

Improving Road Safety through Deterrence-Based Initiatives

A review of research

*Jeremy D Davey and James E Freeman

تحسين سلامة الطرق من خلال مبادرات مبنية على الردع مراجعة بحوث

جيريمي ديفي، جيمس فريمان

الخلاصة: تُعد فعالية الإجراءات المطبقة لسلامة الطرق عبر ردع سائقي المركبات من الانغماس في سلوكيات غير قانونية مهمة جدا عندما يؤخذ بالحسبان التأثيرات الشخصية والاقتصادية لحوادث الطرق في المجتمع. ظلت نظرية الردع الحجر الأساسي في علم الجريمة وسياسة العدل الجنائي في دول عديدة، خاصة فيما يتعلق بسلامة الطرق، لأن صانعي القرار والأجهزة التنفيذية يحاولون زيادة الإدراك فيما يتعلق بتأكيد وشدة وسرعة العقوبات على الذين يمارسون المخالفات المرورية. هذا البحث الذي يعتمد التجربة الأسترالية (خاصة العدد الكبير من البحوث المتعلقة بزيادة المركبات تحت تأثير الكحول)، يراجع المبادئ التي تعزز نظرية الردع واستعمال ذلك من خلال المبادرات العصرية لسلامة الطرق (مثل فحص النفس العشوائي)، وكذلك التركيز على بعض الطرق لتعزيز تأثير الردع. ندرج في هذا البحث أيضا توجيهات لإجراء البحوث المتعلقة بالردع في المستقبل، خاصة الأخذ بعين الاعتبار النتائج الفعالة للعقوبات غير القانونية، وكذلك تحاشي العقوبة وصنع ثقافة للمجتمع تتقبل تغيير السلوك.

مفتاح الكلمات: ردع، سلامة الطرق، إجراءات مضادة، عقوبات، عقوبات غير قانونية.

ABSTRACT: The efficacy of road safety countermeasures to deter motorists from engaging in illegal behaviours is extremely important when considering the personal and economic impact of road accidents on the community. In many countries, deterrence theory has remained a cornerstone of criminology and criminal justice policy, particularly within the field of road safety, as policy makers and enforcement agencies attempt to increase perceptions regarding the certainty, severity and swiftness of sanctions for those who engage in illegal motoring behaviours. Using the Australian experience (particularly the tremendous amount of research into drink driving), the current paper reviews the principles underpinning deterrence theory, the utilisation of the approach within some contemporary road safety initiatives (e.g., random breath testing) as well as highlighting some methods to enhance a deterrent effect. The paper also provides direction for future deterrence-based research, in particular, considering the powerful impact of non-legal sanctions, punishment avoidance as well as creating culturally embedded behavioural change.

Keywords: Deterrence; Road Safety Countermeasures; Sanctions; Non-legal Sanctions

Deterrence Theory

The importance of improving road safety within motorised countries is reflected in the wide array of countermeasures that are presently being employed to reduce the prevalence of engaging in unsafe driving behaviours, e.g., law enforcement, media campaigns, rehabilitation and education, etc. Many of these countermeasures utilise deterrence theory as this theory is central to criminology and

criminal justice policy.^{1,2,3} In regards to deterrence, the Classical Deterrence Theory remains the mostly widely understood model, and it proposes that individuals will avoid offending behaviour(s) if they fear the perceived consequences of the act.^{3,4} Two 18th century utilitarian philosophers, Bentham and Beccaria, are regarded as the founders of this theory which makes implicit assumptions regarding human behaviour. These are, namely, that law breaking is inversely related to the certainty, severity

and swiftness of punishment.⁵ This means that legal threats are most effective when possible offenders perceive a high likelihood of apprehension, and believe that the impending punishment will be both severe and swift.³

Certainty of Apprehension

Within the Classic Deterrence Doctrine, a number of researchers have asserted that the most powerful deterrent effects on offending behaviour are produced by the perceived threat of the certainty of apprehension.^{3,4,6,7} Certainty in the present context refers to the perceived likelihood that an offender will be arrested and punished for their criminal act. In order for the “fear of punishment” to be effective, individuals must believe that the likelihood of apprehension for breaking the law is relatively high.³

