

ALCOHOL INTERLOCKS AS A MANAGEMENT OPTION FOR RECIDIVIST DRINK-DRIVERS

Prepared by: Mary Sheehan, Queensland University of Technology Centre for Accident Research and Road Safety
Prepared: 30 June 2002.

Revised version
Updated by: Mary O'Hare, Monash University Accident Research Centre
Prepared: 30 June 2005.

1.1 A brief statement of the issue

Significant reductions in drink-driving have occurred following the introduction of evidentiary blood or breath alcohol content readings (BACs), random breath testing and changes in public attitudes regarding drink-driving. However, drink-driving remains a major cause of fatal and serious crashes on Australasian roads.

Breath alcohol ignition interlock devices are designed to reduce the incidence of drink-driving. These devices are currently being used in the United States, Canada and Sweden. Several Australasian jurisdictions have alcohol interlock legislation in place while others are seeking legislation changes or conducting trials.

1.2 An assessment of the road safety issue

1.2.1 *What are breath alcohol ignition interlock devices?*

A breath alcohol ignition interlock device is an in-vehicle breath test instrument that is connected to the ignition. The driver must blow into the breath test unit, and if the BAC registers above a pre-determined level, the interlock device prevents the car from starting.

An interlock also has a memory function that records the date, time, and BAC reading for each attempted vehicle start, as well as any instances of interlock bypass. This information can be periodically downloaded by an approved service provider whenever the vehicle is serviced.

There is considerable flexibility built into interlocks and their modes of operation:

- The specified BAC level may be set according to the circumstances of a particular driver. For an offending driver with an open licence, the level could be set at the legal limit [in Australia] of less than 0.05 g/ml of alcohol in the blood. For an offender on a provisional licence, the level could be set at zero BAC.
- Some interlocks can also be adjusted to operate only during certain hours of the day/days of the week thereby, for example, restricting offenders to driving either to or from work.
- Some devices have an emergency bypass option that enables the car to start without the driver providing a breath sample. However, if this option is invoked, the car's lights will flash and the horn will sound continuously whilst the car is in motion (Marques et al. 2003a).

It is recommended that an interlock meets a specified Australian Standard. This requirement has gone a long way towards countering the range of technical difficulties and successful circumvention attempts that occurred during the early days (Marques and Voas 1995, Wilson and Stoke 1990). The latest alcohol interlock devices are fitted with features that both record and protect against circumvention attempts. Pressure and temperature sensors guard against attempts to use stored, filtered or mechanically provided breath samples. In addition, 'rolling tests' require the driver to provide a breath sample at random times whilst the vehicle is in motion to prevent a person other than the driver from providing a breath sample to get the vehicle started (Beirness and Marques 2004). If the driver fails the 'rolling test', the horn sounds and the lights flash until the driver stops the vehicle. The car will not restart until another BAC test is passed (Fulkerson 2003). Data relating to circumvention attempts and failure to undertake re-tests can then be used to inform management programs. (It should still be noted however that circumvention can still occur in some circumstances: for example, by having a passenger supply the air samples).

1.2.2 Possible uses for breath alcohol ignition interlock devices

A review of traditional road safety options (Eilers 1994) concluded that, in terms of both general deterrence and specific impact upon recidivist drink-drivers, licence removal was the most effective means of reducing drink-driving. However, even for this best-performed countermeasure, the effectiveness was a long way short of complete. Perhaps up to 75% of those with suspended licences chose, at least under some circumstances, to continue to drive (and in some cases, to drink-drive) without a licence (Morse and Elliott 1992). The magnitude of the problem was supported by the finding that 9% of drivers involved in fatal crashes in the USA in a particular year were disqualified from driving at the time of the crash (Eilers 1994).

Alcohol interlocks, on the other hand, prevent an alcohol impaired driver from driving the car fitted with the device. The main way in which a driver can successfully circumvent the device is to drive a non-interlock vehicle (Voas and Marques 2003).

