Interlock performance standards

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In the past decades the condition of the driver, more so than the condition of the roads, has received apt attention as a target for improving highway safety. FARS (Fatal Accident Reporting System) data for 1989 showed nearly 40% of drivers in fatal accidents had a BAC in excess of .10% w/v; 90% of those had a BAC in excess of .12% w/v. and many are repeat DUIs. One weak link in the chain of preventive countermeasures is poor compliance of some DUIs with court-ordered driving restrictions. Technical monitoring with a Breath Alcohol Ignition Interlock Device (BAIID) is a promising alternative because the BAIID reduces discretionary choice by requiring the driver to blow a low or alcohol-free breath sample before ignition is possible.

The BAIID is entering into a period of greater interest and use. At least 3 countries: the USA, Canada, and Australia have States or Provinces with legislation supporting BAIID programs. In the USA, California began the first program with passage of the Farr-Davis Driver Safety Act in 1986. By late 1991, 20 of the 50 U.S. States had some kind of legislation — or pilot program authorization — supporting the use of a BAIID. In response to States' interest in these devices, the U.S. National Highway Traffic Safety Administration (NHTSA), initiated a process to examine the elements of effective interlock programs. Doing so was a problem because no controlled field studies had been conducted which explored the best way to use, certify, or monitor these devices. Certification standards for the devices were being written by each State, often at great expense for both for States and manufacturers. While the Federal government did not want to issue a National Standard — as it had for Evidential Breath Test devices — it did want to make recommendations to the States and thereby encourage some semblance of uniformity (and cost containment) in the State Standards. The NHTSA guidelines were undertaken to identify certification issues, propose minimum model specifications, but also point toward areas which need improvement and development. In the absence of field-use data, the certification testing experiences of the various States and the experience of installers formed the bases for the guidelines. The remainder of this paper examines some of the benefits, problems and issues in using the BAIID as a countermeasure.

1.0 Interlock Benefits

One of the obvious advantages of the BAIID is that these devices seek to remove driver
motivation as a link in the chain of preventive intervention. Once assigned to a BAIID, a driver is monitored each time he or she wants to start the car. For a DUI offender motivated to comply, the BAIID can be both educational and a check against unintended indiscretions. With a data monitoring system which records each episode of BAIID use, the results can be fed back both to the probation officer charged with monitoring an individual’s compliance, and to an evaluation team for monitoring the BAIID program per se. Interlocks have found some acceptance by the courts since it is a way to gradually transition a driver from suspension back to full driving privileges. There is considerable concern that BAIIDs not be used as an alternative to suspension.

Aside from removing the driver’s discretionary choice to comply with court-ordered restrictions, the BAIID also creates an educational opportunity for drivers who have not yet learned the relationship between consumption and illegal BACs. This same information could be of value to a probation officer or treatment provider in the position of helping the offender learn to control his drinking. By recording the BAC at each start attempt, researchers will eventually gain valuable information both about consumption/circumvention patterns, as well as gain new insight into BAIID programs than would not otherwise be available.

2.0 Interlock Problems

The largest flaw in the effectiveness of a BAIID program is the ease with which any driver can decide to use a car other than the one in which the interlock is installed. This may be a significant problem; Jones (1992) reports that 40% of drivers assigned a BAIID and later involved in a reported vehicular incident were not driving the car stipulated by the courts. This constitutes a violation of the court order, and is not different in principal from the choice made by drivers who drive without a valid license after having privileges suspended.

The devices are not fool-proof; it is still relatively easy to construct a cotton or paper filter to trap ethanol before the sensor, to concoct a non-human or stored source of air (e.g., a balloon) to deliver to the sensor head, or to enlist the cooperation of a person at curbside to blow. In all those cases, driver motivation is obviously not yet out of the causality loop since anyone willing to drive illegally can still do it — with or without an interlock. Some of these problems can be guarded against through the certification requirements that are imposed on the manufacturers. Circumvention protection is the weakest part of the BAIID.