Evaluations regarding the certainty of apprehension have been extensively reviewed for a variety of different criminal acts (e.g., robbery, violent crimes, shop lifting, drug abuse), with a considerable body of research demonstrating a significant, although weak, negative relationship between certainty of arrest and crime rates.^{4,8,9,10,11,12} That is, individuals who perceive the chances of arrest as high are more deterred from committing an offence than individuals who believe that they are unlikely to be apprehended.³ As a result, road safety operations that increase the perceptions of apprehension certainty for engaging in illegal behaviours are likely to have a positive effect on deterring offenders.¹³

Severity of Sanctions

The perceived severity of legal sanctions has also been considered to be extremely important when examining the deterrent effects of legal penalties on offending behaviour(s).⁴ The Classic Deterrence Doctrine proposes that individuals will be reluctant to commit an offence if they consider that the penalty for such an offence is severe.⁴ Not only have the deterrent effects of perceived severity of punishment not received the same level of attention as that of certainty,^{14,15} but also the results within the literature are conflicting.

A considerable body of early research demonstrated a weak negative relationship between

perceived severity of sanctions and a range of illegal behaviours.^{11,12,14,16,17} That is, as perceptual severity increases, the likelihood of an individual committing that offence decreases;⁴ however, an opposing body of research demonstrates that perceptions regarding the severity of penalties do not have the salient deterrent impact that was once assumed.^{3,6,11,15,17} In fact, some researchers have reported a counter-intuitive relationship, with crime rates actually increasing with increases in the severity of the penalty.^{10,12,18,19} Nevertheless, it may be suggested that the greatest deterrent impact in regards to severity of sanctions will be found among those who have never committed an offence, rather than habitual offenders.³

Swiftness of Sanctions

The third aspect of the Classic Deterrence Doctrine refers to the deterrent effect of celerity, as it is proposed that the application of punishments for illegal behaviour will be most salient when they are administered soon after the criminal act.³ This belief has direct links to models of learning and experimental psychology (e.g., conditioning), as it has been demonstrated that the time between stimulus and response is vital in regards to learning new behaviours.⁷ Likewise, it is recognised that for road safety, the swiftness of impending penalties is an important aspect for achieving deterrence.^{3,20} However, despite the link between the speed of the response and learned behaviour, the effects of the celerity of legal sanctions is by far the least studied of the three major deterrent mechanisms in the Classic Deterrence Doctrine.²⁷ This is partly because penalties are rarely applied swiftly in the criminal justice system.²

Specific Versus General Deterrence

While there are many different variations of deterrence, in the broadest sense there are two deterrence processes commonly known as specific and general deterrence.^{3,4} Specific deterrence is most commonly understood to be the process whereby an individual who has been apprehended and punished for a criminal act refrains from further offending behaviour for fear of incurring additional punishment.^{3,21} In contrast, general deterrence

occurs when an individual refrains from engaging in a criminal behaviour as a result of observing others being punished for the offending behaviour or they are warned of the impending penalties for committing an offence such as through media campaigns.^{3,4}

In regards to specific deterrence, the application of legal sanctions following a conviction for an offence such as drink driving or speeding has a number of purposes including punishment, reform, retribution and possibly incapacitation.²² However, a primary goal of the sanctioning process is to deter offenders from repeating the same crime in the future, and thus, the penalty should be perceived as certain, severe and swift.^{3,22} Attempts to deter motoring offenders through the application of legal sanctions form a core component of current sentencing practices,^{2,23} and a growing body of research has demonstrated that sanctions have the capacity to reduce the likelihood of re-offending among a range of motoring groups for a range of offences including speeding,^{24,25} unlicensed driving,^{26,27} drink driving,^{3,28} etc.

