ABSTRACT
This study was designed to identify consistencies among drinking and driving measures from three sources: a roadside survey, a subsequent interview, and department of motor vehicles (DMV) records. Data pertain to 362 drivers recruited at late-night, weekend roadside surveys. Relationships were noted among the three sets of data, in that the roadside BAC, DMV records, and self-reported alcohol use and drink-driving behaviours show strong associations. Multiple regression analyses indicate that measures of usual drinking and drink-driving behaviors effectively predict roadside BAC. However, self-reported weekend drinking is not a predictor of weekend nocturnal roadside BAC nor are scores on an alcohol problem scale.

The data suggest that future studies should address: (1) drivers’ BACs at times other than late-night Fridays and Saturdays, to determine whether these are also more closely related to usual drinking patterns, or, rather, are specific to a particular day or set of days; and (2) more detailed investigations of the immediate circumstances preceding drinking-driving, i.e., natural histories of decisions to drink and drive. These studies should also be conducted on both weekdays and weekends and should concentrate on reasons both for drinking and for motorists’ decisions to drive after drinking.

INTRODUCTION
A persistent problem of drinking and driving studies is consistency of measures. Although we have reasonable confidence in the accuracy of certain measures -- in particular, blood/breath alcohol concentration (BAC) measured with evidentiary-quality instruments -- we are not certain how these measures reflect respondents’ longer-term, usual patterns of alcohol use. Correspondingly, when interviewing respondents about drinking and driving, we must validate drivers’ answers by such independent data as roadside BAC (Meyers et al., 1993; Perrine, 1990a, 1990b; Perrine et al., 1971; Wolfe, 1990); official records (Beerman et al., 1988); unobtrusive observation (Perrine, 1993a; 1993c); and/or biochemical state markers (Chan, 1990). Insofar as we find consistencies, they demonstrate a kind of convergent validity, which in turn increases confidence in both the accuracy of interview responses and the stability of the behaviors they describe.

To address consistencies, the present report uses targeted analysis of roadside data, supplemented by data from extensive interviews and state division of motor vehicle (DMV) driver records. The two hypotheses are: (1) persons who use alcohol frequently and heavily in general are likely to have higher BAC at roadside; further, a heavy weekend drinker is
likely to have high BAC at roadside on weekend nights; and (2) persons who are relatively often involved in alcohol-related behaviors such as drinking-driving are likely to have high roadside BAC. In the present study, roadside BAC serves both as an independent external criterion for consistencies across data sources and as a dependent variable for multiple regression.

**METHOD**

The Vermont Alcohol Research Center (VARC) conducted roadside research and related studies of drinking and driving in four counties of northeastern Ohio during three seasons between April 1990 and October 1992 (for detailed descriptions of the roadside survey methods and results, see Meyers et al., 1993). The research population included Ohio residents driving on Friday and Saturday nights (10:00 p.m. to 3:00 a.m.).

**Roadside Data**

At each site, a uniformed police officer directed drivers from the trafficstream into the research area. Interviewers observed and recorded vehicle type and drivers’ gender, race, and seatbelt use. They explained that participation in the survey was voluntary. Consenting drivers were asked questions about trip origin and destination; perceived risks of apprehension for drunken driving; age; education; whether they had consumed any alcohol during the preceding 12 hours; and, if so, the time at which they had finished their most recent drink. Interviewers then requested a breath sample that was analyzed by Passive Alcohol Sensor (PAS). All respondents with positive BACs, and a 6% random sample of those with BACs = 0, were asked to provide a second breath sample, analyzed with a portable evidentiary-quality breath tester.

**Interview Data**

Consenting respondents completed comprehensive interviews using the Health Attitudes and Practices Survey (HAP) (Perrine, 1993b), a recently revised, 280-item, computerized instrument administered by trained interviewers in a face-to-face format. The HAP-III includes a drinking-related questions, demographic variables, health practices, father’s and mother’s drinking patterns, opinions about drinking, driving history, drinking-and-driving history, drug use, combined alcohol and drug use, and driving after drug use. Drinking patterns are assessed using questions about: (1) usual and more than usual quantity and frequency; (2) quantity on, and frequency of, light and heavy drinking days; and (3) drinking continuation occasions during the last 28 days.

