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A PROFILE OF FATAL ACCIDENTS INVOLVING ALCOHOL

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16. Abstract

Accident investigation research studies were conducted during 1971-75 in the cities of Boston, Baltimore, Oklahoma City and Albuquerque where Alcohol Safety Action Programs (ASAPs) were operating. The specific objectives of the four studies varied somewhat, but certain common information concerning alcohol involvement and other factors was obtained in each investigation. An analysis of all four studies, plus some newly available data on fatal crashes revealed several salient fatal accident characteristic associated with alcohol: Single vehicle accidents are overrepresented and in multiple vehicle accidents the alcohol involved vehicle is the striking vehicle. The accidents tend to occur between 8:00 p.m. and 4:00 a.m. on weekends, involve older model vehicles which are probably poorly maintained, and there is an increased risk that speeding or travelling too fast for conditions is involved. An aggregate profile of the driver who typically was drinking and responsible for the crash appears to be a male, 20-35 years of age, who has no more than a high school education, is single, separated or divorced, has an increased risk of having a previous DWI arrest, or two or more speeding violations, may have a suspended or revoked license at the time of the crash, and is a heavy social or problem drinker. The findings suggest that the profile be utilized once the driver is brought into the system (for a DWI arrest or a second or third speeding violation) for further screening purposes and the appropriate counter-measure action.

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Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
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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
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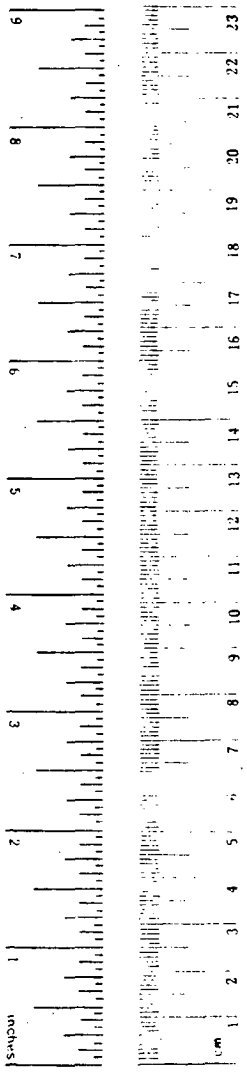

Approximate Conversions from Metric Measures

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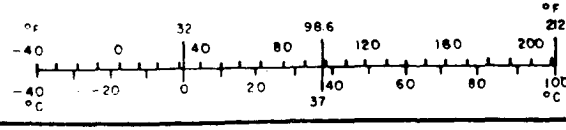
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
	MASS (weight)			
g	grams	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



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A PROFILE OF FATAL ACCIDENTS INVOLVING ALCOHOL

James C. Fell
National Highway Traffic Safety Administration*

ABSTRACT

Accident investigation research studies were conducted during 1971-75 in the cities of Boston, Baltimore, Oklahoma City and Albuquerque where Alcohol Safety Action Programs (ASAPs) were operating. The specific objectives of the four studies varied somewhat, but certain common information concerning alcohol involvement and other factors was obtained in each investigation. Some of the more important findings from each of the individual studies include the following:

- BOSTON - 39% of the most responsible drivers in fatal accidents had been drinking alcohol or had a combination of alcohol and other drugs in their systems just prior to the crash. An additional 9% of the responsible drivers admitted or were found to be under the influence of other intoxicating drugs such as marijuana, barbiturates, etc. without alcohol involvement. Significant overrepresentations of certain characteristics associated with alcohol-involved drivers as compared to a control group of drivers included previous citations for speeding or driving to endanger ($\geq$2), a suspended or revoked license, being separated or divorced, known alcohol related job losses, frequency of alcohol intoxication and a problem drinker diagnosis. A discriminant function analysis was used to develop a predictive formula for the identification of an alcohol involved fatal accident driver.

- BALTIMORE - 54% of the fatally injured drivers studied had a Blood Alcohol Concentration (BAC) $\geq$.05 mg% with a range of .05 mg% to .41 mg%. Of these alcohol involved driver fatal accidents, 68% were single vehicle, 80% occurred between 8:00 p.m. and 4:00 a.m, 10% of the drivers had revoked licenses, 15% had previously been arrested for driving while intoxicated (DWI) or public intoxication, and 17% were separated or divorced. The study also indicated that male drivers most

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* The opinions expressed in this paper are those of the author and not necessarily those of the National Highway Traffic Safety Administration.

responsible for fatal or serious accidents regardless of their age or alcohol involvement displayed certain personality traits (belligerence, verbal expansiveness, impulsiveness, etc.) that were significantly different from the norm.

- OKLAHOMA CITY - The study of fatal accidents in Oklahoma City (with an ASAP) included a comparison group of fatal accidents in Tulsa (without an ASAP). Although the incidence of alcohol involvement in fatal accidents in both cities was not significantly different (Oklahoma City-42%; Tulsa-40%), the proportion of assessed "problem drinkers" in the Tulsa alcohol involved fatals was significantly higher than in the Oklahoma City alcohol involved fatal accidents (Oklahoma City-44%; Tulsa-75%). An analysis of data from both cities showed overrepresentations of separated/divorced drivers, suspended/revoked licenses, alcohol use preferences and patterns, and previous alcohol related arrests.