In regards to general deterrence, a considerable body of evidence suggests that the threat of apprehension and subsequent legal sanctions, especially when supported by well-publicised media campaigns, can produce a deterrent effect, even if short, on offending behaviour.^{3,7,29} More specifically, campaigns to reinforce the consequences of an aberrant behaviour (such as drink driving in the Australian context), or increasing the perceived severity or certainty of penalties (as well as apprehension) have produced a beneficial effect on crashes and serious injury rates¹⁵ as well as actual perceptions of arrest certainty.^{3,29}

Random Breath Testing as an Example of Targeting Cultural Change

In general, research has demonstrated that the utilisation of deterrence-based initiatives can create lasting attitudinal and behaviour change in regards to aberrant driving behaviours, such as speeding and drink driving. In fact, within Australia, deterrence-based countermeasures have been demonstrated to have the potential to create attitudinal and behavioural change even among established, entrenched and previously accepted

cultural behaviours such as drink driving. In regards to the latter, arguably one of the best known examples of general deterrence working effectively is through the implementation of random breath testing (RBT). RBT was introduced into Australia in the 1980s and involves police officers randomly stopping motorists and analysing their breath samples, via a hand held device, to determine if they have consumed more alcohol than is legally permitted in order to operate a motor vehicle. While a number of factors have contributed to the reduction of drink driving in Australia over the past 30 years, studies evaluating the effectiveness of RBT have revealed this countermeasure to be one of the primary reasons why alcohol-related crashes have reduced in Australia.^{30,31} For example, a review of RBT in Queensland found that the introduction of the programme was associated with an 18% reduction in alcohol-related driver and rider fatalities.³² The general deterrent effect is achieved (in part) by the Queensland Police Service (QPS) conducting the equivalent of one (preliminary) breath test for every licensed driver per year. In the financial years 2001–2002 and 2002–2003, the QPS conducted over 2.6 million preliminary breath tests.^{33,34} This currently represents the highest rate of breath testing by any police jurisdiction in Australia,³⁵ and demonstrates a high level of commitment by the QPS to the RBT program as well as to promote a general deterrent effect. This commitment to high testing levels has required high levels of resources including extra manpower, officer hours and equipment, to maintain. The QPS has also implemented improvements to RBT operations through the acquisition of state of the art breath testing equipment, booze buses (e.g., mobile testing units) and the implementation of coordinated intelligence efforts in relation to crash and offender hot spots.^{33,34}

Although the apprehension of drink driving offenders is important, it has been argued that the main purpose of RBT is to deter the general driving population from drink driving.³ This also remains a central aim of other road safety initiatives, such as visible speed cameras on the side of the road to deter motorists from breaking the speed limit. Again in regards to drink driving (or other similar behaviours) the ideal general deterrence-based operation is one that is highly visible, sustained and widespread.^{3,28} However, these features should

remain central to all road safety countermeasures that aim to deter offending behaviours. In regards to RBT, it is also a communication tool, influencing community perceptions of the social unacceptability of drink driving. For example, the aim is not only to target the specific behaviour, but also the cultural climate in which that behaviour occurs and is supported. Community surveys conducted over the years have shown that since the introduction of RBT, there has been an increase in the number of people who disapprove of drink driving.³⁶ As a result, deterrence-based initiatives have the potential to create lasting cultural and attitudinal change in behaviours that were once supported (or tolerated) within the community. For example, in regards to drink driving, while the behaviour was historically accepted for many decades in Australia, research has consistently demonstrated changes in community perceptions regarding the offence. Illustrating this, an earlier study by the Australian Transport Safety Bureau³⁷ found that 54% of Australians believe that drink driving is a major cause of crashes. The same study also found that 97% of Australians support random breath testing enforcement by police.

In addition to RBT, a number of Australian states have commenced, using a similar method, to analyse randomly the oral fluid of motorists to determine if they have recently consumed illicit substances such as cannabis and amphetamines. Preliminary research is beginning to demonstrate that randomly testing motorists can also produce a general deterrent effect, although the practice should be complemented with a wide spread media campaign to increase the overall deterrent effect, e.g., increase motorists' perceptions regarding the wide spread use of the technique as well as the increased likelihood of being detected. Taken together, a foundation of deterrence theory focuses on modifying road safety behaviour, and it can also be applied within a range of road safety concerns such as speeding, unlicensed driving, etc. as well as setting the agenda for cultural change. Within Australia, the tremendous amount of knowledge that has been obtained from focusing on deterring the drinking driver is now being re-directed towards other unsafe driving behaviours such as those mentioned above and which are more common in the Gulf States.

