT				
69	NUMBER MOTORISTS ASKED	759		437	
	TAKING 5TH NON-PRSCPT	1	.13	1	.23
	ONCE A DAY	1	.13	0	0.00
	2 TIMES A DAY	0	0.00	0	0.00
	3 TIMES A DAY	0	0.00	0	0.00
	4 TIMES A DAY	0	0.00	0	0.00
	5-6 TIMES A DAY	0	0.00	0	0.00
	7-8 TIMES A DAY	0	0.00	0	0.00
	WHEN NEEDED	0	0.00	1	.23
	NOT TAKING	758	99.87	436	99.77
46	HOW LONG AGO-1ST NON-PSC	112		69	
	1 HOUR OR LESS	19	16.96	3	4.35
	1-2 HOURS	6	5.36	5	7.25
	2-3 HOURS	5	4.46	3	4.35
	3-4 HOURS	4	3.57	2	2.90
	4-8 HOURS	14	12.50	13	18.84
	8-12 HOURS	22	19.64	10	14.49
	12-24 HOURS	24	21.43	14	20.29
	24-36 HOURS	6	5.36	10	14.49
	36-48 HOURS	5	4.46	7	10.14
	2-4 DAYS	4	3.57	0	0.00
	MORE THAN 4 DAYS	4	3.57	2	2.90
	HOW LONG AGO-2ND NON-PSC	28	70.00	16	69.57
	1-2 HOURS	0	0.00	2	8.70
	2-3 HOURS	2	5.00	2	8.70
	3-4 HOURS	2	5.00	1	4.35
	4-8 HOURS	3	7.50	3	13.04
	8-12 HOURS	3	7.50	3	13.04
	12-24 HOURS	7	17.50	2	8.70
	24-36 HOURS	2	5.00	2	8.70
	36-48 HOURS	1	2.50	0	0.00
	2-4 DAYS	1	2.50	0	0.00
	MORE THAN 4 DAYS	1	2.50	0	0.00
	HOW LONG AGO-3RD NON-PSC	14	127.27	6	100.00
	1 HOUR OR LESS	2	18.18	1	16.67
	1-2 HOURS	1	9.09	0	0.00
	2-3 HOURS	0	0.00	0	0.00
	3-4 HOURS	0	0.00	0	0.00
	4-8 HOURS	5	45.45	1	16.67
	8-12 HOURS	2	18.18	2	33.33
	12-24 HOURS	2	18.18	1	16.67
	24-36 HOURS	2	18.18	0	0.00
	36-48 HOURS	0	0.00	0	0.00
	2-4 DAYS	0	0.00	0	0.00
	MORE THAN 4 DAYS	0	0.00	1	16.67

Question		Dallas Number	Dallas Percent	Memphis Number	Memphis Percent
	HOW LONG AGO-4TH NON-PSC	1	20.00	2	100.00
	1 HOUR OR LESS	0	0.00	0	0.00
	1-2 HOURS	0	0.00	0	0.00
	2-3 HOURS	0	0.00	0	0.00
	3-4 HOURS	0	0.00	0	0.00
	4-8 HOURS	1	20.00	0	0.00
	8-12 HOURS	0	0.00	0	0.00
	12-24 HOURS	0	0.00	1	50.00
	24-36 HOURS	0	0.00	0	0.00
	36-48 HOURS	0	0.00	0	0.00
	2-4 DAYS	0	0.00	0	0.00
	MORE THAN 4 DAYS	0	0.00	1	50.00
	HOW LONG AGO-5TH NON-PSC	1	50.00	1	100.00
	1 HOUR OR LESS	1	50.00	0	0.00
	1-2 HOURS	0	0.00	1	100.00
	2-3 HOURS	0	0.00	0	0.00
	3-4 HOURS	0	0.00	0	0.00
	4-8 HOURS	0	0.00	0	0.00
	8-12 HOURS	0	0.00	0	0.00
	12-24 HOURS	0	0.00	0	0.00
	24-36 HOURS	0	0.00	0	0.00
	36-48 HOURS	0	0.00	0	0.00
	2-4 DAYS	0	0.00	0	0.00
	MORE THAN 4 DAYS	0	0.00	0	0.00
73	DRINKS IN LAST 4 HOURS	686		407	
	NONE	375	54.66	208	51.11
	1	68	9.91	47	11.55
	2	47	6.85	18	4.42
	3	25	3.64	8	1.97
	4	14	2.04	10	2.46
	5	7	1.02	2	.49
	6	4	.58	4	.98
	7-9	8	1.17	1	.25
	10-14	4	.58	3	.74
	15-19	0	0.00	0	0.00
	20 OR MORE	1	.15	1	.25
	DON"T DRINK	133	19.39	105	25.80
75	HOW LONG AGO	177		92	
	LESS THAN 4 HOURS AGO	11	6.21	17	18.48
	LESS THAN 3 HOURS AGO	17	9.60	15	16.30
	LESS THAN 2 HOURS AGO	31	17.51	12	13.04
	LESS THAN 1 HOUR AGO	43	24.29	18	19.57
	LESS THAN 30 MINUTES	25	14.12	13	14.13
	LESS THAN 15 MINUTES	39	22.03	14	15.22
	WAS DRINKING WHEN STOPD	11	6.21	3	3.26