- ALBUQUERQUE - A sample of 220 alcohol related crashes regardless of severity were studied. It was determined that 90% of these alcohol-involved drivers were considered responsible for the accident; they drove poorly maintained vehicles 5-7 years old; 20% had invalid licenses at the time of the crash; 56% had BACs $\geq$.15 mg % when tested after the accident; 53% were considered to be problem drinkers; and almost 1 in 4 drivers admitted using other drugs at various times while drinking.

An analysis of all four studies, plus some newly available data on fatal crashes revealed several salient fatal accident characteristics associated with alcohol:

Single vehicle accidents are overrepresented and in multiple vehicle accidents the alcohol involved vehicle is the striking vehicle. The accidents tend to occur between 8:00 p.m. and 4:00 a.m. on weekends, involve older model vehicles which are probably poorly maintained, and there is an increased risk that speeding or travelling too fast for conditions is involved.

An aggregate profile of the driver who typically was drinking and responsible for the crash appears to be a male, 20-35 years of age, who has no more than a high school education, is single, separated or divorced, has an increased risk of having a previous DWI arrest, or two or more speeding violations, may have a suspended or revoked license at the time of the crash, and is a heavy social or problem drinker.

The findings suggest that the profile be utilized once the driver is brought into the system (for a DWI arrest or a second or third speeding violation) for further screening purposes and the appropriate countermeasure action.

BACKGROUND

In 1971 and 1972, the National Highway Traffic Safety Administration (NHTSA) began establishing a number of demonstration projects to attack the alcohol problem as related to highway safety. These Alcohol Safety Action Programs (ASAPs) [1]* were eventually established in 35 different communities (or in some cases entire States, e.g. New Hampshire, Idaho) around the United States and involved a multisystems approach to alcohol countermeasures. The basic concept was to surround the "problem drinker driver" with a set of countermeasures designed to identify him on the road, make decisions regarding remedial and rehabilitative procedures, and then take action to put these measures into effect. The ASAP demonstration projects provided federal funding to each of these communities in the areas of enforcement, prosecution, rehabilitation and public information and education with the objective of demonstrating the feasibility of this systems approach and eventually catalyzing each State into action to improve their alcohol safety programs.

At the same time, the NHTSA was also sponsoring a number of accident research studies [2] involving the employment of Multidisciplinary Accident Investigation (MDAI) teams. These MDAI teams were located at universities and research centers in 14 different areas of the country with four of them (Boston, Baltimore, Oklahoma City, Albuquerque) in new ASAP areas. Thus, it became logical to use these four MDAI teams to provide accident research support to each of the local ASAPs. Individual accident studies were then designed involving NHTSA, ASAP and MDAI personnel in order to (1) provide accident data support to the ASAPs, (2) develop a more accurate picture of the alcohol/accident problem in that community, (3) aid in better identifying the "problem drinker driver" most likely to become involved in an alcohol-involved crash, and (4) to some extent, provide some information regarding the immediate impact of the ASAP in that community.

Each of the four accident studies had slightly different objectives and different experimental designs according to local ASAP needs. The accident sampling procedures and the use of control groups (comparison data) were, therefore,

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*Numbers in brackets [ ] indicate references listed at the end of the paper.

different in each study. However, the studies were similar enough to initiate collection of some standardized data and to perform certain simple data analyses. The Office of Statistics and Analysis, who managed the MDAI teams, decided to collect 41 important variables in each of the accident investigations and required the four teams to produce 14 standard data tables in their final reports [3]. Many of these variables produced similar results in each of the four studies and provided the salient characteristics of the profile described in this paper.

The purpose of this paper is three-fold:

- to synopsize the important results of each of the four studies on an individual basis,
- to describe certain salient characteristics that were consistently produced in each of the studies and, consequently, develop a "profile" of fatal accidents involving alcohol, and
- to recommend a use for these data in future research and countermeasure efforts.

It should be stated at the outset what this paper is not. It does not describe studies of "accident proneness" in the classical sense. It also does not advocate "big brother" procedures such as using the information to screen licensing applicants and prevent drivers who fit the profile from obtaining a license. The information, at this point in time, should only be used as a secondary screening procedure once a driver has appeared in the "system" as a potential problem (e.g. arrested for driving while intoxicated and/or multiple arrests for speeding or driving to endanger).

Given this introduction and a few ground rules, a brief description of the study designs and methodologies is in order.

STUDY DESIGN, METHODOLOGY AND DATA COLLECTION

As mentioned in the background, each study had different objectives and slightly different experimental designs according to local ASAP needs. However, certain common data elements were collected in each study and the procedures for gathering the data were basically the same - interviews, driver records, blood alcohol concentrations, accident causal and driver responsibility assessments, and accident reconstruction by experienced professional investigators. Note that each study used a different control group to produce comparison data and yet some of the frequencies and

overrepresentations (as shown in the results) are remarkably similar.