Extending Deterrence Theory: Non-Legal Sanctions

Despite the prominence of the deterrence doctrine within road safety initiatives, a number of additional theories that focus on social, developmental, environmental and biological factors have been developed in an attempt to understand a range of criminal activities. As a result, a number of models have stemmed from, and expanded the scope of, the Classic Deterrence Doctrine. One significant direction of theoretical change has been to commence examining the deterrent effect that non-legal sanctions have on decisions to commit an offence, e.g., social control theory. This endeavour has resulted in an increase in the number of factors proposed to influence criminal behaviour, e.g., social disapproval, feelings of guilt, fear of physical injury. One of the reasons for this expansion was criticisms that traditional deterrence models did not account for the large array of non-legal factors that may influence an individuals' decision regarding committing an offence, as it is recognised that penalties are not applied within a social vacuum.^{38,39,40} In fact, researchers have argued that road safety offences occur within a social context, and that there are a plethora of additional attitudinal and behavioural factors (e.g., morality, peer pressure, etc) that may produce a stronger impact on offending behaviour(s) than traditional legal sanctions.^{3,39}

As a result, a number of additional models have been developed that focus on rational choice and prospect theories, and thus suggest that both legal and non-legal sanctions affect a person's decision to commit an unsafe driving behaviour. This re-orientation has resulted in an increase in the number of factors proposed to influence offending behaviour, such as peer/social sanctions, fear of being injured, moral attachment to the norm, and moral obligations to the law. As a result, such additional factors have now influenced associated educational campaigns designed to increase motorists' attitudes regarding the importance of road safety. While a complete review of the many non-legal factors proposed to influence criminal and "at-risk" behaviour is beyond the scope of the current paper, some factors are briefly discussed below and may be relevant to societies with high

degrees of social pressure such as those in the Gulf area.

One non-legal sanction that has consistently been proposed to influence motorists' driving behaviours has been the threat of injuring oneself or another motorist.^{3,41} This deterrent factor forms a central component of many road safety advertising campaigns that promotes the serious negative health consequences that may result from an offence such as drink driving, e.g., crashes and fatalities. A second non-legal sanction that has been hypothesised to affect criminal behaviour is moral commitment to the norm, such as whether individuals are willing to break the law. More broadly, both moral commitment to the norm and respect for the law have been identified as having an effect on the prevalence of criminal activities.^{3,10,42,43} As a result, increasing individuals' awareness of social norms (such as not drink driving) has considerable merit to influence subsequent driving behaviours. Another non-legal factor involves the threat of social stigma resulting from informal sanctions. Given that deterrence is a psychological process that takes place within a larger social context of human activity,³ it has been hypothesised that social and cultural norms affect the prevalence of offending behaviours in a community.^{4,7,40} A considerable body of research has demonstrated that informal sanctions such as social disapproval or fear of social stigma produce a significant deterrent effect on a number of illegal acts such as shoplifting, violent behaviour, etc.^{4,15,17,41} In fact, some researchers have reported that the threat of informal sanctions produces a greater deterrent effect on offending behaviour than the threat of formal legal sanctions.^{12,44,45} As a result, the negative effect of social sanctions are also increasingly being included in campaigns designed to improve road safety.

