An Evaluation of the Alcohol Level Evaluation Roadside Tester (ALERT) Under Laboratory and Field Conditions

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\textbf{INTRODUCTION}

The detection of alcohol impaired drivers by means of clinical signs alone is known to be a difficult task even for medically trained specialists\textsuperscript{3, 14}. The likelihood of impaired drivers being detected by police is decreased by the difficulty of the task and by other factors such as available resources, motivation, etc.\textsuperscript{1, 15} Roadside screening by police is a technique designed to improve the probability of detecting an impaired driver by providing an immediate indication of the blood alcohol concentration (BAC). Recent amendments to the Criminal Code of Canada\textsuperscript{4} provide for the police use of approved roadside screening devices and the compulsory participation of drivers 'suspected of having alcohol in their bodies'.

The Alcohol Level Evaluation Roadside Tester (Alert)\textsuperscript{c} is designed to indicate predetermined ranges of BAC at the roadside. This portable electronic device features automatic controls. Breath alcohol is sensed by a Taguchi cell.\textsuperscript{16} Harger\textsuperscript{6} has provided a useful description of the Alert.

\textbf{LABORATORY EVALUATION}

\textit{Simulated Breath Measurement}

Two each of two J2A models of the Alert were evaluated\textsuperscript{10} at the Edmonton Laboratory of the Royal Canadian Mounted Police.

Alert model J2A-1000 is a slightly improved production version of model J2A. Essential improvements were: (a) more tests between charges, (b) faster initial warm-up, (c) improved temperature control.\textsuperscript{2} Both models were tested with alcohol-water solutions contained in Simulators, Mark I.\textsuperscript{d} Ethanol-water solutions mixed to provide vapours equivalent to BACs of 90 and 110 mg% were stored refrigerated in 5 litre flasks. Ethanol concentrations were verified by chemical analysis.\textsuperscript{13} 500 ml aliquots from the flasks were used in the simulators up to ten times before replacement. Appropriately prepared and verified Simulator solutions were used to calibrate the Alerts according to the manufacturer's instructions\textsuperscript{8} to 'WARN' at 50 mg% and 'FAIL' at 100 mg% BAC. Testing ceased and batteries were recharged overnight when such action was indicated. Testing of the J2A model involved a recalibration after each battery recharge. The J2A-1000 model was not recalibrated after charging. Results are displayed in Table I.

\textsuperscript{a} Royal Canadian Mounted Police
\textsuperscript{b} The assistance provided to the author by the Staff of the Alcohol Section at the Edmonton Laboratory of the Royal Canadian Mounted Police is acknowledged.
\textsuperscript{c} Alert-Alcohol Countermeasures Systems, Sarnia, Ontario, Canada (Developed by Borg-Warner, Chicago, Illinois).
\textsuperscript{d} Smith & Wesson Electronics, Eatontown, N.J.

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TABLE I  Alerts calibrated to ‘FAIL’ at 100 mg% tested with Simulated BACs of 90 and 110 mg%.

<table>
<thead>
<tr>
<th>PASS</th>
<th>90 mg%</th>
<th>110 mg%</th>
<th>90 mg%</th>
<th>110 mg%</th>
</tr>
</thead>
<tbody>
<tr>
<td>WARN</td>
<td>29</td>
<td>1</td>
<td>30</td>
<td>1</td>
</tr>
<tr>
<td>FAIL</td>
<td>1</td>
<td>29</td>
<td></td>
<td>29</td>
</tr>
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</table>

Both models of the Alert responded correctly within ± 10 mg%. (P < .05, n = 30).

**Actual Breath Measurement**

The correlation between Alert responses and direct blood and Breathalyser measurements was examined using human subjects who had consumed alcoholic beverages of their choice. Breathalyser operator candidates were taught to operate Alerts previously calibrated by laboratory staff to ‘WARN’ at 50 mg% and ‘FAIL’ at 100 mg%. Breathalysers calibrated to measure within ± 3 mg% at 200 mg% simulated BAC were operated by candidates on their final day of practice operations on a two-week Breathalyser course. (Past experience with Breathalyser operator training leads to the presumption that the candidates are at or near maximum technical competency at this time.) Alert tests were performed within ten minutes of the Breathalyser test with which it was paired. Breath testing commenced at least 1½ hours after the end of drinking in order to assure BACs in the post-absorptive stage of all thirty-two drinking subjects with BACs of 10 to 180 mg%. Testing with two units of each Alert model took place on four separate occasions. Ten Breathalysers model 900 and 900A were operated by different student operators on each occasion.

Two cubital vein blood samples in the post-absorptive stage (at least 1½ hours after drinking) were collected at least one hour apart from each of sixteen drinking subjects with BACs of 10 to 180 mg%. Blood was withdrawn by qualified Medical Laboratory Technologists from the subjects’ arms (swabbed with 0.1% aqueous benzalkonium chloride) into Vacutainers, gently mixed with the preservative and then refrigerated until analysed within twenty-four hours. Ethanol was quantitated by a modified Widmark procedure. Alert tests were taken within 15 minutes of the blood samples. Results of this testing are displayed in Table II.

TABLE II  Cumulative results of near-simultaneous samples of blood and breath obtained from live subjects.

<table>
<thead>
<tr>
<th>ALERT</th>
<th>BLOOD</th>
<th>BREATHALYSER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model J2A 53 trials</td>
<td>Model J2A 75 trials</td>
</tr>
<tr>
<td>0 mg%</td>
<td>67%</td>
<td>71%</td>
</tr>
<tr>
<td>± 10 mg%</td>
<td>79%</td>
<td>81%</td>
</tr>
<tr>
<td>± 20 mg%</td>
<td>98%</td>
<td>96%</td>
</tr>
</tbody>
</table>

The results obtained with actual breath samples are consistent with the manufacturers claim of ±20% accuracy at 100 mg%. Dubowski reported that 100% of Alert tests were within ±20 mg% of the direct blood analysis. We found 98% of the J2A model Alert tests in this range.

