

Left on the Side of the Road? A Review of Deterrence-Based Theoretical Developments in Road Safety

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Abstract

Deterrence-based initiatives form a cornerstone of many road safety countermeasures. This approach is informed by Classical Deterrence Theory, which proposes that individuals will be deterred from committing offences if they fear the perceived consequences of the act, especially the perceived certainty, severity and swiftness of sanctions. While deterrence-based countermeasures have proven effective in reducing a range of illegal driving behaviours known to cause crashes such as speeding and drink driving, the exact level of exposure, and how the process works, remains unknown. As a result the current study involved a systematic review of the literature to identify theoretical advancements within deterrence theory that has informed evidence-based practice. Studies that reported on perceptual deterrence between 1950 and June 2015 were searched in electronic databases including PsychINFO and ScienceDirect, both within road safety and non-road safety fields. This review indicated that scientific efforts to understand deterrence processes for road safety were most intense during the 1970s and 1980s. This era produced competing theories that postulated both legal and non-legal factors can influence offending behaviours. Since this time, little theoretical progression has been made in the road safety arena, apart from Stafford and Warr's (1993) reconceptualisation of deterrence that illuminated the important issue of punishment avoidance. In contrast, the broader field of criminology has continued to advance theoretical knowledge by investigating a range of individual difference-based factors proposed to influence deterrent processes, including: moral inhibition, social bonding, self-control, tendencies to discount the future, etc. However, this scientific knowledge has not been directed towards identifying how to best utilise deterrence mechanisms to improve road safety. This paper will highlight the implications of this lack of progression and provide direction for future research.

Introduction

The significance of improving road safety continues to be reflected in the range of countermeasures and interventions that are currently being implemented to reduce traffic violations (e.g., law enforcement initiatives). The majority of these countermeasures utilise (or are founded upon) deterrence theory, which is central to criminal justice policy (Piquero et al., 2011). In regards to deterrence, the Classical Deterrence theory remains the mostly widely cited model, and it proposes that individuals will avoid offending behaviour(s) if they fear the perceived consequences of the act (Homel, 1988; Von Hirsch et al., 1999). The model was originally developed by two 18th century utilitarian philosophers named Bentham and Beccaria and proposes that offending behaviours are inversely related to the certainty, severity and swiftness of punishment (Taxman & Piquero, 1998). That is, the threat of legal sanctions are most effective when individuals perceive a high likelihood of apprehension when committing an illegal act, and believe that the impending punishment will be both severe and swift (Homel, 1988). This is known as *general deterrence*. In contrast, *specific deterrence* is 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 (Homel, 1988). The primary focus of this review is on general deterrence, although specific deterrence is still of relevance (and difficult to

ignore) when examining the impact of different road safety countermeasures. Given the increasing utilisation of deterrence-based approaches in road safety (e.g., the expansion of random drug testing initiatives and speed cameras) it is timely to consider evidence regarding the effectiveness of the approach. It is also timely to consider whether theoretical progression of deterrence-based theory has kept pace with its corresponding application.

Method

The systematic review incorporated core principles of the “Preferred Reporting Items for Systematic reviews and Meta-Analyses” (PRISMA) statement checklist, including defining: (a) eligibility criteria e.g., studies between 1960 and 2015, (b) information sources e.g., electronic databases, reference lists, (c) study selection approach e.g., peer reviewed publications, and (e) study characteristics. However, given a primary aim of the study was to focus on the existence of theoretical progression (rather than effect sizes) the review focused on identifying (rather than quantifying the impact of) deterrence-based road safety research. Studies that reported on perceptual deterrence between 1960 and June 2015 were searched in electronic databases including PsychINFO and ScienceDirect. Key words were used such as: Classic deterrence doctrine, perceptual deterrence, certainty, severity, swiftness of sanctions. This was supplemented with scanning of reference lists of relevant manuscripts to identify other studies of direct relevance, including in the “grey literature.” Studies that focused on drink driving, speeding and other road safety violations as well as broader criminological publications were included.

Results

Certainty, Severity and Swiftness

In regards to the three factors of Classic Deterrence, a considerable body of broader criminological research has demonstrated a significant (although relatively weak), negative relationship between certainty of arrest and a variety of crime rates (Grasmick et al., 1983; Grosvenor, Toomey & Wagenaar, 1999; Silberman, 1976; Sherman & Berk, 1984; Teevan, 1976; Von Hirsch et al., 1999). In regards to road safety, the findings have not been so clear. Australian speeding-based studies have indicated that greater certainty of punishment predicted more frequent speeding (Fleiter et al., 2009; Fleiter & Watson, 2006). However at an aggregate level, increasing the perceived likelihood of detection has been demonstrated to be effective, particularly in the area of drink driving with the introduction of random breath testing (RBT) (Harrison, et al., 2003; Henstridge, Homel & Mackay, 1997; Watson et al., 2005). It may be suggested that the effectiveness of RBT is (in part) based on increasing the perceived likelihood of detection (Davey & Freeman, 2011), although evidence remains that higher levels of perceived apprehension related to RBT does not always produce a strong deterrent effect (Watson & Freeman, 2007). This disparity may suggest that individual differences exist in motorists’ responses to the threat of apprehension, which has been reported in the broader criminological literature (Piquero et al., 2011) and is considered below.