1.3 Current practices in Australasian jurisdictions

In Australasia, interlocks have been proposed and supported as an adjunct method for controlling drink-driving recidivism for well over a decade. Australia's National Road Safety Action Plan for 2001 and 2002 recommended the introduction of alcohol ignition interlocks as a sentencing option and/or administrative sanction, especially as a re-licensing requirement for repeat drink-drivers (Australian Transport Council), with this emphasis continued in later versions of the Plan. Prompted by the need for a consistent Australasian approach to the issue, Austroads (1995) recommended the following guidelines for interlocks:

- targets for assignment to an interlock program to include drink-drivers who meet the following criteria:
 - first offenders with high BACs of at least 0.15 g/100 ml
 - recidivists whose repeat infringements have involved a BAC equal to or exceeding 0.08 g/100 ml, driving under the influence (DUI), refused test, etc.
- in organising the program, interlocks to be used as a complementary countermeasure with traditional licence-disqualification penalties and other established programs
- main features of the program to include:
 - the court or the licensing authority to stipulate use of an interlock in addition to a minimum licence disqualification period, or the offending driver to volunteer for the program in return for a reduction in the period of licence disqualification

- three years' installation of an interlock is recommended, with two years being regarded as the minimum
- specific and sustained enforcement of the program is regarded as essential
- there is the need to include an interlock code on a driver's licence, licence checks need to be incorporated in random breath test operations and mandatory carriage of licence is encouraged. For drivers assigned to the program, driving another vehicle not fitted with an interlock should attract a severe penalty
- interlocks to be serviced and calibrated regularly, both to ensure effective functioning of the device and to monitor each driver's extent of compliance.

It needs to be stressed however that the above guidelines were released in 1995. Given the amount of research that has occurred both in Australasia and around the world since then, these guidelines need to be re-visited and where appropriate, updated in light of the latest findings.

The status of alcohol interlock legislation in Australian jurisdictions is as follows:

- **New South Wales** Legislation is in place. Emphasis is on repeat offenders or first offenders with a BAC greater than 0.15 g/100 ml. Interlock program participation is via court order and is voluntary. Person must first complete a licence 'disqualification compliance period' prior to program entry. Interlock program participation is not available to 'habitual traffic offenders' (three or more like offences in the past five years).
- **Victoria** Legislation is in place. Emphasis is on repeat drink drivers and first time offenders with a BAC of 0.15 g/100 ml or greater. Prior to obtaining an alcohol interlock endorsed licence, a disqualification period must be completed. The licence endorsement can only be removed by an Interlock Condition Removal Order from the Court.
- **Queensland** No legislation is in place. An alcohol interlock trial has been completed. A full evaluation of the trial is still underway.
- **Western Australia** No legislation is in place. A Repeat Drink Driving strategy endorsed by Cabinet in October, 2004 supports the use of alcohol interlocks. Currently, WA is looking at legislation to support the use of alcohol interlocks.
- **South Australia** Legislation is in place. Persons convicted of drink driving may apply to the Registrar of Motor Vehicles to obtain an alcohol interlock licence after the mid-point of their licence disqualification period. It is a voluntary system.
- **Tasmania** No legislation is in place.

- Australian Capital Territory Provision is made within the legislation. There are no set criteria for assignment to an interlock program, with assignment being wholly at the magistrate's discretion.

The system is to be administered by the Road Transport Driver Licensing area. Licences can be endorsed with the letter 'I' signifying the holder is required to drive a car fitted with an alcohol interlock. The program is currently not operational.
- Northern Territory No legislation is in place. A published government review on alcohol in the NT included a recommendation for alcohol interlock use.

In New Zealand there is no legislation in place.

1.4 A review of the research

Research suggests that alcohol interlock devices are extremely effective in preventing alcohol impaired drivers from operating vehicles fitted with these devices. As such, they also protect the public from exposure to the increased safety risk posed by drink-drivers. However, this effect lasts only as long as the interlocks are fitted; following their removal, recidivism rates rise to similar levels as those found amongst offenders who have not had the alcohol interlocks installed.

1.4.1 *The benefits of breath alcohol ignition interlock devices*

Consistently, evaluations in the USA and Canada have indicated that interlocks reduced drink-driving recidivism over and above more traditional approaches, at least while the interlock was fitted to an offender's vehicle (Australian Transport Council, Beck et al. 1997, Beirness and Marques 2004, Morse and Elliott 1992, Raub et al. 2003). Morse and Elliott (1992) found that in Ohio, the use of interlocks was associated with a 65% reduction in the likelihood of a drink-driving re-offence over a 30-month period, compared to licence disqualification. It was also associated with a 91% decrease in the rate of 'driving while suspended' offences. Popkin et al. (1993) found that the use of interlocks was effective in reducing recidivism among second-time offenders in North Carolina.