Beyond the above compliance factors though there are also technical problems with interlocks. The normal car environmental (hot/cold, dusty, vibrations etc) is hostile to precise chemical analysis even with the best of equipment. Ethanol vapor can be absorbed by dust, or condensed by cold. Cars in the U.S. are exposed to temperatures ranging from 40 °C below
zero to +85 °C; the Society of Automotive Engineers regards thermal factors as "probably the most pervasive environmental hazard to automotive electronic equipment." DC voltages in a car can vary between 11-16 VDC depending on load, voltage regulation and other conditions. The first generation of interlocks that came onto the market in the USA were based on the Tagucci semiconductor device. This sensor has a reputation for being quick, relatively low cost, and durable, but it is also non-specific to ethanol (it can be activated by cigarette smoke, various mouthwashes, certain breath gum), is dependent on pO₂ and is therefore likely to read high at higher altitude, and may also be affected by relative humidity. The BAIID is likely to drift off of its setpoint with frequent usage. Despite these potential sources of error, manufacturers attest that over 5000 Tagucci-cell BAIIDs have been installed and have provided reliable service in the past 4-5 years. More specific fuel-cell interlock devices for ethanol analysis are being developed at this time, but these will be more costly and there is less experience at this time to draw upon in predicting their adequacy as a BAIID.

3.0 Key Aspects of an Interlock Program

There are at least two key aspects to setting up an interlock program within a State — the certification process for the device and the support program that monitors all aspects of implementation. First, the device ought to be shown capable of serving the intended purpose. This assurance is provided by the certification process to ensure minimal performance standards of a BAIID. Testing for compliance with these standards is ordinarily performed by an approved independent or state laboratory. Second, the adequacy of the interlock support program — administration, data tracking, enforcement — is a key element in success. Without a procedure for enforcing compliance and documenting processes and outcomes, it will be difficult to attribute change to the BAIID program.

3.1 Certification Issues

One of the ways the model specifications recently published by NHTSA diverge from earlier State-issued standards is by placing less emphasis on the ability of the interlock device to measure ethanol with a high degree of precision and accuracy. Conversely these new specifications have formalized the need to provide some method for recording BAIID usage data, as well as calling for a rolling retest protocol to discourage curbside blowing assistance from a non-drinker. The emphasis throughout the guidelines focused attention on the "safety-sensitive" questions as opposed to "utility" questions. This safety vs utility distinction was introduced to emphasize tests which evaluate the ability of the interlock to lock out high BACs as a first priority. Performance of the BAIID on the utility criteria is not as critical, so certification costs can be separated.
3.1.1 Accuracy/Precision

The Federal performance standards for evidential breath testing devices require devices to be accurate to at least .005% w/v or no more than 5% error on 100% of all test trials. This can be readily met with sensing technologies which rely on the more stable infrared and fuel-cell detectors. The California standard for interlock devices was less stringent than the evidential standard calling for 100% lockout of all samples beyond .01% w/v above the setpoint, and lockout of 95% of all samples .005% w/v above the setpoint. This is not a significant challenge for semiconductor interlocks under non-stressed conditions such as normal ambient temperature and following only periodic use. But as field experience with the semiconductors accumulated, it confirmed expectations showing considerable instrument drift over time. When altitude, temperature, frequent cycling and other factors were added in, the early generation interlocks had trouble.

The lockpoints adopted by the States have usually been .02% (NY) to .03% (CA); the NHTSA adopted a midpoint .025% as a recommended lockpoint. Allowing for BACs above zero is not an act of generosity, but an acknowledgement of the limits to accuracy. Even some evidential quality BAC-measuring instruments are unreliable at very low BACs. Setting lockpoints much below .02% would prevent some legitimately zero BAC drivers from starting their cars.

In an effort to determine how precise and accurate a BAIID needs to be and still be able to serve the intended purpose, reports were taken from installation and calibration service technicians working with the Tagucci-based BAIIDs (Voas & Marques, 1992). Results showed that the average error after 2 months of field use was in excess of .01% above or below the intended lockpoint. It became evident that some exposure or field use conditions do influence accuracy and precision and should be simulated in the certification tests. Consequently, testing was recommended to cycle the BAIIDs through frequent usage equivalent to 10 starts per day for a period equivalent to the manufacturers recommended service interval plus an added seven days. If the recalibration interval was every 60 days, this would entail 700 tests to determine how well the device holds after repeated use. Ten percent of those tests were stipulated to be conducted with a .10% ethanol sample. This use-cycling ought to approximate some of the rigors that a BAIID will confront when in real service. Following the use-cycling, further environmental exposure conditions such as temperature ranges, vibrations, and voltage ranges need to be imposed. This gave rise to a need to distinguish between "stressed" and "unstressed" testing conditions, and two separate acceptable error criteria were imposed depending on the testing conditions.