**Department of Motor Vehicle Records**

The Ohio DMV supplied data tapes that included 3-year histories of drivers’ motor vehicle convictions, penalty points, sanctions, procedural violations, and administrative actions. “DUI conviction” here includes convictions for offenses that are overwhelmingly alcohol involved, e.g., reckless driving.
Variables

Table 1 describes the 11 study variables and their sources; notes all aggregations, transformations of values, and scoring; and provides means, standard deviations, and ranges. Age and sex were included as possible controls (e.g., Yu et al., 1992). The Vermont Alcohol Problems Scale (VAPS) is a summated scale, consisting of 17 self-administered questions about alcohol-related problems with work, interpersonal relationships, health, and the law. Many of the items were derived from the MAST (Selzer, 1972), CAGE (Ewing, 1984), and TWEAK (Russell, 1994), but we reworded some and provided each with a five-point response scale (1, “never” and 5, “very often”). The revisions further clarified the questions’ meanings and eliminated some artificial features of the original instruments. Relatively strong correlations were observed among the VAPS items and between these items and other variables in Table 1. Coefficient alpha for the 17 VAPS items is 0.88 (p < 0.01).

Table 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Source</th>
<th>Mean</th>
<th>SD</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAC</td>
<td>Drivers’ BAC (%); range, 0-32%</td>
<td>Roadside</td>
<td>0.07</td>
<td>0.05</td>
<td>360</td>
</tr>
<tr>
<td>TIME</td>
<td>Time of roadside interview</td>
<td>Roadside</td>
<td>1:09 a.m.</td>
<td>88.8</td>
<td>362</td>
</tr>
<tr>
<td>SEX</td>
<td>Drivers’ gender (0, male; 1, female)</td>
<td>Roadside</td>
<td>73.0% male</td>
<td></td>
<td>362</td>
</tr>
<tr>
<td>AGE</td>
<td>Drivers’ age; range, 18-72</td>
<td>Roadside</td>
<td>32.48</td>
<td>11.19</td>
<td>362</td>
</tr>
<tr>
<td>FREQ</td>
<td>Drinking frequency; range, 1-9*</td>
<td>HAP</td>
<td>5.70</td>
<td>1.75</td>
<td>361</td>
</tr>
<tr>
<td>QUANT</td>
<td>No. of drinks/sitting; range, 0-30</td>
<td>HAP</td>
<td>4.20</td>
<td>2.92</td>
<td>361</td>
</tr>
<tr>
<td>WKEND</td>
<td>Fri. &amp; Sat. drinking quantity; range, 0-55**</td>
<td>HAP</td>
<td>8.02</td>
<td>7.75</td>
<td>330</td>
</tr>
<tr>
<td>VAPS</td>
<td>Vermont Alcohol Problem Scale; possible range, 0-85</td>
<td>HAP</td>
<td>25.34</td>
<td>7.11</td>
<td>355</td>
</tr>
<tr>
<td>DRIVILG</td>
<td>Self-reported driving frequency with illegal BAC in past 3 years; Log10 transformation; range, 0-3***</td>
<td>HAP</td>
<td>0.77</td>
<td>0.65</td>
<td>359</td>
</tr>
<tr>
<td>DUI</td>
<td>Whether drive had Ú1 DUI or other alcohol-related conviction; 0, no; 1, yes</td>
<td>DMV</td>
<td>9.4% (yes)</td>
<td></td>
<td>362</td>
</tr>
<tr>
<td>POINTS</td>
<td>No. traffic violation points (alcohol &amp; nonalcohol related); range, 0-24</td>
<td>DMV</td>
<td>2.21</td>
<td>3.45</td>
<td>362</td>
</tr>
</tbody>
</table>

* Values from 1-9 represent, respectively, drinking once or twice a year, less than once a month, once a month, 2 or 3 times a month, once a week, twice a week, 3 or 4 times a week, 5 or 6 times a week, and daily.
** Summated scale of average number of drinks on Fri. and Sat. The two items correlate at 0.76 (p < 0.01).
*** Natural metric ranges from 0 to 998. Log10 transformation used to cope with the skewness of the variable. One was added to the natural metric variable to avoid negative values in the log transformation.

Procedures

For bivariate analysis, a correlation matrix was generated showing the relationships between and among each pair of variables from the three sources. For multivariate analysis,
having determined bivariate relationships among roadside BAC, the dependent variable, and the independent variables in Table 1, we tested several alternative regression equations. Regression models were designed with concern for theoretical consistency, multicollinearity, and multiple tests.

RESULTS

Correlations

BAC has significant and relatively strong correlations with variables from the interview and DMV data. Higher roadside BAC is associated with larger quantity and higher frequency alcohol use, heavier weekend drinking, more characteristics of problem drinking, more frequent driving at illegal BAC, more traffic violations, and higher likelihood of DUI convictions. The HAP interview alcohol use and drink-driving variables show relatively strong associations with the official DUI records and traffic-violation points. Persons with DUI convictions on their records and more violation points are also more likely to score high on quantity and frequency of alcohol use, weekend drinking, problem drinking, and the frequency of driving with illegal BAC.

Correlations among the variables within each data source were consistent and as expected. Late-night drivers tend to have high BAC. Persons with official DUI records have more traffic-violation points. Both usual and weekend drinking are associated with problem drinking, and driving with illegal BAC has strong correlations with drinking and problem drinking variables.

