FINAL REPORT

TRENDS IN DRINKING-DRIVING AT NIGHT
A Comparison of the Four Roadside Surveys of the Fairfax Alcohol Safety Action Project

by

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ABSTRACT

As part of the Fairfax Alcohol Safety Action Project (ASAP), staff members of the Virginia Highway and Transportation Research Council, acting in their role as evaluators of the project, have conducted four nighttime roadside surveys in Fairfax, Virginia. A baseline survey was conducted in January 1972 prior to the start of ASAP operations (February 1972), a second survey in October 1972, a third in October 1973, and a fourth in October 1974. The ASAP concept recognizes the major role that alcohol plays in fatal and serious highway crashes, and the project consists of countermeasures designed to identify drunken drivers, remove them from the road, and refer them to proper educational or rehabilitation programs.

The ultimate objective of the ASAP is to reduce the number of fatalities, personal injuries, and property damage accidents caused by the drinking driver. The purpose of the nighttime roadside surveys of randomly selected drivers is to provide a secondary measure of the project's effectiveness in reducing the incidence of driving while under the influence of alcohol. This report compares the findings of the four surveys with particular emphasis on the BAC's (blood alcohol concentration) of sampled drivers. It appears that there has been an increase in public knowledge regarding the ASAP project and the presumptive limit in Virginia. However, there is no evidence from the roadside surveys to indicate that the Fairfax ASAP has been successful in reducing the incidence of drunken driving as measured by the percentages of drivers above the presumptive limit.

SUMMARY OF FINDINGS

1. Drinking and Drunken Driving Among the Total Sample

   (a) There was a statistically significant increase ($p < .05$) in the percentage of drivers registering a positive BAC (.02% or higher) from the baseline survey percentage of 19.6% to 22.4% on the fourth survey.

   (b) There was a statistically significant increase ($p < .05$) in the percentage of drunken drivers (BAC $\geq$ .10%) from a 3.02% on the third survey to 4.62% on the fourth.

   (c) The increase in the percentage of drunken drivers from 4.26% on the baseline survey to 4.62% on the fourth was not statistically significant.

2. Drinking and Drunken Driving by Time Period

   (a) For the time period from 7:00 p.m. to 9:20 p.m., the following characteristics were observed:

      (1) A statistically significant increase ($p < .01$) in the percentage of positive BAC readings from 11.3% on the baseline survey to 15.8% on the fourth.

      (2) A statistically significant increase ($p < .05$) in the percentage of drunken drivers from 1.11% on the third survey to 2.81% on the fourth.

      (3) A drunken driver passed the survey site every 3.2 minutes on the fourth survey compared with one every 5.9 minutes on the baseline survey.

   (b) For the time period from 9.50 p.m. to 12:10 a.m.:

      (1) A statistically significant increase ($p < .01$) in the percentage of positive BAC readings from 12.6% on the third survey to 18.3% on the fourth.

      (2) No significant differences between the baseline (2.60%), third (2.34%), and fourth surveys (3.13%) in the percentage of drunken drivers.

      (3) A drunken driver passed the survey site every 5.9 minutes on the fourth survey compared with one every 8.2 minutes on the baseline survey.

(c) For the third time period from 12:40 a.m. to 3:00 a.m.:

(1) A statistically significant increase ($p < .01$) in the percentage of positive BAC readings from 27.3% on the third survey to 35.0% on the fourth.

(2) No significant differences in the percentages of drunken drivers between the baseline (12.43%) and fourth surveys (8.98%) or between the third (6.29%) and fourth surveys (8.98%).

(3) A drunken driver passed the survey site every 3.3 minutes on the fourth survey compared with one every 4.0 minutes on the baseline survey.

(4) Statistically significant greater percentages of positive BAC readings and drunken drivers than either of the two earlier time periods for all four surveys.

3. Weekends (F,S) Compared with Weeknights

(a) For the fourth survey, the percentages of positive BAC readings were higher on weekends than on weeknights for the first time period (18.8% vs 14.1%, $p < .05$) and the third time period (47.4% vs 30.9%, $p < .01$).

(b) For weekends, the percentages of positive BAC readings were significantly higher on the fourth survey compared to the baseline survey for both the first (18.8% vs 11.5%, $p < .05$) and third time periods (47.4% vs 38.0%, $p < .05$).

(c) For weeknights, only the third time period was significantly different from the baseline survey for positive BAC's — a reduction from 41.9% to 30.9% ($p < .05$).

(d) For the fourth survey, the percentage of drunken drivers was higher on weekends than on weeknights (12.31% vs 7.16%, $p < .05$).

(e) For weekends, the percentage of drunken drivers was higher on the fourth survey compared to the baseline survey for the first time period (3.66% vs 1.05%, $p < .05$).

(f) For weeknights, there were no significant differences among the surveys for any of the time periods in the percentage of drunken drivers.

4. Sample Characteristics

(a) Characteristics were relatively stable among the four surveys.

(1) Average ages were 32.5, 32.7, 32.7, and 32.8, respectively, for the four surveys. The nighttime driving population was younger than the general population of licensed drivers, whose average age was 38.4.

(2) About four out of five of the nighttime drivers were males (81%, 79%, 79%, and 77% for the four surveys, respectively).

(3) More than nine out of ten were white (94%, 93%, 92%, and 91%, respectively for the four surveys).

(4) About four out of five drink alcoholic beverages (83%, 79%, 83%, and 83%, respectively for the four surveys).

5. Drunken Driver Characteristics (BAC above .10%)

(a) For all four surveys, the age group of drivers under 20 was underrepresented in terms of nighttime driving exposure, and the age group from 30-39 was overrepresented.

(b) For all four surveys, males were more likely to be drunk than were females. These differences were statistically significant on the baseline ($p < .01$), third ($p < .05$) and fourth surveys ($p < .01$).

(c) A significant increase in the percentage of drunken male drivers occurred between the third and fourth surveys ($p < .01$).

(d) On all four surveys, the percentages of black drivers who were drunk were higher than the percentages for whites ($p < .01$ on the baseline, $p < .05$ on the second, and not significant on the third and fourth surveys).

6. ASAP Residents Versus Non-ASAP Residents

(a) ASAP residents were less likely to register positive BAC's, but the difference was significant only on the baseline survey ($p < .01$).

(b) For ASAP residents, a significant increase occurred in the percentage of positive BAC readings from the baseline to the fourth survey (17.9% to 21.8%, $p < .01$).

(c) For non-ASAP residents, there was no significant difference in the percentages of positive BAC readings from the baseline to the fourth survey (24.1% and 24.2%).

(d) For both ASAP and non-ASAP residents, there were significant increases in the percentages of drunken drivers from the third to the fourth survey (ASAP, 2.57% to 3.97%, $p < .05$; non-ASAP, 3.90% to 6.71%, $p < .05$).

(e) On the fourth survey, the percentage of non-ASAP residents who were drunk was significantly higher than that for ASAP residents (6.71% vs 3.97%, $p < .01$).

(f) ASAP residents improved significantly in knowledge of the presumptive limit, but non-ASAP residents did not ($p < .01$).

7. BAC by Beverage Preference

(a) Beer was the favorite beverage, followed by liquor, and then wine for all four surveys.

(b) For beer drinkers, there was a significant increase in the percentage who were drunk from 4.2% on the third survey to 7.4% on the fourth ($p < .01$).

(c) There were no significant differences among the surveys for either wine drinkers or liquor drinkers in the percentages who were drunk.

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BACKGROUND

The Fairfax Alcohol Safety Action Project (ASAP) was initiated in January 1972 as one of a number of three-year, federally funded demonstration projects designed to implement and evaluate the concept of the use of comprehensive community alcohol countermeasures in combating the problem of drunken driving. The ultimate objective of the Fairfax ASAP is to reduce the number of crashes which result in fatalities, personal injuries, and property damage by concentrating its efforts on reducing the incidence of drunken driving. It has already been demonstrated that drunken drivers account for a disproportionately large share of serious and fatal accidents. If the ASAP is successful in intervening in the normal drinking patterns of drunken drivers so that their incidence of drunken driving is significantly reduced, it follows that the number of alcohol-related accidents could be reduced.

The purpose of the nighttime roadside surveys is to provide a secondary measure of the project's effectiveness in reducing the incidence of drunken driving. The first roadside survey, hereafter called the baseline survey, was conducted in January 1972 prior to the implementation of the ASAP countermeasures. The baseline survey results were established as the base from which changes in drinking habits could be measured during the subsequent yearly surveys during the three-year course of the project. The second survey was conducted in October 1972 after nine months of ASAP operations, the third in October 1973, and the fourth in October 1974.

METHODOLOGY

The basic survey procedures were patterned after the procedures outlined in the U. S. Department of Transportation's report entitled Methodological Considerations in Conducting and Evaluating Roadside Research Surveys, by M. W. Perrine of the University of Vermont. The two primary functions of the roadside surveys as stated in the Perrine report are: "(1) to provide data for describing the basic problem in terms of identification and specification of assumedly relevant parameters, and (2) to provide data for evaluating results of any changes in circumstances surrounding the basic problem, whether they are the result of unplanned natural events, on the one hand, or controlled premeditated countermeasures, on the other." (1)

Sampling Frequency

Four roadside surveys were conducted during the Fairfax Alcohol Safety Action Project. The first survey was conducted each night from January 5, 1972, through the early morning hours of January 16, 1972. The baseline survey had to be conducted in January because of the need to establish comparative data prior to implementation of the enforcement countermeasure on February 1, 1972, and after contracts with the five cooperating police agencies in the area had been signed so that police assistance could be secured in the baseline survey. The second survey was conducted in October 1972, the third was in October 1973, and the final survey in October 1974. By conducting the surveys during October, the annual changes in BAC levels can be measured without worrying about seasonal variations in drinking patterns. In addition, the survey results are available in time for analysis and inclusion in the annual evaluation report. In a more practical nature, the weather in October would seem to be more conducive to the taking of an outdoor survey.

Sample Size and Day of the Week

U. S. Department of Transportation guidelines specify a minimum sample size of 640. The guidelines also suggest that the samples be taken on Friday and Saturday nights. However, since ASAP's in North Carolina and Michigan had found positive readings of 22.2% and 19.0%, respectively, when they surveyed throughout the week compared with the positive reading percentage of 42.0% reported by the Oregon ASAP, which surveyed only on Fridays and Saturdays, it was believed to be important to test both periods in Fairfax. By testing both periods the information would be available to allow the Fairfax ASAP to focus increased police patrols on the periods which showed the greatest number of drunken drivers. Thus, all four surveys were conducted on both weekends and week nights. With minimum sample sizes set at 640 for both weeknights and weekends (Friday, Saturday), a total of three sets of statistics will be available such that the levels of drinking by nighttime drivers can be measured on weekends, on weeknights, and in the aggregate.

Hour of Day

The hours of 7 p.m. to 3 a.m. were used for sampling the drinking driving patterns in Fairfax. This eight-hour period was divided into three 2-hour- and 20-minute periods in which the interviews were conducted and an additional hour allowed for travel time between sites. The time periods were 7:00 p.m. — 9:20 p.m. (Site 1), 9:50 p.m. — 12:10 a.m. (Site 2), and 12:40 a.m. — 3:00 a.m. (Site 3). The three time frames were used rather than the four suggested by the U. S. Department of Transportation guidelines in order to increase the amount of interview time in relation to travel time by reducing the travel time between sites by 33%.

Site Selection

It was determined that the general locations for survey sites would be roughly proportioned among the five participating police jurisdictions on the basis of their resident populations and number of police officers. This decision was made in order to achieve representative samples of the various driving conditions in Fairfax as well as getting all of the police departments involved from the very beginning of the ASAP. After asking the police departments for a list of sites which conformed to the U. S. Department of Transportation guidelines, a staff member of the Virginia Highway and Transportation Research Council reviewed this list of sites. Sites were selected which seemed to be a representative mixture of the rural and urban areas in Fairfax as well as being dispersed throughout the county. The final determination of which site would be sampled at what time was made under the condition that the travel time between sites would be under twenty-five minutes. Thus, the site and sampling period combinations were made from subsets consisting of sites in the entire ASAP area chosen so that travel time between consecutive sites would not exceed twenty-five minutes. Thus, the driving population was sampled randomly within the constraints of travel time and research design.

Questionnaire

The standard U. S. Department of Transportation questionnaire for roadside surveys was used. This questionnaire consisted of questions dealing with the respondent's place of residence, driving habits, drinking habits, drinking attitudes and knowledge, demographic data, and, most importantly, the BAC reading on the breath test. A copy of the questionnaire is shown in Appendix A.

Breath Test Instruments

The breath-testing device for the baseline survey was the Intoximeter-Mark II, manufactured by Intoximeters, Inc. of St. Louis, Missouri. Both the Intoximeter and a breath-testing machine called the HALT model manufactured by Borg-Warner Corporation were used on the second survey. The instrument for the third and fourth surveys was the Breathalyzer, model 900A.

Administrative Procedures

The five participating police departments provided the necessary patrolmen for traffic control. The coordinators were members of the Safety Section of the Virginia Highway and Transportation Research Council. The interviewers and data recorders were provided under a subcontract to the Stoneland Corporation of Chesapeake, Virginia. The breath-test operators were ASAP lab technicians and Breathalyzer-certified police officers provided by Fairfax County.

The coordinators selected the vehicles to be stopped by the policemen, designating the first eligible vehicle whenever a vacancy existed within the mobile vans used for interviews. The policemen simply directed the motorist out of the line of traffic and over to the coordinators, who were identified by their white lab coats. It was the job of the coordinators to secure a motorist's cooperation in the survey. The percentages of motorists who participated were 91%, 90%, 95%, and 95%, respectively, for the four surveys. It is strongly believed that the few who did not participate were not overrepresentative of drinking drivers in that any reluctant driver that a coordinator thought had been drinking was almost invariably convinced that his participation was in the best interest of preserving his anonymity. After securing a motorist's cooperation, the coordinator led the driver to one of the two interview vans where he was greeted by a lab technician, who immediately administered the breath test. Then the questionnaire was administered, and by the time the interview was finished, the BAC reading had been calculated and was recorded on the questionnaire. The coordinator thanked the morotist for his cooperation, and he was allowed to proceed on his way if his BAC reading was under .10%. Those drivers whose BAC was .10% or above were given options of being driven by a sober passenger when available, by a member of the local Jaycees, by volunteers from the military, or by volunteers from the ASAP program. Subjects who were slightly above .10% were also given the option of remaining at the site for a long enough period of time for their BAC to drop below .10% upon retesting.

DISCUSSION OF SURVEY FINDINGS

The data from the baseline survey showed that there was significantly more drinking on weekend nights (Friday and Saturday) than on weeknights, and that the percentage of drivers above the presumptive level of .10% was highly correlated with the three time periods. On the baseline survey the percentages of drivers who were above the presumptive level were 1.6%, 2.6%, and 12.4% for time periods1, 2, and 3, respectively. It is important for the reader to keep in mind that the aggregate statistics discussed in this report are influenced by the percentages of interviews in the three time periods. Generally, there were more interviews conducted during the two later time periods on the follow-up surveys than on the baseline survey; therefore, it might be expected that the influence on the aggregate statistics would be an increase in the percentages of subjects who had been drinking or who were drunk.

To avoid possible misinterpretation of the aggregate statistics, the breath test results or BAC data will be arrayed in three separate formats. First the raw aggregate data will be discussed. Then in the latter portion of this report the data will be arrayed by time periods for an analysis of any changes that might have occurred in one of the time periods. Finally, the BAC data for drunken drivers will be arrayed after they have been properly weighted to adjust the results to a comparable base. This adjustment will assume that the data should be weighted according to the traffic volume during the respective time periods for each survey. Unless otherwise noted, all comparisons of percentages were made using the Z-test, which is explained in Appendix B.

Time Periods and Sample Size

Time Periods	Baseline Survey	Second Survey	Third Survey	Fourth Survey
1	697 (44.3%)	490 (33.1%)	539 (35.4%)	1094 (39.0%)
2	539 (34.2%)	581 (39.3%)	556 (36.5%)	940 (33.5%)
3	338 (21.5%)	409 (27.6%)	429 (28.1%)	770 (27.5%)

On the baseline survey, it should be noted that more than twice as many interviews were conducted during the first time period than in the third period. The decrease in the nighttime traffic as the time grew later was largely responsible for this. However, on the second, third, and fourth surveys, there was a more even distribution of samples among the three time periods. As a result it would normally be expected that the aggregate statistics would be influenced by there being proportionately more samples during the latest time period. This factor should be remembered in examining the BAC data and will be weighted accordingly in a section of the report dealing with the analysis of data by the three time periods.