Positive evidence regarding interlocks also comes from a study in Alberta, Canada (Weinrath 1997). Over the course of the program, and compared with an equivalent sample of other drivers convicted of drink-driving but not on an interlock program, interlock users were:

- twice as likely to avoid repeat drink-driving convictions
- 4.4 times less likely to incur new serious driving violations
- 3.9 times less likely to be involved in a casualty accident.

A study conducted in Illinois, USA compared the recidivism rates of two groups of drivers charged with DUI offences. One group installed interlocks and the other group had received a restricted driving permit. While the interlock was installed, drivers were only one-fifth as likely to be re-arrested at the end of the first year for DUI compared to the group with a restricted driving permit (1.3% of the interlock users vs. 8.7% of restricted driving permit drivers) (Raub et al. 2003).

Sweden's comprehensive alcohol interlock program focuses on changes in lifestyle and drinking behaviour. This two-year program is voluntary and requires participants to undergo periodic invasive medical examinations that monitor alcohol consumption through the testing of five biological markers, to complete self-esteem questionnaires and to fit alcohol interlocks to their vehicles. The results indicate lower alcohol consumption, high compliance with program regulations and no cases of recidivism during the program. In addition, there are early indications of a reduction of annual accident rates amongst program participants (Bjerre 2003). However participants showing evidence of not complying with program directions (for example, continuation or reappearance of elevated biological markers) may be removed from the program before its completion. Their removal may have contributed to elevated success rates, with the overall effectiveness of the program likely to be determined by participants' extent of compliance with program requirements.

Overall, the principal benefits of alcohol interlock devices lie in the prevention of DUI offences and the protection afforded to other road users whilst they are installed (Beirness, Simpson and Robertson 2003, Marques et al. 2003b). Based on the 17 970 alcohol-related fatalities in U.S.A, it has been estimated that the use of alcohol interlocks by all DUI offenders could save 1 750 to

3 500 lives per annum in that country (Sweedler 2003).

1.4.2 The limitations of breath alcohol ignition interlock devices

Popkin et al. (1993) found that the positive effects of interlocks on second-time offenders did not persist once the interlocks were removed. Similar results were obtained with second offenders in West Virginia (Tippetts and Voas 1997). Other studies have also reported that recidivism rates climb following interlock removal (Beirness and Marques 2004, Raub et al. 2003). These results suggest that the use of alcohol ignition interlocks alone may be similar to licence actions and function effectively as an exposure-control measure but only while the device is in place.

Another study from Alberta suggests that the inclusion of rehabilitation interventions as part of the interlock period may have a positive effect on recidivism rates after the interlock is removed (Marques et al. 1997). Evaluation of this program has also shown that those offenders with high failure rates in their use of the device were 2-3 times more likely to commit another drink-driving offence after the interlock was taken off the vehicle (Marques et al. 2000).

Instead of stipulating a fixed period for alcohol interlock use, it has been suggested that interlocks should remain on DUI offenders' vehicles until their drink-driving behaviour indicates that the interlocks are no longer necessary (Sweedler 2003) or until they abstain from drinking (Raub et al. 2003). It has also been suggested that it is unrealistic to expect alcohol interlocks to reform those with alcohol addictions, if the underlying problem is not dealt with while the interlock is in situ. These devices were not intended to treat alcohol abuse, but were designed to prevent a driver with elevated BAC levels from driving the vehicle (Beirness and Marques 2004).

Although the weight of research has demonstrated that recidivism rates climb following the removal of alcohol interlocks, one study has noted that some cumulative benefit derived from these devices remains. It has been reported that in Alberta, alcohol interlock users had substantially lower re-offence rates than a comparison group without the interlocks. Three years after the program, first-time offenders in the interlock group had 15.3 offences per 1 000 drivers while the comparison group had 43.8; five years after the program, repeat offenders in the interlock group had 63 offences per 1000 drivers while the comparison group had 130 (reviewed in Beirness and Marques 2004).

1.4.3 The status of the research

On the one hand, research studies have consistently established that assignees to interlock programs were more likely to avoid a range of driving violations including drink-driving, and were less likely to be involved in crashes for the duration of their assignment to the programs.