Published results into the perceived severity of legal sanctions have also been conflicting. Some early criminological research reported a weak, negative relationship between perceived severity of sanctions and a range of illegal behaviours (Grasmick & Bryjak, 1980; Klepper & Nagin, 1989; Paternoster & Iovanni, 1986; Teevan, 1976; Tittle, 1980). An opposing body of research (including within the road safety field) demonstrates that the perceived severity of penalties does not have the desired deterrent impact (Decker et al., 1993; Homel, 1988, Paternoster & Iovanni, 1986; Piquero & Pogarsky, 2002; Ross, 1982; Teevan, 1976). In fact, for specific deterrence, some studies have reported a counter-intuitive relationship, with crime rates actually increasing

with increases in the severity of the penalty (Mann et al., 1991; Silberman, 1976; Tittle, 1980) or offenders remaining impervious (e.g., recidivist drink drivers) (Freeman et al., 2006; Lenton, Fetherston & Cercarelli, 2010). For speeding behaviours, a comparative study of Australian and Chinese motorists found that penalties were not viewed as particularly harsh for the Chinese (Fleiter et al., 2009). Some studies on drink drivers report that punished offenders were more likely to re-offend (Piquero & Paternoster, 1998) or sanctions do not reduce drink driving recidivism, after controlling for alcohol-related problems (Yu, 2000). Piquero and Pogatsky (2003) considered this to be a “resetting effect”, whereby offenders believe they are less likely to be apprehended again soon after coming in contact with the police. In New South Wales, no significant deterrent effect was found for higher fines imposed by magistrates (Weatherburn & Moffatt, 2011). However, it is also noted an opposing body of research has demonstrated that sanctions have the capacity to reduce the likelihood of re-offending for a range of offences including speeding (Elvik & Christensen, 2007; Paola, Scoppa & Falcone, 2010), unlicensed driving (Siskind, 1996; Voas, Tippetts & Lange, 1997), and drink driving (Homel, 1988). A clear example of this was the 2003 introduction of a penalty point system for driving offences in Italy that demonstrated a significant reduction in aberrant driving behaviours (Paola et al., 2010). Researchers have further suggested that a critical relationship exists between perceived certainty and severity, as punishment severity only creates a deterrent effect when the perceived likelihood of apprehension is high (Grasmick & Byrjak, 1980; Howe & Loftus, 1996).

The third aspect of Classic Deterrence (e.g., swiftness of sanctions) has received less attention (Babor et al., 2003; Nagin & Pogarsky, 2001). This may be considered surprising given that models of learning and experimental psychology demonstrate that the time between stimulus and response is vital for learning new behaviours (Nagin & Pogarsky, 2001). Nevertheless, it has been suggested that this is because penalties are rarely applied swiftly in the criminal justice system (Babor et al., 2003) and scant research has shown that motorists do not believe penalties are delivered quickly (Fleiter et al., 2010). Taken together, empirical support for the principles of Classic Deterrence has been mixed (Davey & Freeman, 2011). This outcome has been suggested to be dependent upon the fact that the: (a) model is not a comprehensive theoretical explanation of human behaviour and (b) the differences between objective and perceptual punishment are rarely considered (Fleiter, Watson, & Lennon, 2013).

Extending Deterrence Theory: Non-Legal Sanctions

A number of models have stemmed from, or expanded the scope of, Classical Deterrence Theory. The earliest attempt at theoretical expansion commenced with an examination into the deterrent effect that non-legal sanctions have on decisions to commit an offence (e.g., Social Control Theory). This resulted from recognition that penalties are not applied within a social vacuum (Berger & Snortum, 1986; Sherman, 1993). Scientific efforts to understand deterrence processes were most intense during the 1970s (Andenaes, 1974; Gibbs, 1975; Zimring & Hawkins, 1973) and 1980s (Cornish & Clarke, 1986; Homel, 1988; Ross, 1984; Vingilis & Mann, 1985; Williams & Hawkins, 1986). This era produced competing theories that included both legal and non-legal factors, as well as preliminary work into the perceived personal benefits of crime (Katz, 1988). In fact, the literature associated with this period bristles with reviews, theoretical arguments, reconceptualisations and rebuttals (Homel, 1988). A range of social, developmental and environmental factors were proposed in an attempt to understand a range of criminal activities (Davey & Freeman, 2011), which eventually extended beyond purely deterrence-frameworks to include a range of sociological and psychological principles, such as Akers (1977) Social Learning Theory.