Another prominent direction of theoretical development in regards to deterrence has been to consider the effect of avoiding punishment and exposure to others avoiding punishment, which has been proposed to have a major influence on subsequent offending behaviour. In 1993, Stafford and Warr proposed a reconceptualised model of deterrence that incorporates four categories of experiences that have been suggested to affect the deterrent process: a) direct experience of punishment; b) direct experience of punishment

avoidance; c) indirect (vicarious) experience of punishment; and d) indirect (vicarious) experience with punishment avoidance. The model suggests that both general and specific deterrence have the potential to influence an individual's decision to commit an illegal behaviour, and are thus compatible with contemporary learning theories through the acknowledgement that both experiential and vicarious experiences have a direct effect on learning and decision making.⁴⁶ The model highlights the fact that the experience of punishment is not the only important factor to achieve deterrence, but also recognises that the process of punishment avoidance is likely to influence further offending behaviours.⁴⁷ Preliminary research has suggested the model has considerable potential to shed light on why some individuals are not deterred by the threat of legal sanctions, particularly in regards to the problem of personally avoiding detection and punishment and/or observing others achieve similar outcomes. For example, preliminary research has demonstrated punishment avoidance to be negatively associated with perceptions of arrest certainty, and positively associated with illegal drug use in high school students.⁴⁷ These findings highlight the need to implement road safety initiatives that maximise the probability of apprehending individuals who violate road rules.

Directions for Future Research and Theoretical Limitations

Despite the tremendous amount of research that has focused on the mechanisms and processes of deterrence over the past 30 years, researchers admit that the precise circumstances under which sanctions (or the threat of sanctions) are likely to influence or change a person's behaviour are still not known.^{2,48} One limitation within the deterrence literature is the lack of research that has examined convicted offenders,⁶ particularly repeat offenders, and why they seem immune or impervious to the threat of legal sanctions.⁴⁴ Specifically, research has yet to determine whether repeat offenders consider penalties to be "certain, severe and swift", or why a considerable proportion continue to drink and drive despite incurring increasingly severe sanctions.^{3,15}

Another major limitation within the deterrence field is that the vast majority of deterrence research

has focused on college students and the general public.¹⁶ More specifically, current understanding regarding the mechanics of deterrence initiatives is heavily skewed towards programmes of research that have focused predominantly on younger populations. Thus, less is currently known about the general deterrent impact of possible future legal punishment on wider motoring populations' actual offending behaviours. In part, this limitation stems from the difficulties associated with determining causal directions, eliminating competing explanations,³ and examining large groups of motorists' self-reported attitudes and offending behaviours. What is commonly understood is that deterrence processes are generally unstable and fluctuate over time,³ which suggests that individuals' perceptions of sanctions, and the impact that such sanctions have on their behaviours, are likely to change. Therefore, one of the primary concerns with deterrence theory is that deterrence is considered to be unstable and can change over time.³ There thus remains a continual need to investigate and refine the deterrent impact of current countermeasures on the motoring population.

Increasing Deterrent Effects

The various principles incorporated within deterrence theory have together been proven to increase road safety in a number of motorised countries (e.g., United States, Canada, Australia, etc.) and within a range of areas including speeding, unlicensed driving, drink driving, and drug driving. However, in order to maximise the greatest deterrent effect, it appears that policy makers and enforcement agencies need to maintain a balance between both the general and specific deterrent aspects of the theory. For example, in regards to speeding enforcement, the overall efficiency of the programme could be optimised by maintaining (and increasing over time) the high level of speed cameras and mobile operations as well as increasing the number of drivers detected. Importantly, in order to create and maintain a deterrent effect, policing operations should be highly visible, sustained and widespread.^{3,35} This ensures that all motorists, whether newly licensed or experienced, perceive a constant high risk of apprehension.

If drivers do not regularly observe policing operations, they may become undeterred which may be then reinforced by successfully engaging in offending behaviours that remain undetected, e.g., punishment avoidance. Stemming from this, the effectiveness of any deterrence-based enforcement practice is heavily dependent upon increasing motorists' perceptions regarding the risk of being apprehended for an offence, e.g., general deterrence. As a result, there is a need to utilise a variety of public education strategies to ensure motorists are aware of current efforts to apprehend offenders. One proven method is to conduct regular publicity campaigns that highlight sustained efforts to detect offenders through a variety of mediums including television advertising, radio, brochures, posters, etc. In general, research has begun to demonstrate that well-executed mass media campaigns (that are widely implemented, targeted and persuasive rather than fear eliciting) have the potential to reduce offending behaviours and/or culturally-embedded unsafe behaviours.^{49,50,51}

