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A COMPARISON OF ALCOHOL INVOLVEMENT IN PEDESTRIANS AND PEDESTRIAN CASUALTIES

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16. Abstract A field accident research study was conducted in the City of New Orleans in 1975-76 in order to (1) determine the percentage and relative risk of alcohol involvement in adult pedestrian fatal and injury accidents; (2) identify in the alcohol involved accidents any unique accident types, behavioral errors, or other characteristics which distinguish these accidents from non-alcohol pedestrian accidents; and (3) study the alcohol use patterns and the drinker classifications of these pedestrians.

The study was based on extensive data collection on adult (age $\geq$14) pedestrian fatal and non-fatal accident cases and the establishment of control groups based on accident and random site sampling.

Positive blood alcohol concentrations (BACs) were found in approximately half of both the fatally injured pedestrians and non-fatally injured group. The outcome indicates that the degree of alcohol involvement in non-fatal crashes (where the pedestrian is treated at a hospital) is as great as in fatal accidents and that a startling proportion of the victims in both groups have very high BACs.

Depending upon the control group used, the relative risk of accident involvement increases at BAC levels $\geq$.10% and accelerates rapidly at higher BAC levels.

There were indications that (1) the path the pedestrian chose in crossing the road, (2) the culpability of the pedestrian, and (3) the frequency of the pedestrian striking the vehicle were related to the pedestrian's BAC.

Countermeasure implications of these and other results are discussed as well as recommendations for continuing accident research.

17. Key Words Pedestrian accidents; Alcohol Involvement; BAC levels; Accident Site Control Group; Random Site Control Group; Relative Risk; Culpability; Countermeasures

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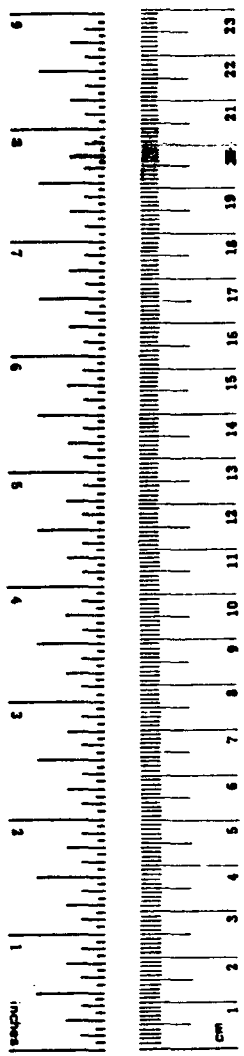
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

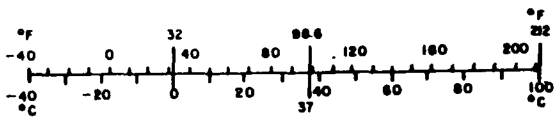
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	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



A COMPARISON OF ALCOHOL INVOLVEMENT IN PEDESTRIANS AND PEDESTRIAN CASUALTIES*

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ABSTRACT

A field accident research study was conducted in the City of New Orleans in 1975-76 in order to (1) determine the percentage and relative risk of alcohol involvement in adult pedestrian fatal and injury accidents; (2) identify in the alcohol involved accidents any unique accident types, behavioral errors, or other characteristics which distinguish these accidents from non-alcohol pedestrian accidents; and (3) study the alcohol use patterns and the drinker classifications of these pedestrians.

The study was based on extensive data collection on adult (age ≥ 14) pedestrian fatal and non-fatal accident cases and the establishment of control groups based on accident and random site sampling. Specifically, the following groups were developed:

- Fatal Accident Group (N=86) - all pedestrians (ages ≥ 14) who died within 24 hours of a motor vehicle accident in New Orleans during 1972-76.
- Injury (non-fatal) Accident Group (N=180) - pedestrians (ages ≥ 14) taken to Charity Hospital in New Orleans following an accident that occurred between March 1975 and March 1976.
- Accident Site Control Groups (N=1208) - similarly exposed but non-accident involved pedestrians (ages ≥ 14) passing the site of the fatal and injury accidents within $\pm$ 30 minutes on the same day of the week as the original accidents.

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- Random Site Control Group (N=80) - 112 street locations chosen at random and sampled for one hour periods with sampling evenly distributed insofar as possible by time of day and day of week.

Positive blood alcohol concentrations (BACs) were found in approximately half of both the fatally injured pedestrians and non-fatally injured group. The outcome indicates that the degree of alcohol involvement in non-fatal crashes (where the pedestrian is treated at a hospital) is as great as in fatal accidents and that a startling proportion of the victims in both groups have very high BACs.