Day of Week	Baseline Survey	Second Survey	Third Survey	Fourth Survey
Sunday	97 (6.1%)	243 (16.4%)	282 (18.5%)	493 (17.6%)
Monday	167 (10.6%)	225 (15.2%)	208 (13.6%)	248 (8.8%)
Tuesday	153 (9.7%)	72 (4.9%)	88 (5.8%)	146 (5.2%)
Wednesday	167 (10.6%)	186 (12.6%)	217 (14.2%)	447 (15.9%)
Thursday	254 (16.1%)	145 (9.8%)	202 (13.3%)	432 (15.4%)
Friday	358 (22.7%)	301 (20.3%)	259 (17.0%)	507 (18.1%)
Saturday	381 (24.2%)	308 (20.8%)	268 (17.6%)	531 (18.9%)
Weeknight	838 (53.1%)	871 (58.9%)	997 (65.4%)	1766 (63.0%)
Weekend (Fri., Sat.)	739 (46.9%)	609 (41.1%)	527 (34.6%)	1038 (37.0%)

The surveys generally showed more people drinking on weekends than weeknights but no difference in the percentages who were drunk. The weekend percentage of the sample decreased from the baseline survey, and this could influence the aggregate statistics by finding fewer people drinking, simply because of this shift in the sample to the period of less drinking. Again the BAC data will be analyzed at a later time by weekends and weeknights.

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Demographic and Driving Characteristics

Age of Respondent	Baseline Survey	Second Survey	Third Survey	Fourth Survey	Driving Age Population
Under 20	319 (20.2%)	278 (18.8%)	252 (16.5%)	453 (16.2%)	11.0%
20-29	508 (32.3%)	495 (33.5%)	563 (36.9%)	1009 (36.1%)	22.7%
30-39	338 (21.5%)	306 (20.7%)	312 (20.5%)	623 (22.3%)	21.6%
40-49	231 (14.8%)	247 (16.7%)	229 (15.0%)	390 (13.9%)	23.3%
50-59	143 (9.1%)	111 (7.5%)	140 (9.2%)	240 (8.6%)	13.5%
60 or over	35 (2.2%)	41 (2.8%)	28 (1.9%)	81 (2.9%)	7.9%

Sex of Respondent	Baseline Survey	Second Survey	Third Survey	Fourth Survey
Male	1,268 (80.6%)	1,166 (78.8%)	1,207 (79.2%)	2,139 (77.1%)
Female	306 (19.4%)	314 (21.2%)	317 (20.8%)	635 (22.9%)

Race of Respondent	Baseline Survey	Second Survey	Third Survey	Fourth Survey
White	1,485 (94.3%)	1,381 (93.3%)	1,400 (91.9%)	2,490 (90.7%)
Black	73 (4.6%)	79 (5.3%)	106 (6.9%)	181 (6.6%)
Other	16 (1.1%)	20 (1.4%)	18 (1.2%)	73 (2.7%)

Place of Residence	Baseline Survey	Second Survey	Third Survey	Fourth Survey
Fairfax ASAP	1,109 (70.5%)	691 (46.7%)	1,011 (66.3%)	2,131 (76.1%)
Other Va.	373 (23.7%)	684 (46.2%)	408 (26.8%)	461 (16.4%)
Out-of-State	92 (5.8%)	105 (7.1%)	105 (6.9%)	209 (7.5%)

Time at Current Address	Baseline Survey	Second Survey	Third Survey	Fourth Survey
Less than 1 Mo.	34 (2.2%)	74 (5.0%)	86 (5.7%)	87 (3.1%)
1-6 Months	141 (9.0%)	148 (10.0%)	185 (12.1%)	299 (10.7%)
7-11 Months	71 (4.5%)	98 (6.7%)	85 (5.6%)	85 (3.0%)
1-2 Years	235 (14.9%)	207 (14.1%)	220 (14.4%)	482 (17.2%)
3-4 Years	161 (10.2%)	83 (5.6%)	105 (6.9%)	279 (10.0%)
Over 4 Yrs.	932 (59.2%)	862 (58.6%)	843 (55.3%)	1,567 (56.0%)

Miles Driven Per Year	Baseline Survey	Second Survey	Third Survey	Fourth Survey
Less than 10,000	362 (23.0%)	418 (28.2%)	418 (27.4%)	777 (27.8%)
10,000 - 19,999	680 (43.2%)	570 (38.5%)	666 (43.7%)	1,199 (43.0%)
20,000 - 29,999	323 (20.5%)	287 (19.4%)	242 (15.9%)	444 (15.9%)
30,000 - or More	209 (13.3%)	205 (13.9%)	198 (13.0%)	372 (13.3%)

Days of Driving in a Typical Week	Baseline Survey	Second Survey	Third Survey	Fourth Survey
Everyday	1,215 (77.2%)	1,097 (74.1%)	1,229 (80.6%)	2,089 (74.5%)
6	119 (7.5%)	122 (7.6%)	68 (4.5%)	209 (7.5%)
5	108 (6.9%)	144 (9.7%)	80 (5.3%)	205 (7.3%)
4	43 (2.7%)	35 (2.4%)	35 (2.3%)	93 (3.3%)
3	39 (2.5%)	46 (3.1%)	49 (3.2%)	87 (3.1%)
2	33 (2.1%)	30 (2.0%)	34 (2.2%)	77 (2.7%)
1	11 (0.7%)	15 (1.0%)	25 (1.6%)	28 (1.0%)
None	6 (0.4%)	1 (0.1%)	4 (0.4%)	16 (0.6%)

For all four surveys, the demographic and driving characteristics of the samples were relatively stable with only one notable exception. There appears to have been a major shift in the place of residence on the second survey. However, the author does not believe that so large a shift actually occurred. The most likely reason for the reported change is that the data recorders had to make judgements concerning whether a person's residence was in the ASAP area or not, and it appears likely that small town addresses which were actually within Fairfax County were recorded as being "other Virginia" addresses on the second survey. The results of the third and fourth surveys, when compared to the baseline survey, tend to corroborate the conclusion that on the second survey there was considerable error variance in the interpretation by interviewers regarding whether or not a subject was an ASAP resident.

Drinking Knowledge

Definition of Blood Alcohol Concentration

Definition	Baseline Survey	Second Survey	Third Survey	Fourth Survey
Substantially Correct	1,075 (68.3%)	1,066 (72.6%)	1,230 (80.8%)	1,960 (70.3%)
Wrong or Don't Know	499 (31.7%)	402 (27.4%)	293 (19.2%)	830 (29.7%)

This question calls for the judgement of the interviewer in deciding if the answer is correct, and this probably accounts for the variation throughout the surveys. The percentage of respondents who were substantially correct in

defining blood alcohol concentration increased significantly ($p < .01$) until the fourth survey, when there was a significant decrease ($p < .01$) from the third survey's high of 80.8%. The baseline and fourth surveys were not significantly different in the percentage of correct responses. The trend over the surveys is shown in Figure 1.

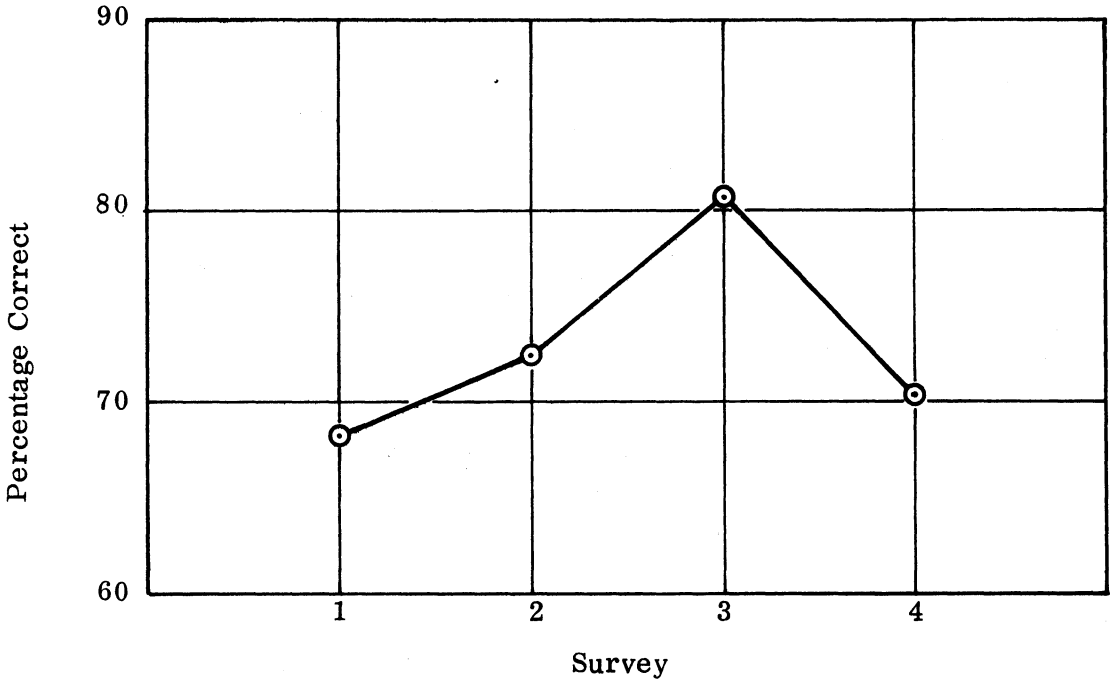

Figure 1. Definition of Blood Alcohol Concentration.

Presumptive Level for Drunken Driving in Virginia

BAC Level	Baseline Survey	Second Survey	Third Survey	Fourth Survey
Any Trace	29 (1.8%)	23 (1.6%)	30 (2.0%)	34 (1.2%)
.05%	182 (11.6%)	242 (16.4%)	212 (13.9%)	432 (15.4%)
.08%	98 (6.2%)	159 (10.8%)	156 (10.2%)	206 (7.4%)
.10%	161 (10.2%)	308 (20.8%)*	394 (25.9%)*	684 (24.4%)*
.12%	81 (5.1%)	102 (6.9%)	57 (3.7%)	85 (3.0%)
.15%	299 (19.0%) *	106 (7.2%)	72 (4.7%)	120 (4.3%)
.20%	48 (3.1%)	54 (3.6%)	40 (2.6%)	64 (2.3%)
Don't Know	676 (43.0%)	484 (32.7%)	563 (37.0%)	1,175 (42.0%)

When the baseline survey was conducted, the presumptive level in Virginia was .15%. This level was lowered to .10% on July 1, 1972, which was before the second survey. Thus the correct answers are marked above with asterisks, and the percentages of correct responses are analyzed on the basis of the change in the laws.

There was no significant change in the percentage of correct responses between the baseline and the second survey. However, there was a statistically significant improvement in correct answers between the second and third surveys ($p < .01$). There was actually a slight decrease on the fourth survey, but it was not significant. The trend in correct responses is depicted in Figure 2, which shows the increases on the second and third surveys followed by the decrease on the fourth survey. The fourth survey results remained significantly higher ($p < .01$) than those on the baseline survey.

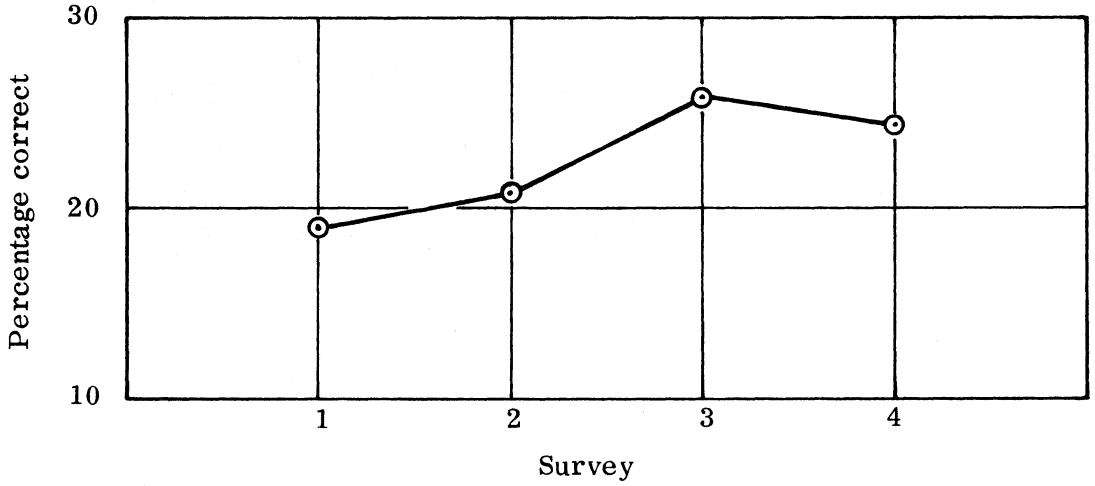

Figure 2. Presumptive level for drunk driving.

Drinks Necessary for Respondent to Reach Presumptive Level

Drinks	Baseline Survey	Second Survey	Third Survey	Fourth Survey
1 or Less	85 (5.4%)	136 (9.2%)	112 (7.4%)	245 (8.7%)
2	136 (8.6%)	214 (14.5%)	221 (14.5%)	487 (17.4%)
3	207 (13.2%)	235 (16.0%)	245 (16.1%)	600 (21.4%)
4	202 (12.8%)	149 (10.1%)	197 (12.9%)	395 (14.1%)
5	125 (7.9%)	106 (7.2%)	87 (5.7%)	168 (6.0%)
6	131 (8.3%)	121 (8.2%)	88 (5.8%)	149 (5.3%)
7	47 (3.0%)	27 (1.8%)	24 (1.6%)	27 (1.0%)
8	58 (3.7%)	32 (2.2%)	52 (3.4%)	28 (1.0%)
9	23 (1.5%)	4 (0.3%)	12 (0.8%)	15 (0.5%)
10 or More	122 (7.8%)	72 (4.9%)	56 (3.7%)	93 (3.3%)
Don't Know	438 (27.8%)	377 (25.6%)	428 (28.1%)	597 (21.3%)
Average =	3.45 drinks	2.94 drinks	2.82 drinks	2.78 drinks

The blood alcohol content is dependent on a number of variables, among which the main ones are the individual's weight, his rate of alcohol metabolism, the length of time over which the alcohol is consumed, and of course, the amount of alcohol consumed. Generally, the motorists underestimated the number of drinks necessary to reach the presumptive level, the number of drinks being calculated on the basis of the respondent's weight. For all four surveys, about one-fourth said they didn't know, about one-half underestimated the amount, about 15%-20% were in the right range, and about 5%-10% overestimated the amount. However, there has been a consistent reduction in the percentage answering that they could drink 10 or more. The average number of drinks on the fourth survey was 2.78, which is about one-half of the actual number of drinks generally needed by the composite of the sample, which had an average weight of 165 pounds.

Drinking Habits

Ever Drink Beer, Wine, or Liquor?

Drink	Baseline Survey	Second	Third	Fourth
Yes	1,313 (83.4%)	1,172 (79.2%)	1,272 (83.5%)	2,335 (83.4%)
No	261 (16.6%)	308 (20.8%)	252 (16.5%)	464 (16.6%)

About four out of five of the motorists do drink beer, wine, or liquor. The results on the fourth survey are identical to the baseline survey results. They also compare favorably with the 83.5% of the baseline Household Survey respondents who drink. It is evident that drinking is a normal component of the lifestyle for most people in Fairfax. The stability of the results over time is apparent from the graph in Figure 3.

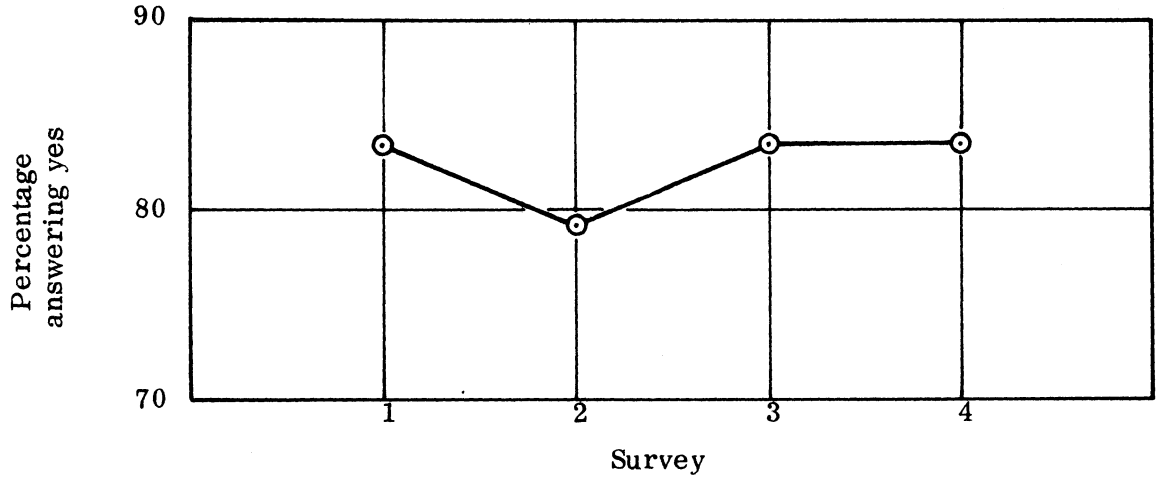

Figure 3. Ever drink beer, wine, or liquor?

