The Drinking Driver: Identification of High-Risk Alcoholics

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National statistics on traffic safety repeatedly show the drinking driver to be implicated in automobile accidents and traffic fatalities. ‘Alcoholics’ are grossly overrepresented among impaired drivers (8, 20) and among those drivers responsible for automotive accidents and fatalities (12, 16, 17, 18). Thus the alcoholic driver provides a serious threat to himself and to the rest of the driving population.

While a number of studies have isolated apparent personality traits of alcoholics (1, 4, 7, 10), relatively little research has been done to attempt to relate those characteristics to the driving behavior of alcoholics possessing such characteristics.

Psychiatric studies have demonstrated that alcoholics tend to be more aggressive, hostile, and self-destructive than control subjects (13, 15), and thereby confirm the relationship between prolonged abuse of alcohol and a psychopathology. However, as Schmidt and Smart have noted (16), this evidence does little to establish the causal relationship between enduring personality traits and the occurrence of traffic accidents.

A more direct relationship between the personality of alcoholics and their driving behavior was found by Zelhart (19). The citation histories of groups of alcoholics, identified by Lawlis and Rubin (7), were compared to determine the extent to which personality was related to dangerous driving habits. The Ss with significantly lower frequencies of citations were among the group which had been described as “inhibited or maladaptive, and frustrated,” while the Ss with a greater frequency of citations were from the group identified as “unsocialized and aggressive”. Such a finding, although based upon a rather small sample size, and dealing only with a population of identified alcoholics, seems to provide direct support for Selzer’s study (13) but also points to the possibility that not all alcoholics represent the same degree of highway hazard.

Progress towards implementing countermeasure programs would be greatly improved if independent and objective measures could identify drivers representing risks

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to highway safety. Present systems do not appear to offer effective prediction of hazardous drivers. In many jurisdictions an individual is not assumed to have a problem with alcohol until his second conviction for impaired driving. Two convictions may well indicate alcoholism. Nevertheless, nearly 88% of the highway fatalities involving drinking drivers cannot be isolated by the prior occurrence of impaired driving convictions (12). Thus independent indices must be developed. To this end, the present study attempts to determine any personality characteristics that may be related to dangerous behavior and to the prediction of highway hazard.

Previous evidence identifies the driver who is impaired by alcohol as representing the greatest risk to highway safety not only in terms of his involvement in automobile accidents but with respect to the incidence of “reckless” driving and excessive speed citations (3). Yet there is another group of drivers whose records indicate imprudent driving behavior and an increased safety risk but who have avoided, either through judicious drinking-driving behavior or fortuitous circumstances, prior conviction for (alcohol) impaired driving. These we have defined as high-risk drivers.

The purported prevalence of alcoholism among impaired drivers suggests the occurrence of another group of drivers offering a threat to highway safety. This group is composed of individuals who consume beverage alcohol in sufficient quantities and behave in such a way as to be classified as alcoholics. Of that group there are those who have avoided conviction for dangerous or impaired driving. That is, they are alcoholics who, when drinking, were prudent enough to avoid driving or took other precautions so as not to draw the attention of the police.

Finally, there is a group representative of the vast majority of the driving population. These are drivers who consume beverage alcohol but who would not be classified as alcoholic and who have histories of safe driving behavior. Such individuals are of interest because they are exposed to the toxic effects of alcohol yet do not manifest the behavioral symptoms of either the alcoholic or the driver presenting a highway hazard.

METHOD

Subjects

Five groups of subjects, representing varying degrees of highway hazard and involvement with alcoholic beverages were employed in this study. The members of all groups were males who possessed a currently valid Alberta Operator’s License.

Group ID. This group consisted of a sample of 201 convicted impaired drivers participating in the Alberta Impaired Drivers’ Program (AIDP).

Group HR. A group of 200 high-risk drivers was obtained through interviews conducted by the Driver Review Board of the Alberta Department of Highways. The subjects of group HR had accumulated 9 to 14 Highway Traffic Act demerit points in the 24 months preceding their interview but had no alcohol-related accident or conviction for impaired driving.

Group AL. This group consisted of a sample of institutionalized alcoholics obtained through the Alberta Alcoholism and Drug Abuse Commission’s Henwood Treatment Facility and Outpatient Clinic. After interviewing some 950 clients, the staff was able to isolate 58 who had never been cited for impaired driving and whose records showed no moving violations or traffic accidents during the preceding 24 months.
Group CN. The members of this group and of the remaining group CA were volunteers from Division K of the Royal Canadian Mounted Police and the Alberta Attorney General’s office. The men were assigned to one of these two groups according to their responses to mailed questionnaires and the Michigan Alcoholism Screening Test (MAST, 14). Group CN (N=140) were “normal social drinkers” or non-drinkers, and scored less than 4 on the MAST.

Group CA. The subjects assigned to group CA (N=49) were reported “regular and frequent” consumers of alcohol and exceeded the performance criterion “suggestive of alcoholism” on the MAST.