Question		Dallas		Memphis	
		Number	Percent	Number	Percent
100	TAKING PRESCRIBED DRUGS	120		62	
	ONE KIND	80	66.67	43	69.35
	TWO KINDS	27	22.50	14	22.58
	THREE KINDS	11	9.17	3	4.84
	FOUR KINDS	0	0.00	1	1.61
	FIVE KINDS	2	1.67	1	1.61
101	TAKING NON-PRESCRIBEDMED	129		84	
	ONE KIND	107	82.95	76	90.48
	TWO KINDS	18	13.95	6	7.14
	THREE KINDS	3	2.33	2	2.38
	FOUR KINDS	1	.78	0	0.00
	FIVE KINDS	0	0.00	0	0.00
76	BAC - BREATHALYZER	691		416	
	NEGATIVE	440	63.68	257	61.78
	01	70	10.13	67	16.11
	02	29	4.20	8	1.92
	03	18	2.60	8	1.92
	04	19	2.75	15	3.61
	05	16	2.32	10	2.40
	06	9	1.30	8	1.92
	07	11	1.59	2	.48
	08	9	1.30	4	.96
	09	8	1.16	6	1.44
	10	4	.58	3	.72
	11-14	16	2.32	7	1.68
	15-19	9	1.30	2	.48
	20 OR MORE	2	.29	3	.72
	REFUSED	28	4.05	16	3.85
	EQUIPMENT/OPR PROBLEMS	3	.43	0	0.00
78	URINE SAMPLE	694		416	
	ACCEPTED-WILLING	443	63.83	268	64.42
	ACCEPTED-UNWILLING	2	.29	3	.72
	ACCEPTED TO MAIL	145	20.89	102	24.52
	ACCEPTED,SS AND MAILER	70	10.09	29	6.97
	REFUSED-POLITE	31	4.47	12	2.88
	REFUSED-BELLIGERENT	3	.43	2	.48
79	BLOOD SAMPLE	695		416	
	GIVEN-WILLING	506	72.81	304	73.08
	GIVEN-UNWILLING	25	3.60	6	1.44
	REFUSED-POLITE	105	15.11	83	19.95
	REFUSED-BELLIGERANT	5	.72	2	.48
	NOT ASKED-UNDER AGE	30	4.32	10	2.40
	NOT ASKED-HEALTH REASON	2	.29	1	.24
	COULD NOT LOCATE VEIN	22	3.17	10	2.40

Question		Dallas		Memphis	
		Number	Percent	Number	Percent
80	SWAB SAMPLES	607		357	
	ALL THREE SWABS	551	90.77	303	84.87
	BOTH HANDS	1	.16	1	.28
	LIPS	0	0.00	0	0.00
	LIPS AND LEFT HAND	0	0.00	0	0.00
	LIPS AND RIGHT HAND	1	.16	0	0.00
	LEFT HAND	0	0.00	0	0.00
	RIGHT HAND	0	0.00	0	0.00
	REFUSED-POLITE	53	8.73	51	14.29
	REFUSED-BELLIGERENT	1	.16	2	.56

APPENDIX H

MEDICATIONS AND DRUGS MENTIONED IN LIVING DRIVER SURVEYS

DRUG GROUPS

1. Tranquilizers
2. Analgesics and Antipyretics
3. Stimulants and Anorectics
4. Hormones and Steroids
5. Sedatives and Hypnotics
6. Anti-infective Agents - Antibiotics
7. Vitamins and Minerals
8. Antidiabetics
9. Antihistamines
10. Anticoagulants
11. Analgesic Narcotics
12. Anticholinergics
13. Diuretics and Uricosurics
14. Antiasthmatics
15. Antiarthritics
16. Antispasmodics
17. Antacids and Intestinal Absorbents
18. Laxatives
19. Anesthetics
20. Marijuana
21. L.S.D.
22. Hashish
23. Mescaline
24. Miscellaneous
25. Unknown

Group 1 - Tranquilizers

1.	Librium	1
2.	Valium	11
3.	Tranquilizer	1
4.	Reserpine	1
5.	Equanil	1
6.	Serap	2
7.	Aldomet	3
8.	Anti-hypertension	2
9.	Medication for hypertension	8
10.	Librax	1
11.	Mellaril	1
12.	Etrafon	1
13.	Esimil	1
14.	Lithium	1
15.	Thorazine	1
16.	Chlorpromazine	1
17.	Aldactazide	1
18.	Aldactone	1
19.	Serax	1

Group 2 - Analgesics and Antipyretics

1.	Aspirin	71
2.	Bufferin	2
3.	Exedrin	2
4.	Tylenol	6
5.	Darvon	5
6.	Empirin	1
7.	Anacin	4
8.	BC Tablets	2
9.	Talevin	1
10.	Peritrate	2
11.	Tandearil	1
12.	Pyridium	1
13.	Datril	1
14.	Percodan	1

Group 3 - Stimulants and Anorectics

1.	Diet Pill	5
2.	Elavil	1
3.	Digitalis	1
4.	Nitroglycerin	1

Group 3 - Stimulants and Anorectics

5.	Didrex	1
6.	Biphetamine	1
7.	Winstrol	1
8.	Appedrine Diet Pills	1
9.	Unknown Stimulant	1

Group 4 - Hormones and Steroids

1.	Thyroid medication	1

Group 5 - Sedatives and Hypnotics

1.	Phenaphen	1
2.	Seconal	1
3.	Sominex	1
4.	Dalmane	1
5.	Tuinal	1

Group 6 - Anti-infective Agents - Antibiotics

1.	Penicillin	5
2.	Tetracycline	7
3.	Micrin	1
4.	Achromycin	1
5.	Antibiotic	8
6.	Antibiotic for tooth infection	1
7.	Antibiotic shot	1
8.	Decongestant	3
9.	Desenex	1
10.	Ampicillin	2
11.	Like Penicillin	1
12.	Streptomyacin	1

Group 7 - Vitamins and Minerals

1.	Multiple Vitamins	49
2.	Calcium Tablets	1
3.	Vitamin C	5
4.	Vitamin E	8
5.	Vitamin A	1
6.	Vitamin B_{12} Shot	3
7.	Theragram - M	1
8.	Geritol	1
9.	Kelp (iodine)	2

Group 7 - Vitamins and Minerals

10.	Lecithin	1
11.	Minerals	1
12.	Vitamin B_6	1
13.	Vitamin B	1
14.	Sodium Fluoride	1
15.	Selenium	1

Group 8 - Antidiabetics

1.	Insulin	2
2.	Lente Insulin	1
3.	Orinase	1
4.	Pills for Diabetes	6
5.	Diabinese	3

Group 9 - Antihistamines

1.	Ornade	3
2.	Contac	6
3.	Actifed	1
4.	Dristan	6
5.	Allerest	2
6.	Ornade Spansules	1
7.	Nyquil	1
8.	Sinutabs	2
9.	Chlortrimeton	3
10.	Sinus Tablets	8
11.	Antihistamine	4
12.	Coricidin	4
13.	Coricidin II	1
14.	Tuss Ornade	1
15.	Sinarest	1
16.	Benadryl	1
17.	Dimetapp	1
18.	Napril	1
19.	Sinulin	1
20.	Drixoral	1