Preference Among Beer, Wine, Liquor

Preference	Baseline Survey	Second	Third	Fourth
Beer	665 (50.7%)	633 (54.1%)	744 (59.6%)	1,388 (59.5%)
Wine	196 (14.9%)	194 (16.6%)	189 (15.1%)	347 (14.9%)
Liquor	452 (34.4%)	342 (29.3%)	316 (25.3%)	596 (25.6%)

Beer continued to be the most preferred beverage, followed by liquor and wine in that order. The percentage of respondents preferring wine varied very little among the surveys. However, it appears that beer is becoming increasingly popular while the percentage of respondents preferring liquor is declining. The change in preference from the baseline survey to the fourth survey is significant ($p < .01$). Figure 4 depicts this increasing preference for beer over the course of the surveys.

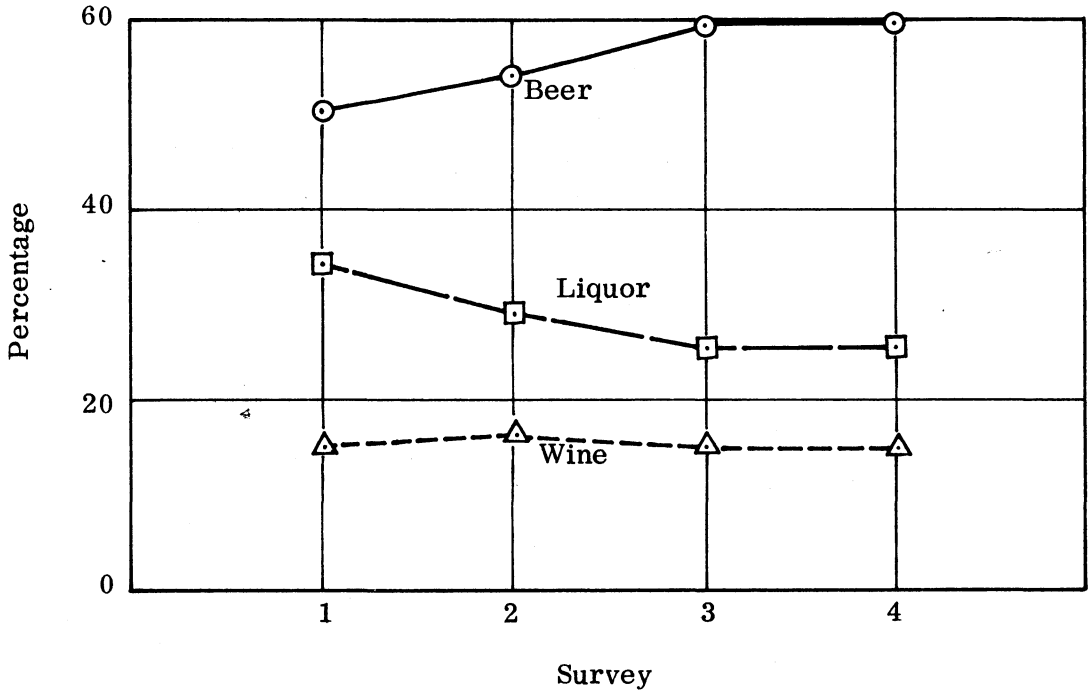

Figure 4. Preference among beer, wine, and liquor.

Self-Categorization of Drinking

Drinking Category	Baseline Survey	Second Survey	Third Survey	Fourth Survey
Very light	559 (42.6%)	586 (50.1%)	601 (48.5%)	1,060 (45.6%)
Fairly Light	392 (29.9%)	286 (24.5%)	317 (25.6%)	669 (28.8%)
Moderate	338 (25.7%)	270 (23.1%)	300 (24.2%)	550 (23.6%)
Fairly Heavy	21 (1.6%)	15 (1.3%)	14 (1.1%)	32 (1.4%)
Heavy	3 (0.2%)	12 (1.0%)	8 (0.6%)	15 (0.6%)

There has been very little variation over the course of the four surveys in self-categorization of drinking. On all four surveys, about three-fourths of the respondents classified themselves as being either very light or fairly light drinkers. About one-fourth classified themselves as moderate drinkers, and only about 2% viewed their drinking as either fairly heavy or heavy. In view of the breath test results, this question demonstrates that many people tend to underestimate their alcohol consumption.

Breath Test Results (BAC)

BAC	Baseline Survey	Second	Third	Fourth
Neg. - .015	1,266 (80.4%)	1,161 (78.4%)	1,281 (84.1%)	2,134 (77.6%)
.02 - .04	140 (8.9%)	138 (9.3%)	113 (7.4%)	286 (10.4%)
.05 - .09	101 (6.4%)	119 (8.1%)	84 (5.5%)	203 (7.4%)
.10 - .14	43 (2.7%)	44 (3.0%)	33 (2.2%)	103 (3.7%)
.15 - .20	18 (1.1%)	10 (0.7%)	8 (0.5%)	21 (0.8%)
Over .20	6 (0.4%)	8 (0.5%)	5 (0.3%)	3 (0.1%)

Probably the most important variable on the roadside survey questionnaire was the result of the breath test taken by each driver. The results have been mixed in that the downward trend on the third survey was reversed on the fourth survey. This reversal of trend is clearly shown in Figure 5.

The 15.9% for the percentage of positive readings (BAC $\geq$.02%) was significantly lower on the third survey than the 19.6% on the baseline survey ($p < .01$). However, the percentage of 22.4% on the fourth survey was significantly higher than both the baseline survey ($p < .05$) and the third survey ($p < .01$). This increase in the percentage of drivers who have been drinking is unexplainable in the context of the continued operation of the ASAP project in Fairfax except as to the mere speculation that the increase is associated with the rising unemployment in the area.

Johns Hopkins sociologist and public health professor M. Harvey Brenner has reported to the American Public Health Association that the economy affects drinking habits. [3] Brenner said that heavy drinking during unstable economic conditions often leads to contacts with the criminal justice system, and that while hard liquor consumption goes up with economic downturns, the increased consumption of wine and beer is linked to periods of economic stability.

In examining the influence of economic conditions on drunken driving in Fairfax, unemployment data for Northern Virginia were obtained from the Manpower Research Department of the Virginia Employment Commission. The unemployment rates of 2.2%, 2.7%, 3.4%, and 3.8% were correlated with the percentages of drunken driving for the respective survey periods of 4.2%, 4.2%, 3.0% and 4.6%. In Fairfax the correlation was -.09, which is very low as well as being negative, which would seem to fairly well rule out the hypothesis that the increased drunken driving could be attributed to rising unemployment in the Fairfax area.

The changes in drunken driving (BAC's $\geq$.10%) parallel those among the percentage of positive readings. From a low of 3.0% on the third survey, the percentage of drunken drivers increased to a high of 4.6% for the four surveys. This increase is statistically significant ($p < .05$). The percentage of 4.6% is higher than the baseline percentage of 4.2%, but the difference is not significant.

Figure 5 depicts the breath test results for the four surveys. The decrease in each BAC category on the third survey is followed by an increase in each category on the fourth survey.

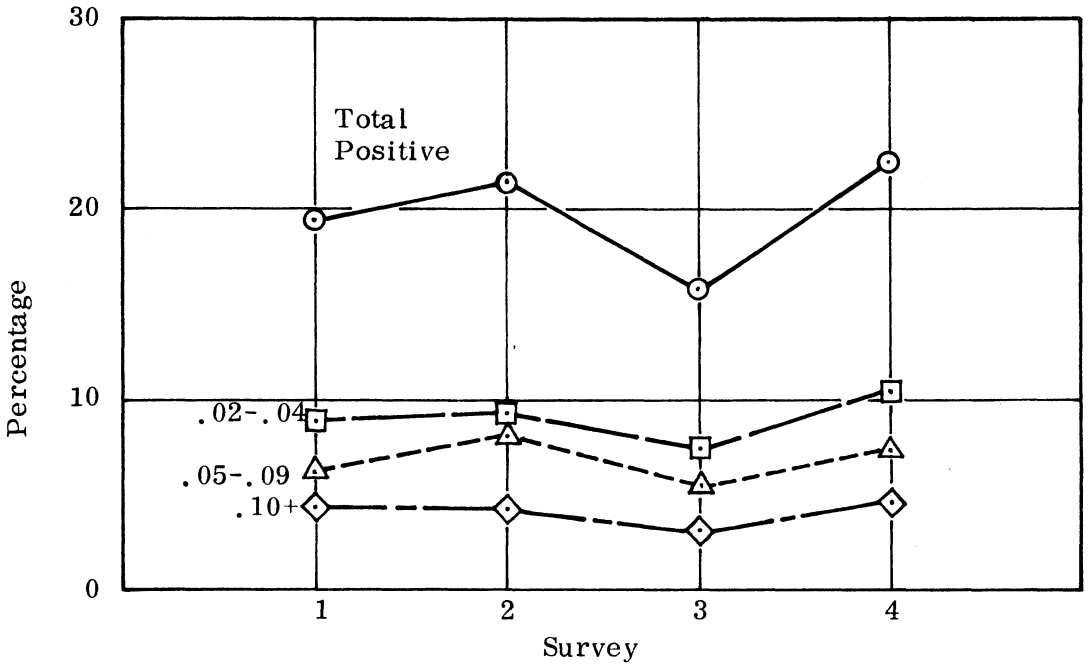

Figure 5. Breath test results.

Drunk Any Beer, Wine, or Liquor in Last Two Hours

Category	Baseline Survey	Second	Third	Fourth
Yes	427 (27.1%)	426 (29.1%)	373 (24.5%)	862 (31.2%)
No	1,147 (72.9%)	1,039 (70.9%)	1,148 (75.5%)	1,902 (68.8%)

Neither the second nor third surveys showed any statistically significant change in the percentage of drivers who said they had been drinking within the two previous hours when compared to the baseline percentage of 27.1%. However, there was an increase to 31.2% on the fourth survey, which was significantly higher than both the baseline survey ($p < .01$) and the third survey ($p < .01$). The graph in Figure 6 shows the trend during the surveys. By comparing Figure 6 to Figure 5, the same trend is noted for the percentage of positive BAC's. The number of people having positive BAC's was correlated with the number of people who said they had had a drink in the previous hours and yielded a correlation coefficient of .996. This high correlation tends to indicate that most drivers answered quite honestly whether they had been drinking and corroborates that the incidence of drinking had gone down on the third survey but had risen on the fourth.

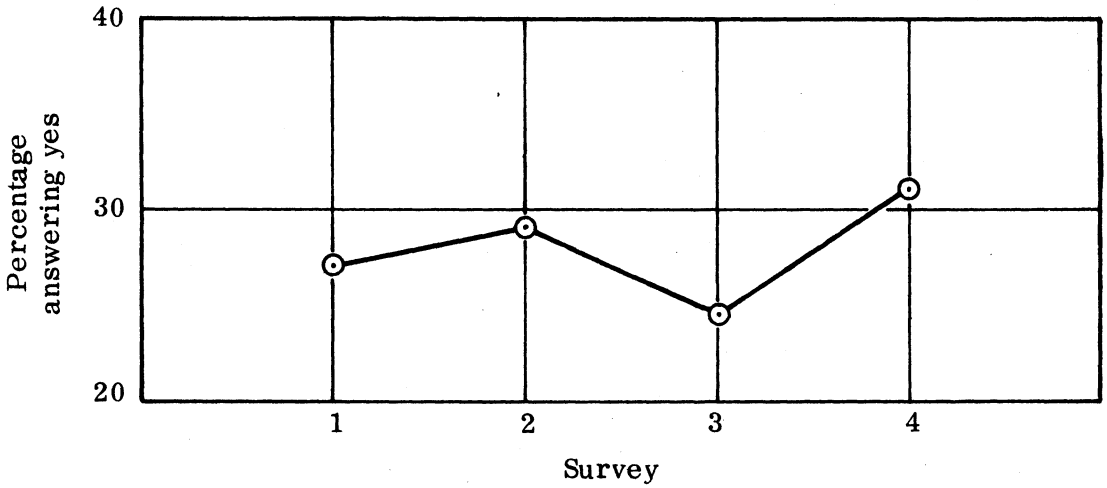

Figure 6. Drunk any beer, wine, or liquor in last two hours.

DISCUSSION OF SIGNIFICANT CROSS-TABULATIONS

I. Fourth Survey Highlights

A. BAC by Day of the Week

Figure 7 depicts the BAC levels by the days of the week. The graph shows that there were more drinking drivers and more drunken drivers on Fridays and Saturdays when compared to the other days of the week. It is interesting to note that the BAC data for Sundays were lower than those for Fridays and Saturdays but higher than those for any other day of the week. Thus it seems the Sunday data fit neither the weekend nor weeknight patterns, but were between the two.

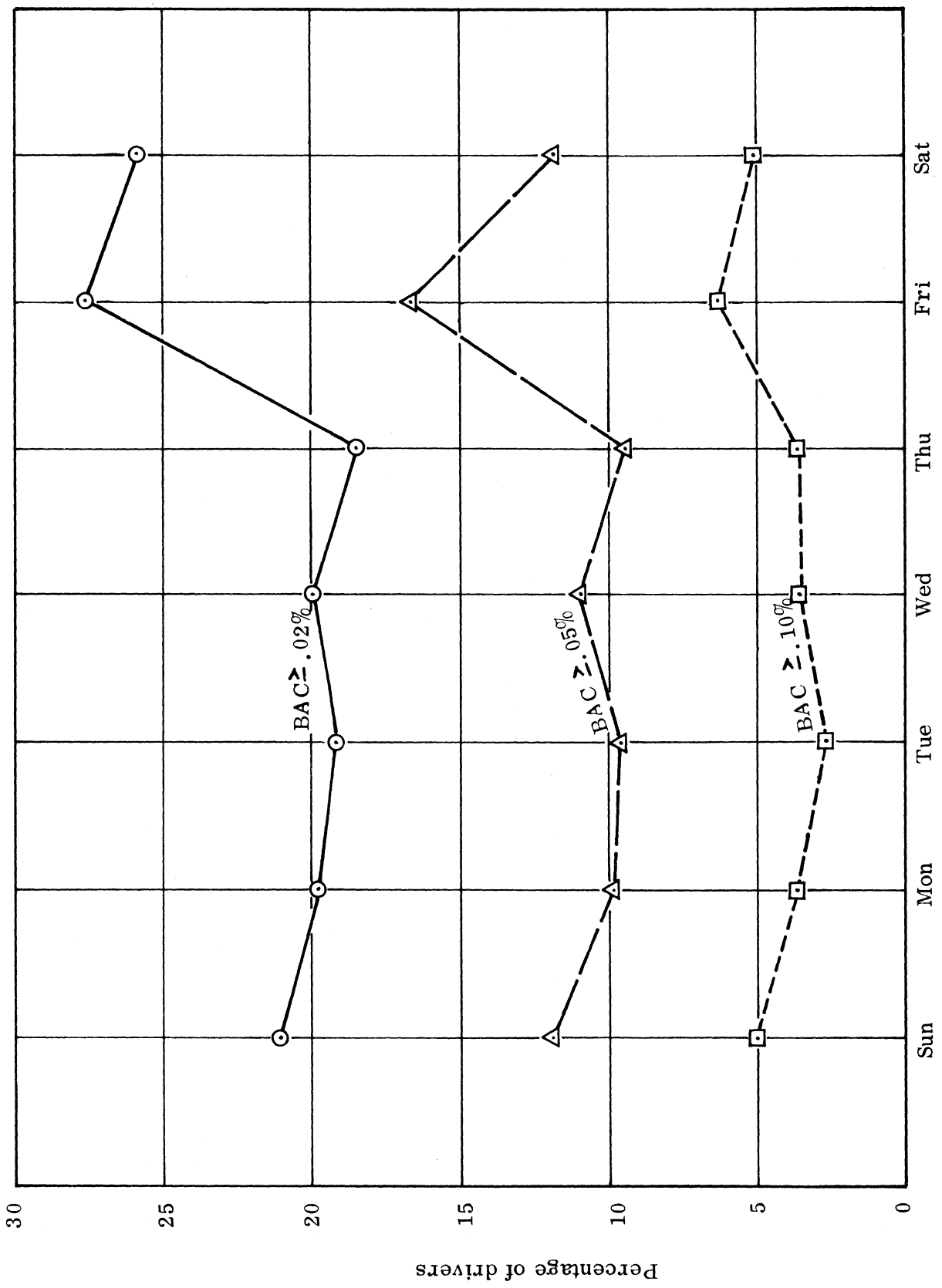

Figure 7. BAC data by day of week.