Subjects in Groups CN and CA were all safe drivers as indicated by a citation- and accident-free record in the 36 months preceding their participation in the project.

Test Materials

Each S completed a 40-item Personal Information Questionnaire (PIQ) designed as the basic socio-demographic instrument of the AIDP. The questions assessed the major socio-demographic attributes of the respondent in addition to eliciting a self-report of his prior involvement with beverage alcohol and previous encounters with legal authorities. In addition, each S completed the Howarth Personality Questionnaire (HPQ, 6) and the Psychoticism, Extroversion and Neuroticism Inventory (PEN; Eysenk3). Responses to the MAST were obtained from all groups with the exception of group HR, where time limitations of the interview made its administration impractical. For the purpose of the present study the final two questions of the MAST, which deal specifically with prior alcohol-related arrests, were eliminated in scoring the S’s responses.

RESULTS

Major Socio-Demographic Attributes

Several interesting, and in some cases surprising, results from the PIQ appeared, and these require attention. In general, the groups were less different on major socio-demo- graphic indices than had been expected. Virtually all were Caucasian (at least 89% in each group), and from a Christian faith. The majority were married and living with their first wife at the time of the interview. Only alcoholics under treatment (Group AL) showed a marked incidence of divorce or separation (31.2%). While the younger driver was somewhat overrepresented among Groups ID and HR, the mean age of the Ss was 37 years and failed to differ significantly among the groups. At least two-thirds of the Ss in each group had completed a minimum of nine years of education and more than one-half had completed some portion of high school.

The groups did differ, however, with respect to their Social Economic Standing (SES) as determined by Hollingshead’s Two-Factor Index of Social Position (5). While all other groups were identified as representing the ‘middle class’ (Class III), the mean SES score for Group ID placed them within Class IV (‘lower middle’). An analysis of variance of the SES scores evidenced the significant effect between groups (F = 25.25, df = 4, 587, p < .001) and post hoc comparisons identified further differences among the ‘middle class’ groups. While the Ss in Group ID had significantly higher SES scores (i.e., lower social standing) than all other groups, Groups CN and CA had significantly lower mean scores than Groups HR and AL (p < .05). In fact, the mean SES scores for

3Personal communication, Sybil Eysenck, 1972.
Groups HR and AL were closer to the classification of being from the 'lower middle' than the 'middle' class. This is not particularly surprising due to the nature of the jobs held by the members of Groups CN and CA.

Before proceeding with the discussion of the Ss' responses to questions dealing with their use of beverage alcohol and prior arrests a word of caution is necessary. While the incidence of failing to respond to innocuous questions on the PIQ was relatively low, a large number of Ss avoided responding to items which dealt with their use of beverage alcohol: in some cases as many as 17% of the Ss overall. Regardless of the multitude of reasons which may be responsible for this, failure to respond makes interpretation difficult and conclusions tenuous. In addition, with this type of instrument, we inherently trust the veracity of the S's report. However, the work of Pinneau and Melton (11) shows that when questions relate to behavior which may be seen as socially deviant or carries social and legal sanctions, greater caution must be exercised in assessing self-report data. It was not feasible, and in many cases impossible, for us to search the numerous official records to validate a S's responses. Thus, in the following discussion, we present several interesting reports by our Ss which were not independently confirmed and thus remain the Ss' reports.

Patterns of Drinking Behavior

We asked the Ss how old they were when they had their first drinking experience and their responses are shown in Figure 1. With the exception of Group CN, which contained a number of "non-drinkers," at least 73% of the Ss reported using alcohol prior to their 21st birthday. A substantially greater proportion of the high-risk drivers (Group HR, 33%) than the alcoholics under treatment (Group AL, 14%) reported having consumed alcoholic beverages before the age of 15 years. Interestingly, the least frequent incidence of reported teenage drinking was among the convicted impaired drivers (Group ID, 8%).

![Figure 1](image-url)  
**Figure 1** Age of First Drinking Experience. The Unfilled Bars Represent Responses 'Prior to 21st Birthday' and the Filled Bars 'Prior to 15th Birthday'.
When asked if they "suspected they might have a drinking problem" the vast majority of the alcoholics under treatment (Group AL) responded affirmatively (Figure 2). Far fewer of the Ss in Groups CN (2.9%) and HR (8.5%) reported a suspected drinking problem than did the Ss in Group ID (19.9%) and Group CA (19.1%). This is interesting since the latter groups would be classified as "suspected alcoholics" by means of the MAST. Although 19% of all the Ss reported a suspected drinking problem, only 11% reported ever having "sought help" for their problem from any source whether it were A.A., medical doctors, clergy or family. Eighty-eight per cent of the alcoholics under treatment reported a suspected drinking problem. The lack of unanimity among the Ss was somewhat surprising since all were participating in an alcohol treatment program at the time they were questioned.