With regards to the relative risk comparisons, three subgroups of control subjects were employed: (a) site matched controls, (b) age/sex/site matched controls, and (c) random controls.

Depending upon the control group used, the relative risk of accident involvement increases at BAC levels $\geq .10\%$ and accelerates rapidly at higher BAC levels. The implications of the results are discussed.

An analysis of accident types, behavioral errors and predisposing factors surprisingly did not indicate major significant differences between alcohol involved and non-alcohol involved cases. There were, however, indications that (1) the path the pedestrian chose in crossing the road, (2) the culpability of the pedestrian, and (3) the frequency of the pedestrian striking the vehicle were related to the pedestrian's BAC.

Countermeasure implications of these and other results are discussed as well as recommendations for continuing accident research.

IN THE UNITED STATES, annually, approximately 8,000 pedestrians are killed and at least 100,000 are injured in traffic accidents (1,2). During the past 10-15 years, a growing body of data have been accumulated which indicate that alcohol consumption by adult pedestrians may play a contributing role in a sizeable percentage of these events.

A review of the literature of previous research efforts regarding the possible association between alcohol and pedestrian safety (3) has disclosed that:

- An appreciable volume of data are available concerning alcohol-involvement among <u>fatally injured pedestrians</u>. However, the various studies which had addressed this issue differed substantially among themselves with respect to the proportions of pedestrian fatalities found to have been drinking.

At the extremes, Haddon, et al (4) reported the presence of alcohol in 74% of the 19 adult pedestrian fatalities they studied, while Waller, et al (5) found that only 35% of 435 fatally injured adult pedestrians had been drinking prior to their accidents. There is an obvious need to get a more detailed picture of the role of alcohol in pedestrian fatalities.

- Little data are available concerning alcohol-involvement among non-fatally injured pedestrians. Further, such data as do exist generally are not based upon measurement of blood alcohol concentration (BAC) or other quantitative indicators of alcohol involvement. Alcohol involvement data from non-fatal pedestrian accidents using quantitative alcohol testing techniques is needed.

- Controlled studies of pedestrian accidents (i.e., those which compare the characteristics of pedestrian victims with samples of similarly exposed but non-accident involved individuals) are extremely rare. In the U.S., only the study by Haddon, et al (4) is known to have been undertaken. In this work, 50 adult pedestrians killed in New York City were compared with site, age and sex matched controls obtained by visiting each accident site on a subsequent date at the same time of day and day of the week as the accident. Data obtained for the victims included accident investigation records and post mortem testing for alcohol. Data from control subjects were derived from interviews and breath specimens. It should be noted that alcohol data were obtained on only 19 of the 50 victims included in the study. Thus, the results are based on a small sample. Also, as noted earlier, Haddon, et al (4) found alcohol present far more frequently than did other studies based on post mortem examinations.

Therefore, a controlled study of pedestrian casualties compared to pedestrians not involved in accidents but similarly exposed is a vital step in understanding the pedestrian problem. A controlled study can determine the relative risk of alcohol at various levels of intoxication.

- Finally, the literature review pointed out the paucity of information on behavioral errors made by pedestrians in accidents and whether there are any differences between the errors or situations in alcohol involved accidents compared to non-alcohol involved accidents. Some studies, for example, indicate that the majority of alcohol involved pedestrians were responsible for their own demise, but again the data are extremely variable.

Waller (6) indicates that among 44 fatally injured pedestrians who had BACs of .10 percent or higher, 52 percent were responsible for the accidents, the driver was responsible in 30 percent of the accidents and fault was not established in 18 percent of the cases.

Marsden (7) found that among 50 fatally injured pedestrians known to have been drinking the pedestrian was at fault in 66 percent of the cases, the driver was responsible in 12 percent of the cases and there was no fault, or it was unknown who was responsible for 22 percent of the deaths. Also, among 120 adult pedestrians in New Jersey (8) who had a Blood Alcohol Concentration (BAC) of .10 percent or more, and where responsibility had been determined, 94 percent were classified as either responsible or partially responsible.

Based upon the above review it was obvious that a well-controlled epidemiological study of the alcohol problem in pedestrian accidents was needed. In 1974, the National Highway Traffic Safety Administration (NHTSA) embarked on such a study. Conducted by Dunlap and Associates, Inc., the study attempted to fill in the many gaps found in the literature review plus provide more insight into other areas of the alcohol problem.