BOSTON

The basic objective of this three year study conducted by Boston University was to collect and analyze relevant alcohol, drug, and human factors information on the most responsible drivers involved in 300 consecutive fatal accidents in metropolitan Boston. A subsequent control group of 801 "matched" non-accident drivers was collected for comparison purposes. The basic instrument for collecting the data was a Human Factors Index (HFI) [4] which contained over 300 variables divided into the following eight categories: (1) Basic Demographic Data, (2) Psychosocial History, (3) Physical Health History, (4) Alcohol, Marijuana, and Other Drug Use Patterns, (5) Legal, Arrest and Citation History, (6) Focal Accident Data, (7) Focal Human Factor Stress Scale, (8) Risk Taking Behavior Scale.

The experimental design can be synopsized as follows:

EXPERIMENTAL GROUP	CONTROL GROUP
• Drivers most responsible for fatal accidents as assessed by investigations using the police report, interview data and accident reconstruction.	• Drivers never involved in a fatal accident and selected from the Boston population at large.
• Time period: September 1971 -February 1974 (30 months)	• Time period: January 1975-May 1975 (5 months)
• Sample Selection: 306 consecutive fatal accidents (victim died within 24 hours) which occurred in Greater Boston. 39 drivers subsequently eliminated from the analysis for the following reasons: 20 had a fatal precrash heart attack (determined during autopsy), 13 were hit-and-run accidents where the driver was not apprehended during the study period, 6 involved no cooperation from any involved parties	• Sample Selection: 801 licensed drivers never involved in a fatal accident and who lived in Greater Boston. From 1585 drivers originally contacted the following 784 drivers were rejected: 316 wrong address or could not be contacted, 86 no valid drivers license, 201 refused to cooperate 181 not needed due to matching criteria

- 267 drivers finally analyzed
- 300 variables from Human Factors Index collected on each driver
- Between 2 and 23 interviews conducted in each case.

- Matching criteria:
  (1) by residence: 4 community clusters matched
  (2) by sex: 88% male (some as experimental)
  (3) by age (same age distributions).
- Same variables (except focal accident data)
- One interview conducted with specific operator only

BALTIMORE

This three year study conducted by the Maryland Medical Legal Foundation, had two basic objectives: (1) to determine any differences between drivers who were killed in accidents and a matched sample of drivers only moderately injured (AIS=1-3) in similar accidents, and (2) to determine any significantly different psychosocial personality characteristics of drivers killed in accidents as measured by a set of norms. The basic instruments used were the Maryland Medical Legal Foundation Accident Investigation Psychosocial Questionnaire [5] and the Katz Adjustment Scale Behavior Inventory-R Forms [6].

The experimental design is depicted below:

EXPERIMENTAL GROUP	CONTROL GROUP
• Objective 1. 76 drivers who were fatally injured (within 24 hours) in a collision occurring in the Greater Baltimore metropolitan area.	• 79 drivers involved in non-fatal injury collision (AIS=1-3) which were matched with the fatal collisions.
• Time period: June 1972-June 1975.	• Time period: same.
• Sample Selection: Every driver killed in a traffic accident during that period.	• Sample Selection: Accidents "matched" with experimental group using following criteria: (1) same day of week (2) same hour of day (3) same type of collision (single or multiple) (4) same alcohol involvement (yes or no)

- Instruments used: MMF Psychosocial Questionnaire (141 questions) Katz Adjustment Inventory (205 questions).
- Interviews with informants (family or friends of deceased driver).
- Objective 2. 137 fatally injured drivers - 71 non-fatally injured male drivers
- Combined data from 1968-1975.
- Same instruments

The above were matched on a one-to-one basis one week after the fatal collision.

- Same instruments.
- Interview with driver himself and in some cases informants.
- Norms developed from the Katz Adjustment Scale Inventories R-Forms [6].

OKLAHOMA CITY

This was a one-year study conducted by the University of Oklahoma in an attempt to determine any alcohol associated differences between fatal accidents in Oklahoma City and fatal accidents at a control site. The control site selected was the city of Tulsa, which was very similar to Oklahoma City in population and demographics, yet did not have an operational ASAP.

The collection instrument was very similar to the Boston University HFI as modified for local purposes by the University of Oklahoma MDAI team. A key member of the MDAI team was also a key member of the official ASAP Evaluation Project which enhanced communication between the two groups.

The experimental design was as follows:

EXPERIMENTAL GROUP

- 59 drivers considered to be most responsible for the fatal accidents which occurred in Oklahoma City (ASAP).
- Sample selection: all fatal accidents where the victim died within 24 hours (no cases were dropped). An additional 14 fatal accidents occurred during the time period but the victims died after a 24 hour period.

CONTROL GROUP

- 30 drivers considered to be most responsible for the fatal accidents which occurred in Tulsa (non-ASAP).
- Sample selection: same criteria.

- Time period: October 1973-October 1974 (12 months).
- Instrument used contained 110 data items [7].
- Time period: December 1973-October 1974 (10 months)
- Same instrument.