Figure 3 shows marked differences among the groups with respect to the reported "daily consumption of alcohol." While one-half of the Ss in the control-normal (Group CN, 50.4%) and the high-risk group (Group HR, 46.2%) reported consuming not more than 3 drinks in a "normal drinking day," 38.8% of the Ss in Groups ID and CA reportedly consumed more than six drinks daily. This rate was easily exceeded by the alcoholics under treatment where 80% of the Ss reported consuming more than six drinks in a drinking day. While this rate of consumption was greater among the high-risk drivers (24.3%) than in the control-normal group (16.2%), the reported frequency of excessive alcohol consumption remains far less than for groups with suspected or confirmed alcohol dependencies. By and large, the alcoholics under treatment showed the most excessive daily consumption of alcohol. The reported patterns among the Ss in Groups ID and CA appeared similar but distinct from those of Groups HR and CN.
Although the convicted impaired drivers reported a greater daily consumption of beverage alcohol than did the high-risk drivers, the frequency of "drinking days per week" was not dramatically different between the groups, as can be seen in Figure 4. Sixty-four per cent of Group ID, 57.5% of Group CA and 55.9% of Group HR reported consuming alcohol on no more than two days during the week. The only group demonstrating a positive relationship between the frequency of consumption and the amount consumed was the AL Group, where 77.6% reported at least five drinking days during the week. However, the Ss in Group CN again showed considerable moderation in their pattern of alcohol consumption.

Clearly, alcoholics under treatment are distinguished from all other groups on the basis of their excessive involvement with alcohol. What appears to distinguish the alcohol impaired drivers from the high-risk drivers was not the frequency with which they consumed beverage alcohol but the differential quantities consumed when they did drink. Thus, it would seem that while high-risk drivers may have attempted to operate motor vehicles after drinking as frequently as impaired drivers, the impaired drivers may be more readily identified because they are impaired to a greater extent.

Indices of Alcohol Dependency

Some of the traditional indices of alcohol dependency are: objections among family members to the individual's drinking behavior, the loss of employment as the result of his drinking and the occurrence of "blackouts". The responses of the Ss to these questions are provided in Figure 5. When we asked Ss about family objections nearly twice the proportion of the impaired drivers (30.0%) confirmed a family conflict over their drinking than did the Ss in the high-risk drivers group (16.7%). In addition, a
substantial proportion (20%) of the Ss in Group CA responded positively to this question. The incidences, however, did not approach those of Group AL. As would be expected, the incidence of family conflicts over drinking was the lowest in Group CN (2.2%). The only group to reportedly have had a substantial incidence of loss of employment due to drinking was the alcoholics under treatment (36.7%). This may be one important factor in an individual’s identification of a problem with alcohol consumption. Group AL also reported the largest incidence of “blackout” (82.5%). However, nearly twice the proportion of Ss in Group CA (44%) indicated that they had experienced “blackout” than did the impaired drivers (23.9%). The lowest reported incidence was among the high-risk drivers (13.6%) and the control-normal group (6.6%).

The Ss in Group AL appeared to be distinguishable from all other groups, not only in terms of their (previous) involvement with beverage alcohol but also, by the traditional indices of chronic alcohol dependency. For the other groups, however, there was not a consistent pattern among these data, except among the control-normal sample, who consistently demonstrated the least frequent indicators of alcoholism. Although impaired drivers and control-alcoholics demonstrated similar patterns of drinking behavior, they were not easily distinguished from the Ss in Group HR, who might be suspected of an alcohol problem but had not yet evidenced it through their driving behavior.
Prior Arrests

The Ss were asked the number of times they had been arrested by a police officer and the number of times they had been arrested on alcohol-related offences. No impaired driver was arrest-free: 43.3% had a single arrest (i.e., for driving while impaired by alcohol) 29.8% of the Ss had three or more arrests. For 23.4% of the impaired drivers there had been three or more alcohol-related arrests. Virtually all of the high-risk Ss (84.1%), control-normal Ss (98.5%) and the control-alcoholic Ss (95.7%) had never been arrested. Among the alcoholics under treatment 54.6% of the Ss had been arrested at least once and 40% on at least one alcohol-related offence; but not alcohol impaired driving. Seventeen per cent of Group AL had three or more alcohol-related arrests.

One variable distinguishing the Group ID from Group AL appeared to be their involvement with legal authorities over their use of beverage alcohol. Although the alcoholics tended to have used beverage alcohol more excessively than the impaired drivers, they reported that they had less contact with the legal authorities. In addition, the incidence of alcohol-related arrests among high-risk drivers suggested that the impaired driver may be distinguished from the former groups, not only in terms of their consumption of alcoholic beverages, but in terms of what he does after excessive drinking. While the high-risk drivers and the alcoholics under treatment may have reached similar degrees of impairment as the result of their drinking, the former apparently avoided contact with the legal authorities while impaired.
**Personality Data**

Mean scores on the four scales of the PEN and the 10 scales of the HPQ are presented for the five groups of Ss in Table I. In general, the greater the value of any of the scales the more predominant the traits associated with the scale are within the personality of the S. However, the absolute value associated with the scale must be taken with respect to some underlying value within the general population; i.e., the normative value for the scale.