OBJECTIVES

The material that follows presents a summary of this field research study. Specifically, the study had five major objectives. These were:

1. To determine the percentage of adult pedestrian fatal and other injury accidents in which the pedestrian had been drinking alcoholic beverages prior to the crash.
2. To determine if alcohol consumption is "overrepresented" in pedestrian accidents.
3. If alcohol is overrepresented, to determine if it has a unique causal role.
4. To determine, through the use of a standard pedestrian accident typology, the types of accidents in which alcohol impaired pedestrians are involved.
5. To identify the characteristics of alcohol involved pedestrian accident victims.

METHOD

The present study was carried out in the City of New Orleans (1970 population of 593,471) during a period which extended from early 1975 through early 1976. The city has a large medical facility, the Charity Hospital of Louisiana at New Orleans, which handles most of the local emergency trauma cases. The willingness of the hospital to participate in the study and the cooperation of the Parish Coroner, the Police Department and other city officials were key factors in the selection of the city as the study site.

The study was based on data collection on adult (age 14 or older) pedestrian fatal and non-fatal accident cases and the establishment of control groups based on accident and random site sampling.

Specifically, the following groups and data sources were developed:

- <u>Fatal Accident Group</u> - all pedestrians aged 14 or older who died within 24 hours of a motor vehicle accident in New Orleans (Orleans Parish) between March 1, 1972 and March 31, 1976; 86 cases.
- <u>Injury (non-fatal) Accident Group</u> - pedestrians aged 14 or older taken to Charity Hospital following a motor vehicle accident occurring between March 1, 1975 and March 31, 1976; 180 cases.
- <u>Accident Site Control Groups</u> - similarly exposed but non-accident involved pedestrians aged 14 or above passing the site of the fatal and injury accidents within ± 30 minutes on the same day of the week as the original accidents and as soon as possible after their occurrences. For the fatal accidents which occurred before the study period, control sampling took place on the same day of the year (e.g., the third Tuesday in June) as the accident; 1,208 of 1,469 eligible persons provided a breath test specimen and an interview.
- <u>Random Site Control Group</u> - 112 street locations chosen at random and sampled for one hour periods with sampling evenly distributed insofar as possible by time of day and day of week; 80 of 94 eligible persons provided a breath test specimen and an interview.

A summary of the study method is shown in Figure 1.

RESULTS

1. DEGREE OF ALCOHOL INVOLVEMENT - BAC results were obtained from 80 of the 86 fatally injured pedestrians and from 143 of the 180 injured taken to Charity Hospital. The results of these tests are shown in Table 1.

Table 1 - BAC Levels for Adult Fatal and Non-Fatal Crash Involved Pedestrians

BAC*	Fatal (N=80)	Non-Fatal (N=143)
.000	49%	51%
.001 - .049	2	9
.050 - .099	4	4
.100 - .149	11	6
.150 - .199	8	7
.200 - .249	9	10
.25 +	18	13
	100%	100%

*BAC data throughout this paper are given as percent/weight/volume.

Figure 1 - Methods Overview

PEDESTRIAN CRASHES	Fatally injured adult pedestrians 3-1-72 - 4-1-76 N = 86	Non-fatal adults taken to Charity Hospital for treatment 3-1-75 - 4-1-76 N = 180
ALCOHOL CONCENTRATION	*From Coroner:* report on pedestrian's BAC at time of death	*From Hospital:* report on pedestrian's BAC at time of admission
BASIC CRASH INFORMATION	Police Report - State of Louisiana Uniform Motor Vehicle Traffic Accident Report	
DETAILED CRASH INFORMATION		Interview pedestrian and driver
ALCOHOL HISTORY		Interview Pedestrian
PEDESTRIAN AND DRIVER ARREST RECORD	Obtain the arrest records from Police Computer	
WEATHER INFORMATION	Obtain weather data for time of each crash from U.S. Weather Bureau	
CONTROL SUBJECT DATA	Sample pedestrians at crash location, same time of day, same day of week as crash. Obtain Control BAC and interview data.	

The figures in the table indicate that for both the fatal and non-fatal groups, approximately one half had been drinking prior to their accidents. (The underlying BAC distributions of the two groups are not significantly different - $\chi^2 = 6.24$, with 6 d.f.). The results for the fatally injured group are similar to the findings of other reports based on post mortem testing. The present outcome indicates that the degree of alcohol involvement in non-fatal injury accidents (where the pedestrian requires or seeks emergency medical treatment) is as great as in fatal accidents.