In summary, deterrence remains unstable and requires high levels of police resources and commitment in order to maintain it. As highlighted previously, it should also be noted that our current understanding of the mechanisms of deterrence is based heavily on studies that have focused on younger populations. In fact, the bulk of published deterrence-based studies are from a small number of highly industrialised countries (e.g., United States, Canada, Australia, etc), and thus deterrent forces are likely to fluctuate with the surrounding environment. In fact, it should be acknowledged that environmental modifications have the potential to create a greater level of behavioural change in some countries than deterrence-based initiatives.⁵² Nevertheless, in order to 'maximise' deterrent effects, enforcement operations should consider utilising targeted and intelligence-led enforcement methods to increase the likelihood of identifying and apprehending motorists engaging illegal behaviours. In regards to speeding, this might involve commencing mobile operations at high risk times in high risk locations where people are most likely to speed. This could be complemented with the use of crash and apprehension data which highlights where and when crashes or previous arrests have occurred. However, there are other enforcement methods

that have resulted in increased detection rates including the use of covert operations comprised of unmarked cars and plain-clothes police.⁵³ This approach may prove particularly useful in rural areas and the greatest effects may be achieved through a mixture of overt and covert enforcement methods.

However, it is noted that any deterrence-based method employed in isolation does not offer a panacea for the problem of road accidents and fatalities, and thus researchers and policy makers also need to look beyond such principles to identify other methods both to increase motorists' awareness of the importance of safe motoring as well as to create lasting behavioural change. In fact, there are a number of initiatives that are likely either to complement the general deterrent effect of law enforcement operations (e.g., use of publicity, media advocacy, changing community norms), or improve the management of convicted offenders, e.g., rehabilitation, licence actions, vehicle sanctions. Therefore, it is important that deterrent-based approaches are not considered in isolation, but rather, form part of a multi-modal approach (including education) to improve road safety and change entrenched "at-risk" driving behaviours. More generally, and when attempting to alter behaviour, there are two main pathways to ensure compliance: 1) the extrinsic pathway governed by systems and rules with rewards and punishments, and 2) the intrinsic pathway that establishes voluntary compliance via individual commitment to safety. While deterrence theory may be argued to be one of the key ingredients to improve road safety, it is noted that an excessive amount of extrinsic motivation in the form of policies and regulations may actually trigger further issues by reducing the intrinsic motivation of drivers to perform safety behaviours. As a result, establishing intrinsic commitment to road safety throughout the community can only assist in achieving more sustainable and reliable behavioural change.