**TABLE 1 PEN and HPQ Group Mean Scores**

<table>
<thead>
<tr>
<th>Group</th>
<th>PEN Factors</th>
<th>HPQ Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E</td>
<td>N</td>
</tr>
<tr>
<td>Control: normal (CN)</td>
<td>12.70</td>
<td>3.93</td>
</tr>
<tr>
<td>Control: alcoholic (CA)</td>
<td>11.41</td>
<td>6.20</td>
</tr>
<tr>
<td>AIDP (ID)</td>
<td>12.77</td>
<td>5.63</td>
</tr>
<tr>
<td>Alcoholics under Treatment</td>
<td>9.79</td>
<td>13.00</td>
</tr>
<tr>
<td>High-Risk Drivers (HR)</td>
<td>13.46</td>
<td>5.43</td>
</tr>
<tr>
<td>Grand Mean</td>
<td>12.59</td>
<td>5.91</td>
</tr>
</tbody>
</table>

Canadian Norms:
- Male University Students – 7.52, 4.86, 5.88, 5.01, 3.67, 4.35, 7.98, 3.68, 7.37, 6.30
- Male Soldiers – 8.85, 3.84, 5.33, 7.49, 3.37, 4.26, 9.13, 2.65, 8.53, 6.76

The scores of Ss within Group CN differed from the norms of Canadian University students (males) on two dimensions of the HPQ but were consistent with the norms for Canadian soldiers on all dimensions. On the scales labeled Super Ego (SG) and Cooperativeness-Considerateness (CC) these Ss were at least one standard deviation (sd) higher than the norm for the University students. They were, however, somewhat lower than the norm on the Adjustment-Emotionality (AE) scale.

Control Ss who drank more frequently (Group CA) scored lower than both normative samples on the Sociability (Sy) scale of the HPQ and higher on the the SG scale than the Canadian University students. Virtually no differences were found when the profiles of the impaired drivers (Group ID) were compared with the Canadian norms.

The mean scores for Group AL differed from the norms on a number of scales. They were far less sociable (Sy) and more “neurotic” than army personnel and they tended to be more hypochondriacal (HM) than both students and soldiers. They also scored higher on the Inferiority scale (IF) and lower on the Persistence scale (PS) than the soldiers. The Ss in Group AL appeared to have a group personality profile which showed a considerable amount of pathology. From their performance on the HPQ, they were characterized as withdrawn, neurotic, and anxious with feelings of inferiority and inability to maintain directionality in life or work.

Although there are no separate Canadian norms, normative data for the PEN were available for various groups; i.e., students, psychotics and neurotics. Comparing the profiles of our groups with the students' norms, it was clear that the current samples were not unusual in terms of the Extroversion scale (E); all groups were within one sd of the male student norms. Comparisons on the Neuroticism (N) scale showed

A description of the personality attributes associated with these scales is provided in Appendix A.
Group CN to be a full sd below the norms of the students and the least "neurotic" of the present groups. On the other hand, the Ss in Group AL were the most "neurotic," with the group mean higher than, but within one sd of the norm for neurotics. The mean scores of Groups ID, HR and CA did not suggest neuroticism as an important trait. Only group AL scored highly on the Psychoticism (P) scale of the PEN. Their mean score was within one sd of the neurotics' and psychotics' norm. The remaining groups were well within the lower range of the normative university sample.

In summary, a clinical analysis of the personality profiles of the various groups revealed that only the Ss in Group AL presented a marked pathology. In terms of their responses to the HPQ and the PEN, these Ss appear to be highly neurotic. The group profiles of the other samples are well within the limits of 'normal' personality attributes.

**Discrimination Among Groups of Drivers**

The method of multiple discriminant analysis attempts to derive one or more sets of weighted, linear functions of variables which have the maximum potential of discriminating among the members of different a priori groups of Ss. Each set of weighted combinations of the original variables, i.e., discriminant functions, maximizes the variance between the groups relative to the pooled within-groups variance among the original variables while maintaining independence (orthogonality) between the functions.\(^5\)

Having determined the linear functions that maximize the difference among the group means of the original variables, a procedure of classifying Ss, or determining the a priori group to which each S most likely belongs, may be performed. The effectiveness of the discriminant functions in providing adequate separation among the groups is assessed by means of the errors in classification. The less often Ss are misclassified the more effective the functions are in isolating the groups. In addition, the degree of correct classification indicates the extent to which the a priori groups represent distinct collections of Ss within the general populations with respect to the dependent measures taken. Although the classification functions may maximally separate the groups, errors in classification may be substantial. Under these circumstances, not only is the ability to distinguish among the Ss of the a priori groups reduced but it is likely that variance within the groups is sufficient to provide a significant overlap between the subsets of the population.