Men and younger drivers tend to use alcohol frequently and in large quantities, drink on weekends, drive with illegal BACs, and have DUI and other traffic-violation records. However, age and gender do not have significant relationships with roadside BAC.

Multiple Regression

Analyses were performed for three specific equations. The weekend drinking equation includes TIME, VAPS, weekend drinking, self-reported driving with illegal BACs, DUI, and POINTS. The usual drinking equation contains TIME, VAPS, usual drinking quantity and frequency, self-reported driving with illegal BAC, DUI, and POINTS. The third equation includes both weekend and usual drinking, plus the remaining independent variables. Since age and sex did not show significant relationships with BAC (the dependent variable), we excluded them from the regression analysis.

In the weekend drinking equation, BAC is best predicted by DUI and DRIVILG. When weekend drinking and usual drinking quantity and frequency were analyzed in the same equation, the beta for weekend drinking was reduced to 0.02, but the effects of drinking quantity and frequency remained.

Table 2 shows the results of the usual drinking equation, with variables presented in decreasing order of contribution to total variance in BAC. The measures of usual drinking quantity and frequency are relatively good predictors of roadside BAC; with beta coefficients of 0.19 for FREQ and 0.17 for QUANT, they explain 7% and 10% of the
variance in BAC, respectively. Three driving-related variables (TIME, DRIVILG, and DUI) also provide some explanatory power for BAC.

### Table 2
Results from the Stepwise Regression Analysis on Roadside BAC (0 g/dl) (n = 352)

<table>
<thead>
<tr>
<th>Variable</th>
<th>b</th>
<th>Beta</th>
<th>R² Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>QUANT</td>
<td>.004</td>
<td>.17</td>
<td>.10*</td>
</tr>
<tr>
<td>FREQ</td>
<td>.006</td>
<td>.19</td>
<td>.07**</td>
</tr>
<tr>
<td>DUI</td>
<td>.033</td>
<td>.18</td>
<td>.03**</td>
</tr>
<tr>
<td>TIME</td>
<td>.002</td>
<td>.12</td>
<td>.02*</td>
</tr>
<tr>
<td>DRIVILG</td>
<td>.009</td>
<td>.11</td>
<td>.01*</td>
</tr>
<tr>
<td>VAPS</td>
<td>.0004</td>
<td>.05</td>
<td>.00</td>
</tr>
<tr>
<td>POINTS</td>
<td>-.0004</td>
<td>-.03</td>
<td>.00</td>
</tr>
<tr>
<td>Total R²</td>
<td></td>
<td></td>
<td>.23</td>
</tr>
</tbody>
</table>

*p < 0.05; **p < 0.01

**DISCUSSION AND CONCLUSIONS**

The analyses generally support our hypotheses of consistencies among data collected from the three different sources: the roadside surveys, in-depth personal interviews, and official DMV records: (1) Strong associations were observed among variables from all three data sources: late night driving and roadside BAC; self-reports of alcohol use, alcohol-related problems, and driving with BAC over the limit; and official records of DUI and other driving offenses. (2) Strong predictive power on the roadside BAC was noted by at least one measure from each of the three sources: usual quantity and frequency of alcohol consumption, previous driving while over the BAC limit, arrests for DUI and other alcohol-involved offenses, and the time of night stopped at roadside. (3) Drivers’ usual drinking patterns (quantity and frequency) tend to be the most consistent predictors of their weekend roadside BACs, stronger than such other alcohol-use measures as weekend drinking and problem drinking.

These results suggest that the nocturnal weekend BAC at roadside generally reflects consistent patterns of driving and alcohol use. The correlational analysis indicates strong congruities among all three data sources in that the data collected to measure specific behaviors at one point in time and data collected to measure general behavioral patterns converge. Multiple regression analysis suggests that such general behavioral patterns as alcohol use and driving behaviors predict drinking-and-driving at a specific point in time. Motorists who use alcohol and drive after drinking in general are most likely to have high BACs on weekend nights.
REFERENCES


Perrine, M. W. (1993a). The drinking driver research program of the Vermont Alcohol Research Center (pp. 1096-1102).*


Perrine, M. W. (1993c). Rapprochement between epidemiology and experimentation concerning driving-after-drinking problems (pp. 809-820).*

Perrine, M. W. (1990a). Random breath testing for research and enforcement (pp. 81-89).*


Wolfe, A. C. (1990). Random roadside surveys to measure the incidence of drunk driving (pp. 66-75).*


** From H. D. Utzelmann, G. Berghaus, & G. Kröö (Eds.), *Alcohol, drugs, and traffic safety - T92.* Cologne: ToV-Rheinland.