2. OVERREPRESENTATION OF ALCOHOL AND RELATIVE RISK - Accident site control sampling was carried out for 241 of the 266 accidents included in the study.* In all, 1,469 pedestrians were approached at the accident sites, with 1,208 (82%) of these agreeing to participate and providing a breath sample. Breath samples were analyzed on site using the Alco-Limiter instrument. Operationally, this device cannot reliably distinguish very low BACs from negative (zero) BACs. Readings from the device up to .049%, therefore, are considered negative herein.

As noted earlier, control sampling was also carried out at 112 randomly selected sites in the city. These sites produced 80 subjects for whom breath alcohol measurements were available.

Overall, 13.5 percent of the accident site controls tested were found to have BACs of .05% or higher compared with 43.0 percent of the tested accident involved pedestrians. Among the random site controls, 7.5 percent had BACs of .05% or more.

Relative risk calculations are one method for comparing crash and control samples and quantifying any increased risk related to BAC level. The equation used for relative risk at each specified BAC level, as suggested by Clayton, et al (9) was:

$$\text{Relative Risk (at specified BAC level)} = \frac{\dfrac{\text{\% accident sample at specified BAC level}}{\text{\% control sample at same BAC level}}}{\dfrac{\text{\% accident sample at .00 - .049\%}}{\text{\% control sample at .00 - .049\%}}}$$

This equation has the effect of setting relative risk at .00% BAC equal to one. Relative risk can be interpreted as a factor specifying the amount, if any, of increased risk of accident involvement associated with a specified BAC relative to .00% BAC. Thus,

*Sampling was not carried out at 25 sites primarily because of clerical problems in matching hospital reports of accidents with police accident reports, e.g., aliases and misspelled names could not be reconciled in a timely manner.

for example, a relative risk of 10.00 implies that pedestrians with that specified BAC level are ten times more likely to be involved in an accident than pedestrians at .00% BAC.

In developing the relative risk comparisons, three subgroups of the control subjects were employed. These were:

(a) Site Matched Controls (N=559) - this group consisted of three control subjects at each accident site whose time of breath testing was closest to the exact time of the accident. Some sites did not produce three control subjects. In these instances, the one or two available subjects were included.

(b) Age/Sex Site Matched Controls (N=193) - this group consisted of that one control subject at the accident location who was the same sex as the pedestrian victim and was closest to the victim in terms of age.

(c) Random Controls (N=80) - this group consisted of subjects tested at the randomly selected sampling sites.

The age/sex site matched controls provide the most conservative basis for determining relative risk in that this group controls for both demographic and site related variables. It is the most appropriate comparison group to the extent that pedestrian behavior and associated risk are correlated with age, sex, time of day, day of week and location. However, comparisons with this group will yield conservative results insofar as the demographic and site variables are correlated with alcohol use irrespective of risk. The site matched controls provide a less conservative basis for judging relative risk because they control for site variables but not for demographic variables. Finally, the random site group provides comparison with an estimate of the total pedestrian population without control of site or demographic variables.

The results of the relative risk calculations are shown graphically in Figure 2.

Relative risk based on the conservative age/sex matched controls does not show a sharp increase until .20% or higher. When the pedestrian victims are compared to the somewhat less conservative site matched controls, there is a substantial increase in risk at .15%. Finally, comparison with the least conservative random or population controls highlights a substantially increased crash risk at .10%.

3. BEHAVIORAL ERRORS - The question of whether alcohol may play a unique causal role in pedestrian accidents was examined by classifying the behavioral errors involved in the accident cases included in the study. The method employed involved trained judges who followed the typology and crash sequence model of Snyder and Knoblauch (10). The elements of the sequence are: Course (location and negotiation); Search (drivers looking for pedestrians; pedestrians looking for vehicles);