The principal goal of employing discriminant analysis in the present study was to isolate a set of test scores (or scales) which would separate and identify the members of the present groups. Because of this, and due to a high degree of dependence among certain of the test scales, it was decided to employ a procedure which would allow for the selection of test scales that had the ability to maximize the group differences. To this end the scale scores for each of the Ss on the PEN and HPQ were submitted to a stepwise discriminant analysis.\(^6\)

\(^5\) An alternative manner of viewing the discriminant function is in terms of a canonical variate which maximizes the squared deviations among group centroids relative to the within-groups variance (2, 9).

\(^6\) The analysis was conducted at Computing Services, University of Alberta and employed the use of BMD07M, Stepwise Discriminant Analysis from the Biomedical Computer Program Library (University of California, Los Angeles, 1972).
The characteristics distinguishing a stepwise discriminant from its standard analytic form are in the manner of incorporating tests within the discriminant functions. For the purposes of the present analysis, the first variable selected maximized the difference among the groups having the most similar centroids. The second and succeeding variables were selected such that they maximized the minimal group difference remaining after previous variables had entered the discriminant functions. The process was continued until none of the remaining variables had the ability to distinguish significantly among the groups. Having satisfied the criteria limiting the addition of variables, the Ss were then classified as members of one of the a priori groups on the basis of the degree of 'similarity' among their weighted test scales and the group centroid.

Of the original 14 personality scales, 6 were required to maximally differentiate among the groups. The variables entering the final discriminant function were the SG, IF, Sy, TS and AD scales of the HPQ and the N scale of the PEN. Table II provides the coefficients of the group classification functions which, among other things, indicate the 'contribution' of the particular scale to the discrimination of any one group from all others and the weighting provided to the S's scores in the classification to that group.

<table>
<thead>
<tr>
<th>Variables</th>
<th>ID</th>
<th>AL</th>
<th>HR</th>
<th>CN</th>
<th>CA</th>
</tr>
</thead>
<tbody>
<tr>
<td>N 1</td>
<td>.259</td>
<td>.758</td>
<td>.301</td>
<td>.264</td>
<td>.428</td>
</tr>
<tr>
<td>SG 2</td>
<td>1.647</td>
<td>2.008</td>
<td>1.645</td>
<td>1.953</td>
<td>2.042</td>
</tr>
<tr>
<td>IF 3</td>
<td>.852</td>
<td>1.270</td>
<td>.652</td>
<td>.701</td>
<td>.719</td>
</tr>
<tr>
<td>Sy 4</td>
<td>.890</td>
<td>.691</td>
<td>.859</td>
<td>.718</td>
<td>.653</td>
</tr>
<tr>
<td>TS 5</td>
<td>.562</td>
<td>.134</td>
<td>.551</td>
<td>.426</td>
<td>.354</td>
</tr>
<tr>
<td>AD 6</td>
<td>.496</td>
<td>.838</td>
<td>.655</td>
<td>.657</td>
<td>.687</td>
</tr>
</tbody>
</table>

By and large, the responses of the Ss on the SG scale of the HPQ contributed most to the classification functions of all the groups, although the N scale of the PEN showed the greatest ability to differentiate among the least different groups. The reason for this appears to be in the discrimination of the alcoholics under treatment from the remaining groups. While the classification function for each of the remaining groups did not differ noticeably, the function for Group AL demonstrated a markedly distinct pattern. Far greater weight was given to scales relating to fear, feelings of inferiority and suspicion for this group than for any of the others. This was particularly true for the IF and AD scales of the HPQ and the N scale of the PEN.

Performance on the SG, IF and Sy scales of the HPQ were the greatest contributors to the classification of Ss as impaired drivers. While there was less effect of the responses to the items on the IF scale in the classification of high-risk drivers, the relative contribution of the AD scale was enhanced over that of Group ID. However,

7Conditions established on the inclusion and/or exclusion of variables were: F-ratio to enter = 5.0, to remove = 4.9 (p < .001, df = 4, 600) and a priori assignment probabilities = 1/Ni.
8A summary of this analysis is provided in Appendix B.
the functions for Groups CN and CA did not appear to be markedly different from that of Group HR except in the contribution of scores on the SG scale of the HPQ.

Tables III and IV provide an indication of the ability of the group discriminant functions to distinguish among the a priori groups. The values of Table III show the tests of the equality of the centroids between pairs of groups. As in the univariate F-ratio, as the value increases the group centroids become more dissimilar. It is apparent that the weighted mean vectors for the groups differed significantly. If there were a degree of similarity, it existed between Groups CN and CA. The greatest differences appeared in the comparisons of the alcoholics under treatment with the other groups. The mean vectors of Groups ID and HR demonstrated striking differences when compared with that of Group CN.