B. BAC by Weekend Nights and Weeknights

Figure 8 depicts the BAC levels by weekends (Friday, Saturday) and weeknights. This graph consolidates the data shown previously in Figure 7. Similarily to Figure 7, Figure 8 shows that there were more drinking drivers and more drunken drivers on weekend nights than on weeknights.

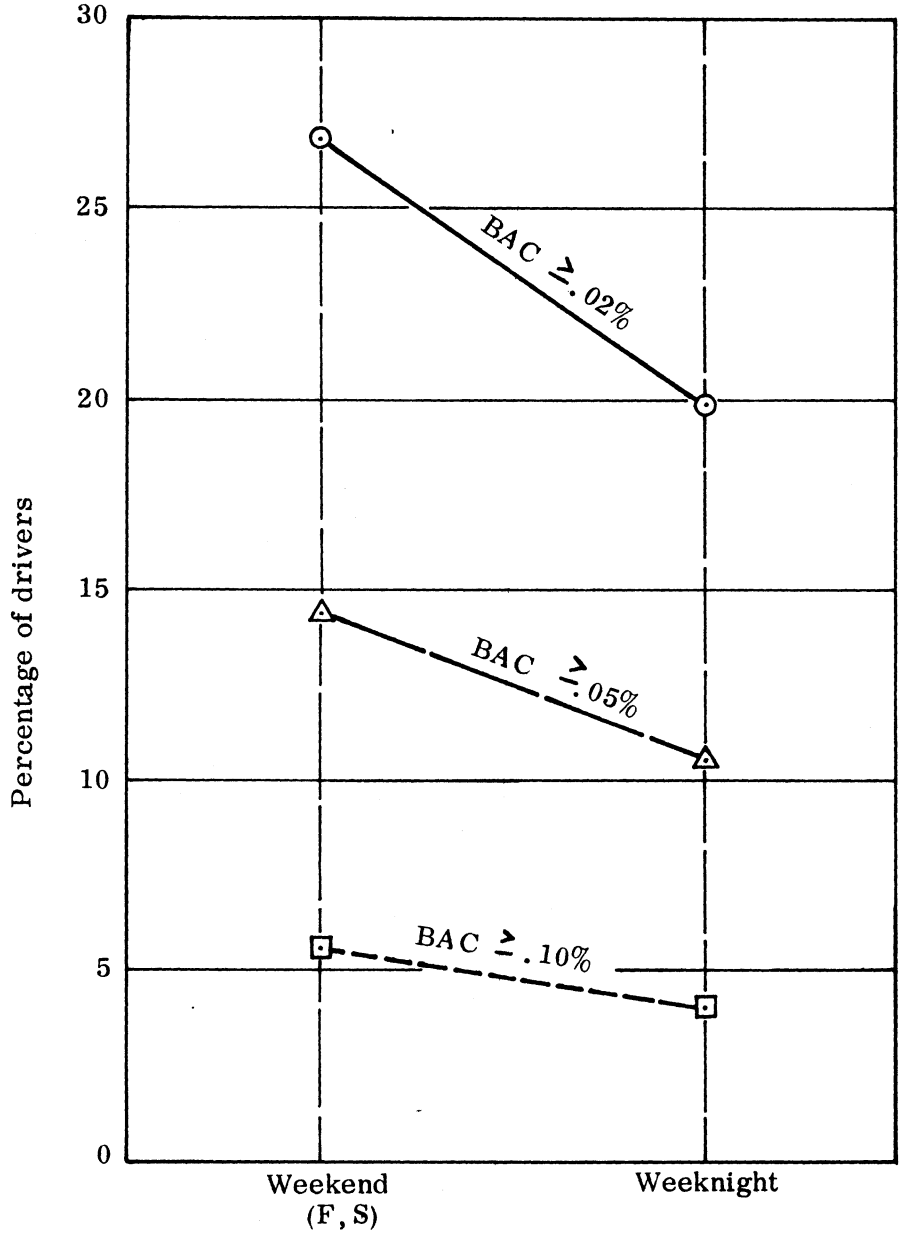

Figure 8. BAC data by weekend night and weeknight.

C. BAC by Time Period

Figure 9 depicts the BAC levels by the three time periods (Period 1 — 7:00 p.m. to 9:20 p.m., Period 2 — 9:50 p.m. to 12:10 a.m., and Period 3 — 12:40 a.m. to 3:00 a.m.). There is very little difference noticeable between the BAC levels for periods 1 and 2. However, the BAC levels for period 3 are about twice as high for each of the three categories when compared to the first two periods. The third time period would seem to be a logical time frame for selective enforcement by the ASAP police patrols because of the higher level of drunken driving during this period.

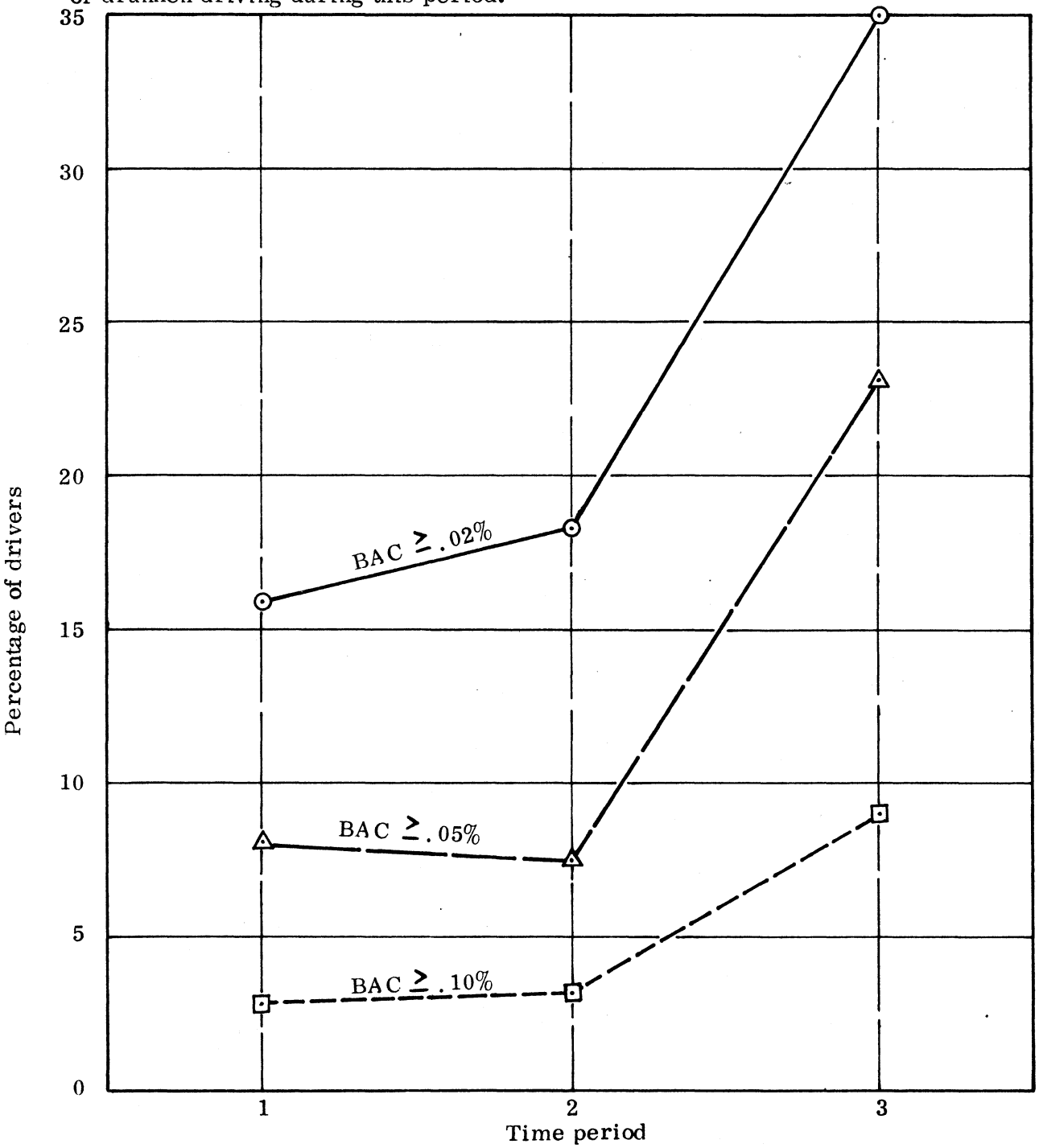

Figure 9. BAC by time period.

D. BAC by Age Group

The BAC levels for six age groups are shown in Figure 10. Drivers under 20 or over 60 were less likely to be drinking than were the drivers in the four other age groups. Drivers under 20 or 50-59 were least likely to be drunk (BAC $\geq$ .10%). Drivers in the 30-39 age group were most likely to be drinking and most likely to be drunk.

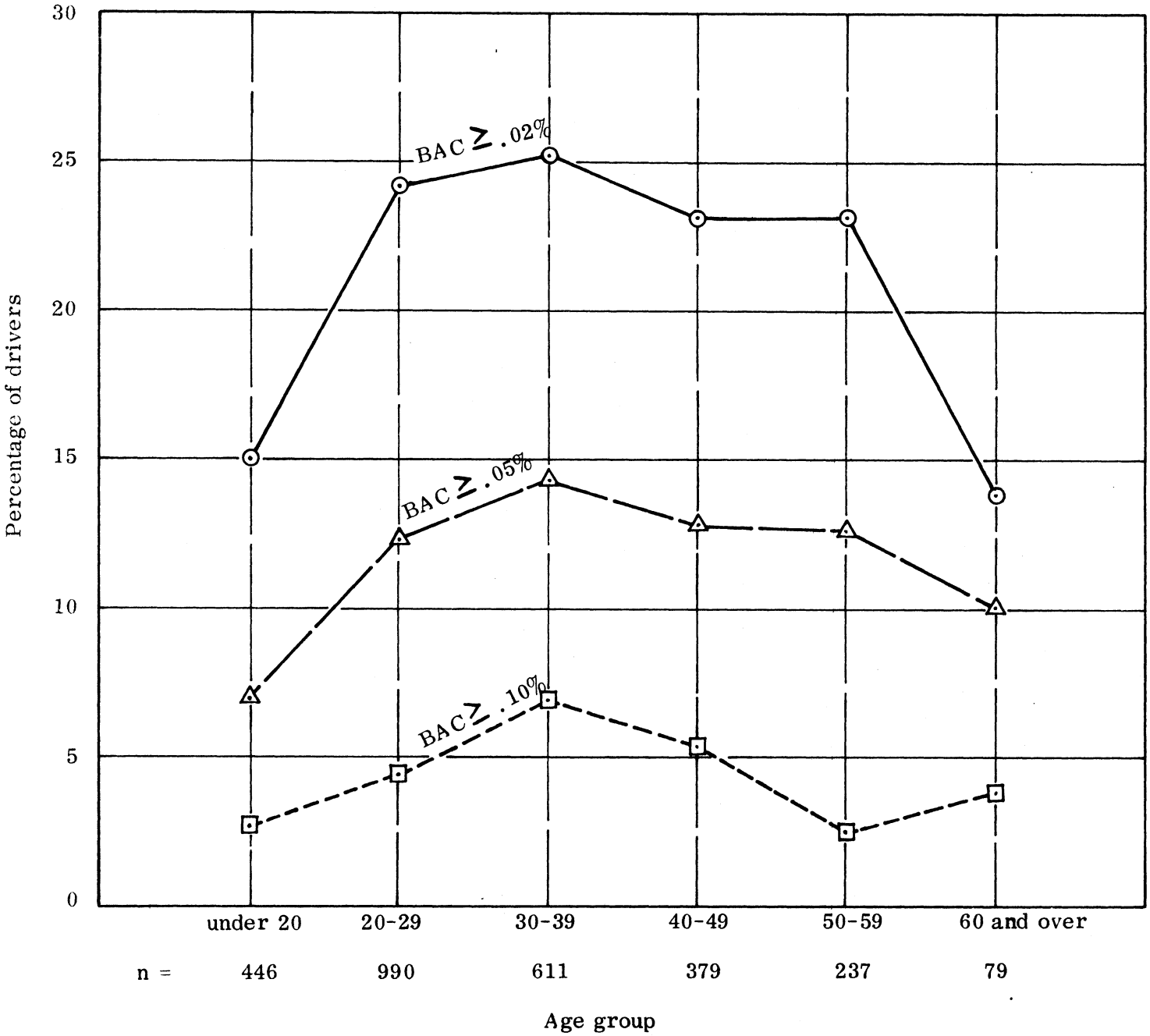

Figure 10. BAC by age group.

E. BAC by Sex

The BAC levels for male and female respondents are shown separately in Figure 11. Males were more than twice as likely to be drinking than were females, and they were five times more likely to be drunk. Since the number of male drivers at night was more than three times the number of female drivers, the total number of drunken drivers who were males was approximately 15 times as great as the number of female drunken drivers.

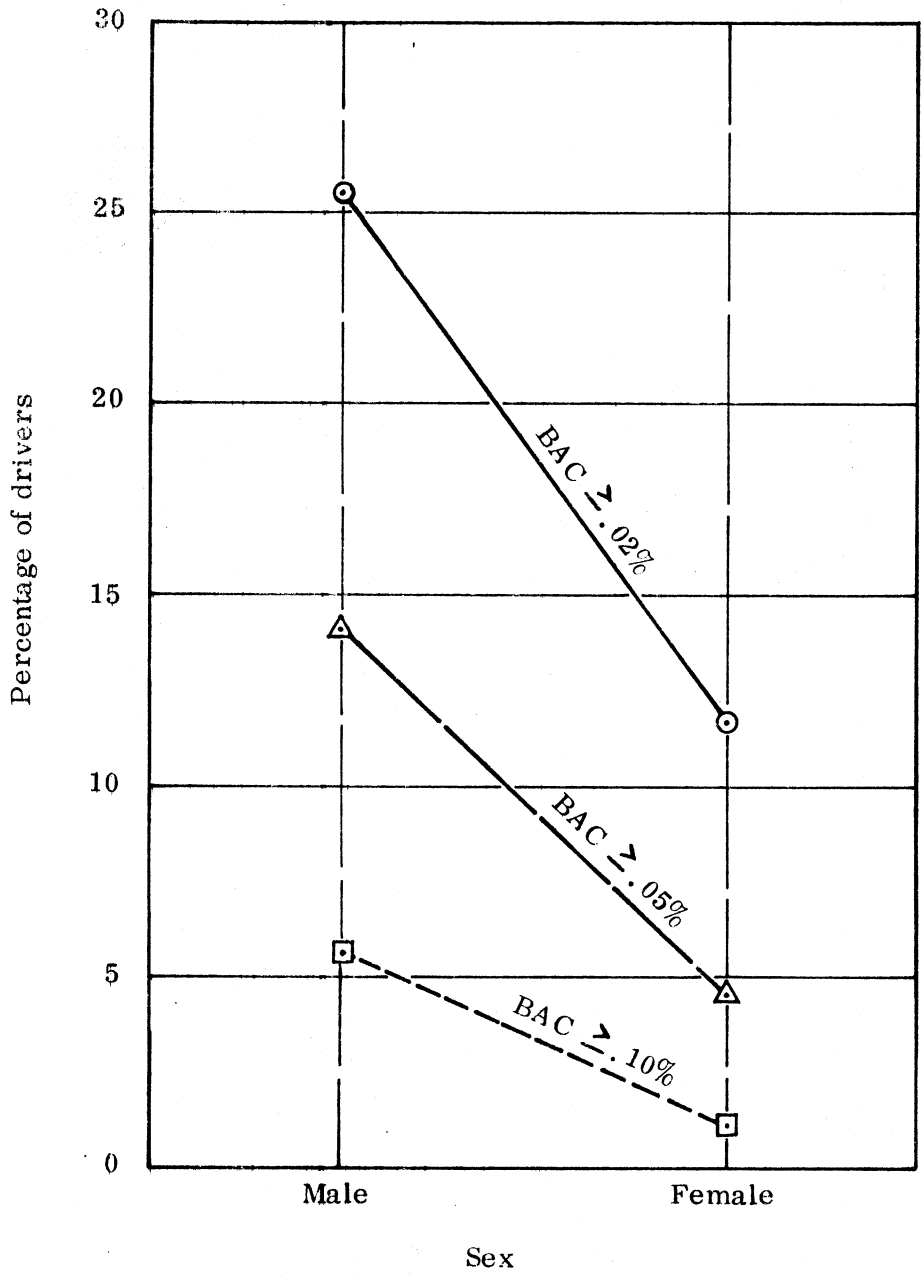

Figure 11, BAC levels by sex.