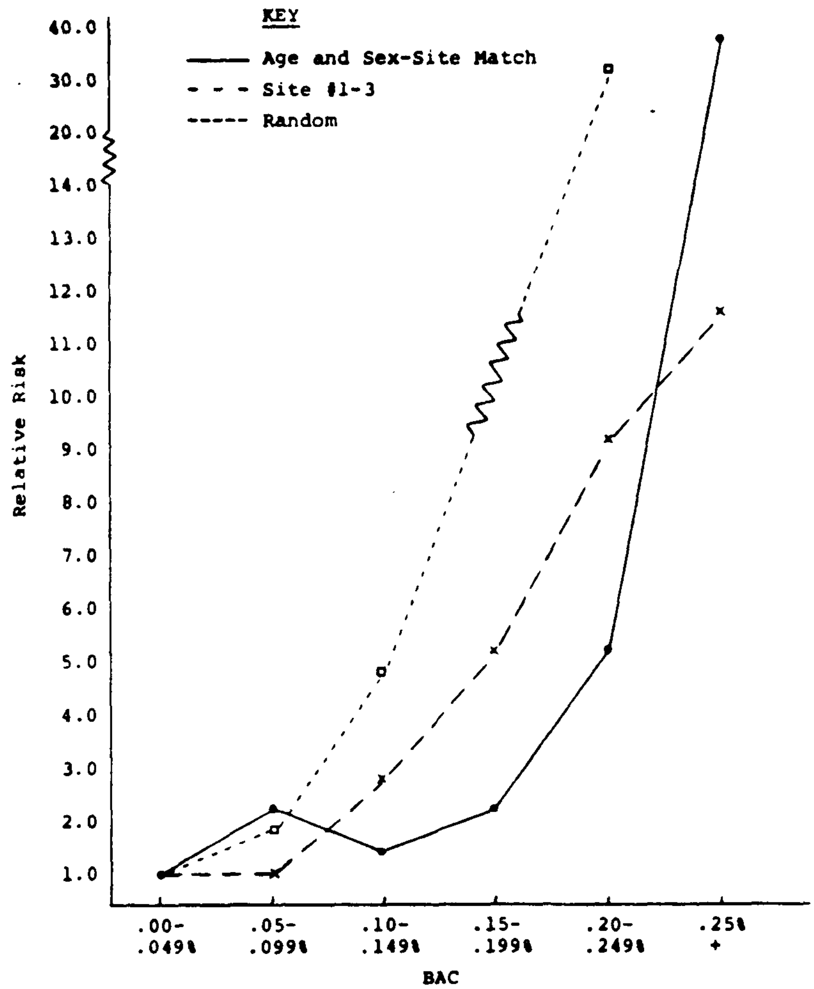

Figure 2. Relative Risk of Accident Involvement by BAC as Determined by the Three Control Groups.

Detection ("seeing" the threat); Evaluation (understanding what must be done to avoid a crash); Action (performing the required crash aviodance action). Pedestrian accident analysis seeks to identify the specific errors, referred to as primary precipitating factors, made within the appropriate elements of the sequence. For example, crossing against the light is a pedestrian course error.

In the present study, there were 212 accidents in which the pedestrian's BAC was known and for which sufficient information existed for accident typing. A total of 485 precipitating factors or errors were determined in these accidents with 205 of these being judged as "first" or most important factors. Table 2 shows the distribution of these first factors as a function of pedestrian BAC. The most frequently cited factor grouping was Pedestrian

Course-Negotiation which includes such errors as "running" and "short time exposure." The second most frequently cited category was Pedestrian Search followed by Pedestrian Course-Location (covers "unexpected," "unusual," "poor" and "high exposure" locations).

The data in Table 2 provide two indications that there may be behavioral differences between the alcohol and non-alcohol

Table 2 - Distribution of First Precipitating Factors by Pedestrian BAC

	Pedestrian BAC		
	.000%	.001 - .099%	.10% +
First Precipitating Factor	(N=109)	(N=22)	(N=81)
Ped Course - Location	4%*	18%	17%
Ped Course - Negotiation	48%	41%	40%
Ped Search	13%	14%	14%
Ped Detection	2%	5%	1%
Ped Evaluation	1%	5%	6%
Ped Action	2%	0%	0%
Ped Factor (Not Specified)	2%	0%	5%
All Driver Factors	29%	18%	10%
No First Factor	0%	0%	7%
	100%	100%	100%

*Entry is percent of cases with that factor, e.g., 4% of the 109 cases in which pedestrian BAC was .000% had Ped Course - Location coded as a first factor.

crashes. First, pedestrian errors, as compared to driver errors, are more prevalent in those accidents where the pedestrian had been drinking. The second indication of behavioral differences between the alcohol and non-alcohol involved crashes comes from the category Pedestrian Course-Location. This factor was noted as a first primary precipitating factor for only four percent of the crashes where the pedestrian's BAC was zero and for 17 percent of the crashes where the pedestrian's BAC was .10% or higher. These figures imply that location of crossing or location in the road is more relevant to the alcohol than the non-alcohol accident.

Also, as a part of the accident analysis process, a judgment was made as to who was culpable for the accident. Cupability was defined as the commission of a behavioral error, the elimination of which would likely have resulted in crash avoidance. Judged culpability was assigned to the pedestrian, the driver, both or (in rare cases) to neither. The results are contained in Table 3 by pedestrian BAC.