ALBUQUERQUE

The purpose of this study was to provide an in-depth detailed analysis of alcohol-related crashes which occurred in Bernalillo County, New Mexico where the ASAP was operating. The two year effort was conducted by the University of New Mexico and differed with the other studies in that its primary focus was not fatal accidents, but alcohol-related accidents regardless of their severity. The alcohol-involved driver in these accidents was the focus of this study with the drivers who did not have alcohol involvement in these accidents serving as a control group (a form of "induced exposure"). Another control group which was used for comparison purposes was the drivers who were arrested for DWI and were given in-depth psychosocial diagnosis by the Alcohol Treatment Program personnel in the ASAP.

The basic instrument was a 75 element questionnaire developed by the team with the approval of the NHTSA and the local ASAP people. The experimental design was somewhat unique and is depicted below:

EXPERIMENTAL GROUP	CONTROL GROUP
• 223 drivers with confirmed alcohol involvement in 220 crashes.	• 74 drivers with no alcohol involvement in the same 220 crashes.
• Time period: July 1972-September 1974.	• Time period: Same.
• Sample selection: Level I - 2859 accidents in which the police reported some alcohol involvement during the study period. Used to describe alcohol-related accidents on the basic level and to select the 220 accidents for further study.	• Sample selection: Level I - the remaining 28,000 accidents which occurred during the study period without police designated alcohol involvement.
Level II - A subset of 220 accidents from Level I which generally involved an injury or a fatality (the more severe accidents)	• Level II - the 74 drivers in the 220 accidents who did not have alcohol involvement. These were obviously the "other"

(13% PD; 74% IP; 13% F)
Level III - A subset of 15 accidents from Level II in which in-depth analyses were made (4 standard questionnaires given, etc.).

drivers in multiple vehicle accidents.
- Level III - the 9 drivers in the 15 accidents without alcohol involvement.

- Instruments used:
Level II - 75 item psychosocial questionnaire [8].
Level III - (1) Michigan Alcoholism Screening Test (MAST) [9]. (2) Sensation Seeking Questionnaire [10]. (3) Risk Taking Questionnaire [11]. (4) Wechsler Adult Intelligence Scale [12].

- Instruments used: same.

RESULTS

The first part of this section will synopsize the important results from each of the four studies. The second part briefly presents some new data from a sample of 743 fatal accidents which were investigated by over 20 MDAI teams during the years from 1968-1976. These findings tend to verify many of the salient characteristics produced in the four original studies.

BOSTON

This was the most comprehensive of the four studies with respect to sample sizes, control group data, and the development of a profile based upon discriminant function analyses. The final report is actually in three volumes [4, 13, 14] with a wealth of information in each.

The final sample of 267 accidents included 38% where the "most responsible" driver was killed, 24% where the most responsible driver survived but some other driver or occupant was killed, and the remaining 38% where a pedestrian was struck and killed. In the pedestrian cases it was later determined that the pedestrian was "most responsible" approximately 70-80% of the time. The driver, however, was still the focus of these cases and that must be kept in mind.

Of the studied collisions, it was found that 39% involved alcohol (most responsible driver had a BAC $\geq$.05 mg% or a clinical evaluation thereof when no BAC was taken) or a combination of alcohol and other drugs. An additional 9% involved other intoxicating drugs such as marijuana,

barbiturates, etc., without alcohol involvement. Therefore,48% involved alcohol or some other intoxicating drugs. It is interesting to note that 16% of the drivers either admitted, (or informants told the investigators) that they were under the influence of marijuana at the time of the crash. Over half of those marijuana involved drivers had also been drinking alcohol.

No significant differences were found between the proportion of alcohol involvements in young and old drivers. That is, in the group of drivers aged 19 or less most responsible for a fatal accident, 37% involved alcohol as compared to 42% of the drivers between 20 and 29, and 40% of the drivers between 30 and 49 years of age.

Some important overrepresentations of certain characteristics are listed in Table 1. One can see the beginning of a profile in this table.

TABLE 1

Characteristics Found in Drivers Responsible for Fatal Accidents in Boston and a Control Group of Drivers Not Involved in Fatal Accidents

Characteristic	Drivers Responsible for Fatal Accidents (N = 267)		Control Group of Drivers (N = 801)
	Alcohol Involved	Non-Alcohol Involved	
Previous DWI Arrest(s)	9%	2%	2%
Previous Citations for Speeding or Driving to Endanger ≥ 2	23%	15%	1%
Invalid Drivers License (Suspended/Revoked)	9%	1%	1%*
Marital Status Was Separated or Divorced	18%	7%	4%
Known Alcohol Related Job Loss	25%	8%	3%
Frequency of Alcohol Use Weekly to Daily	51%	29%	38%
Frequency of Alcohol Intoxication Weekly or Greater	40%	12%	9%
Some Attempt to Drink Less	30%	13%	18%
Diagnosed as Problem Drinker**	63%	25%	19%

*5% of the drivers contacted had either no license or it was suspended/revoked. The investigators estimated that about 1/5 of those people had a suspended or revoked license.