F. BAC by Race

The BAC levels by race are shown in Figure 12. Black drivers were more likely to be drinking and more likely to be drunk than were white drivers, but the differences are so small that neither is statistically significant, based upon the relatively small sample of black drivers.

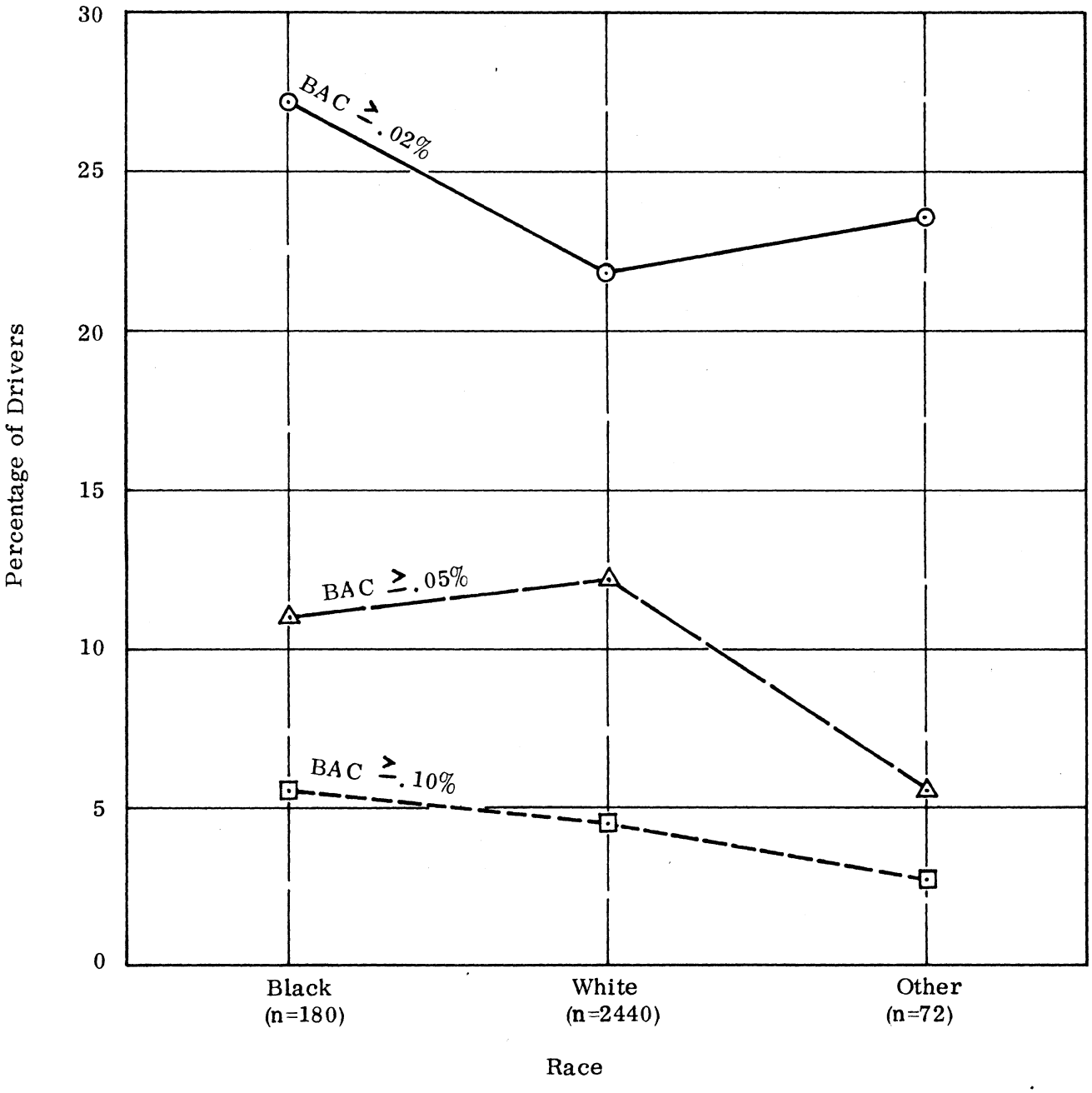

Figure 12. BAC level by race.

II. Time Period Analysis

The three times to be examined for differences in characteristics are the periods 7:00 p.m. to 9:20 p.m., 9:50 p.m. to 12:10 a.m., and 12:40 a.m. to 3:00 a.m., and are subsequently referred to as periods 1, 2, and 3, respectively,

A. Traffic Volumes and Percentages of Vehicles Sampled

Traffic Volume	Baseline Survey	Second	Third	Fourth
Period 1	8,127	5,562	8,304	9,464
Period 2	2,315	3,490	4,464	4,586
Period 3	1,558	2,335	2,540	2,800

On all four surveys, the traffic volume passing the survey sites dropped sharply after the first time period.

Percentage Sampled	Baseline Survey	Second	Third	Fourth
Period 1	8.6%	8.8%	6.5%	11.5%
Period 2	23.4%	16.6%	12.5%	20.5%
Period 3	21.8%	17.5%	16.9%	27.5%

As the number of passing vehicles declined in the later time periods, the percentage of vehicles which were sampled increased in order to support the interviewing operations.

B. Percentages of Drivers Who Drink Alcoholic Beverages

Time Period	Baseline Survey	Second	Third	Fourth
Period 1	80.8%	77.0%	79.6%	82.3%
Period 2	82.6%	78.7%	82.8%	80.9%
Period 3	90.8%	83.6%	88.5%	88.1%

There were no significant differences in the percentages of drivers who drink alcoholic beverages when the fourth survey was compared to the baseline survey and the third survey for any of the time periods. There was not much difference between the first two time periods, but the percentages for the third time period were significantly higher than the first two periods for all four surveys ($p < .01$).

C. Percentage of Drivers Who Registered a BAC $\geq$ .02%

Time Period	Baseline Survey	Second	Third	Fourth
Period 1	11.3%	12.6%	10.4%	15.8%
Period 2	17.6%	16.7%	12.6%	18.3%
Period 3	39.3%	39.8%	27.3%	35.0%

For all four surveys, a trend of increasing percentages of positive readings* occurred among the time periods. This pattern is shown in Figure 13, which separates positive BAC's into the three time periods. There were no significant changes between the baseline and second surveys. On the third survey, the percentages were significantly lower for both the second and third time periods ($p < .01$ for each period). However, on the fourth survey the percentages were significantly higher ($p < .01$) than those of the third survey for all three time periods. The percentage for the first time period was significantly higher ($p < .01$) than that of the baseline survey, but those for the second and third periods were not significantly different from the baseline survey.

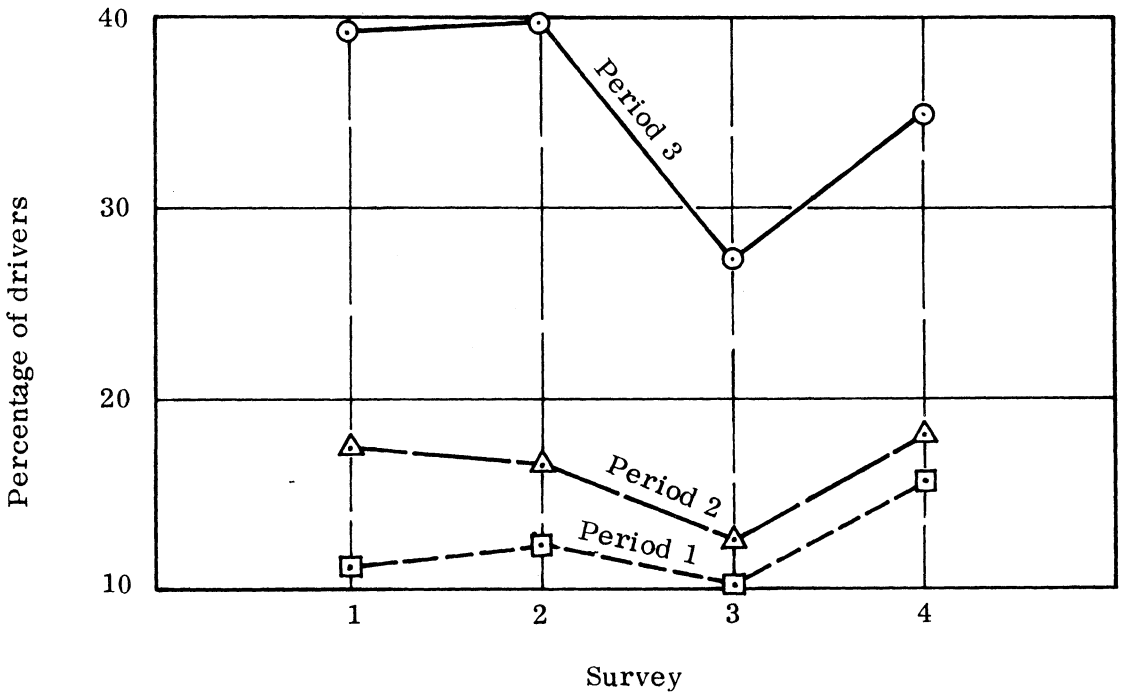

Figure 13. BAC's $\geq$ .02% by time period.

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* It should be noted that on the second survey, there were a number of false positive readings of .01%, which were discovered through cross-tabulation and data verification procedures, resulting in a decision to use .02% as the minimum level for positive readings. Undoubtedly, there were some people who had been drinking whose BAC's were .01%, but it appeared that the most careful comparison of the surveys necessitated using the cutoff point of .02%.

D. Percentage of Drivers Above .10% BAC

Time Period	Baseline Survey	Second	Third	Fourth
Period 1	1.6%	2.2%	1.1%	2.8%
Period 2	2.6%	2.6%	2.3%	3.1%
Period 3	12.4%	8.9%	6.3%	9.0%

For all four surveys, the pattern of increasing percentages of drunken drivers with each successive time period was evident. The results of the fourth survey were not significantly different from those of the baseline survey. In comparison to the third survey, however, the increase from 1.1% to 2.8% in the first time period was statistically significant ($p < .05$).

For all four surveys, the percentages of drunken drivers in the third time period were significantly higher ($p < .05$) than those of either the first or second time periods. There were no significant differences between the first two time periods for any of the four surveys. This relationship is illustrated in Figure 14.

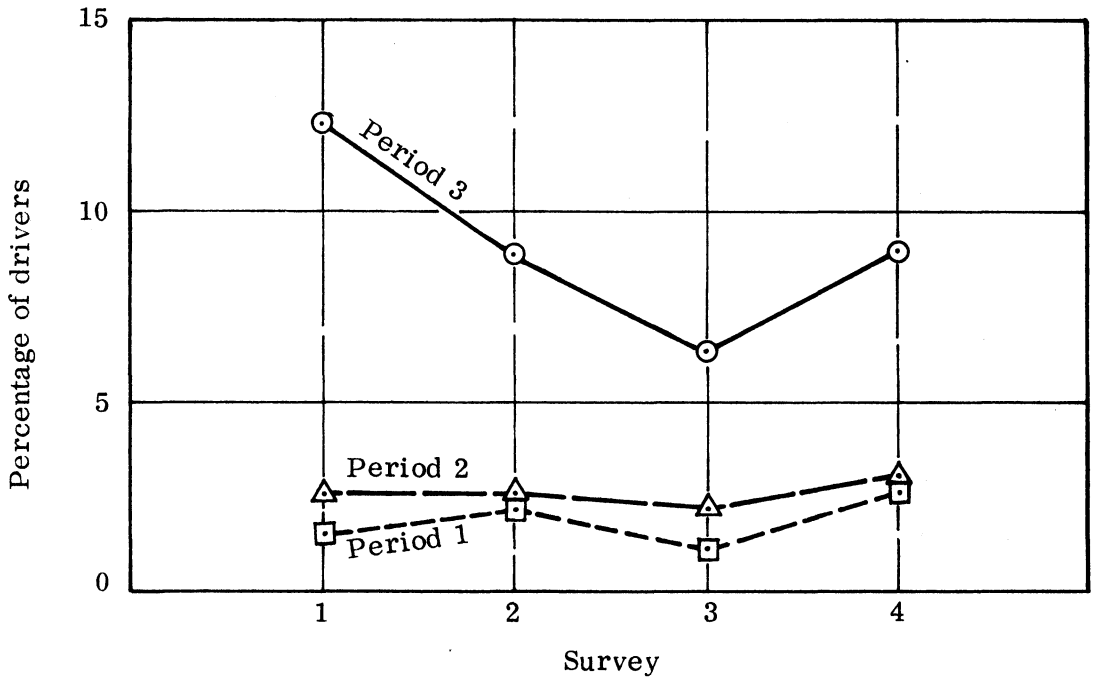

Figure 14. BAC's $\geq$.10% by time period.

E. Total Number of Drunken Drivers (Estimated)

Period	Baseline Survey	Second	Third	Fourth
Period 1	130	122	91	265
Period 2	60	91	103	142
Period 3	193	208	160	252
Total	383	421	354	659

As the nights progressed, there were greater percentages of drivers above .10% BAC. At the same time, the numbers of vehicles passing the survey sites decreased. In order to estimate the total number of drunken drivers, the percentage of drunken drivers was multiplied by the number of passing vehicles for each respective site. This yielded the estimated number of drunken drivers passing from one direction. Since these are merely based upon an extrapolation of the sample characteristics to the population of passing vehicles, it would be improper to use any statistical tests on these estimates.

The fourth survey had the greatest traffic volume as well as the highest overall percentage of drunken drivers, which, when multiplied, yielded the highest estimated number of drunken drivers. Time period 3 generally accounted for the most drunken drivers, except for the fourth survey. A graph of the estimates is shown in Figure 15. The rates at which drunken drivers passed the survey sites from one direction during time period 3 were calculated to be every 8.0 minutes, 8.1 minutes, 10.5 minutes, and 6.7 minutes for surveys 1, 2, 3, and 4, respectively. If an observer had driven a car at the average speed of the approaching traffic, he could have expected to meet a drunken driver every 3 minutes and 20 seconds, on the average for this time period on the fourth survey.

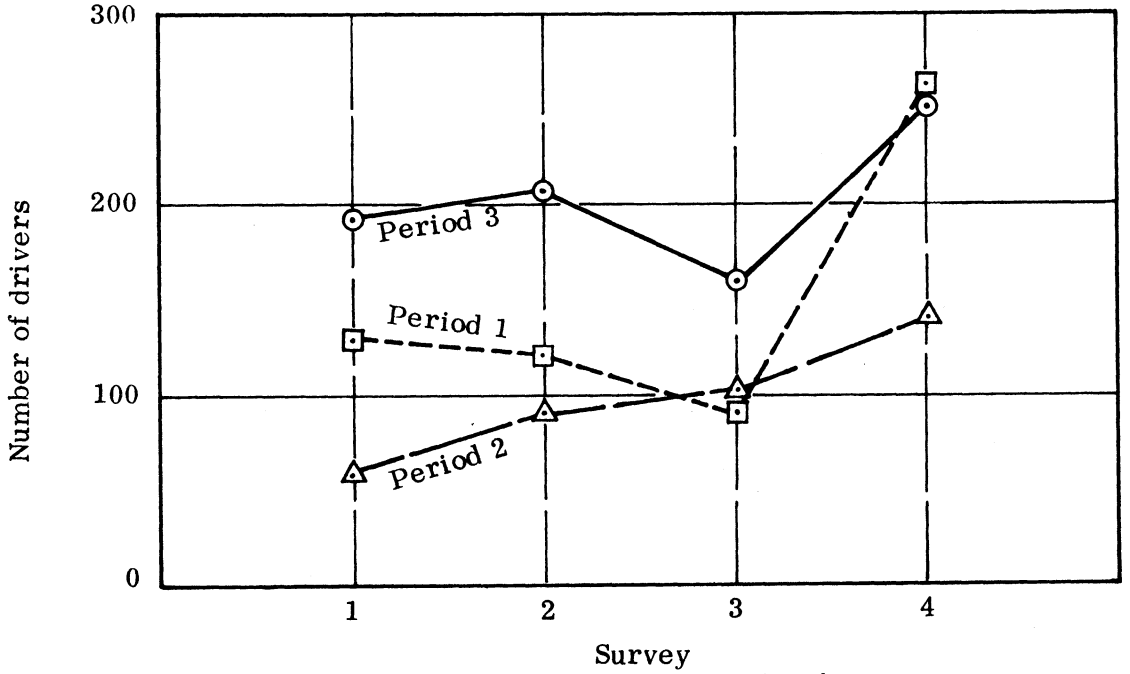

Figure 15. Estimated number of drunken drivers.