Group 10 - Anticoagulants

1.	Coumadin	1
2.	Anticoagulant	2

Group 11 - Analgesic Narcotics

1.	Codeine	2

Group 12 - Anticholinergics

1.	Donnatal	1

Group 13 - Diuretics and Uricosurics

1.	Diuretics	7
2.	Lasix	2
3.	Ayazide	1
4.	Hygroton	2
5.	Hydrochlorithazide	1
6.	Water Pill	1

Group 14 - Antiasthmatics

1.	Tedral	1
2.	Bronkotabs	1
3.	Quibron	1
4.	Asthma Spray	1
5.	Asthma Medication	1
6.	Norisodrine	1
7.	Bronkometer	1
8.	Sudafed	2
9.	Marax	1
10.	Bronchial Dilator	2
11.	Bronchitis Medication	1
12.	Lung Dialator	1
13.	Primatine	1

Group 15 - Antiarthritics

1.	Pill for Arthritis	2

Group 16 - Antispasmodics

1.	Dilantin	3
2.	Mysoline	1

Group 17 - Antacids and Intestinal Absorbents

1.	Gelusil	2
2.	Pepto Bismol	1
3.	Alka-Seltzer	2
4.	Medication for Hyperacidity	1
5.	Rolaids	1
6.	Maalox	4
7.	Antacids	1
8.	Alka-Seltzer Plus	4
9.	Mylanta	1
10.	Digel	1
11.	Win Gel	1

Group 20 - Marijuana

1.	Pot - Marijuana	3

Group 24 - Miscellaneous

1.	Atromid - S	1
2.	Lomotil	1
3.	Equagesic	1
4.	Vicks 44	1
5.	Sulfur	1
6.	Lanoxin	1
7.	Lenodopa	1
8.	Quinamum	1
9.	Apresoline	1
10.	Vasodialator (Prevent hardening of arteries)	1
11.	Bell-AlR - PB # 60	1
12.	Afrin Spray (decongestant)	1
13.	Doan's Pills	1
14.	Sinex (decongestant)	1
15.	Sinade (decongestant)	2
16.	Inderal	3
17.	Isordill	2

Group 25 - Unknown

1.	Allergy shots	2
2.	Cold capsules	2
3.	Eye drops	1
4.	Blood thinner	1
5.	Medication for ulcers	2

Group 25 - Unknown

6.	Hay fever medication	1
7.	Nerve Pills	3
8.	Unknown Drug	1
9.	Cough Drops	1
10.	Shot for Nerves	1
11.	Medication for back pains - Contains Codeine	1
12.	Medication for Flu	1
13.	Unknown drug for Arthritis	1
14.	Unknown drug (antihistamine or Antibiotic)	1
15.	Large pink Pill (Breathing)	1
16.	White Water Pill	1
17.	Nasal Spray	1
18.	Arnex	1
19.	Histavagrin	1
20.	Idanmin	1
21.	Endocine	1
22.	Cough Medicine	1
23.	Heart Pill	1
24.	Pain Pill	4
25.	Muscle Relaxant	6
26.	High Blood Pressure Medication	32
27.	Spec T	1
28.	Dinatab Cap II	1
29.	Pituitary Gland Supplement	1
30.	Debid	1
31.	Meltab	1
32.	Agc Airet	1
33.	Gout Pill	2
34.	Dina Bold	1
35.	Tembids	1
36.	Kidney Medication (non-perscription)	1
37.	Chronotab	1
38.	Glycerine	1
39.	Kidney Medication (perscription)	1
40.	Calcium Glucamate	1
41.	Cold Pill (Copavin)	1
42.	Medicine for Chest Cold	1
43.	ARM (allergy)	1
44.	Headache Medication (prescribed)	1

Group 25 - Unknown

45.	Prescription for Dry Mouth and Lips	1
46.	Low Blood Pressure Medication	1
47.	Pill for High Cholestral	1
48.	Pill for Bowels	1
49.	Primazone	1
50.	Phlebitis Medicine	1
51.	Lexophlin (lung dialator)	1
52.	Pills for Inner Ear Problem (Dizziness)	1

APPENDIX I

POSITIVE DRUG FINDINGS IN BLOOD SAMPLES BY LEVEL OF CONCENTRATION

The statistical analysis of the fluid sample findings for the 43 drugs listed in Table 3 (see Section II, Part G), included only the findings confirmed by gas chromatography (GC) and quantitated at any level of concentration. The concentrations of the quantitated drugs, although available, were not utilized as parameters in the analysis. The decision to consider only one level of drug concentration stemmed from the lack of universally acceptable criteria that could be used to partition the drug findings into different levels.

A number of factors complicate the formulation of a simple, but meaningful concentration level criteria. For a study such as the one reported herein, where multiple fluid specimens are examined for drugs, it is possible to detect a given drug in none, one or any combination of the samples collected from an individual. In addition, the concentration of the drug found can vary between fluid specimens. The drug detected and its concentration depend upon several conditions such as the drug taken, its dosage, and the time(s) between ingestion and the collection of the fluid samples. Also, the drug findings in one fluid can not be equated to the drug findings in a missing fluid sample. In other words, a urine sample can not be substituted for a missing bile sample or vice versa.

In a recent study on drug use among drivers,* a simple concentration level criteria was used in the analysis. Two concentration levels were used to divide the drug findings from drivers providing both a blood and urine sample. One level was the same as is used in this report. The second level used was more stringent in that it included only those drugs confirmed by GC and quantitated in the blood (any concentration) and/or confirmed and quantitated in the urine (and/or bile for the fatally injured drivers) at concentrations of 1.0 µg/ml or greater. The second level of concentration was somewhat arbitrary, although it did conveniently split the overall drug findings into two approximately equal sized groups, which was a statistical advantage. The approach, like the one used herein, placed the drug findings on a common basis. That was, detections of a given drug were accepted from either a blood or urine sample according to the criteria provided both fluid samples were available for analysis. The approach, however, had a shortcoming in that a common concentration division was used for each fluid sample for all quantitated drugs. For blood, the concentration division was set at "confirmed by GC" (trace or larger amount detected).