*Vacutainer, ® Becton, Dickinson & Co., Mississauga, Canada (7 mg Thymol, 70 mg NaF in 10 ml blood).*
The results obtained by many student Breathalyser operators using ten different Breathalysers showed a correlation of ±20 mg% in over 95% of the trials with both Alert models. These results are an indication of the correlation that can be expected under field conditions, except that occasional mouth alcohol, absorption and elimination of alcohol should increase the variation encountered in police work.

FIELD EVALUATION

Two months of voluntary field testing commenced November 1973 in Calgary, Alberta. Two model J2A-1000 Alerts were made available for use by sixteen recently-trained Breathalyser operators in the Calgary City Police. A total of seventy-two requests for breath samples were made to suspected impaired drivers. Breathalyser tests were obtained following 'Fail' responses on the Alert from twenty-nine drivers. The mean BAC of these tests was 143 mg%. During the same time period the mean BAC of the remaining drivers tested in Calgary was significantly greater at 184 mg% (P<.001). The 181 mg% mean BAC of all 375 suspected impaired drivers tested during this period was significantly lower than the 196 mg% mean of 188 similar drivers tested in Calgary during the same time period in 1972. (P = .002). The increased enforcement of impaired driving laws reflected in these statistics is attributed in part to the interest generated by this Alert project.

Additional field trials were held in a rural area of Alberta. Members of the Stony Plain detachment (30 members) of the Royal Canadian Mounted Police were provided with the two model J2A-1000 Alerts for a sixty-day period commencing in March 1976. Thirteen of twenty-eight suspected impaired drivers who 'Failed' an Alert test were not offered Breathalyser tests nor were they charged. It is presumed that the clinical signs of impairment necessary to cause an arresting officer to believe the driver to be impaired were not observed in these cases. Had the 1975 amendments to the Criminal Code been operating during these tests then these 13 drivers could represent an 86% increase in charges. The Minnesota SBT Field Test on a much larger sample of drivers resulted in a 62% increase in arrests in those police patrols using Alerts.

Roadside vs Evidential BAC Measurement

Roadside screening device results cannot be expected to coincide with subsequent Breathalyser tests especially when the driver's BAC is near the level at which the Alert is set to 'Fail'. This phenomenon can cause practical problems at the enforcement level of operations. Seven of the 29 drivers in the Calgary project and 2 of 15 drivers in the Stony Plain project who 'Failed' the Alert test and were subsequently measured on a Breathalyser had BACs of less than 100 mg% as measured by a Breathalyser. Twelve per cent of similar drivers in the Hennepin County project and 14% of drivers in the North Dakota project had BACs of less than 100 mg% when subsequently measured on a Breathalyser. (The latter two projects used Alerts set to 'Fail' at 110 mg% while the former two projects involved Alerts set to 'Fail' at 100 mg%).

The percentage of apparent false readings obtained at the roadside can be lessened if the roadside screening device is calibrated to 'Fail' at a concentration 10 or 20 mg% greater than the level at which formal charges are laid. But such a policy while attractive administratively has a detrimental effect on traffic safety. Increasing the 'Fail' threshold of response 'would negate a portion of the BAC distribution where portable breath testing is more useful'. Drivers in the 'grey zone' in which the frequency of impairment increases as the BAC increases towards 100 mg% can now be identified by a 'Warn' response. Legislation allowing a peace officer to summarily suspend the driving privileges of a driver who has registered
at ‘Warn’ for a period of twenty-four hours in lieu of any formal charges should serve to prevent identified ‘grey zone’ drivers from committing unsafe acts. Such legislation would also rationalise a policy of calibrating the ‘Fail’ level 20 mg% above the legal level in order to reduce the percentage of false positive results. The identified borderline driver would then cease to be an immediate safety problem.

Roadside Screening by Police

The use of sophisticated electronic equipment to screen for impaired drivers requires firm administrative control of the equipment and its use. Alerts piled in the corner of a police office are of little use. Studies in Alberta, Canada7 and Minnesota, U.S.A.11 indicate that maximum utilisation of the roadside screening technique will not occur automatically. Peace officers must be motivated to use the equipment if full benefit is to be derived from this new technology.

Two groups of peace officers from two different police forces (one rural, one urban) were given a course of instruction of 2–3 hours’ duration. The training included a brief description of the following topics:
(1) Description of the Alert
(2) Physiology of breath testing
(3) Absorption and elimination of alcohol
(4) Enforcement policy and legal requirements
(5) Practice with equipment

The subsequent field performance of each group was monitored. The degree of use of the Alerts varied widely with different peace officers. Some individuals did not take an Alert on patrol at any time during the two-month trial. Other individuals did not use the equipment. Both groups contained such individuals.

Additional training aimed at the detection of impaired drivers together with sufficient instruction to allow the peace officer to calculate the amount of liquor that he personally must consume in order to reach a BAC of 100 mg% is recommended in order to increase awareness of impaired driving symptoms. A discussion of the magnitude of local accident experience and the police role in traffic accident prevention can also generate enthusiasm for impaired driving countermeasures. Such enthusiasm at the Alert operator level is essential.

REFERENCES

12. SMI ‘Final Evaluation of the Portable Pre-Arrest Breath Testing Device in North Dakota’, State Highway Department, Bismarck, N.D., U.S.A.