**TABLE III  F-Statistic for Equality of Group Centroids**

<table>
<thead>
<tr>
<th>Groups</th>
<th>ID</th>
<th>AL</th>
<th>HR</th>
<th>CN</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>44.03</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HR</td>
<td>6.74</td>
<td>48.36</td>
<td>11.67</td>
<td></td>
</tr>
<tr>
<td>CN</td>
<td>14.70</td>
<td>45.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA</td>
<td>9.77</td>
<td>18.16</td>
<td>8.84</td>
<td>2.51</td>
</tr>
</tbody>
</table>

\(F(6,627) > 2.10 (p = .05); > 2.80 (p = .01)\)

It should be recalled that the discriminant functions differentiate among the groups in terms of the centroids or mean vectors of original test scores. Although the centroids may be made significantly different by linear transformation, there may be sufficient overlap among the distributions of the groups to produce errors in classification. That is, while the average performance of the Ss may be sufficient to distinguish among the a priori groups, the dispersion about the group centroid may be great enough to interfere with correct classification. The classificatory ability of the discriminant functions is represented by the 'hit-rate' or the proportion of Ss 'correctly' assigned to the appropriate group. As the hit-rate increases there is greater evidence of the distinctiveness of the groups and the reliability of the discriminant functions. Alternatively, a high hit-rate may indicate the validity of the assumption of a priori groups being distinguished by the battery of tests included. Table IV provides the classification matrix produced in this analysis.

**TABLE IV  Classification of Ss to A Priori Groups**

<table>
<thead>
<tr>
<th>Original Group</th>
<th>ID</th>
<th>AL</th>
<th>HR</th>
<th>CN</th>
<th>CA</th>
<th>Hit-Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>106</td>
<td>10</td>
<td>55</td>
<td>29</td>
<td>1</td>
<td>52.7%</td>
</tr>
<tr>
<td>AL</td>
<td>7</td>
<td>43</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>74.1%</td>
</tr>
<tr>
<td>HR</td>
<td>58</td>
<td>7</td>
<td>86</td>
<td>38</td>
<td>0</td>
<td>45.5%</td>
</tr>
<tr>
<td>CN</td>
<td>34</td>
<td>6</td>
<td>34</td>
<td>66</td>
<td>0</td>
<td>47.1%</td>
</tr>
<tr>
<td>CA</td>
<td>9</td>
<td>6</td>
<td>14</td>
<td>20</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

(47.9%)
Except for the alcoholics under treatment, there is little evidence to indicate that Ss within the groups could be effectively distinguished on the basis of the selected factors of the PEN and the HPQ. Indeed, there is a high degree of misclassification (i.e., confusion resulting from similarity in test performance) among the high-risk and convicted impaired drivers: nearly 31% of the Ss in Group HR (high-risk) were misclassified as members of Group ID and 28% of these (impaired drivers) were erroneously classified as high-risk drivers. It is interesting to note that only two of the 637 Ss were classified as members of the CA group and that Ss within that a priori group were most likely to be assigned to the HR or CN groups. On the other hand, the Ss within the CN group were most likely to be misclassified as either members of Group ID or HR. It is clear that, with the exception of the alcoholics under treatment, there was a high degree of overlap among the personality dimensions of the Ss, although the group means differed significantly. Moreover, the results suggest that it may be impossible to distinguish among groups of Ss who differed in their use of beverage alcohol and driving behavior by means of personality profiles. That is, the tests are insensitive to the differences among groups which demonstrated different behavioral indices of alcohol dependency and highway hazard.

On the other hand, the discriminant analysis may be isolating groups on the basis of a factor which has been ignored. One possibility lies in the extent of alcohol involvement among the Ss within the groups. It is conceivable that this may be evidenced in their personality profiles. In order to assess this possibility, the mean MAST scores were computed for the groups according to the classification of Ss by the analysis. These data are presented in Table V.

**TABLE V**  Mean MAST Scores of Original Groups and as a Function of Classification by Discriminant Analysis

<table>
<thead>
<tr>
<th>Original Groups</th>
<th>ID</th>
<th>HR</th>
<th>AL</th>
<th>CN</th>
<th>CA</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>9.37</td>
<td>7.07</td>
<td>13.30</td>
<td>4.65</td>
<td>8.0</td>
<td>8.18</td>
</tr>
<tr>
<td>AL</td>
<td>29.43</td>
<td>35.33</td>
<td>34.56</td>
<td>28.5</td>
<td>49.0</td>
<td>33.81</td>
</tr>
<tr>
<td>CN</td>
<td>1.06</td>
<td>1.59</td>
<td>1.00</td>
<td>1.49</td>
<td>1.37</td>
<td></td>
</tr>
<tr>
<td>CA</td>
<td>6.66</td>
<td>7.29</td>
<td>11.00</td>
<td>7.20</td>
<td>7.59</td>
<td></td>
</tr>
<tr>
<td>Meanb</td>
<td>8.30</td>
<td>6.14</td>
<td>24.87</td>
<td>4.13</td>
<td>28.5</td>
<td></td>
</tr>
</tbody>
</table>

aNumbers in italics are n's within cell.
bExcludes high-risk drivers where MAST was not available.
The means of the rows indicate the average MAST scores of the a priori groups, while the means of the columns are the averages for the Ss classified as being “most similar” to the a priori group. One would expect that the MAST scores of the alcoholics under treatment would be greater than all other groups and that impaired drivers would score higher than either of the control samples. This prediction was upheld for the a priori groups as well as for the classification groups identified in the analysis. The only exception was in assigning Ss to Group CA, but this was probably due to the low frequency of assignment.