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* Glauz, W. D. and R. R. Blackburn, "Drug Use Among Drivers," Contract No. DOT-HS-119-2-440 (MRI Project 3668-E) Midwest Research Institute Final Report, February 1975 (DOT HS-801411).

A drug not-confirmed in the blood by GC was either not present or below the sensitivity limit of detection. The same criteria were used in this study.

It is not appropriate to speak of a common concentration division for all drugs if one is interested in determining an "under the influence" category from the drug findings. First, the blood findings alone should be used for this determination as dictated by pharmacological theory. Secondly, different concentration divisions should be acknowledged for individual drugs since their dosages, distribution and excretion vary.

Data from the literature were collected to establish three levels of concentration in the blood for each of the 43 drugs included in the quantitated drug screen. These levels are: therapeutic, toxic, and lethal. The concentration limits found for the three levels along with the sensitivity limit of the chemical analysis employed in this study are presented in Table I-1 for each of the 43 drugs.

Several facts are readily apparent from a comparison of the analytical sensitivity limit for each drug with the limits of the different concentration levels. The analytical procedures used to detect sedatives and hypnotics appear to be very reasonable in that the sensitivity limit of the screen is well below the lower limit of the therapeutic range. However, such is not the case for tranquilizers. Here the sensitivity limit for six of the eight tranquilizers considered is at or above the lower limit of the therapeutic range. Some of the tranquilizers investigated are suspected to be frequently used, but the sensitivity level precludes detections of most of the tranquilizers except at mid-to-high therapeutic levels. The sensitivity level for almost all the drugs in the stimulant and antidepressant group is above the therapeutic range. Likewise, the sensitivity limit for most of the drugs in the rest of the drug groups, except hallucinogens, is within the therapeutic range.

The above observations would suggest that the concentrations of drugs other than those in the sedative/hypnotic group and one or two tranquilizers would need to be in the mid to upper therapeutic range or larger before the drug could be detected in the blood. This was verified by listing the positive drug findings in the blood for both the fatally injured and living drivers.

Table I-2 shows the positive drug findings in the 825 blood samples analyzed from the fatally injured drivers. Four concentration levels are presented: trace amounts, therapeutic, toxic, and lethal

levels. Most of the findings are for drugs in the sedative/hypnotic and narcotic analgesics group and for two tranquilizers. About half of the detections are at the trace level. It is interesting to note that six of the fatally injured drivers had toxic levels of drugs in their system, while one driver had a lethal level of morphine.

Table I-3 shows the positive drug findings for the 817 blood samples analyzed from the living drivers. All the findings are for three drugs in the sedative/hypnotic group and one in the miscellaneous group. Most of these detections are at the trace level. One driver had a toxic level of phenobarbital in his system.

TABLE I-1

LIMITS FOR THREE CONCENTRATION LEVELS OF DRUGS IN BLOOD

Type of Drug	Chemical Analysis Sensitivity Limit (µg/ml)	Therapeutic Level (µg/ml)	Toxic Level (µg/ml)	Lethal Level (µg/ml)
Sedative and Hypnotics				
Phenobarbital (luminal)	0.25	8.0-20.0	40.0-60.0	80.0+
Pentobarbital (Nembutal)	0.25	1.0-2.0	7.0-?	10.0+
Amobarbital (Amytal)	0.25	3.0-5.0	10.0-30.0	30.0+
Secobarbital (Seconal)	0.25	1.0-2.0	7.0-?	10.0+
Butabarbital (Butisol)	0.25	5.0-8.0	10.0-30.0	30.0+
Butobarbital (Butethal)	0.25	3.0-5.0	10.0-30.0	30.0+
Diphenylhydantoin (Dilantin)	0.50	2.0-20.0	50.0-?	100.0+
Glutethimide (Doriden)	1.00	3.0-10.0	10.0-80.0	80.0+
Methaqualone (Quaalude)	0.25	1.0-5.0	10.0-30.0	30.0+
Tranquilizers				
Meprobamate (Miltown)	1.00	5.0-10.0	100.0-?	200.0+
Chlordiazepoxide (Librium)	1.00	1.0-3.0	5.0-?	20.0+
Diazepam (Valium)	0.50	0.2-2.5	5.0-?	20.0+
Chlorpromazine (Thorazine)	0.50	0.5-0.9	1.0-2.0	3.0+
Promazine (Sparine)	0.50	0.5-0.9	1.0-2.0	3.0+
Thioridazine (Mellaril)	0.50	1.0-1.5	10.0-?	20.0+
Trifluoperazine (Stelazine)	0.50	0.2-1.9	2.0-?	NA
Oxazepam	1.00	0.5-?	NA	NA
Stimulants and Antidepressants				
Methylphenidate (Ritalin)	4.00	0.05-?	NA	NA
Imipramine (Tofranil)	0.25	0.05-0.15	0.7-?	2.0+
Amitriptyline (Elavil)	0.25	0.05-0.20	0.4-?	10.0+
Amphetamine (Dexedrine)	0.25	0.02-0.03	0.5-?	2.0+
Methamphetamine (Desoxyn)	2.00	0.03-?	5.0-?	40.0+
Antihistamines and Decongestants				
Chlorpheniramine	0.50	0.02-?	20.0-30.0	30.0+
Diphenhydramine	0.50	0.1-?	10.0-?	10.0+
Tripelennamine	0.50	0.1-?	10.0-?	10.0+
Methapyriline	0.50	0.1-?	NA	1.2+
Phenylpropanolamine	0.50	0.1-?	NA	NA
Narcotic Analgesics				
Nalorphine (Nalline)	0.50	NA	NA	NA
Morphine	0.25	0.05-?	NA	4.0+
Codeine	0.25	0.03-?	NA	NA
Meperidine (Demerol)	0.25	0.3-0.6	5.0-?	30.0+
Cocaine	0.50	NA	NA	1.0+
Methadone (Dolophine)	0.25	0.1-0.8	NA	4.0+
Hydromorphone (Dilaudid)	0.25	0.01-?	NA	0.1+
Propoxyphene (Darvon)	0.25	0.05-0.20	5.0-20.0	50.0+
Hallucinogens				
Dimethyltryptamine (DMT)	0.50	NA	NA	NA
Diethyltryptamine (DET)	0.50	NA	NA	NA
Mescaline	0.50	NA	NA	NA
2,5-Dimethoxy-4-methylamphetamine (STP)	0.50	NA	NA	NA
Miscellaneous				
Phendimetrazine	2.00	0.05-?	NA	NA
Procaine	0.50	0.10-?	NA	NA
Lobeline	0.50	0.20-?	NA	NA
Quinine	0.25	1.00-?	NA	12.0?