F. Percentage of Drivers Above .10% BAC — Adjusted for Differences in Traffic Volume

	Baseline Survey	Second	Third	Fourth
Weighted Percentage	3.19%	3.70%	2.31%	3.91%

The above percentages are the percentages of all drivers passing the survey site who are estimated to be above .10% BAC. These percentages represent what would be expected if all passsing vehicles had been surveyed instead of just a portion of them. These population percentages differ from the sample percentages because of three main reasons:

(1) Traffic volumes decreased from the earliest period to the latest periods.

(2) The percentages of drivers who were drunk increased from the earlier periods to the latest time periods.

(3) The three surveys had a different mix of samples in the time periods so that aggregate statistics should be compared with caution.

For a breakdown of statistics by time period, please refer to section II D.

III. Weekend Nights Versus Weeknights

A. Percentage Registering Positive BAC (.02% or higher)

Time Period 1	Baseline Survey	Second	Third	Fourth
Weekend	11.5%	17.0%	14.4%	18.8%
Weeknight	11.2%	9.4%	8.4%	14.1%
Time Period 2	**Baseline Survey**	**Second**	**Third**	**Fourth**
Weekend	19.0%	15.7%	16.1%	20.0%
Weeknight	16.4%	17.2%	10.5%	17.3%
Time Period 3	**Baseline Survey**	**Second**	**Third**	**Fourth**
Weekend	38.0%	41.1%	36.2%	47.4%
Weeknight	41.9%	38.0%	22.5%	30.9%

The percentages of drivers registering positive BAC's were compared among time periods for each of the four surveys. For the baseline survey, there were no statistically significant differences between weekend nights (Friday, Saturday) and weeknights for any of the three time periods. For the second survey, only the first time period had a significant difference in that weekend nights were statistically higher ($p < .05$). For both the third and fourth surveys, both the first ($p < .05$) and third time periods ($p < .01$) showed significantly more drinking on weekend nights than on weeknights. The comparisons of weekends and weeknights by time periods are shown in Figures 16A, 16B, and 16C.

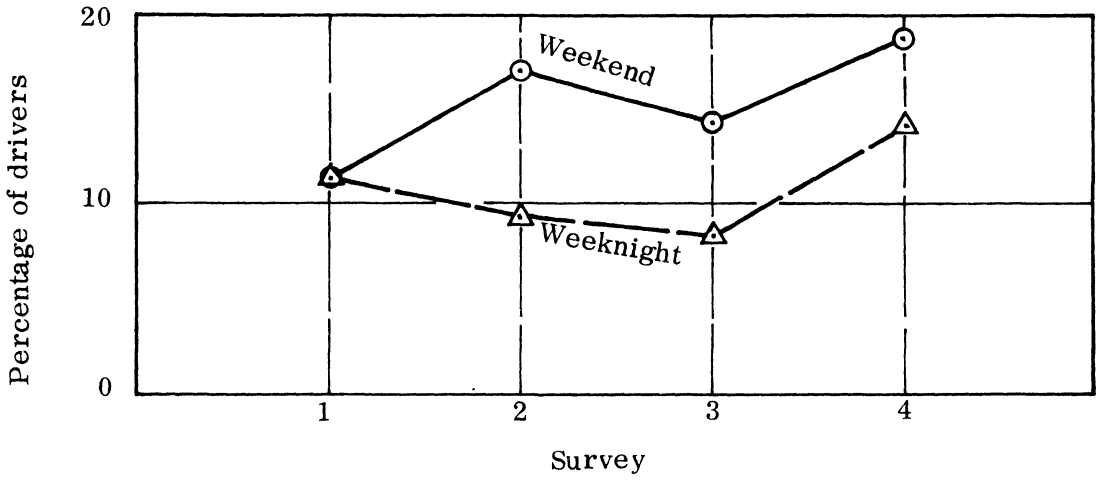

Figure 16A. BAC's $\geq .02\%$ — Period 1.

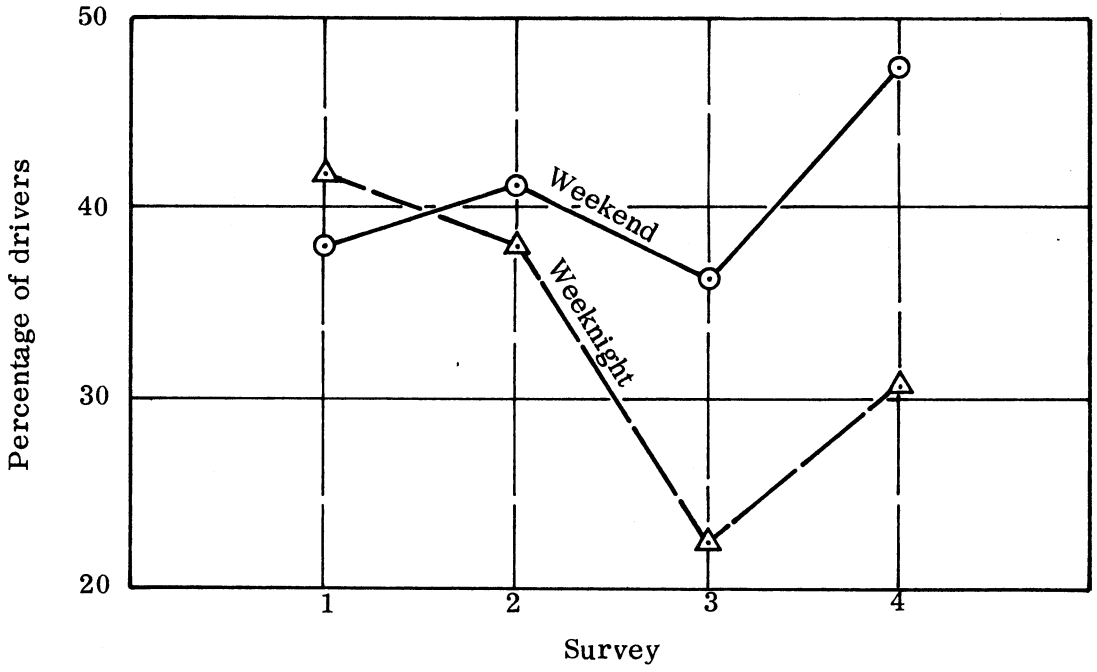

Figure 16C. BAC's $\geq$.02% — Period 3.

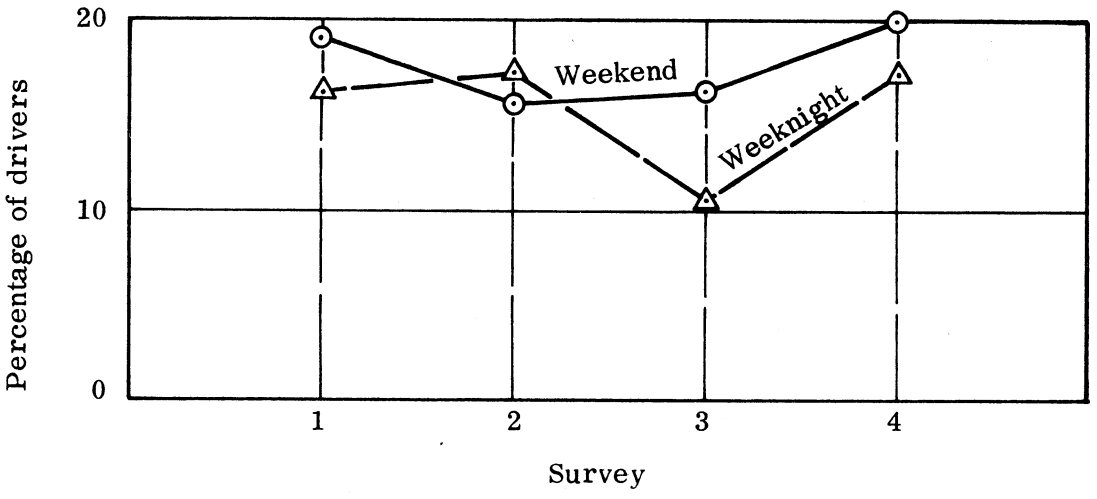

Figure 16B. BAC's $\geq$.02% — Period 2.

The percentages of drivers registering positive BAC's were also compared between the baseline and the fourth surveys to examine long-term trends and between the third and fourth surveys to examine short-term changes. Among the twelve such comparisons, there were seven that were statistically significant. Six of the seven showed more drinking on the fourth survey. These significant differences are summarized in Table 1.

TABLE 1

Significant Differences

Time Period	Weekend	Weeknight
1	$p_1 < p_4$ (.05)	$p_3 < p_4$ (.05)
2		$p_3 < p_4$ (.01)
3	$p_1 < p_4$ (.05)	$p_4 < p_1$ (.05)
	$p_3 < p_4$ (.05)	$p_3 < p_4$ (.05)

B. Percentage Above .10% BAC

Time Period 1	Baseline Survey	Second	Third	Fourth
Weekend	1.05%	2.43%	1.71%	3.66%
Weeknight	1.95%	2.11%	0.82%	2.34%
Time Period 2	**Baseline Survey**	**Second**	**Third**	**Fourth**
Weekend	3.38%	1.96%	3.05%	3.01%
Weeknight	1.97%	3.07%	1.67%	3.20%
Time Period 3	**Baseline Survey**	**Second**	**Third**	**Fourth**
Weekend	12.96%	7.66%	8.96%	12.31%
Weeknight	11.29%	10.00%	5.37%	7.16%

The percentages of drivers registering BAC's of .10% or higher were compared between weekend nights and weeknights for each time period of each survey. For all 12 of the survey — time period combinations, there was only one statistically significant difference between weekend nights and weeknights, and that difference ($p < .05$) was in the third time period on the fourth survey.

For the twelve comparisons of the fourth survey percentages above .10% BAC to the results of the baseline and third surveys, only one statistically significant difference was found. There were no significant differences for weeknights, but the fourth survey percentage for weekends during the first time period was significantly greater than the percentage on the baseline survey (3.66% > 1.05%, $p < .05$). The percentages of drivers above .10% are shown in Figures 17A, 17B, and 17C.

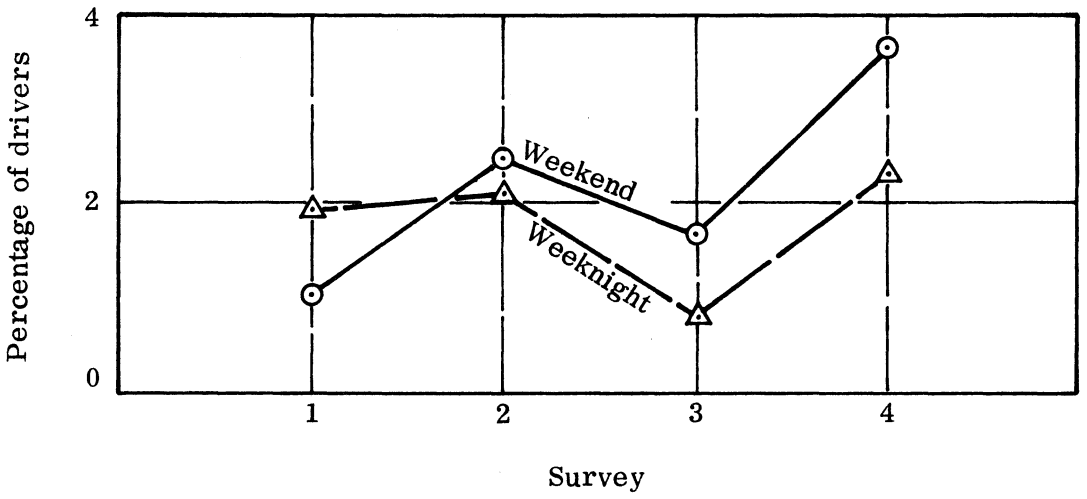

Figure 17A. BAC's $\geq$.10% — Period 1.

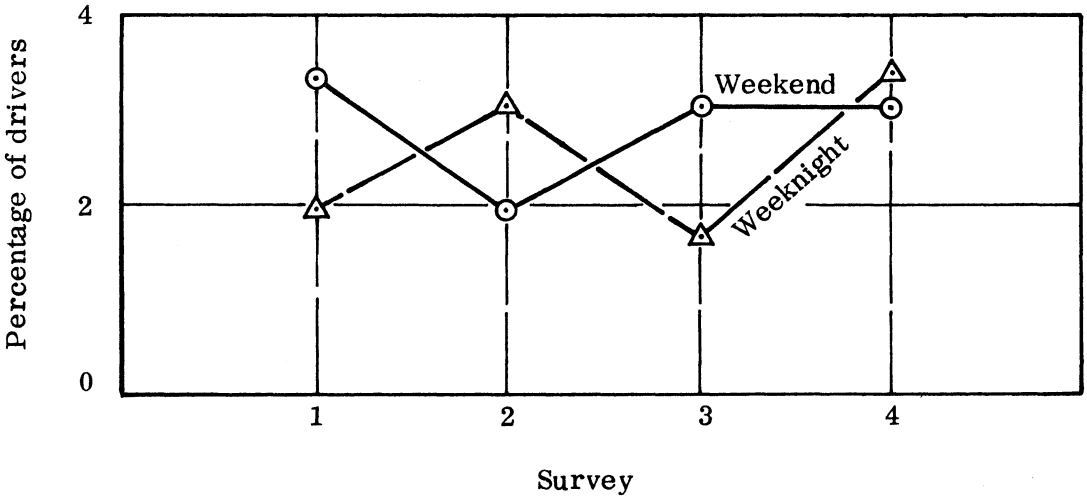

Figure 17B. BAC's $\geq$.10% — Period 2.

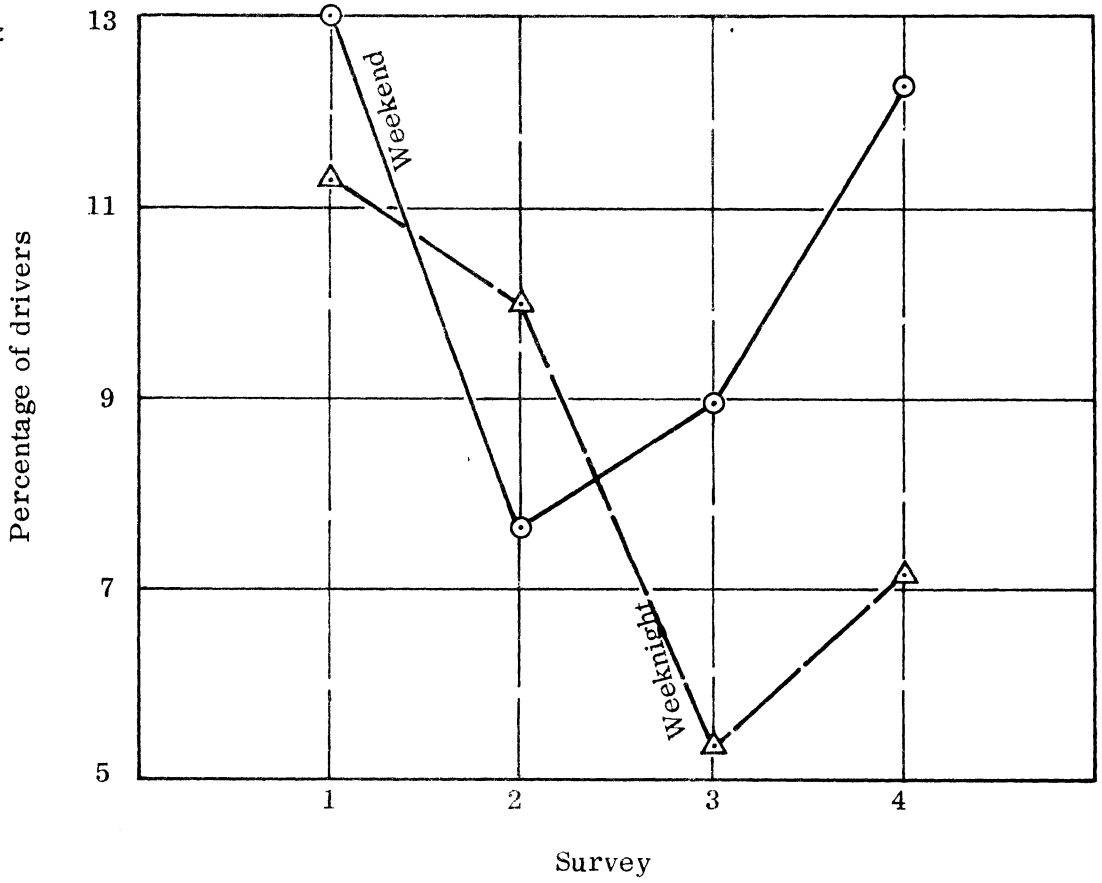

Figure 17C. BAC's $\geq$.10% — Period 3.