All Ss assigned to Group AL had the highest MAST scores except among the original CN Ss; resulting from our original selection criteria. The results were, however, not consistent within all of the remaining groups. The expected pattern was noted among the original HR group but, for Groups AL and CA, the Ss assigned to Group HR scored higher on the MAST than those assigned to Group ID. In addition, there was little difference between the means of the AL Ss classified as members of the ID or CN groups. This seems to confirm our suspicion that the personality tests were incapable of correctly isolating Ss on the basis of their prior driving behavior or involvement with alcohol. The exception to this is in the case of Ss whose involvement with alcohol was probably at an extreme.

DISCUSSION

The strategy adopted in the current project was to draw samples of Ss from various a priori groups of drivers and to compare their demographic and personality characteristics. The type of information obtained from such a strategy depends, to a great extent, upon the astuteness with which the a priori groups are selected. Numerous other groups of Ss could have been examined in addition to the five groups which were selected. In addition, the criteria identifying members of particular groups might be re-examined with the aid of hindsight. For instance, one might use some measure other than accumulated demerit points as a criterion of the high-risk drivers. Regardless, the current report provides important, if not definitive, information concerning the demographic and personality characteristics of the selected groups.

Demographic Characteristics of the Groups

Two of the five groups (Groups ID and HR) represented individuals contributing to major highway safety problems. While both groups shared some common characteristics, they tended to differ markedly on a number of aspects. The high-risk drivers tended to be somewhat better educated, to have first consumed alcohol at an earlier age and, although they consumed alcohol as frequently, they tended to drink less than the group of impaired drivers. Sixty per cent of the Ss in Group HR were under the age of 29 years, compared with 41% within Group ID. Further, a greater proportion of the latter were over 40 years of age (35%) while only 21% of Group HR were over 40. It would appear that the poor driving behaviors manifested by the high-risk drivers were closely tied to age and the habits of younger drivers. The lack of older Ss in Group HR could be accounted for by a number of variables; for example, social maturity and improved driving skills, movement into another category such as impaired drivers, and death.

If one assumes for the moment, that the problems of Ss in Group HR were largely cured by time and experience, it follows that the problems of the drivers in
Group ID were exacerbated by the same variable. Certainly, such a position would be congruent with prior conclusions that a high proportion of impaired drivers are alcoholic (14, 17), and, as their alcoholism develops, they present a greater degree of highway hazard.

Many of the responses of the impaired drivers to questions on the PIQ support such a description: for instance, the prevalence of suspected drinking problem and prior help for that problem, in addition to the quantities of alcohol they may have consumed and the frequency of that consumption. A substantial majority of the ID Ss reported that their families had objected to their drinking and about as many had experienced "blackout" as the result of excessive drinking. Few, if any, of the Ss in Group ID would have escaped being identified as alcoholic by virtue of their MAST score, but certainly a great proportion had some problem in control of alcohol consumption. It is, however, difficult (largely due to the ambivalent definition of alcoholism) to say what exact proportion of impaired drivers were alcoholic. In the opinion of the authors, treatment modalities and countermeasure programs which assume all impaired drivers to be alcoholic will be inappropriate for a large segment of the impaired driving population.

Groups AL and CA provided some of the most important demographic information. Despite repeated and vigorous attempts to obtain Ss for Group CA, the result was disappointing. After trying a number of sources (for example, rugby clubs and fraternal organizations) it became clear that persons who drink excessively do not volunteer to serve as control Ss in a study of alcohol-related social problems. The Ss were more readily obtained only after statements about their current drinking behaviors were eliminated from the recruitment message. Such defensiveness on the part of these Ss may have been due to their assumptions about the inaccuracy of the social sanctioning process or could have been based upon their private knowledge of their drinking and driving behaviors. Thus, information about the drinking behavior of the CA groups is not available. However, some insight might be provided by examining the characteristics of the Ss in Group AL.

Alcoholics under treatment have gone beyond the basic identifying criteria for alcoholism. It is interesting to note, however, that although the alcoholics in our sample had submitted themselves for treatment in a public institution, they were not unanimous in their acknowledgement of their alcoholism. Many continued to put up a defence against self disclosure of the nature of their situation. The most important characteristic of Group AL, however, was the low frequency with which Ss were located whose driving records were not affected by their alcoholism. In Alberta, at least, only a small proportion of the alcoholics under treatment have avoided the highway safety and law enforcement processes. Their driving citations present, therefore, the richest source of data to be used to identify the driver with alcohol-related problems. Obviously, the criteria for the identification of dangerous and potentially dangerous drivers requires further and intensive research.