NA = Not Available.

TABLE I-2

POSITIVE DRUG FINDINGS BY CONCENTRATION LEVEL IN 825 FATALLY INJURED DRIVER BLOOD SAMPLES

Type of Drug	Concentration Level			
	Trace*	Therapeutic	Toxic	Lethal
Sedatives and Hypnotics				
Phenobarbital (Luminal)	14	5	0	0
Pentobarbital (Nembutal)	1	4	1	0
Amobarbital (Amytal)	6	0	0	0
Secobarbital (Seconal)	0	1	0	0
Diphenylhydantoin (Dilantin)	1	1	0	0
Methaqualone (Quaalude)	0	4	1	0
Tranquilizers				
Meprobamate (Miltown)	1	1	0	0
Chlorpromazine (Thorazine)	1	0	1	0
Stimulants and Antidepressants				
Amitriptyline (Elavil)	0	0	1	0
Amphetamine (Dexedrine)	0	0	1	0
Antihistamines and Decongestants				
Chlorpheniramine	0	1	0	0
Diphenhydramine	0	1	0	0
Narcotic Analgesics				
Morphine	0	1	1	1
Codeine	0	1	0	0
Miscellaneous				
Quinine	1	0	0	0
Totals	25	20	6	1

* A trace concentration level here is defined for each specific drug. It is an amount either found at the quantifiable level (sensitivity limit) or found at a quantitated level below the accepted therapeutic level.

TABLE I-3

POSITIVE DRUG FINDINGS BY CONCENTRATION LEVEL IN 817 LIVING DRIVER BLOOD SAMPLES

Type of Drug	Concentration Level			
	Trace*	Therapeutic	Toxic	Lethal
Sedatives and Hypnotics				
Phenobarbital (Luminal)	10	1	1	0
Butabarbital (Butisol)	1	0	0	0
Diphenylhydantoin (Dilantin)	0	1	0	0
Miscellaneous				
Quinine	0	1	0	0
Totals	11	3	1	0

* A trace concentration level here is defined for each specific drug. It is an amount either found at the quantifiable level (sensitivity limit) or found at a quantitated level below the accepted therapeutic level.

APPENDIX J

STATISTICAL EQUATIONS EMPLOYED

A majority of the data analyses conducted in the study dealt with the production of the drug incidence or proportion estimates from the living and dead driver data and ratio (relative risk) estimates from the combination of both sets of data. The equations used to generate these estimates are described in this Appendix.

The data structure is similar for both living and dead driver data sets, in that they can be described in a stratified cluster framework. Living driver data are clustered around sites where driver fatalities have occurred; fatally injured driver data are clustered around the 24 submission areas. Two strata were examined: location (Memphis or Dallas), and drug involvement (yes or no). The responses considered were the proportions of positive drug incidences.

Within stratum h, the (living or dead driver) proportion estimate and its variance are given by:*

$$P_h = \sum_{i=1}^{n_h} a_{ih} \Big/ \sum_{i=1}^{n_h} m_{ih} \qquad (1)$$

$$V_{(p_h)} = \frac{1}{n_h \bar{m}_h^2} \cdot \frac{\sum_{i=1}^{n_h} a^2_{ih} - 2p_h \sum_{i=1}^{n_h} a_{ih} m_{ih} + p_h^2 \sum_{i=1}^{n_h} m^2_{ih}}{n_h - 1} \qquad (2)$$

where p_h = survey proportion (in stratum h)

a_{ih} = number of positives in i^{th} cluster (in stratum h)

m_{ih} = number of samples in i^{th} cluster (in stratum h)

n_h = number of clusters (in stratum h)

$\bar{m}_h$ = average cluster size (in stratum h).

The p_h's must be added over all strata resulting in the overall estimate given by:**

$$p = \sum_{h=1}^{L} W_h p_h \qquad (3)$$

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* Cochran, W. G., Sampling Techniques, John Wiley and Sons, Inc. (1963).

** Cochran, W. G., Sampling Techniques, John Wiley and Sons, Inc., Chapter 5 (1963).

$$V_{(p)} = \frac{\sum_{h=1}^{L} W_h^2 \, p_h \, (1 - p_h)}{n_h} \qquad (4)$$

where W_h is the h^{th} stratum size; i.e., ratio of number of units of h^{th} stratum to number of units in the population.

In addition to investigating the incidence of drug use among living and dead drivers, it was also of interest to produce the relative risk quantity $R = p_D/p_L$ (where p_D and p_L refer to incidence proportions among dead and living drivers, respectively). These quantities have variances given by:*

$$V(R) \cong \frac{R^2}{n} \left[\frac{V(p_L)}{p_L^2} + \frac{V(p_D)}{p_D^2} - \frac{2CV(p_L p_D)}{p_L p_D} \right]$$

where $CV(p_L p_D) = \left[V(p_L) V(p_D) \right]^{1/2}$ x the correlation between p_L and p_D.

* Cochran, W. G., Sampling Techniques, John Wiley and Sons, Inc., Chapter 6 (1963).