On the other hand, despite the spread of interlock programs in North America and elsewhere, we are not much closer to a firm conclusion, at least in regard to any lasting impact on crash statistics. In particular, methodological issues continue to confound any assessment:

- Small sample sizes in early evaluation studies in the USA have prevented definitive evaluation outcomes.
- Short follow-up periods in all studies to date mean that the long-term impact of interlock programs remains largely unknown.
- Biases introduced by the self-selection or court-selection of program participants mean that generalisability of results is questionable. For example, those that do participate in alcohol interlock programs may be less likely to re-offend regardless of assignment to an interlock program (Beirness and Marques 2004).
- Only a small percentage of eligible DUI offenders participate in alcohol interlock programs in instances where participation was either voluntary or at the discretion of the courts (Beirness and Marques 2004).

1.5 Political, social and other factors associated with interlocks

1.5.1 Alcohol interlock program participation levels

Overseas, alcohol interlock legislation that permits the fitment of interlocks to repeat DUI offenders has been implemented in 43 states in the United States and in five Canadian jurisdictions (Beirness, Simpson and Robertson 2003). Although alcohol interlocks are widely available, only a small percentage of eligible users install them (Bjerre 2003, DeYoung 2002, Raub et al. 2003, Voas et al. 2002, Voas et al. 2004) and the numbers assigned to programs could be as low as 2% of eligible offenders (Voas 2002).

As a general statement, interlock programs, whether in the US, Australia or elsewhere, have not been accepted by the courts as a meaningful sentencing and rehabilitation option. Factors affecting this lack of acceptance of interlocks include:

- Installing an interlock on a family vehicle sentences not only the offender but also all other users of the vehicle.
- The implications for the state or for interlock manufacturers, if offenders on interlock programs injure themselves or others, particularly in the event of interlock malfunction or bypass, are unclear.
- There is an issue of equal access. Programs generally entail the offender paying for installation and other costs arising from the program, including the lease or purchase price of the device. An examination of data from the USA and Canadian trials suggests that these programs are more likely to have been taken up by persons of higher economic status who are employed and eligible for 'work licences'. These are not the offenders who would be considered the core target group in Australia. Indeed, Australian data indicate that many offenders eligible for referral to an interlock program are over-represented in lower educational levels (65% completed grade 10 or less), in lower income groups (44% earn under \$12 000 p.a.) and unemployed (43.6%) (Ferguson et al. 1998). In recognition of this issue, some Australian jurisdictions (Victoria, New South Wales and South Australia) subsidise program costs for low-income referrals.

- Interlock programs require efficient and well-monitored implementation. The obvious requirement to ensure installation of the device was often overlooked or inadequately managed in many United States programs. Once installed, interlocks need regular maintenance, both to ensure continued accuracy and to enable monitoring of compliance with the program. The practical issues of determining relevant departmental or other agency responsibility for overseeing any interlock program, including maintenance of the interlock and monitoring the log data on use and possible abuse, need to be resolved.
- To state the obvious, an effective interlock program requires that the offender drives an interlock-equipped vehicle. Particularly when there is non-compulsory carriage of licence, or there is otherwise little chance of being detected driving without a licence, offenders can, with likely impunity, choose to drive other vehicles. In one program, 40% of drivers assigned to using interlocks who were then involved in a road accident, were not driving the cars stipulated by the courts (Marques and Voas 1995).
- Interlock assignment has not always proven acceptable in a legislative context. In particular, it seems that magistrates view interlock assignment for recidivist drink-drivers who were re-apprehended drink-driving while disqualified, as a 'soft' sentencing option which allows offenders to get back onto the road if serving a subsequently shortened disqualification period.
- The reluctance in all jurisdictions to modify the penalty of licence loss and mandatory hard suspension periods means that many recidivist offenders may have very long periods of licence loss before they are eligible to have an interlock fitted. In the case of the large minority of serious recidivist offenders who are already unlicensed at the time of conviction, they are unlikely to be eligible for many years and are already driving outside the system.
- Many offenders have no vehicle (DeYoung 2002).

Other options for encouraging the use of interlocks have included insurance policy discounts for those drivers prepared to fit interlocks, and pre-wiring of new cars to accept these devices. Volvo for example is taking steps for its commercial vehicles in Sweden to have interlock wiring fitted (Sweedler 2003). It has been estimated that currently there are between 1 400 to 3 000 commercial vehicles in Sweden that have alcohol interlocks fitted, as an occupational health and safety step (Beirness, Simpson and Robertson 2003; Bjerre 2003, respectively).