This finding, however, supports the position that driving citation histories serve as a major variable in determining those who are to offer serious threats to highway safety (12). The data seem to imply that an individual convicted of impaired driving may have a drinking problem, and those with multiple alcohol-related offences may have exaggerated problems in alcohol-control. Further, the data imply that few alcoholic drivers would be missed by a screening procedure based on such information. It would be necessary, of course, to minimize the number of non-alcoholics erroneously selected for treatment by such criteria. This could be effectively accomplished, however, by programmed research of the selection and treatment processes. But, the
information as to who the dangerous and alcohol-involved drivers are appears to be available in the Ss driving-citation history, as evidenced in Pollack’s study (12).

**Personality Characteristics of the Groups**

In general, the results of the group comparisons on the selected personality scales were disappointing. Certainly, the Ss in Group AL presented a uniform and readily identifiable profile. It was, however, not a uniquely alcoholic profile, but rather a highly neurotic profile. The selected test scales showed no great ability to discriminate among the remaining groups of Ss. Moreover, the profiles of those groups appeared to be clinically 'normal'.

It would appear that the tests employed, and probably all general personality tests, are too gross to produce the necessary discriminations. While a specific test might be developed, it would be an arduous task requiring careful assessment and long-term validation. In addition, there is the question of the necessity of developing such an instrument. Individual drivers come to the attention of the courts and licensing agencies because of their driving behaviors. If these primary behavioral data could be made more predictive and their diagnostic ability improved, personality tests might become redundant. Pollack (12) has emphasized the predictive power of prior driving histories but further development and assessment is necessary. It is the authors’ contention that this type of development would proceed more easily than that required for the development of an adequate personality test. However, personality tests might be employed to identify or confirm extreme cases of alcohol dependency or to identify the types of individuals best served by programs offering countermeasures to the drinking-driving problem.

**APPENDIX A  Test Materials**

*Howarth Personality Questionnaire (HPQ).* The HPQ is a personality inventory consisting of 120 true-false questions (6). Prior analysis of the responses to these items have evidenced the existence of 10 polar factors which may be briefly described as:

1. **Sociability (Sy).** Measures the degree to which a person tends to seek out the company of others. This factor would be analogous to an introversion-extroversion dichotomy.

2. **Adjustment-Emotionality (AE).** An anxiety factor which includes a number of aspects of “neuroticism.” Its main focus is on adjustment and emotional control.

3. **Ascendence-Dominance (AD).** The degree to which an individual is independent minded and assertive.

4. **Super Ego (SG).** Analogous to conscience in Freudian terminology. Measures responsibility, concern about moral standards and rules as well as other traits.

5. **Hypochondriac-Medical (HM).** An anxiety factor expressed in concern over bodily functions.

6. **Impulsiveness (IP).** Important aspect of extroversion. Degree to which individual acts on impulse rather than exercising control.

7. **Cooperativeness-Considerateness (CC).** Contains some aspects of tender mindedness and also of tolerance.
8. **Inferiority (IF).** Degree to which individual feels inferior to others.

9. **Persistence (PS).** Measure of persistence in one’s work, activities and life goals.

10. **Trust versus Suspicion (TS).** Paranoia-like factor which has been replicated in normal Ss.

### APPENDIX B

#### TABLE B1 Variables Incorporated in Discriminant Function, in Order of Acceptance, Entering F Ratio, and Wilks Lambda.

<table>
<thead>
<tr>
<th>Step #</th>
<th>Variable</th>
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<th>Lambda</th>
<th>$[F_{approx. (df)}]$</th>
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<tr>
<td>1</td>
<td>P.E.N.—N</td>
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<td>.668</td>
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<td>2</td>
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<td>17.73</td>
<td>.613</td>
<td>[28.26 (12,1667.1)]</td>
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<tr>
<td>3</td>
<td>H.P.Q.—IF</td>
<td>14.22</td>
<td>.586</td>
<td>[22.95 (16,1922.3)]</td>
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<tr>
<td>4</td>
<td>H.P.Q.—Sy</td>
<td>7.11</td>
<td>.555</td>
<td>[20.24 (20,2083.8)]</td>
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<tr>
<td>5</td>
<td>H.P.Q.—TS</td>
<td>8.84</td>
<td>.525</td>
<td>[18.52 (24,2188.6)]</td>
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<td>6</td>
<td>H.P.Q.—AD</td>
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#### Canonical Variates

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<th>Variables</th>
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<th>3</th>
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<th>6</th>
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<td>N 1</td>
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<td>-.006</td>
<td>-.123</td>
<td>.166</td>
<td>-.043</td>
<td>.127</td>
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<td>.247</td>
<td>-.380</td>
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<td>.131</td>
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<td>.138</td>
<td>-.128</td>
<td>-.309</td>
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<td>-.105</td>
<td>-.253</td>
<td>-.233</td>
<td>.017</td>
<td>-.115</td>
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<td>.898</td>
<td>4.812</td>
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#### REFERENCES