APPENDIX K

DETAILED ALCOHOL FINDINGS FOR DALLAS AND MEMPHIS SITES USED IN THE SURVEYS

TABLE K-1

SITE-BY-SITE RESULTS FOR DALLAS, TEXAS

Site Number	Survey Number	Sex of Fatally Injured Driver	Kit Number of Victim	Location	Date of Survey	Day of Week of Survey	Time Interval of Survey	Number Drivers Stopped	Number Accepting Interview	Number BAC's	BAC Level 0	0.01-0.04	0.05-0.09	0.10-0.14	0.15+
17	1	Male	892	Colorado Boulevard and Jefferson Boulevard	5-30-75	Friday	1:30 AM - 3:30 AM	7	5	4	3	0	0	0	1
18	1	Male	898	EB 3500 W. Camp Wisdom Road	6-4-75	Thursday	8:30 PM - 10:30 PM	14	10	10	10	0	0	0	0
19	1	Male	893	St. Francis and San Leandro	5-30-75	Friday	11:30 PM - 1:30 AM	10	8	8	4	2	1	1	0
20	1	Male	827	I-20 and Barry Avenue	5-31-75	Saturday	9:00 PM - 11:00 PM	9	8	7	4	1	0	1	1
21	1	Male	829	R. L. Thornton Freeway and Marsalis Street	6-1-75	Sunday	11:00 PM - 1:00 AM	13	10	10	7	2	1	0	0
22	1	Male	578	800 S. Walton Walker Boulevard	6-2-75	Monday	9:00 PM - 11:00 PM	17	11	11	8	2	1	0	0
24	1	Male	270	9900 Bruton Road	6-4-75	Wednesday	1:30 AM - 3:30 AM	12	9	9	8	1	0	0	0
25	1	Male	268	St. Louis and Harwood Streets	6-4-75	Thursday	11:30 PM - 1:30 AM	8	4	4	2	1	0	0	1
26	1	Male	575	5637 Military Parkway	6-1-75	Sunday	2:00 PM - 4:00 PM	6	6	6	2	2	1	0	1
27	1	Female	948	7525 Greenville Avenue	5-31-75	Saturday	7:30 AM - 9:30 AM	17	9	9	9	0	0	0	0
28	1	Male	951	9500 Block Harry Hines Boulevard	6-2-75	Monday	1:30 AM - 3:30 AM	7	5	5	0	3	1	1	0
29	1	Male	978	2500 Block N. Beckley Avenue	6-1-75	Sunday	6:00 AM - 8:00 AM	13	10	10	7	1	2	0	0
30	2	Male	1004	Walton Walker and Northwest Highway	7-26-75	Saturday	12:30 PM - 2:30 PM	7	7	7	2	2	1	2	0
32	2	Male	945	13910 N. Central Expressway - Exit 23	7-26-75	Saturday	4:00 PM - 6:00 PM	11	6	6	2	2	1	1	0
33	2	Male	975	3600 W. Davis and Kramer	7-28-75	Monday	9:30 AM - 11:30 AM	10	7	7	6	1	0	0	0
34	2	Male	-	2700 S. Westmore Avenue	7-27-75	Sunday	2:00 PM - 4:00 PM	8	8	8	5	2	1	0	0
35	2	Male	947	Cedar Crest and 11th	8-2-75	Saturday	12:30 AM - 2:30 AM	9	8	7	2	3	2	0	0
36	2	Male	639	Canty and North Tyler	7-27-75	Sunday	1:00 PM - 3:00 PM	8	6	6	3	2	1	0	0
37	2	Male	1002	Lawnview Avenue and R. L. Thornton Freeway	7-25-75	Friday	6:00 PM - 8:00 PM	11	8	8	7	1	0	0	0
38	2	Male	1084	231 N. Marsalis Avenue	7-24-75	Thursday	2:00 PM - 4:00 PM	9	9	9	7	2	0	0	0
39	2	Male	1088	8825 S. Central Expressway	7-26-75	Saturday	8:30 AM - 10:30 AM	8	8	8	4	3	1	0	0
40	2	Male	1087	Clarence and S. Central Expressway	7-28-75	Monday	6:30 PM - 8:30 PM	9	7	7	7	0	0	0	0
41	2	Male	952	2745 West Northwest Highway	8-1-75	Friday	12:30 AM - 2:30 AM	6	6	5	2	2	0	1	0
42	2	Male	1089	4616 W. University and Roper Street	8-1-75	Friday	7:00 PM - 9:00 PM	7	4	3	2	1	0	0	0
43	3	Male	950	Bruton Road and St. Augustine Drive	9-19-75	Friday	11:00 PM - 1:00 AM	9	9	7	4	2	0	1	0
44	3	Male	943	Mehalian and Crossvood	9-25-75	Thursday	5:00 PM - 7:00 PM	7	7	7	7	0	0	0	0
45	3	Male	0073	Pacific Avenue and Pearl	9-21-75	Sunday	11:30 PM - 1:30 AM	8	8	8	6	1	1	0	0

TABLE K-1 (Continued)