Table 3 - Accident Culpability by Pedestrian BAC

	Pedestrian BAC		
Judged Culpability	.000% (N=109)	.001 - .099% (N=22)	.10% + (N=81)
Driver	22%	0%	7%
Pedestrian	61	59	72
Both	15	41	16
Neither	0	0	1
Not Determined	2	0	4
	100%	100%	100%

The data show that a driver was judged culpable in about 23 percent of the non-alcohol crashes and in only 7 percent of those in which the pedestrian had been drinking (.10% or above). Also, the frequency of pedestrian sole culpability was approximately the same in non-alcohol crashes and those with relatively low BACs, but increased where the BAC was .10% or higher.

4. ACCIDENT TYPES - A global technique for describing what happened in a crash is Accident Type. In the present study, the typing method of Snyder and Knoblauch (10) was employed. The results for the 212 accidents where BAC was known and there was sufficient information to assess accident type, are summarized in Table 4 by major class of accident type.

Table 4 - Accident Type by Pedestrian BAC

	Pedestrian BAC		
Accident Type	.000% (N=109)	.001 - .099% (N=22)	.10% + (N=81)
Darts and Dashes	44.1	31.7	45.7
Specific Situations, e.g., Vehicle Turn/Multiple Threat	47.7	59.0	24.5
Non-Specifics			
Ped Strikes Vehicle	1.8	0.0	13.6
Weird	0.0	0.0	3.7
Not Classifiable	6.4	9.1	12.3
(Total non-specifics)	8.2	9.1	29.6

By major category, 48 of 109 (44 percent) of the non-alcohol crashes were typed as darts and dashes as were 44 of 102 (43 percent) of those where alcohol was present.

The specific situation types were assigned in 52 of 109 (48 percent) of the non-alcohol crashes and in 33 of 103 (32 percent) of the alcohol crashes. Finally, the "non-specific" categories were used in eight percent of the non-alcohol and in 25 percent of the alcohol related accidents. It is noteworthy that 11 of 103 alcohol related crashes were assigned the "pedestrian strikes vehicle" type (all in the high BAC category) while only two of 109 non-alcohol accidents were assigned the type. Thus, with regard to accident typing, the darts and dashes do not differentiate alcohol and non-alcohol involved accidents, specific situation types appear less frequent among the high BAC accidents and the "non-specific" category (pedestrian strikes vehicle, weird and not classifiable) is more frequent in the high BAC crashes.

5. PEDESTRIAN ACCIDENT CHARACTERISTICS

(a) Pedestrian Characteristics - Table 5 shows the distribution of BACs of the male and female accident victims. Among females, 68% were alcohol free at the time of their accidents compared with only 41 percent of the males. Almost 31 percent of the males had BACs of .20% or more while just under 12 percent of the females did so. Thus, alcohol involvement was found to be more prevalent among males.

Table 5 - Sex by Measured Pedestrian BAC

	Sex	
BAC	Males (N=146)	Females (N=77)
.00%	41.1%	67.5%
.001 - .099%	9.6	13.0
.100 - .199%	18.5	7.8
.20% or more	30.8	11.7
	100.0%	100.0%

The ages of the accident victims by BAC are shown in Table 6.

Table 6 - Age Group by Measured Pedestrian BAC

	Age						
BAC	14-19 (N=23)	20-29 (N=38)	30-39 (N=30)	40-49 (N=34)	50-59 (N=24)	60-69 (N=33)	70+ (N=41)
.00%	73.9%	47.4%	30.0%	38.2%	29.2%	60.6%	68.3%
.001 - .099%	21.7	15.8	20.0	8.8	0.0	0.0	9.8
.100 - .199%	0.0	15.8	13.3	14.7	25.0	18.2	14.6
.20% - up	4.3	21.1	36.7	38.2	45.8	21.2	7.3
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

The majority of the teenaged, and persons 60 or more were alcohol free at the time of their crashes. The proportions in the very high BAC categories (.20% and above) build up with advancing age until the 50-59 year old group and then decline. It may also be noted that the majority of victims between 30 and 59 years of age had BACs of .10% or more.

Additional data on the pedestrian victims included their residence, previous arrest history and for a small subsample of the victims (N=49) a Mortimer-Filkins (M-F) Problem Drinking Screening Questionnaire (11). With respect to residence, fully 91 percent of the accident victims were New Orleans residents, and this percentage did not vary significantly as a function of BAC. The arrest data suggested that pedestrian victims with prior arrest records were more likely to have been drinking prior to their accidents than those without arrest records (61% of those with 4 or more arrests had BACs of .10% or higher).