**See Definition of Problem Drinker in [13, Appendix F].

A discriminant function analysis was performed with the accident involved drivers divided into alcohol involved and not alcohol involved. The formula was then applied to the control drivers. The results are presented in Tables 2 and 3. The seven variables finally selected based upon their discriminating power included: (1) Alcohol Use Pattern, (2) Reported Frequency of Alcohol Drunkeness, (3) Number of Siblings, (4) Previous DWI arrests, (5) Psychological Treatment History, (6) Occupation and (7) Education. The implications of these findings and a recommendation for its use is discussed in the last section of this paper.

TABLE 2*

Summary Table for Discriminant Function Analysis Using Experimental Operators Involved in Non-Alcohol Related Accidents and the Experimental Operators Involved in Alcohol Related Accidents**

STEP NUMBER	VARIABLE ENTERED	F TO ENTER	SIG. OF WILKES' LAMBDA	SIG. OF CHANGE IN RAO'S V	NON-ALCOHOL MEAN	ALCOHOL MEAN
1	Alcohol use pattern	63.82567	.001	.001	1.4756	2.6408
2	Number of siblings	4.96623	.001	.013	3.5305	3.0971
3	Frequency drunkenness	5.56646	.001	.008	1.4695	2.8155
4	Psychological history	3.15201	.001	.042	0.2195	0.3010
5	DWI arrests	3.53313	.001	.030	0.0183	0.0874
6	Occupation	2.01383	.001	.099	4.3171	4.7282
7	Education	2.38000	.001	.071	3.9268	3.9612

STANDARD DISCRIMINANT FUNCTION COEFFICIENTS	FUNCTION 1
Alcohol use pattern	0.43350
Number of siblings	−0.19666
Frequency drunkenness	0.29288
Psychological history	−0.17308
DWI arrests	0.16649
Occupation	0.18746
Education	−0.15893

CENTROIDS OF GROUPS	FUNCTION 1
Non-alcohol	−0.30538
Alcohol	0.48337

*Reproduced in entirety from [13].
**An alcohol related accident was one where the focal operator had a Blood Alcohol Concentration ⩾.05 gm/100 ml % or a clinical evaluation of the same.

TABLE 3*

Prediction Results in 2 Way Discriminant Function Analysis Using the Experimental Operators Involved in Non-Alcohol Related Accidents and the Experimental Operators Involved in Alcohol Related Accidents** With Controls as Unclassified Cases

ACTUAL GROUP MEMBERSHIP	Number of Operators	PREDICTED GROUP MEMBERSHIP GROUP 1	GROUP 2
GROUP 1 (Non-Alcohol Accidents)	164	129 78.7%	35 21.3%
GROUP 2 (Alcohol Accidents)**	103	34 33.0%	69 67.0%
UNCLASSIFIED CASES (Controls)	801	641 80.0%	160 20.0%

PERCENT OF GROUPED CASES CORRECTLY CLASSIFIED: 74.16%

*Reproduced in entirety from Reference [13].
**An alcohol related accident was one where the focal operator had a Blood Alcohol Concentration ⩾.05 gm/100 ml % or a clinical evaluation of the same.

Finally, it should be noted that before ASAP operations began in Boston the alcohol involvement in the 101 fatal accidents occuring from September 1971 until January 1973 was 45%. During ASAP operations between January 1973 and February 1974 the alcohol involvement in 166 fatal accidents was 35%. This decrease was very close to being statistically significant and was certainly in the desired direction. Also, the drinking age in Massachusetts was lowered from 21 to 18 years of age in May 1973 during the ASAP operations. However, the alcohol involvement between that legal change and February 1974 was only 36%. There was no immediate expected rise in alcohol involvement.

BALTIMORE

The findings for the first objective of this study were conspicuous by the absence of any meaningful differences between the fatally injured drivers and the matched control group of drivers in non-fatal collisions [15]. This most certainly had something to do with the matching criteria in the selection of the non-fatal crashes (same proportion of alcohol involvement; same proportion of single vehicle accidents; same proportion of male drivers, etc.). However, it may also have been partially due to findings in the second part of the study - the personality characteristics of those drivers who are responsible for fatal and serious crashes.

In the 76 accidents involving a driver fatality it was found that 54% had a BAC $\geq$.05 mg% with a range of .05 mg% to .41 mg%. Of the alcohol-involved driver fatal accidents: 68% were single vehicle accidents, 80% occurred between 8:00 p.m. and 4:00 a.m., 10% of the drivers had revoked licenses, 15% had been previously arrested for DWI or public intoxication, 100% of them were considered culpable for the accident, and 17% of the drivers were separated or divorced. Due to the sample sizes, matching process, and other factors, none of the above percentages were significantly different for the 79 non-fatal collisions. The MDAI team concludes that driver fatal and driver serious injury accidents are not very different when comparing most responsible driver characteristics. (See Table 4).