References

1. Andenaes J. Punishment and deterrence. Ann Arbor: The University of Michigan Press, 1974.
2. Babor T, Caetano R, Casswell S, Edwards G, Giesbrecht N, Graham K, et al. Alcohol: no ordinary commodity. Research and public policy. Oxford: Oxford University Press, 2003.
3. Homel J. Policing and punishing the drinking driver. A study of specific and general deterrence. New York: Springer-Verlag, 1988.
4. Von Hirsch A, Bottoms A, Burney E, Wikstrom P. Criminal deterrence and sentence severity: an analysis of recent research. Oregon: Hart Publishing, 1999.
5. Taxman S, Piquero A. On preventing drunk driving recidivism: an examination of rehabilitation and punishment approaches. *J Crim Justice* 1998; 26:129–43.
6. Decker S, Wright R, Logie R. Perceptual deterrence among active residential burglars: a research note. *Criminol* 1993; 31:135–47.
7. Nagin S, Pogarsky G. Integrating celerity, impulsivity, and extralegal sanction threats into a model of general deterrence: theory and evidence. *Criminol* 2001; 39:865–89.
8. Grasmick HG, Jacobs D, McCollom CB. Social class and social control: an application of deterrence theory. *Soc Forces* 1983; 62:359–74.
9. Richards P, Tittle CR. Socioeconomic status and perceptions of personal arrest probabilities. *Criminol* 1982; 20:329–46.
10. Silberman M. Toward a theory of criminal deterrence. *Am Sociol Rev* 1976; 41:442–61.
11. Teevan JJ. Subjective perception of deterrence (continued). *J Res Crime & Delinq* 1976; 13:155–64.
12. Tittle CR. Evaluating the deterrent effects of criminal sanctions. In: Klein MW, Teilmann KS, Eds. *Handbook of Criminal Justice Evaluation*. Beverly Hills: Sage Publications, 1980.
13. Watson B, Freeman J. Perceptions and experiences of Random Breath Testing in Queensland and the self-reported deterrent impact on drunk driving. *Traffic Injury Prevent* 2007; 8:11–19.
14. Grasmick HG, Bryjak GJ. The deterrent effect of perceived severity of punishment. *Soc Forces* 1980; 59:471–91.
15. Ross HL. *Deterring the drinking driver. Legal policy and social control*. Lexington, MA: Lexington Books, 1982.
16. Klepper S, Nagin D. The deterrent effect of perceived certainty and severity of punishment revisited. *Criminol* 1989; 27:721–46.
17. Paternoster R, Iovanni L. The deterrent effect of perceived severity: a reexamination. *Soc Forces* 1986; 64:751–77.
18. Mann RE, Vingilis ER, Gavin D, Adlaf E, Anglin L. Sentence severity and the drinking driver: relationship with traffic safety outcome. *Accident Anal & Prevent* 1991; 23:483–91.
19. Meier RF, Johnson WT. Deterrence as social control: the legal and extralegal production of conformity. *Am Sociol Rev* 1977; 42:292–304.