The guidelines for unstressed testing conditions — when the BAIID has been exposed only
to normal ambient temperatures ranging from 10-30 °C (and recently recalibrated) — call for 90% of all samples within .01% w/v of the setpoint to be locked out. When adding stresses by temperature, vibration, use-cycling and other challenges, a less stringent lockout criterion — 90% of all samples under .02% w/v above the setpoint — has been recommended. The intent of this less restrictive recommendation was to divert attention away from a preoccupation with analysis of ethanol and divert it toward a more useful preoccupation with circumvention detection, monitoring, and eventually program administration. The guidelines were issued with the understanding that as the technology improves the measurement standards should follow. But at this stage of development the interests of highway safety are more strongly served by preventing the high BAC drunk from driving than by trying to discriminate between someone whose BAC is .02% or .03%. BACs below .045% in non-tolerant drinkers do present some risks of impairment, but DUIs assigned BAIIDs are rarely non-tolerant and the proportion of .045% w/v drivers who pass an interlock test will be very small.

3.1.2 Data Recorder

The NHTSA guidelines have called for a data system which would log physical tampering with the unit, the date and time of vehicle use, whether the ignition switch was used, BAC test results with pass/fail, and the service history. These requirements will help lay the groundwork for the collection of research data and the establishment of a data-driven monitoring system to ensure program compliance. The recorder will help clarify the ways in which interlocks are used or misused. If the assigned vehicle is not being used, this too will be of interest to the probation department. A data recorder can provide machine readable, or printable records for the extraction of BAIID usage patterns. Simple algorithms can be devised which scan the dataset for questionable usage. For example, 2 or more high BAC failures followed by a zero BAC start within a 30 minute interval would be of interest.

3.1.3 Rolling Retest

The retesting of a driver who has blown a sample and passed was implemented in some earlier interlock models in order preclude drinking while driving, or curbside assistance before driving away. Those earlier models of a rolling retest called for a potentially hazardous sequence of horns or flashing lights if a driver failed — or failed to take — a retest when cued. In the current rendition, a failed retest does not set off a sequence of alarms but simply warns the driver that if a retest is not taken then a record of the refusal (or failure) will be logged onto the data recorder. To prevent a permanent lockout condition after 5 days, the interlock service center would have to see the car and the data record downloaded by the technician. A report would be sent to the probation officer or interlock program monitor. This consequence has no immediate effect on the assignee at the time of the infraction, but
it does set the occasion — with clear documentation — for action to prevent future usage violations. Ideally, when costs can be justified, a unique alert signal which warns other motorists of a drunk driver would be desirable.

This circumvention prevention strategy has the potential to defeat the three most frequently cited bypass methods reported by BAIID assignees in the Hamilton County Ohio study. The techniques include curbside assistance, letting the car idle unattended, and roll starting the car in order to bypass the ignition switch (Morse & Elliott research reported by Linnell & Mook, 1991). The rolling retest requirement described cannot work effectively, however, without a data recorder to document the time and circumstances of the infraction as well as the BAC when the car was started. Similarly, use of the recorder and the rolling retest are of limited value unless there is an active compliance monitoring support program underway.

3.2 Support Programs

An interlock program should be managed under the authority of a responsible State agency which can receive input from multiple sources including the service/installation centers, the probation department, the court, and the BAIID user. Currently most interlock programs are implemented by local courts and the equipment manufacturers play a key role in establishing the program. A single State level authority would be able to administer all interlock activities within the State and do so in coordination with the legislation supporting the interlock program. Responsibility is now often split among several State agencies. The State authority ought to require assurances in six areas from the manufacturers, including: liability insurance, maintenance and service facilities, cost limits for clients, record maintenance systems, reporting procedures, and product performance certification. Through the responsible agency, the State also needs to initiate a procedure for recertification of installed devices. This could be done through a periodic random evaluation sample of devices taken by a State inspector. Skills and procedures of service technicians maintaining the devices should also be examined.

4. References