In the second part of the study, all of the accident cases investigated by the team were pooled from the period 1968-1975. Of these accidents, 137 male drivers had sufficient data for factor analysis of the MMF Psychosocial Questionnaire and 88 male drivers had sufficient data for factor analysis of the Katz Adjustment Scale (KAS). These cases were taken from 237 fatal driver accidents and only the "responsible male drivers" were analyzed. Some of the important findings are listed below:

TABLE 4

Characteristics Found in Fatally Injured Most Responsible Drivers and Non-Fatally Injured Most Responsible Drivers in Accidents in Baltimore

Characteristics	Fatally Injured Drivers (N = 76)		Non-Fatally Injured Drivers (N = 79)	
	Alcohol Involved	Non-Alcohol Involved	Alcohol Involved	Non-Alcohol Involved
License Suspended or Revoked at Time of Crash	10%	0%	9%	0%
Previous Conviction for DWI	7%	0%	7%	2%
Marital Status Separated/Divorced	17%	18%	12%	10%
Place of Drinking Not in the Home	65%	40%	81%	57%
Problem Drinker	41%	5%	63%	9%
Education Less Than High School Graduate	55%	29%	54%	33%

- 25% of the married drivers were reported to have had recent marital difficulties due to alcohol.
- Over 50% of the drivers were said to either occasionally or frequently drink while driving and this percentage did not differ regardless of age or BAC at the time of the accident.
- 26% of the older drivers with alcohol involvement had previously been involved in accidents while they were under the influence of alcohol.
- 35% of the alcohol involved older drivers were said to have been in trouble with the law as adults.
- 20% of the drivers had previous license suspensions.
- 45% of the drivers had one or more speeding convictions.

However, the most important finding of this second part of the analysis was that responsible male drivers (RMDs) in these accidents displayed certain personality traits that were significantly higher than a normative group tested on the KAS regardless of whether they were killed or injured in the accident, regardless of their age, regardless of their alcohol involvement at the time of the crash, and regardless of whether it was a single or multiple vehicle accident. A quote from the final report summarizes this finding [5, page 23] :

"To begin, it seems to us that the evidence is altogether overwhelming that, on the whole, RMD's involved in fatal or potentially fatal automobile crashes are not representative of the general population of male drivers. Rather, they appear on the average to be characterized by a number of distinguishing features, usually, but not always, of an undesirable sort. They seem, for example, to be much more likely to drink while driving and to have a much greater incidence of alcohol-related problems than the male driving population at large. In addition, they appear to have a greater number of past traffic violations of all sorts, and previous arrests and/or convictions for unrelated illegal activities are not at all uncommon. Finally, independent assessments by relatives or friends describe them as being more belligerent, verbally expansive, impulsive, and extraverted than the general male population at large. All this should not be taken to mean that persons lacking these characteristics never have serious accidents. Indeed they do. However, the evidence seems virtually conclusive that males possessing these characteristics are disproportionately represented among drivers involved in serious automobile crashes, i.e., that male drivers possessing these characteristics are at a greatly increased risk of becoming automobile fatalities."

OKLAHOMA CITY VS. TULSA

Of the 59 fatal accidents (all types) investigated in Oklahoma City, 25 accidents (42%) involved alcohol. [7] This compares to 12 out of the 30 fatal accidents in Tulsa (40%) and these proportions were not significantly different. In fact, the only finding which pointed to any difference between the two cities as regards alcohol was that 44% of the alcohol involved drivers in Oklahoma City were classified as "problem drinkers" while 75% of the alcohol involved drivers in Tulsa were classified as such. These proportions were significantly different and could have been due in part to the ASAP. On the other hand, because of the large number of statistical tests performed this may have been a spurious result.

Other findings of interest are summarized in Table 5.

The profile drawn by the Oklahoma MDAI team of the alcohol-involved fatal crash is as follows:

- single vehicle accident on a Friday night/Saturday morning
- between 8:00 p.m. and 4:00 a.m.
- involving an older vehicle (5-7 years old)
- coming from a tavern
- involving an unemployed married male with a high school education
- age 30-35
- problem drinker

TABLE 5

Characteristics Found in Most Responsible Drivers in Fatal Accidents in Oklahoma City and Most Responsible Drivers in Fatal Accidents in Tulsa

	Oklahoma City (N = 59)		Tulsa (N = 30)	
Characteristics	Alcohol Involved	Non-Alcohol Involved	Alcohol Involved	Non-Alcohol Involved
Driver Marital Status Separated/Divorced	36%	24%	33%	6%
Problem Drinker	44%	3%	75%	0%
Preferred Drinking in Tavern	36%	0%	42%	0%
Preferred Beverage Is Beer	68%	32%	33%	38%
Frequency of Drinking Is Weekly or Greater	84%	29%	92%	33%
Transportation When Drinking – Drives Own Car	80%	21%	83%	22%
Alcohol Related Marital, Social or Employment Problems	44%	3%	42%	0%
Previous Alcohol-Related Arrest	16%	0%	17%	0%
License Status: Suspended/Revoked	20%	3%	17%	0%

ALBUQUERQUE

The major results of the three levels of data will be summarized here as the final report is voluminous [8, 542 pages]. In general, the Level I police data were useful in defining the accident descriptors on a statistical basis (N=2859). It was found that 16% of all accidents reported in Bernalillo County involved alcohol as reported by the police. This is a higher figure for general accident data than most other cities report. Two thirds of these alcohol involved crashes occurred at night on weekends. Single vehicle, lone driver, rollover, and fixed object collision were all highly overrepresented in the alcohol crashes, when compared to all accidents reported to police. In multiple vehicle accidents, the alcohol-involved vehicle was the striking vehicle over 75% of the time. Approximately 17% of the alcohol-related accidents involved police reported speeds $\geq$60 mph. Alcohol-involved accidents involved higher incidences of injuries and fatalities than all accidents (see Table 6).