Site Number	Survey Number	Sex of Fatally Injured Driver	Kit Number of Victim	Location	Date of Survey	Day of Week of Survey	Time Interval of Survey	Number Drivers Stopped	Number Accepting Interview	Number BAC's	BAC Level 0	0.01-0.04	0.05-0.09	0.10-0.14	0.15+
47	3	Male	-	Lake Highland and Country Club Drive	9-21-75	Sunday	5:30 PM - 7:30 PM	9	9	9	5	3	1	0	0
48	3	Female	-	3100 Ledbetter	9-26-75	Friday	8:30 AM - 10:30 AM	11	11	10	9	1	0	0	0
50	3	Male	-	Opera and Marsalis Avenue	9-25-75	Thursday	11:00 PM - 1:00 AM	9	9	9	8	1	0	0	0
51	3	Male	-	Rickover and Crestline Avenue	9-26-75	Friday	1:00 PM - 3:00 PM	8	8	8	8	0	0	0	0
52	3	Male	1181	W. Davis and Bagley	9-21-75	Sunday	8:30 PM - 10:30 PM	9	9	7	2	1	2	1	1
53	4	Male	-	Lawnview Park and Scyene Road	11-7-75	Friday	11:30 PM - 1:30 AM	10	9	9	5	2	1	0	1
54	4	Male	1183	I-20 Ramp EB from Buckner Blvd	11-10-75	Monday	6:30 PM - 8:30 PM	10	10	10	10	0	0	0	0
55	4	Male	1180	Cedar Springs and Inwood Road	11-6-75	Thursday	9:30 PM - 11:30 PM	10	10	10	5	3	2	0	0
56	4	Male	-	3195 Loop 12	11-6-75	Thursday	7:00 AM - 9:00 AM	10	10	10	8	0	1	1	0
57	4	Female	1189	9325 Carpenter Freeway	11-11-75	Tuesday	12:30 AM - 2:30 AM	9	9	8	4	1	3	0	0
59	4	Female	1179	3400 Simpson Stuart Road and Bonnie View Road	11-11-75	Tuesday	11:30 AM - 1:30 PM	11	11	10	9	1	0	0	0
60	5	Male	942	Lane Freeway Ramp and Loop 12	12-19-75	Friday	10:30 PM - 1:00 AM	12	12	8	4	2	1	1	0
61	5	Male	-	6575 C. F. Hawn Freeway	12-16-75	Tuesday	11:00 PM - 1:30 AM	10	10	10	6	1	2	1	0
62	5	Female	-	Tyree Street and Lemon Avenue	12-19-75	Friday	1:00 PM - 3:30 PM	14	13	14	8	5	0	1	0
63	5	Male	-	7200 W. Northwest Highway	12-22-75	Monday	4:30 PM - 7:00 PM	12	12	12	11	0	1	0	0
64	5	Female	-	1500 E. Kiest Boulevard	12-17-75	Wednesday	12:00 PM - 2:30 PM	13	13	13	13	0	0	0	0
66	5	Male	-	8700 S. Central Expressway	12-18-75	Thursday	5:30 PM - 8:00 PM	12	12	11	8	2	1	0	0
67	6	Male	-	5400 Second Avenue	1-20-76	Tuesday	12:00 PM - 2:30 PM	13	13	12	9	3	0	0	0
68	6	Male	-	4408 Idaho Avenue	1-23-76	Friday	4:30 PM - 7:00 PM	8	7	8	6	0	2	0	0
69	6	Male	1343	2451 N. Stemmons Freeway	1-21-76	Wednesday	1:30 PM - 4:00 PM	13	12	9	7	0	1	0	1
70	6	Male	1342	1900 Oak Lawn and Alamo Street	1-28-76	Wednesday	1:30 PM - 4:00 PM	11	11	11	7	3	1	0	0
71	6	Male	1346	2500 John West Road	1-21-76	Wednesday	5:00 PM - 7:30 PM	13	13	11	8	2	1	0	0
73	6	Male	-	1300 N. Westmoreland	1-24-76	Saturday	12:00 AM - 2:30 AM	9	9	9	5	1	2	1	0
75	7	Male	1373	Kiest and Southernland	3-15-76	Monday	11:00 PM - 1:30 AM	12	12	12	9	2	1	0	0
76	7	Male	1374	Elam Road - East of Masters	3-13-76	Saturday	7:00 AM - 9:30 AM	14	12	12	8	3	1	0	0
78	7	Male	1364	Murdock Road and Fairport	3-13-76	Saturday	8:00 PM - 10:30 PM	15	14	12	7	3	0	1	1
79	7	Male	1386	Beckley and Greenbrier	3-17-76	Wednesday	8:00 AM - 10:30 AM	12	12	12	7	5	0	0	0
80	8	Female	1368	Forest Lane and Oakshire Drive	4-26-76	Monday	10:00 AM - 12:30 AM	11	11	11	11	0	0	0	0
81	8	Male	1361	N. Buckner and Edgelake	4-29-76	Thursday	12:00 AM - 2:30 AM	11	11	11	5	5	1	0	0
84	9	Male	1410	9000 Ferguson	6-11-76	Friday	10:30 PM - 1:30 AM	9	9	9	7	2	0	0	0
85	9	Male	1414	Richardson and S. Central Expressway	6-15-76	Tuesday	12:30 PM - 3:00 PM	11	11	10	9	1	0	0	0
87	9	Female	1411	300 N. Cliff Street	6-12-76	Saturday	4:00 PM - 6:30 PM	8	7	8	4	3	0	0	1
88	9	Female	1413	7010 Bruton Road	6-18-76	Friday	11:00 PM - 1:30 AM	8	8	7	3	4	0	0	0
89	9	Female	1406	10700 Forest Lane	6-13-76	Sunday	12:30 AM - 3:00 AM	10	10	9	4	5	0	0	0
90	9	Female	1405	7800 Scyene Road	6-18-76	Friday	4:00 PM - 6:30 PM	10	10	9	5	3	0	0	1
92	10	Male	1427	4200 Irving	8-7-76	Saturday	1:30 AM - 4:00 AM	12	11	10	6	1	2	1	0

TABLE K-1 (Concluded)

Site Number	Survey Number	Sex of Fatally Injured Driver	Kit Number of Victim	Location	Date of Survey	Day of Week of Survey	Time Interval of Survey	Number Drivers Stopped	Number Accepting Interview	Number BAC's	BAC Level 0	0.01-0.04	0.05-0.09	0.10-0.14	0.15+
94	10	Male	1377	10600 Elam Road	8-6-76	Friday	10:00 PM - 12:30 AM	12	10	11	7	3	1	0	0
95	11	Male	1387	1200 Carroll	9-9-76	Thursday	12:30 PM - 3:00 PM	11	11	11	6	4	0	0	1
96	10	Male	1436	6200 C. F. Hawn Freeway	7-30-76	Friday	11:00 PM - 1:30 AM	10	9	8	5	1	2	0	0
97	11	Male	1437	8100 S. Central Expressway	9-10-76	Friday	8:00 PM - 10:30 PM	11	11	10	7	1	2	0	0
98	11	Male	1438	1300 E. Ledbetter Drive	9-7-76	Tuesday	2:30 PM - 5:00 PM	11	10	10	4	3	3	0	0
99	11	Male	1444	N. Masters and Moweta	9-12-76	Sunday	12:30 AM - 3:00 AM	9	9	9	3	3	2	1	0
101	11	Male	1447	4600 W. Davis	9-12-76	Sunday	12:30 PM - 3:00 PM	11	11	11	8	3	0	0	0
103	11	Male	1446	Olive and Ross Street	9-9-76	Thursday	7:00 AM - 9:30 AM	11	11	11	5	5	0	1	0
104	11	Male	1430	2600 R. L. Thornton Freeway	9-12-76	Sunday	8:00 AM - 10:30 AM	13	12	12	9	3	0	0	0
105	11	Male	1433	3600 Samuel Boulevard	9-13-76	Monday	12:00 AM - 2:30 AM	11	10	11	6	2	1	2	0
Total								759	687	660	440	136	53	20	11