The Mortimer-Filkins scores, both from the victims and from a subsample of control subjects (N=371) showed a high degree of correlation with the BAC of the subject. However, the victim scores were not significantly different from those for the controls (mean for victims = 14.6, $\sigma = 7.8$; mean for controls = 14.2, $\sigma = 8.4$), making these results difficult to interpret.

The distribution by time period of the accidents by pedestrian BAC indicates that the alcohol related accidents tend to cluster in the nighttime hours. That is, almost 70 percent of the pedestrian accidents in the study that occurred between 8:00 p.m. and 4:00 a.m. involved a pedestrian whose BAC was .10% or higher. By contrast, the large majority of accidents during the hours of 4:00 a.m. and 4:00 p.m. involved a non-drinking pedestrian. Nevertheless, 15 percent or more of the crashes in these hours involved a pedestrian whose BAC was at least .10%. Finally, the hours from 4:00 - 8:00 p.m. appear to be a transition period in that about one half of the accidents included alcohol while the other one half were alcohol free.

With respect to day of week, approximately 54 percent of the accidents on weekends (Saturday-Sunday) involved pedestrians with BACs of .10% or more, compared with about 33 percent of the weekday accidents.

Several of the characteristics of the accident sties were also examined in relation to pedestrian BAC. Alcohol related crashes are not more or less frequent at intersections. Accidents on one or two way roads and expressways were more frequently alcohol related than were accidents on two lane, divided roads and other (e.g., parking lots, alleys, etc.) locations. The frequency of alcohol related crashes was about the same in business and residential locales and was less frequent in "other" (e.g., open) areas. Alcohol was present more frequently in accidents that occurred where no traffic control device existed. Finally, accidents on roads with speed limits of 30 mph or less were more frequently alcohol related.

RESEARCH IMPLICATIONS

There are three areas in which the authors feel that the findings warrant more in-depth accident research. These are:

1. The finding that the location of the pedestrian crossing or the location of the pedestrian in the road was a precipitating factor in 25% of the high pedestrian BAC accident versus only 9% of the non-alcohol pedestrian accidents. This is a threefold increase of this behavioral factor in the high BAC accidents. Why? Are these high BAC pedestrians walking in sections of the roadway where drivers do not expect pedestrians? Are they crossing at areas that surprise drivers? More information on this factor is needed. Also, whether the pedestrian is aware of this hazardous location, e.g., when he was sleeping in the street.

2. The finding that pedestrian culpability increases with high BAC accidents. Is this an investigator bias (since alcohol involvement was known when this judgment was made) or a real problem? The authors believe that some bias may have been introduced in this judgment, however, it is reasonable to assume that most of this is due to the pedestrian's condition and behavior. But, a more precise look at the behavioral errors being committed is needed. Also, the high BAC accidents are happening late at night when it is more likely that a driver is drinking and more susceptible to driver error. Therefore, why the higher pedestrian culpability?

3. Finally, concerning the accident type comparison, a full 29.6% of the high BAC pedestrian crashes were classified in the "non-specific" category. Almost half of these "non-specific" crash types were "Ped Strikes Vehicle" (13.6%). Are these pedestrians so intoxicated that they are walking into the side of

moving vehicles without any detection at all? It would seem so. The other half of this group were "not classifiable" (12.3%). That is a high enough percentage to attempt to examine new "types" of crashes and new sources of behavioral data on crash occurrence.

There is an ongoing program sponsored by the NHTSA called the Pedestrian Injury Causation Study (PICS) (12) where five accident research teams are investigating pedestrian accidents exclusively, with most investigations taking place on-scene. Some of the answers to the above may emerge from this study, although it is a crash-phase injury oriented study. With minor modifications to its data collection procedures, PICs could begin to provide answers to these and other remaining issues.

POTENTIAL COUNTERMEASURE AREAS

The results of this study certainly did not immediately suggest promising countermeasures. However, there are at least five areas in which potential countermeasures should be considered. It should be stressed that prior to implementing any of these countermeasure approaches, field testing is required to determine whether and to what degree they would impact alcohol related pedestrian accidents.

1. Regulations - The alarming number of victims with very high BACs would indicate that a law such as "Walking While Intoxicated" should be considered. A similar law exists in Puerto Rico and has met with some mild success. Pedestrians with BACs $\geq$ .20 should exhibit very obvious behaviors and be readily detectable by police.