The Level II data of 220 severe alcohol-related accidents revealed the following information:

TABLE 6

Injury and Fatality Ratio Comparison Between Alcohol-Related Accidents and All Accidents in Bernalillo County-1973 [8]

	Alcohol-Related Accidents (N = 2859)	All Accidents (N = 16902)
Average Number of Persons Injured Per Accident	.6153	.4200
Average Number of Fatalities Per Accident	.01294	.00485

- alcohol involved drivers drove vehicles that were 5-6 years old on the average and were poorly maintained (as measured by a vehicle condition index developed by the University of New Mexico team [8])
- the alcohol involved drivers were judged responsible for over 90% of the collisions (however, it should be remembered that 64% of the collisions were single vehicle)
- the alcohol involved drivers were alone 70% of the time; if there were passengers they were usually other males who also had been drinking
- 20% of the alcohol involved drivers had invalid drivers licenses
- 56% of the drivers had BACs $\geq$.15 at the time of the accident
- almost 25% of the drivers admitted to sometimes using other drugs while drinking
- 53% of these alcohol involved drivers were diagnosed as "problem drinkers"

The Level III data, of course, contained very small sample sizes (15 alcohol-involved drivers; 9 non-alcohol involved drivers) but an enormous amount of information on each driver (four standard questionnaires were administered to these drivers). Some interesting findings from this level were: 7 of 17 alcohol involved vehicles had invalid or no vehicle inspection stickers; the average measured BAC of the driver was .19 mg %, the MAST [9] indicated that 7 of the 10 alcohol-involved drivers who took the test were problem drinkers (a local psychiatrist confirmed 5 of the 7); human error (comprehension and decision errors) were primarily responsible for 14 of the 15 accidents; 4 of the 15 cases involved multiple drug use.

Table 7 indicates some important percentages concerning alcohol involved drivers as compared to non-alcohol involved drivers in the same accidents (from the 220 Level II cases).

The profile of the alcohol involved driver in Albuquerque was described as: male, between 25-30, Chicano or Indian, separated or divorced, laborer or unemployed,

TABLE 7

Characteristics Found in Alcohol Involved Drivers and Non-Alcohol Involved Drivers in 220 Collisions in Bernalillo County

Characteristics	Alcohol Involved Drivers	Non-Alcohol Involved Drivers*
Most Responsible for Crash	91%	14%
Marital Status Separated/Divorced	24%	14%
License Status:		
Suspended/Revoked	5%	0%
Expired	4%	4%
Never Issued	10%	3%
Frequency of Drinking Weekly or Greater	64%	30%
Problem Drinker	53%	5%
Previous Moving Violations ≥ 2	35%	25%

*Included only drivers with no alcohol involvement in the multiple vehicle accidents. There were no non-alcohol involved drivers in the single vehicle accidents for obvious case selection reasons.

history of previous violations, suffering from some emotional stress, has a high BAC and prefers beer.

MDAI FATAL ACCIDENT FILE

A new accident data file has recently become available for analysis. The file is called the MDAI Fatal Factors File (FFF) [16] and it contains in-depth human factors and environmental information on over 1000 fatal accidents investigated by various MDAI teams over the past 8 years. A total of 743 cases* were investigated by NHTSA sponsored teams (the other cases were investigated by Canadian and Motor Vehicle Manufacturers Association teams) and these were analyzed to verify some of the findings described in this paper. Table 8 indicates some of the findings from this analysis.

It was found that 49% of the 743 accidents were alcohol-involved (BAC $\geq$.05 mg% or clinical evaluation thereof); 91% of the alcohol-involved drivers were male; 68% of the alcohol-involved accidents occurred between 8:00 p.m. and 4:00 a.m.; and 51% of the alcohol-involved drivers were between the ages of 20 and 35.

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*NOTE: MDAI cases are not representative of the national picture. Some biases include the involvement of a late model passenger car, the fatality occurring within 24 hours, and cooperation in the investigation.