1.5.2 Mandatory versus voluntary participation

Alcohol interlock use can be approached from at least two different standpoints: interlocks can be fitted as a mandatory condition of licence reinstatement; or voluntary fitment of alcohol interlocks may replace or reduce a more severe penalty such as licence suspension. A Canadian study found that there was no difference in DWI recidivism (both during interlock fitment and following its removal) of those who had participated in a voluntary versus mandatory interlock program, indicating that both approaches were effective (Beirness, Marques, Voas and Tippetts 2003).

It also needs to be noted that where assignment to an interlock program is voluntary, the period of licence loss is another critical consideration. Where the period is reasonably short, the interlock program (with its concomitant costs) becomes a less attractive option. Similarly, if the probability of being detected while driving without a licence is low, many convicted DUI offenders continue to drive while still suspended (DeYoung 2002). There is once again less to be gained from volunteering for assignment to an interlock program. Therefore, it has been suggested that either stronger sanctions be levelled against DUI offenders who refuse alcohol interlocks, or unappealing alternatives such as house arrest, be imposed (Voas and Marques 2003). One study that investigated the impact of house arrest or jail time as the alternative to alcohol interlock use found higher levels of participation (62%) among eligible offenders as well as a substantial reduction in DUI recidivism compared to those not subject to this policy (Voas et al. 2002).

1.5.3 Other uses of alcohol interlock devices

In the past, research has indicated that the most accurate predictor of recidivism risk is previous DUI offences. Several Canadian studies have found that a better predictor is the number of failed BAC tests proportional to all BAC tests logged by alcohol interlock devices (Marques et al. 2003a, Marques et al, 2003b) particularly those logged between 7-9 am (Marques, Voas and Tippetts 2003). In addition, the alcohol interlock system can gather this information for first-time offenders who have no prior DUI offences. Thus, these devices can also play a role in the prediction of future DUI as well as the prevention of current DUI behaviour (Marques et al. 2003a, Marques et al. 2003b, Marques, Voas and Tippetts 2003).

1.6 Conclusions

Interlocks significantly reduce drink-driving while they are installed and while their use is being monitored. However, once removed, they cannot be shown to produce long term modifications in behaviour, including recidivist drink driving. There is some early indication that linking interlocks to completion of rehabilitation programs may improve long-term behaviour change but this remains to be substantiated.

REFERENCES

- Austrroads 1995, National guidelines for alcohol ignition interlock programs for drink driving offenders, AP-120/95, Austrroads, Sydney.
- Australian Transport Council 2001, National Road Safety Action Plan, 2001 and 2002, Australian Transport Safety Bureau, Canberra.
- Beck KH, Rauch WJ & Baker EA 1997, 'The effects on alcohol ignition interlock licence restrictions on multiple alcohol offenders: A randomized trial in Maryland', proceedings of the 14th international conference on alcohol, drugs and traffic safety – T97, Annecy, France, Centre d'études et de Recherches en Médecine du Trafic, Annecy Cedex, France.
- Beirness DJ & Marques P 2004, 'Alcohol ignition interlock programs', *Traffic Injury Prevention*, vol.5, pp.299-308.
- Beirness DJ, Marques PR, Voas RB & Tippetts AS 2003, 'The impact of mandatory versus voluntary participation in the Alberta ignition interlock program', *Traffic Injury Prevention*, vol.4, no.3, pp.195-198.
- Beirness DJ, Simpson HM & Robertson RD 2003, 'Commentary: International Symposium on enhancing the effectiveness of alcohol ignition interlock programs', *Traffic Injury Prevention*, vol.4, no.3, pp. 179-182.
- Bjerre B 2003, 'An evaluation of the Swedish ignition interlock program', *Traffic Injury Prevention*, vol.4, no.2, pp.98-104.
- DeYoung DJ 2002, 'An evaluation of the implementation of ignition interlock in California', *Journal of Safety Research*, vol.33, pp.473-482.
- Eilers JC 1994, Alternatives to traditional incarceration for serious traffic offenders, report VTRC 94-R23, Virginia Transportation Research Council, Charlottesville, Virginia.
- Ferguson M, Sheehan M, Schonfeld C & Davey J 1998, 'Profiling drink driving offenders in Central Queensland – preliminary findings from the evaluation of a drink driving rehabilitation/treatment program', proceedings of the Road Safety Research, Policing, Education Conference, Wellington, New Zealand, November 16-17, 1998, Land Transport Safety Authority, Wellington, vol.1, pp.120-126.
- Fulkerson A 2003, 'Blow and go: the breath-analyzed ignition interlock device as a technological response to DWI', *The American Journal of Drug and Alcohol Abuse*, vol.29, no.1, pp.219-235.
- Marques PR, Tippetts AS & Voas RB 2003a, 'The alcohol interlock: an underutilized resource for predicting and controlling drunk drivers', *Traffic Injury Prevention*, vol.4, no.3, pp. 188-194.
- Marques PR, Tippetts AS & Voas RB 2003b, 'Comparative and joint prediction of DUI recidivism from alcohol ignition interlock and driver records', *Journal of Studies on Alcohol*, vol.64, no.1, pp.83-92.
- Marques R & Voas RB 1995, 'Case-managed alcohol interlock programs: a bridge between the criminal and health systems', *Journal of Traffic Medicine*, vol.23, no.2, pp. 77-85.
- Marques PR, Voas RB, Beirness DJ, Taylor EP & Cossins DE 1997, 'Alberta Interlock Program: services intervention update', proceedings of the 14th international conference on alcohol, drugs and traffic safety – T97, Annecy, France, Centre d'études et de Recherches en Médecine du Trafic, Annecy Cedex, France, vol.1, pp.193-199.