IV. Drunken Driver Characteristics (BAC above .10%)

A. Age Distribution

Drunken Drivers

Age	Baseline Survey	Second	Third	Fourth
Under 20	5 (7.5%)	6 (9.7%)	2 (4.4%)	12 (9.4%)
20-29	21 (31.3%)	20 (32.2%)	15 (32.6%)	44 (34.6%)
30-39	26 (38.8%)	13 (21.0%)	14 (30.4%)	42 (33.1%)
40-49	9 (13.4%)	17 (27.4%)	11 (23.9%)	20 (15.7%)
50-59	6 (9.0%)	4 (6.5%)	4 (8.7%)	6 (4.7%)
60 +	0 (0.0%)	2 (3.2%)	0 (0.0%)	3 (2.4%)

Non-Drunken Drivers

Age	Baseline Survey	Second	Third	Fourth
Under 20	314 (20.9%)	272 (19.2%)	250 (16.9%)	434 (16.6%).
20-29	487 (32.3%)	476 (33.6%)	548 (37.1%)	946 (36.2%)
30-39	312 (20.7%)	294 (20.7%)	298 (20.2%)	569 (21.8%)
40-49	222 (14.7%)	230 (16.2%)	218 (14.7%)	359 (13.7%)
50-59	137 (9.1%)	107 (7.5%)	136 (9.2%)	231 (8.8%)
60 +	35 (2.3%)	39 (2.8%)	28 (1.9%)	76 (2.9%)

Ratio of Percentages of Drunken Drivers to Non-Drunken Drivers by Age

Age	Baseline Survey	Second	Third	Fourth
Under 20	0.36	0.51	0.26	0.57
20-29	0.97	0.96	0.88	0.96
30-39	1.87	1.01	1.50	1.52
40-49	0.91	1.69	1.63	1.15
50-59	0.99	0.87	0.95	0.53
60 +	0	1.14	0	0.83

In terms of their nighttime driving exposure, the group of drivers under age 20 was consistently underrepresented, while the groups from 30-39 and 40-49 were generally overrepresented. For the total from the four surveys, the group from 20-29 accounted for the most drunken drivers. However, in terms of their nighttime driving exposure, this age group was slightly underrepresented for all four surveys.

Percentage Drunk in Each Age Category

Age	Baseline Survey	Second	Third	Fourth
Under 20	1.57%	2.16%	0.79%	2.69%
20-29	4.13%	4.03%	2.66%	4.44%
30-39	7.69%	4.23%	4.49%	6.87%
40-49	3.90%	6.88%	4.80%	5.28%
50-59	4.20%	3.60%	2.86%	2.53%
60 +	0%	4.88%	0%	3.80%

For the fourth survey the percentages were compared among the six age categories. Only one age category stood out as being significantly different from the others. The percentage who were drunk in the age category of 30-39 was significantly higher than the percentages for age categories under 20 ($p < .01$), 20-29 ($p < .05$), and 50-59 ($p < .05$). The smaller sample size in the 60 or over category precluded any finding of significant difference.

B. Sex - Percentage Drunk

Sex	Baseline Survey	Second	Third	Fourth
Male	5.13%	4.46%	3.48%	5.71%
Female	0.65%	3.18%	1.26%	1.13%

On all four surveys a male driver was more likely to be drunk than was a female driver. This difference was statistically significant on the baseline ($p < .01$), third ($p < .05$) and fourth surveys ($p < .01$), but it was not significant on the second.

For female drivers there was no significant change in the percentage who were drunk during the four surveys. For male drivers, there was a significant reduction ($p < .05$) on the third survey when compared to the baseline, but this was followed by a significant increase ($p < .01$) between the third and fourth surveys. The comparison of the fourth survey results to the baseline results showed no significant difference for male drivers.

C. Race - Percentage Drunk

Race	Baseline Survey	Second	Third	Fourth
White	3.9%	4.0%	2.9%	4.6%
Black	11.0%	8.9%	3.8%	5.6%
All Other	6.2%	0	5.6%	2.8%

On all four surveys, the percentage of blacks who were drunk was higher than the percentage of whites. These differences were statistically significant on both the baseline ($p < .01$) and second surveys ($p < .05$), but there was no difference on the third and fourth. For white drivers, there was a significant increase ($p < .01$) in the percentage who were drunk between the third and fourth surveys. The percentage for white drivers on the fourth survey was higher than on the baseline survey, but the difference was not significant. Due to the smaller sample sizes of black drivers, there were no significant annual changes even though the variation in percentages for the black drivers was greater than it was for white drivers.

D. Miles Driven Per Year — Percentage Drunk

Miles	Baseline Survey	Second	Third	Fourth
Less than 10,000	2.8%	3.6%	2.4%	4.9%
10,000 - 19,999	3.7%	4.6%	2.3%	4.5%
20,000 - 29,999	5.0%	4.9%	5.0%	4.2%
30,000 or More	7.7%	4.4%	4.5%	5.2%

On the baseline survey, it appeared that the more miles a person drove each year, the more likely he was to be drunk. The percentages of drunken drivers on the baseline survey ranged from 2.8% of those driving less than 10,000 miles to 7.7% for those driving more than 30,000 miles. These two percentages were significantly different ($p < .01$). The pattern seems to have changed on the subsequent surveys in that there are not any significant differences between the two extremes of driving groups for the remaining three surveys.

V. ASAP Residents Versus Non-ASAP Residents

A. Drinking Habits

Drinkers by Place of Residence — Percentage Who Drink

Residence	Baseline Survey	Second	Third	Fourth
ASAP Area	82.0%	79.3%	81.8%	83.9%
Other Virginia	86.3%	79.2%	86.5%	82.2%
Out-Of-State	89.1%	81.9%	85.7%	81.7%

There were no significant differences over time in any of the three residence categories. When the categories were compared within each of the four surveys, the only statistically significant difference occurred on the baseline survey when the percentage of drinkers was higher for out-of-state residents than it was for ASAP area residents ($p < .05$).

Percentage Positive BAC (Bac $\geq$ .02%)

Residence	Baseline Survey	Second	Third	Fourth
ASAP	17.9%	20.0%	15.8%	21.8%
Non-ASAP	24.1%	23.2%	16.2%	24.2%

On the baseline survey, the percentage of positive BAC's among non-ASAP residents was significantly higher than it was for ASAP residents ($p < .01$). There were no significant differences for the other three surveys. Among the ASAP residents, there was a significant increase on the fourth survey compared to the baseline survey ($p < .01$) and the third survey ($p < .01$). Among the non-ASAP residents, there was no significant difference between the baseline and fourth surveys. The results of the fourth survey were significantly greater ($p < .01$) than they were for the third survey, however. The comparison of positive BAC readings for ASAP and non-ASAP residents is shown in Figure 18.

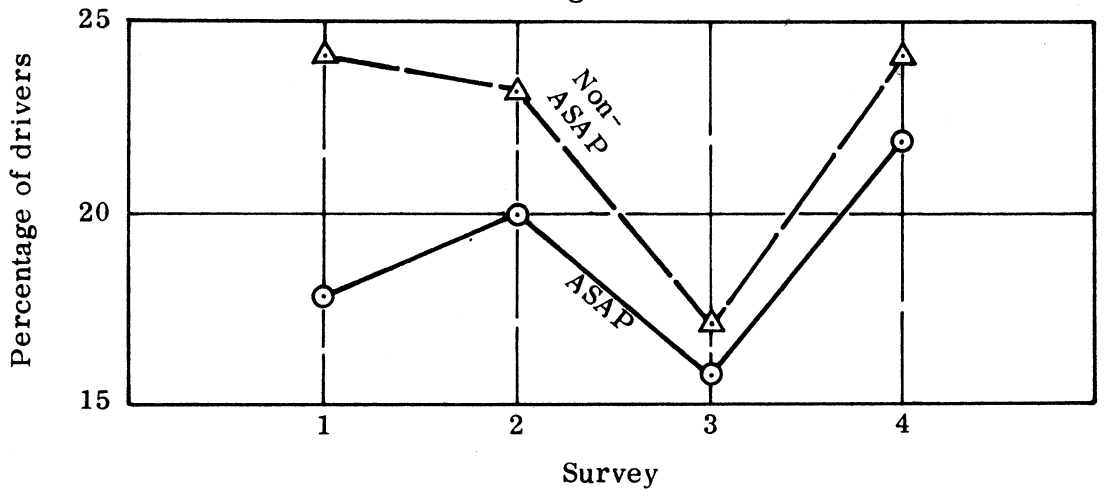

Figure 18. BAC's $\geq$ .02%.

Percentage Above .10% BAC

Residence	Baseline Survey	Second	Third	Fourth
ASAP	3.97%	3.61%	2.57%	3.97%
Non-ASAP	4.95%	4.70%	3.90%	6.71%

For all four surveys, a higher percentage of non-ASAP residents was above .10% BAC. The differences were not significant on the first three surveys, but the percentage for non-ASAP residents was significantly higher ($p < .01$) on the fourth survey. Although the percentage for ASAP residents was exactly the same on the fourth survey as it was on the baseline survey, it was significantly higher ($p < .05$) than the percentage on the third survey. Similarly for non-ASAP residents the difference was not significant between the baseline and fourth surveys, but the increase from the third survey to the fourth was significant ($p < .05$). The increase in both categories from the third to the fourth survey is evident in the graph in Figure 19.

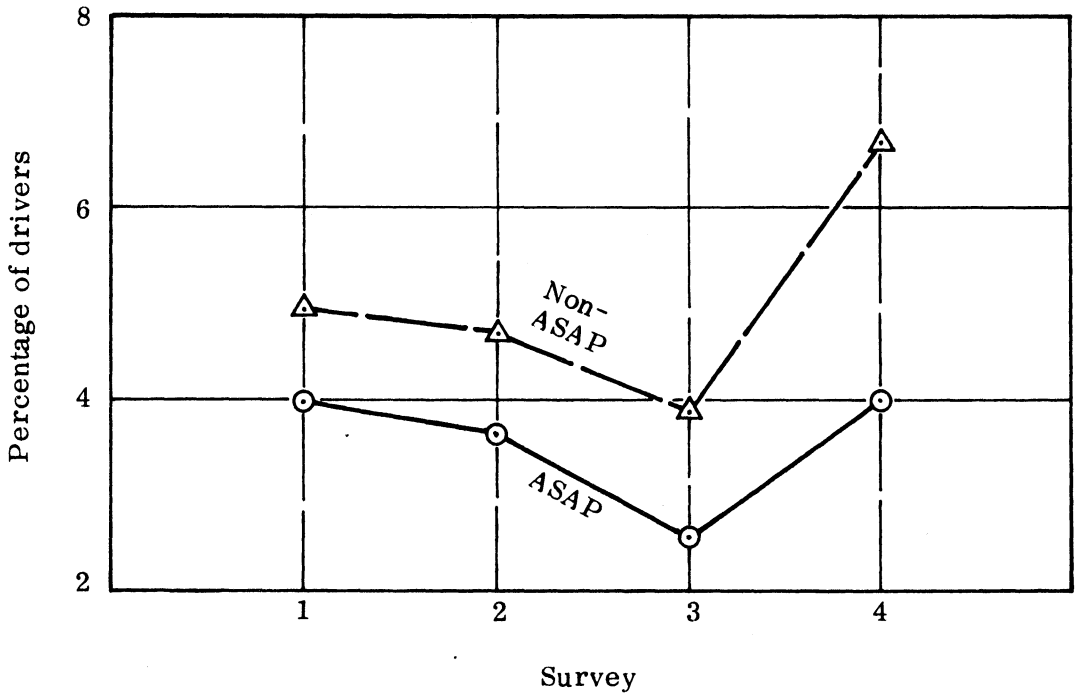

Figure 19. BAC's $\geq$ .10%.

B. Knowledge of the Presumptive Limits — Percentage Correct

Residence	Baseline Survey	Second	Third	Fourth
ASAP	19.4%	22.0%	26.9%	25.6%
Non-ASAP	18.3%	19.8%	22.8%	20.6%

For all four surveys, the ASAP residents had a slightly better knowledge of Virginia's presumptive limit for drunk driving. However, only on the fourth survey was this difference statistically significant ($p < .01$). There appeared to be some improvement for both groups as shown on the graph in Figure 20. However, the upward trend on the first three surveys was reversed on the fourth survey for both ASAP and non-ASAP residents. In comparison to the baseline survey, the improvement among ASAP residents is significant ($p < .01$), but the improvement among non-ASAP residents is not.

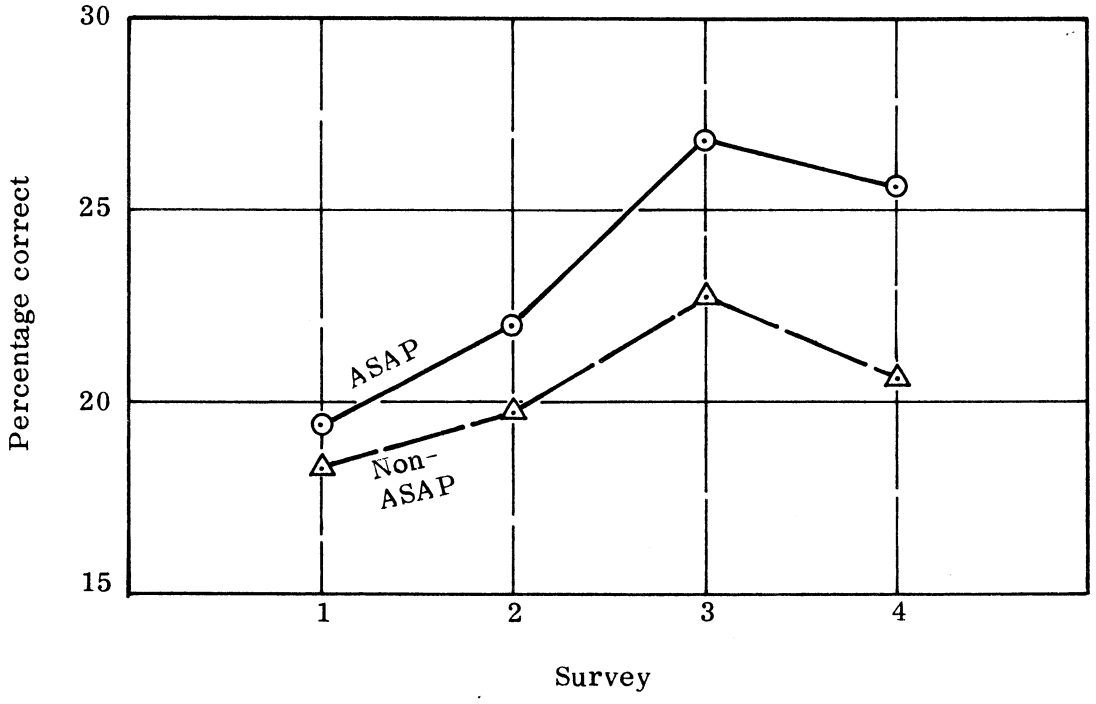

Figure 20. Knowledge of presumptive limits.

VI. BAC's by Beverage Type

Baseline Survey	Beer	Wine	Liquor
Positive (.02%+)	29.2%	6.1%	22.1%
Above .10%	7.3%	0.5%	4.0%

Second Survey	Beer	Wine	Liquor
Positive (.02%+)	30.1%	16.4%	23.2%
Above .10%	7.0%	1.5%	4.4%

Third Survey	Beer	Wine	Liquor
Positive (.02%+)	22.1%	13.0%	17.3%
Above .10%	4.2%	1.0%	4.2%

Fourth Survey	Beer	Wine	Liquor
Positive (.02%+)	30.6%	15.7%	23.5%
Above .10%	7.4%	0.9%	3.9%

On all four surveys, drivers who preferred beer had the highest percentage of positive breath test readings, followed by liquor drinkers and then wine drinkers. On the first two surveys, the positive percentages for beer drinkers were significantly higher than for liquor drinks ($p < .05$), on the third survey the difference was not significant, and on the fourth survey the difference was again significant ($p < .01$). The positive percentages for beer, wine, and liquor drinkers are shown in Figure 21 for all four surveys. Notice that the apparent drop in the percentages on the third survey, which offered promise of ASAP success at the time, did not hold for the fourth survey. The positive percentages for beer drinkers was also significantly higher than for wine drinkers on all four surveys ($p < .05$). In comparing the positive percentages between wine and liquor drinkers, the percentages for liquor drinkers were higher on all four surveys, but only on the baseline ($p < .05$) and fourth surveys ($p < .01$) were the differences significant.

For the percentage of drivers who were drunk, beer drinkers had the highest percentage, followed by liquor drinkers and then wine drinkers for the baseline, second, and fourth surveys. On the third survey, the percentages were the same for beer and liquor drinkers with both percentages higher than that for wine drinkers. In observing Figure 22, which is a graph of the percentages above .10% for beer, wine, and liquor drinkers, only one apparent deviation is noted over the course of the four surveys. On the third survey, the percentage of beer drinkers above .10% appears to have been reduced from the previous surveys. But this reduction was not confirmed by the fourth survey, which resulted in the highest percentage for beer drinkers in the four surveys.