2. Education - A mass media campaign designed to inform the public of the nature and magnitude of the pedestrian alcohol problem and influence their subsequent behavior should be considered. One theme could be that alcohol abuse is a socially unacceptable behavior that could lead to increased pedestrian accident risk. The use of hero figures (sports heroes, movie stars and other celebrities) displaying the pathetic effects of high alcohol levels on motor coordination might help in some respect.

3. Case Finding/Detection - This study documented a profile of the pedestrian accident in terms of pedestrian age, sex, drinking practices, previous arrests, etc., and situational/location factors. This profile could be used as a detection aid for possible screening purposes whenever pedestrians are arrested for alcohol involved offenses or other related problems or for random patrols to remove intoxicated pedestrians from the street.

4. Alter the Product - The gradual lowering of the alcohol content, or proof, of beverages may lower subsequent BAC levels of drinkers. More research is needed to investigate whether the widespread use of the popular "light" beers with lower calories

is also lowering BAC levels since the alcoholic content of these beers is also less than regular beer.

5. Engineering - The high BAC pedestrians just walking into moving traffic poses a unique problem. One possibility that could be investigated is the use of pedestrian barriers or curbs tilted away from the streets. These environmental modifications would presumably prevent the intoxicated pedestrian from wandering into the street by utilizing his own impairment as a deterrent.

CONCLUSION

In conclusion, the authors believe that the excessive use of alcohol by pedestrians is a major highway safety problem. The solution of this problem will require continuing research and countermeasure development efforts. No single approach is likely to provide a total solution to a problem of this complexity and extent. Nevertheless, the various countermeasure approaches identified each have the potential to make a significant impact on part of the problem. The sum of their efforts could produce a sizeable reduction in alcohol-related adult pedestrian crashes. Since these alcohol-related crashes represent approximately half of all adult pedestrian accidents, the potential safety benefit is enormous.

REFERENCES

1. National Safety Council, "Accident Facts." Chicago, 1978.

2. National Highway Traffic Safety Administration, "Fatal Accident Reporting System (FARS) Annual Report." Washington, D.C., Publication DOT-HS-801-954, November 1978.

3. Zylman, R., Blomberg, R.D., and Preusser, D., "A Review of the Literature on the Involvement of Alcohol in Pedestrian Collisions Resulting in Death and Injury." Dunlap and Associates, Inc., Darien, Connecticut, Publication DOT-HS-001413, Washington, D.C., February 1975.

4. Haddon, W., Jr., Valien, P., McCarroll, J.R., and Umberger, C.J. "A Controlled Investigation of the Characteristics of Adult Pedestrians Fatally Injured by Motor Vehicles in Manhattan," Journal of Chronic Diseases, 1961, 14, 655-678.

5. Waller, J.A., King, E.M., Nieson, G., and Turkel, H.W., "Alcohol and Other Factors in California Highway Fatalities," Journal of Forensic Sciences, 1969, 14 (4).

6. Waller, J.A., "Factors Associated with Alcohol and Responsibility for Fatal Highway Crashes," Quarterly Journal of Studies on Alcohol, 1972, 33, 160-170.

7. Marsden, W. E., Jr., "Alcohol and Pedestrian Fatalities: A Study of Fatal Pedestrian Collisions in San Diego County," San Diego: Department of County Engineer, County of San Diego, California, 1972.

8. New Jersey Department of Law and Public Safety, "New Jersey Alcohol Determination Program in Fatal Accident Cases, 1961-63," Trenton, N. J.: Division of Motor Vehicles, Traffic Safety Service, 1964.

9. Clayton, A. B., Booth, A. C., and McCarthy, P. E., "A Controlled Study of the Role of Alcohol in Fatal Adult Pedestrian Accidents," Great Britain Transport and Road Research Laboratory, Supplementary Report No. 332, 1977.

10. Snyder, M.B., and Knoblauch, R. L., "Pedestrian Safety: The Identification of Precipitating Factors and Possible Countermeasures," Vol. I and Vol. II Appendices, Silver Springs, Md.: Operations Research, Inc., 1971, U.S. Department of Transportation Contract No. FH-11-7312.

11. Kerlan, M. W., Mortimer, R. G., Madge, B., and Filkins, L. D., "Court Procedures for Identifying Problem Drinkers," U.S. Department of Transportation Contract No. DOT-HS-800-632, June 1971.

12. "Pedestrian Injury Causation Study," ongoing program sponsored by NHTSA including five data collection teams and a Quality Control and Analysis Contractor, Calspan Field Sciences, Inc., Contract No. DOT-HS-7-01579, 1977-1980.