- Marques PR, Voas RB & Tippetts AS 2003, 'Behavioral measures of drinking: patterns from the Alcohol Interlock Record', *Addiction*, vol.98 Suppl. 2, pp.13-19.
- Marques PR, Voas RB, Tippetts AS & Beirness DR 2000, 'Predictors of failed interlock BAC tests and using failed BAC tests to predict post-interlock repeat DUIs', *Proceedings of the 15th International Conference on Alcohol, Drugs and Traffic Safety*, Stockholm, Sweden, May 22-26, 2000, Swedish National Road Administration, Borlaenge, Paper 908.
- Morse BJ & Elliott DS 1992, 'Effects of ignition interlock devices on DUI recidivism: findings from a longitudinal study in Hamilton Court, Ohio', *Crime and Delinquency*, vol.38, no.2, pp.131-157.
- Popkin CL, Stewart JR, Beckmeyer J & Martell C 1993, 'An evaluation of the effectiveness of interlock systems in preventing DWI recidivism among second-time DWI offenders', *proceedings of the 12th International Conference on Alcohol, Drugs, and Traffic Safety*, Cologne, Germany, Verlage TÜV Rheinland GmbH, Köln, Germany, vol. 3, pp.1466-1470.
- Raub RA, Lucke E & Wark RI 2003, 'Breath alcohol ignition interlock devices: controlling the recidivist', *Traffic Injury Prevention*, vol.4, no.3, pp.199-205.
- Sweedler BM 2003, 'Preventing alcohol crashes: the role of ignition interlocks [Commentary]', *Traffic Injury Prevention*, vol.4, no.3, pp.177-178.
- Tippetts AS & Voas RB 1997, 'The effectiveness of the West Virginia interlock program on second drunk-driving offenders', *proceedings of the 14th international conference on alcohol, drugs and traffic safety – T97*, Annecy, France, Centre d'études et de Recherches en Médecine du Trafic, Annecy Cedex, France, vol.1, pp.185-192.
- Voas B 2002, 'Thirty years later: why aren't there more interlocks in service?', *proceedings of the 81st annual meeting of the Transportation Research Board*, January 2002, Session 170.
- Voas RB, Blackman KO, Tippetts AS & Marques PR 2002, 'Evaluation of a program to motivate impaired driving offenders to install ignition interlocks', *Accident Analysis and Prevention*, vol.34, pp.449-455.
- Voas RB & Marques PR 2003, 'Barriers to interlock implementation: Commentary', *Traffic Injury Prevention*, vol.4, no.3, pp.183-187.
- Voas RB & Marques PR 2004, 'Emerging technological approaches for controlling the hard core DUI offender in the U.S.', *Traffic Injury Prevention*, vol.5, no.3, pp.309-316.
- Weinrath M 1997, 'The ignition interlock program for drunk drivers: a multivariate test', *Crime and Delinquency*, vol.43, no.1, pp 42-59.
- Wilson CB & Stoke CB 1990, *Motor vehicle ignition interlocks: in-vehicle devices that monitor alcohol levels of motor vehicle operators*, report VTRC 90-R11, Virginia Transportation Research Council, Charlottesville, Virginia.