TABLE K-2

SITE-BY-SITE RESULTS FOR MEMPHIS, TENNESSEE

Site Number	Survey Number	Sex of Fatally Injured Driver	Kit Number of Victim	Location	Date of Survey	Day of Week of Survey	Time Interval of Survey	Number Drivers Stopped	Number Accepting Interview	Number BAC's	BAC Level 0	0.01-0.04	0.05-0.09	0.10-0.14	0.15+
1	1	Female	883	South Parkway and Cummings	11-17-75	Monday	3:30 PM - 6:30 PM	13	12	12	10	2	0	0	0
2	1	Female	1222	Deadrick - East of Pendelton	11-19-75	Monday	5:30 AM - 8:30 AM	12	12	12	12	0	0	0	0
3	1	Male	904	Ball Road and Manchester	11-23-75	Wednesday	3:30 PM - 6:30 PM	13	12	12	8	3	1	0	0
4	1	Male	1220	Macon Road and I-40	11-24-75	Sunday	3:30 PM - 6:30 PM	14	12	12	10	1	1	0	0
5	1	Male	-	3rd and Mallory - SB	11-24-75	Tuesday	11:30 AM - 2:30 PM	15	14	13	10	2	1	0	0
6	2	Male	880	N. Thomas and Watkins	12-16-75	Tuesday	12:00 AM - 3:00 AM	15	13	13	6	5	2	0	0
7	2	Female	-	Mill Branch and Winchester	12-14-75	Sunday	3:30 AM - 6:30 AM	13	13	12	8	1	2	1	0
8	3	Male	1221	4th Street South of Georgia	1-15-76	Thursday	8:30 PM - 11:30 PM	14	14	14	9	4	1	0	0
9	3	Male	-	I-240 and South Parkway	1-11-76	Sunday	2:30 AM - 5:30 AM	14	12	12	3	6	1	1	1
10	3	Male	1135	I-55 and Brooks Road	1-15-76	Thursday	7:00 AM - 10:00 AM	16	14	14	13	1	0	0	0
12	3	Male	-	McLean and Madison	1-14-76	Wednesday	8:30 PM - 11:30 PM	18	16	16	9	6	1	0	0
13	3	Female	1357	Egypt and Central	1-11-76	Sunday	9:30 AM - 12:30 PM	17	15	14	10	4	0	0	0
14	4	Male	1355	South Parkway W and Swift	3-6-76	Saturday	9:00 PM - 12:00 AM	11	11	11	5	5	0	0	1
15	4	Male	1354	Danny Thomas and Jefferson	3-8-76	Monday	11:00 PM - 2:00 AM	12	11	11	4	3	2	1	1
16	4	Male	1359	4491 Poplar	3-7-76	Sunday	1:00 AM - 4:00 AM	10	10	10	3	3	3	1	0
17	5	Female	1350	Highland and Dunn	4-23-76	Friday	7:00 AM - 10:00 AM	8	8	8	7	1	0	0	0
18	5	Male	1356	Chelsea and 5th Street	4-19-76	Monday	7:30 PM - 10:30 PM	12	10	10	7	2	1	0	0
19	5	Male	1358	Elvis Presley and Carlton	4-20-76	Tuesday	9:30 AM - 12:30 PM	12	12	12	11	1	0	0	0
20	5	Female	1401	I-240 and Mt. Moriah	4-21-76	Wednesday	11:30 PM - 2:30 AM	7	7	7	3	3	1	0	0
21	6	Female	1398	S 3rd Street N of I-55	5-17-76	Monday	3:30 PM - 6:00 PM	12	11	11	6	5	0	0	0
22	6	Male	1399	N. Thomas at Memphis Mobile City	5-18-76	Tuesday	12:30 AM - 3:30 AM	16	16	15	7	2	4	1	1
23	6	Male	1391	Chelsea and Ellington	5-18-76	Tuesday	10:30 PM - 1:30 AM	15	15	15	9	4	0	2	0
24	6	Male	1392	New Allen and Ridgemont	5-16-76	Sunday	6:00 PM - 9:00 PM	15	15	15	10	3	2	0	0
25	6	Female	1397	Southern Avenue E of Patterson	5-20-76	Thursday	8:00 PM - 11:00 PM	17	16	15	13	2	0	0	0
26	6	Male	1419	Castleman and Cedrick	5-15-76	Saturday	3:30 PM - 6:30 PM	15	15	14	9	5	0	0	0
27	7	Male	1417	Raines and Doubletree	6-26-76	Saturday	5:30 PM - 8:30 PM	12	12	12	9	3	0	0	0
28	7	Male	1415	I-24 and Norris	6-27-76	Sunday	5:30 AM - 8:30 AM	15	13	13	7	4	1	0	1
31	7	Male	1424	McLean and Poplar	6-26-76	Saturday	11:00 PM - 2:00 AM	15	12	13	3	5	2	3	0
32	8	Male	1416	S. Parkway and Latham	9-2-76	Thursday	2:00 PM - 5:00 PM	14	13	13	10	2	1	0	0
33	8	Male	1420	S. Third Street and Nonconnah CK Bridge	8-29-76	Sunday	4:30 PM - 7:30 PM	17	16	15	13	1	1	0	0
34	8	Male	1454	Clark Road and Clark Cove	9-1-76	Wednesday	2:30 PM - 5:30 PM	12	12	12	6	4	2	0	0
35	8	Male	1421	Holmes Road and Waldrup	8-29-76	Sunday	12:00 AM - 3:00 AM	16	14	12	7	5	0	0	0
Total								437	408	400	257	98	30	10	5