TABLE 8

Characteristics Found in Alcohol Involved Drivers and Non-Alcohol Involved Drivers in 743 MDAI Fatal Accidents Investigated by Over 20 Teams During 1968-76

Characteristics	Alcohol Involved Drivers	Non-Alcohol Involved Drivers
Previous Alcohol Related Arrest	38%	6%
Driver Speeding Prior to the Accident (over the speed limit or too fast for conditions)	71%	31%
Driver Most Responsible for Accident	93%	50%
License Status Suspended/Revoked	9%	2%
Previous Moving Violations ≥ 2	49%	34%
Marital Status Separated/Divorced	15%	6%

CONCLUSIONS AND IMPLICATIONS

In reviewing the frequencies, overrepresentations, factor analyses, and discriminant function analyses from these studies it becomes obvious what the profile of a fatal accident involving a drinking driver is likely to be. There are just too many salient characteristics and overrepresentations of factors indicating high risk to be ignored. In summary, some of the accident characteristics are as follows:

- a single-vehicle accident, or if it is multiple vehicle, the alcohol involved vehicle is the striking vehicle
- ocurring between the hours of 8:00 p.m. and 4:00 a.m. on Friday or Saturday night.
- involves an older model vehicle (5 to 8 years old) and probably poorly maintained.
- has an increased risk of involving speeds too fast for conditions or over the speed limit.

A profile of the driver who is at an increased risk involved in a fatal accident in which he was drinking and for which he was responsible is as follows:

- a male between the ages of 20 and 35 (with the means and modes hovering around 30)
- he has a high school education (or less) and there is a significant risk that he has a previous alcohol related, DWI, or two or more speeding arrests

- he may have a suspended or revoked license or had it suspended in the past
- he is single, separated or divorced, with the latter two categories indicating the highest risk
- he tends to prefer beer to other alcoholic beverages and he is more likely a heavy social (drink weekly) or a problem drinker
- he is driving with a BAC $\geq$.10 mg% and an increased risk of it being $\geq$.15 mg%

How can these accident characteristics, and the driver profile in particular, be used by highway safety officials?

The Boston University team suggests the following approach based upon their data [13].

Three lines of variables, or three screens, could be used in a predictive high risk driver formula based upon their discriminant function analysis. They suggest that it be used once the driver is in the system and has been recognized as a potential problem.

The first line screen would be as follows:

1) the drivers first arrest for DWI or,
2) the drivers second arrest for speeding or driving to endanger,
3) the driver is male and between 19 and 39 years old.

If he fits, go to the second line:

4) alcohol use patterns (problem drinker evaluation)
5) frequency of alcohol drunkeness ($\geq$once per week)
6) occupational attainment (low)

If he still fits, go to the third line:

7) physical health history (fair to poor)
8) psychological health history (problematical)
9) education ($\leq$high school)

If he fits these screens then he should be identified for special rehabilitation, remedial action, or other associated countermeasures utilized in the Boston judicial systems.

The Maryland Medical Legal Foundation team discusses these findings in different terms. It is worth quoting their final conclusions [5, page 27].

" Design automobiles with sufficient safety features so as to preclude the possibility of serious injuries occurring. Although the economic cost of producing and owning such vehicles is likely to be high, it may still be lower overall than that associated with the current nationwide death and serious injury toll. The current regulatory trend toward the development of safer motor vehicles is certainly to be welcomed and encouraged.

Provide better enforcement of existing traffic regulations and institute increased surveillance of persons identified as being at increased risk of serious accident. There is now ample evidence that drivers involved in fatal or serious crashes frequently have moderate to extensive records of previous legal (including traffic) violations. Since such persons have already identified themselves as being at increased risk, it would seem socially self-defeating not to make use of this information in an effort to promote the public safety. Better enforcement of existing traffic (not to mention other) laws and regulations would more validly identify the potentially serious traffic offender who could then be subjected to appropriate "probationary" procedures, perhaps including the posting of a sizable bond in order to be permitted to continue driving. Public acceptance of steps in this direction are already evident from the wide-spread utilization of the "point system" as an approach to curbing dangerous driving practices. What is essentially being recommended here is an extension and elaboration of the "point system" to include non-traffic offenses and the introduction of a "bond-posting" provision for persons at increased risk. The latter would seem necessitated by the fact that mere suspension or revocation of license does not invariably (or even usually) result in a cessation of all driving on the part of the person so penalized. The certainty of loss of a sizable amount of money already posted in the event of further violations should act as a powerful deterrent to their occurrence. Such reasoning is entirely consistent with currently popular theories regarding "performance contracting" in the realm of behavior modification."

It is recommended here that at least the following be considered:

(1) Concerning the accident profile characteristics described in the beginning of this section, police authorities should be made aware of these as to likely involvement of alcohol in an accident. Police authorities should be urged to utilize their State laws and encourage their police in the field to order alcohol tests on drivers involved in collisions fitting this mold. Alcohol involved drivers must be detected in these accidents in order to be

deterred from further drinking and driving, if indeed they survive the crash.

(2) Utilize the driver profile in a manner similar to the Boston suggestion. Start with a driver already in the system as a potential problem (a DWI arrest or his second or third speeding violation) and before he is brought to trial, attempt some further screening (age, sex, marital status, alcohol use patterns, etc.), and assign him to certain remedial measures depending upon the outcome. At the very least, this information can be used by officials to educate these drivers and the public that they are at an increased risk of being responsible for a serious or fatal crash if they drink and drive.

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