20. McArthur DL, Kraus JF. The specific deterrence of administrative per se laws in reducing drunk driving recidivism. *Am J Prev Med* 1999; 16:68–75.
21. Watson B. The effectiveness of drink driving licence actions, remedial programs and vehicle-based sanctions. Proceedings of the 19th ARRB Research Conference. Melbourne: Australian Road Research Board, 1998.
22. Freeman J, Liossis P, Schonfeld C, Sheehan M, Siskind V, Watson B. The self-reported impact of legal and non-legal sanctions on a group of recidivist drink drivers. *Transport Res Part F: Traffic Psychol & Behav* 2006; 9:53–64.
23. Smith K. A Qualitative Study of Deterrence and Deviance in a Group of Recidivist Drink Drivers. Unpublished Masters Manuscript. University of Canberra, Australia, 2003.
24. Elvik R, Christensen P. The deterrent effect of increasing fixed penalties for traffic offences: the Norwegian experience. *J Safety Res* 2007; 38:689–95.
25. Glendon A, Cernecca L. Young drivers' responses to anti-speeding and anti-drink-driving messages. *Transport Res Part F: Traffic Psychol & Behav* 2003; 6:197–216.
26. Siskind V. Does license disqualification reduce reoffence rates? *Accident Anal & Prevent* 1996; 28:519–24.
27. Voas RB, Tippetts AS, Lange JE. Evaluation of a method for reducing unlicensed driving: the Washington and Oregon license plate sticker laws. *Accident Anal & Prevent* 1997; 29:627–34.
28. Watson B, Hart S, Freeman J, Tay R, Davey J, Madden J, et al. Review of Random Breath Testing (RBT) in Queensland. Queensland: Queensland University of Technology, 2005.
29. Grosvenor D, Toomey TL, Wagenaar AC. Deterrence and the adolescent drinking driver. *J Safety Res* 1999; 30:187–91.
30. Henstridge J, Homel R, Mackay, P. The long-term effects of random breath testing in four Australian states: A time series analysis (CR 162). Canberra, Australia: Federal Office of Road Safety, 1997.
31. Harrison W, Newman S, Baldock M, McLean J. Issues in developing better practice in enforcement targeting drink driving. Draft Contract Report for AustRoads. Melbourne, Australia: Monash University Accident Research Centre, 2003.
32. Watson B, Fraine G, Mitchell L. Enhancing the effectiveness of RBT in Queensland. Prevention of Alcohol Related Road Crashes: Social and Legal Approaches Conference, Brisbane, Australia. Griffith University and Queensland Transport, 1994.
33. Queensland Police Service Annual Report 2001–2002. Queensland Government. From: http://www.police.qld.gov.au/pr/services/reports/01_02/index.shtml Accessed: Sept 2003.
34. Queensland Police Service Annual Report 2002–2003. Queensland Government. From: http://www.police.qld.gov.au/pr/services/reports/02_03/index.shtml Accessed: Sept 2003.
35. Kolesnik P. Queensland Police Service random breath testing targets issues paper. Brisbane: Queensland Police Service, 2002.
36. Mitchell-Taverner P. Community attitudes to road safety: Community attitudes survey wave 11 (CR 180). Canberra, Australia: Federal Office of Road Safety, 1998.
37. Australian Transport Safety Bureau (ATSB). Road Fatalities Australia: 2000 Statistical Summary. Canberra, Australia: ATSB, 2001.
38. Anderson LS, Chiricos TG, Waldo GP. Formal and informal sanctions: a comparison of deterrent effects. *Soc Probs* 1977; 25:103–14.
39. Berger D, Snortum J. A structural model of drinking and driving: alcohol consumption, social norms, and moral commitments. *Criminol* 1986; 24:139–53.
40. Sherman LW. Defiance, deterrence, and irrelevance: a theory of the criminal sanction. *J Res Crime & Delinq* 1993; 30:445–73.
41. Baum S. Self-Reported drink driving and deterrence. *Austr & NZ J Criminol* 1999; 32:247–61.
42. Brown S. Associations between peer attitudes and behaviour, random breath testing experience and drink driving in a population-representative sample of South Australians. From: <http://www.druglibrary.org/schaffer/misc/driving/s6p4.htm>. Accessed: May 2002.
43. Piquero AR, Tibbetts S. Specifying the direct and indirect effects of low self-control and situational factors in offenders' decision making: toward a more complete model of rational offending. *Justice Quart* 1996; 13:481–510.
44. Beirness DJ, Mayhew DR, Simpson HM. DWI Repeat Offenders: A Review and Synthesis of the Literature. Canada: Health Canada, 1997.
45. Snortum R. Deterrence of alcohol-impaired driving: an effect in search of a cause. In: Laurence MD, Snortum R, Zimring FE, Eds. *The Social Control of Drinking and Driving*. Chicago: University of Chicago Press, 1988. Pp.189–226.
46. Stafford MC, Warr M. A reconceptualisation of general and specific deterrence. *J Res Crime & Delinq* 1993; 30:123–35.
47. Paternoster R, Piquero A. Reconceptualizing deterrence: an empirical test of personal and vicarious experiences. *J Res Crime & Delinq* 1995; 32:251–86.
48. Piquero AR, Pogarsky G. Beyond Stafford and Warr's reconceptualization of deterrence: personal and vicarious experiences, impulsivity, and offending behavior. *J Res Crime & Delinq* 2002; 39:153–86.
49. Elder RW, Shults RA, Sleet DA, Nichols JL,

- Thompson RS, Rajab W. Effectiveness of mass media campaigns for reducing drinking and driving and alcohol-involved crashes. *Am J Prev Med* 2004; 27:57–65.
50. Lewis I, Watson B, White K, Tay, R. Promoting public health messages: Should we move beyond fear-evoking appeals in road safety? *Qual Health Res* 2007; 17:61–74.
51. Lewis I, Watson B, White, K. Response efficacy: the key to minimizing rejection and maximizing acceptance of emotion-based anti-speeding messages. *Accident Anal & Prevent* 2010; 42:459–67.
52. World Health Organisation. *Global Status Report on Road Safety: Time for Action*. Geneva: WHO, Department of Violence and Injury Prevention, 2009.
53. Healy D, Wylie B. Evolving drink driving enforcement strategies and public education in regional Victoria. In: *Proceedings Road Safety Research, Policing, Education Conference*, 16-17 November, Wellington, New Zealand. New Zealand: Land Transport Safety Authority and New Zealand Police, 1998, Vol. 2, pp. 70–3.