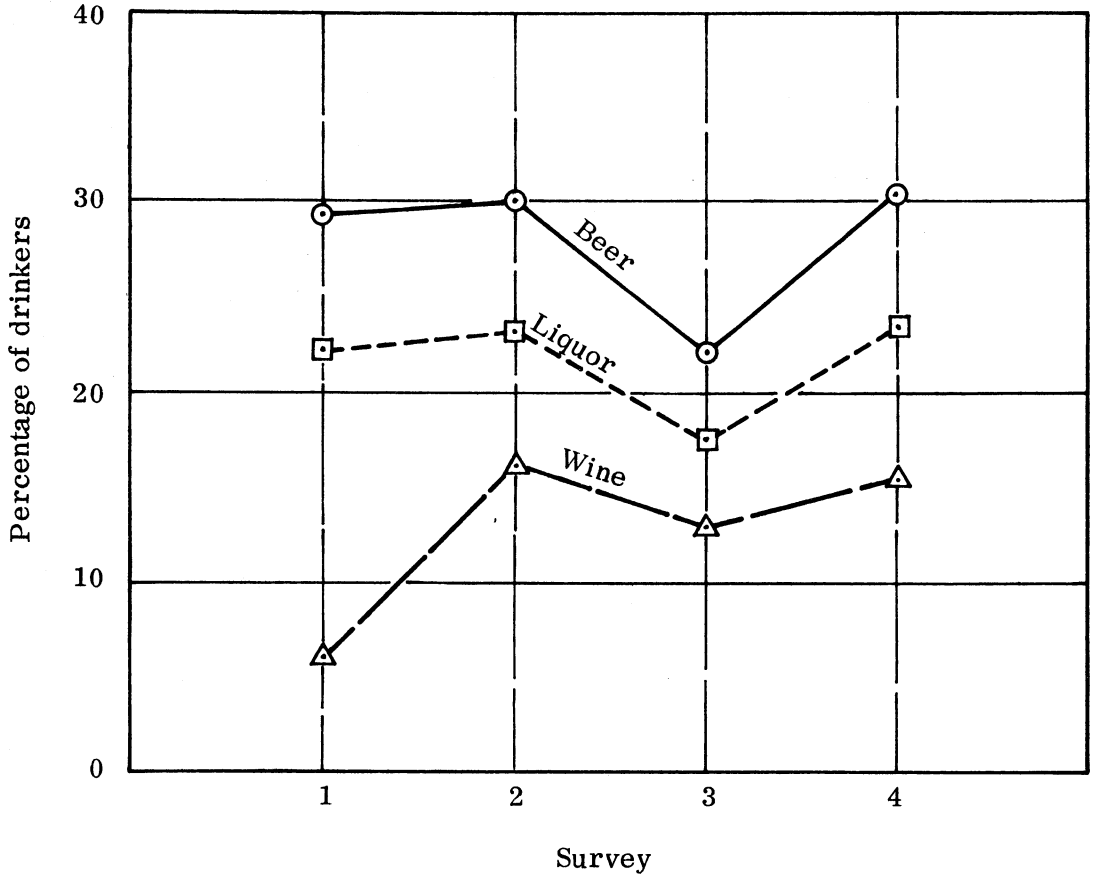

Figure 21. BAC $\geq$.02%.

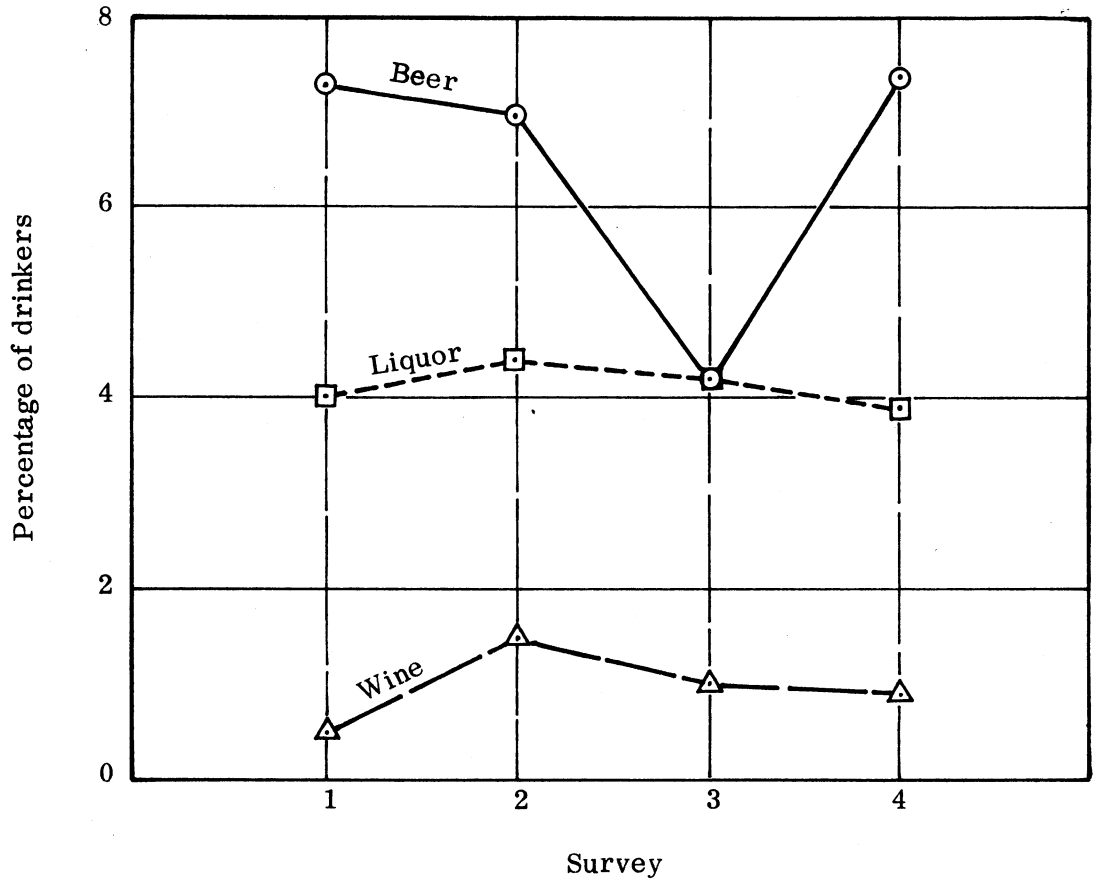

Figure 22. BAC $\geq$.10%.

In comparing the percentages of drunken drivers in a statistical sense, the percentages were greater for beer compared to liquor on the baseline ($p < .05$) and fourth surveys ($p < .01$). The percentages were greater for beer than wine on all four surveys ($p < .01$ for baseline, second, and fourth and $p < .05$ for the third survey). In comparing the percentages for liquor and wine drinkers, because of the relatively smaller sample sizes for wine drinkers, there was no significant difference on the second survey. Differences were significant on the baseline ($p < .05$), third ($p < .05$), and fourth surveys ($p < .01$).

In comparing the results within each category over the course of the surveys, there were several statistically significant changes. In the beer drinker category the decrease from 29.1% positive on the baseline survey to 22.1% on the third survey was significant ($p < .05$). However, this was followed by a significant increase from 22.1% to 30.6% on the fourth survey ($p < .01$). There was no statistical difference between the baseline and fourth survey positive percentages for beer drinkers. Similarly, the reduction among the beer drinker category from 7.3% above the presumptive level on the baseline survey to 4.2% on the third survey was also significant ($p < .05$). But, again, this was offset by a statistically significant increase from 4.2% to 7.4% on the fourth survey ($p < .01$). The baseline and fourth survey results were not significantly different for the BAC's above the persumptive level.

Among the wine drinkers, the only significant change was the increase in the positive percentage of 6.1% on the baseline survey to 15.7% on the fourth ($p < .01$).

Among the liquor drinkers, the only significant change was the increase in the positive percentage from 17.3% on the third survey to 23.5% on the fourth ($p < .05$).

CONCLUSIONS

Do the results of the four roadside surveys provide any quantifiable evidence that the Fairfax ASAP has succeded in accomplishing its objective of reducing the incidence of drunken driving? The data gathered from the four surveys fall into the two general categories of drinking knowledge and drinking behavior as it relates to driving. In the category of drinking knowledge, there are indications that the Fairfax ASAP has been successful. In the more important category of drinking behavior, it can only be concluded that there is no evidence to indicate that the Fairfax ASAP has been successful in reducing the incidence of drunken driving.

Drinking Knowledge

Over the course of the four surveys, there was a statistically significant improvement in the percentage of respondents able to identify the presumptive limit in Virginia. An indication that this increase was attributable to the Fairfax ASAP was that the increase among ASAP residents was statistically significant (from 19.4% to 25.6%), while the slight increase among non-ASAP residents was not (from 18.3% to 20.6%). Even though the improvement among ASAP residents was statistically significant and should certainly be judged as worthwhile, it should not be overlooked that there is still approximately 75% of the population who do not know the presumptive limit in Virginia.

Drinking Behavior

If there had been only the first three roadside surveys, there would have been some positive suggestions of ASAP success. There was a statistically significant reduction in the percentage of drivers who had a positive breath test reading on the third survey. For the percentage above the presumptive limit, the reduction from 4.2% to 3.0% fell just short of statistical significance. However, if these reductions were real or merely random errors in measurement, they were short-lived.

The percentage of drivers registering a positive BAC was the highest of all on the fourth survey — a significant increase from 19.6% on the baseline to 22.4% on the fourth survey. Also the percentage of drunken drivers was the highest on the fourth survey. The increase from 4.2% on the baseline survey to 4.6% on the fourth was not significant. However, the increase from 3.0% on the third survey to 4.6% on the fourth was statistically significant.

Thus, in summary, it appears that there can be no way of crediting the Fairfax ASAP with achieving the results on the third survey without also holding the ASAP responsible for the lack of success evident on the fourth survey. Perhaps neither credit nor blame should be meted, however, since the research design did not employ a control group, and the

significant changes might be accounted for by such threats to internal validity as history and maturation. In the extension of its ASAP projects, the National Highway Traffic Safety Administration is encouraged to use control sites for roadside surveys so that alternative hypotheses which threaten the internal validity of the research design may be ruled out.

REFERENCES

1. M. W. Perrine, Methodological Considerations in Conducting and Evaluating Roadside Research Surveys (National Highway Traffic Safety Administation), February 1971, pp. 1-5.

2. S. B. Richmond, Statistical Analysis (Second Edition), New York, New York, The Ronald Press Company, pp. 204-206 (1964).

3. Behavior Today, December 31, 1973, Volume 4, Number 49, p. 2

APPENDIX A

VOLUNTARY ROADSIDE SURVEY

1. Interviewer Observation: Number of people in the car

   1 2 3 4 5 6 7 8 9 10 OR MORE

2a. First, what city or town do you live in? _____ (CITY OR TOWN)

(INTERVIEWER: ASK 2b AND 2c ONLY IF NECESSARY: BE SURE TO ENTER ANSWERS FOR 2b and 2c)

2b. What county is that?

County:
1 (SURVEY) COUNTY
2 OTHER (Specify):_____

2c. And what state?

State:
1 (SURVEY) STATE
2 OTHER (Specify):_____

3. How long have you lived in _____ county?

1 LESS THAN 1 MONTH
2 1 - 6 MONTHS
3 7 - 11 MONTHS
4 1 - 2 YEARS
5 3 - 4 YEARS
6 OVER 4 YEARS

4. About how many miles do you yourself drive in a year?

1 LESS THAN 10,000
2 10,000 - 19,999
3 20,000 - 29,999
4 30,000 MILES OR MORE

5. In a typical week how many days do you drive?

7 EVERY DAY
6 SIX DAYS
5 FIVE DAYS
4 FOUR DAYS
3 THREE DAYS
2 TWO DAYS
1 ONE DAY
0 NONE IN A TYPICAL WEEK

6. Drinking is an accepted part of business and social activity for many people. Do you ever drink beer, wine, or liquor such as whiskey, gin, or vodka?

1 YES
2 NO → SKIP TO Q. 10

7. Which of these do you drink most often --- beer, wine, or liquor?

1 BEER
2 WINE
3 LIQUOR

8. At the present time do you consider yourself to be a:

1 VERY LIGHT DRINKER
2 FAIRLY LIGHT DRINKER
3 MODERATE DRINKER
4 FAIRLY HEAVY DRINKER
5 HEAVY DRINKER

HAND RESPONDENT CARD "E"

9. About how many days during this past week did you drink the number of drinks shown below? (By drink we mean a glass of wine, a bottle or can of beer, or a single shot of liquor)? Just read me the number of days of each line.

8 OR MORE DRINKS? _____ LINE 1
5 - 7 DRINKS? _____ LINE 2
3 - 4 DRINKS? _____ LINE 3
1 - 2 DRINKS? _____ LINE 4
NO DRINKS? _____ LINE 5

INTERVIEWER: CHECK THAT DAYS TOTAL 7 DAYS

10. Wnat do you think the term Blood Alcohol Concentration or Blood Alcohol Level means?

1 RESPONDENT'S ANSWER COMPLETELY CORRECT
2 RESPONDENT'S ANSWER CORRECT
3 RESPONDENT'S ANSWER WRONG

HAND RESPONDENT CARD "A"

11. The Blood Alcohol Concentration is based on a chemical test, such as a breath test, and is used to determine if a person is legally drunk or intoxicated. Which of these do you understand is the legal definition of being drunk in this state?

1 ANY TRACE
2 .05%
3 .08%
4 .10%
5 .12%
6 .15%
7 .20%
8 DON'T KNOW

12. How many drinks do you think <u>you</u> would have to have to reach the level where you would be considered legally drunk?

1 ONE OR LESS
2 TWO
3 THREE
4 FOUR
5 FIVE
6 SIX
7 SEVEN
8 EIGHT
9 NINE
0 TEN OR MORE
X DON'T KNOW

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

RECORD RESULTS

14. Have you drunk any beer, wine, or liquor in the last two hours?
1 YES
2 NO

(IF "YES" ON Q. 14, ASK):

15. How many drinks have you had in the last two hours, counting a bottle or can of beer, or a 4-ounce glass of wine, or 1½ ounces of liquor each as one drink?
_____ (NUMBER)
X NONE

16. During the past four years, how many times have you moved from one address to another?
1 ONE MOVE
2 TWO MOVES
3 THREE MOVES OR MORE
4 NO MOVE - AT SAME ADDRESS DURING PAST 4 YEARS

(IF ANY MOVES IN THE PAST 4 YEARS, ASK):

17. How many of these moves were from one county to another?
1 ONE
2 TWO
3 THREE OR MORE
4 NONE
5 DON'T KNOW

HAND RESPONDENT CARD "B"

18. Which of these comes closest to your weight? Just give the letter. (INTERVIEWER: ESTIMATE IF NECESSARY)
1 LESS THAN 100 LBS.
2 100-119 LBS.
3 120-139 LBS.
4 140-159 LBS.
5 160-179 LBS.
6 180-199 LBS.
7 200-219 LBS.
8 220-239 LBS.
9 240 LBS. OR more

19. In what 10-year age group do you fall?
1 UNDER 20 YEARS
2 20 - 29
3 30 - 39
4 40 - 49
5 50 - 59
6 60 OR OVER

20. Sex (OBSERVE AND RECORD)
1 MALE
2 FEMALE

21. Race (OBSERVE AND RECORD)
1 WHITE
2 BLACK
3 ORIENTAL
4 LATIN
5 AMERICAN INDIAN
6 OTHER (Specify)_____

22. LOCATION NO.: _____

23. TIME OF DAY: _____

24. DATE_____

25. INTERVIEWER'S SIGNATURE_____

APPENDIX B

MATHEMATICAL FORMULAS

The Difference Between Two Percentages [2/]

1. Expected percentage, $P_e = \frac{n_1 p_1 + n_2 p_2}{n_1 + n_2} = \frac{a_1 + a_2}{n_1 + n_2} \cdot 100$

where: n_1 = number of observations in sample 1

n_2 = number of observations in sample 2

p_1 = percentage in sample 1

p_2 = percentage in sample 2

a_1 = number of successes in sample 1

a_2 = number of successes in sample 2

2. Standard error of the difference between two percentages,

$$s_{p_1-p_2} = \sqrt{p_e(100-p_e)[(n_1+n_2) \div (n_1 n_2)]}$$

3. Number of standard deviations, $Z = \frac{p_1 - p_2}{s_{p_1-p_2}}$