Within the road safety arena, this theoretical work culminated in the development of three prominent drink driving models proposed by: Ross (1982), Laurence, Snortum and Zimring (1988) and Homel (1988). The latter Australian-based researcher included three non-legal constructs in the model: (a) social loss (e.g., peer disapproval), (b) physical loss (e.g., injury) and (c) internal loss (e.g., feeling ashamed). However, since their inception, these models have not been extensively utilised to examine traffic offences. Nevertheless, in the wider criminological field, social disapproval or fear of social stigma have shown to produce a significant deterrent effect on a number of illegal acts such as shoplifting, violent offences, etc (Von Hirsch et al., 1999; Paternoster & Iovanni, 1986; Tittle, 1980). In fact, some researchers have reported that the threat of informal sanctions produces a greater deterrent effect than legal sanctions (Tittle, 1980; Laurence et al., 1988). While this may not be the case for recidivist drink drivers (Freeman et al., 2006), the threat of crashing the vehicle as well as hurting another motorist can influence drink driving behaviours among general motorists (Baum, 1999; Freeman & Watson, 2009).

Extending Deterrence Theory: Punishment Avoidance

Another prominent direction of deterrence-based theoretical development (that also continued to consider the effect of social influence) focused on the effect of punishment avoidance. Stafford and Warr (1993) proposed a reconceptualised model of deterrence that incorporates four categories of experiences that have been suggested to affect deterrent process, which are: 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. As such, concepts of punishment and punishment avoidance were proposed to be central to the expansion of deterrence theory, which may prove particularly relevant for road safety research given that it has been estimated the chances of being apprehended for some offences is low (Voas, 1982). Interestingly, this is one of the few theories where the level of theoretical application is perhaps greater within the road safety arena compared to criminology. In regards to criminological research, Paternoster and Piquero (1995) reported that punishment avoidance is negatively associated with perceptions of arrest certainty, and positively associated with illegal drug use in high schools. In regards to road safety, Piquero and Paternoster (1998) re-examined Snortum and Berger's (1989) data of 1,686 general motorists in the United States and reported higher levels of personal experience with punishment avoidance was a predictor of intentions to drink and drive again in the future. Piquero and Pogarsky (2002) reported a similar result in a sample of 250 college students. Vicarious and personal punishment avoidance experiences have also been demonstrated to be most closely associated with drug driving behaviours (Armstrong, Wills & Watson, 2005; Watling, Freeman, Palk & Davey, 2011), although such effects may differ with gender (Watling et al., 2011). Similar findings have been found for speeding (Fleiter & Watson, 2006), unlicensed driving (Watson, 2004) and recidivist drink driving behaviours (Freeman & Watson, 2006). Researchers have also combined this model with Social Learning Theory (Akers, 1977) to further explore the aetiology of offending behaviours (Fleiter et al., 2013), although such a review is beyond the scope of the current paper e.g., includes operant conditioning and vicarious learning.

Expanding Deterrence Theory: Criminology Research

The review of the deterrence literature indicated that criminological research has continued to make theoretical advances in determining the conditions under which sanctions affect compliance, particularly in regards to individual differences. This has included what types of persons are deterred, as well as for whom sanctions either make things worse or are simply irrelevant (Piquero et al., 2011). Table 1 outlines key theoretical developments that have emerged from the

criminological literature. A complete review of the literature is beyond the scope of the current paper, and other purely criminology-based reviews exist (Kennedy, 2009; Piquero et al., 2011; Pratt et al., 2006). Some brief highlights are discussed below.

While road safety researchers often include the effect of informal sanctions within deterrence models (Freeman, 2006; Homel, 1988), criminological research has further extended this concept through social bonding concepts to include *present orientation* and *self-centeredness* (Nagin & Paternoster, 1994). An extension of social bonding is an individual's moral commitment to the law (Piquero et al., 2011), which also has clear links to research on defiance theory (Sherman, 1993). Although this avenue of research focuses more heavily on responses to the application of sanctions (e.g., specific deterrence [Scheff & Retzinger, 1991; Tyler, 1990]). The concept of defiance has also received considerable attention within the broader criminological field, which has indicated that deviance towards regulatory bodies can become a way of life that is a defensible lifestyle and subculture (Braithwaite, 1989). While road safety research has regularly considered the influence of impulsivity, particularly among younger cohorts (Scott-Parker et al., 2013), it has rarely been considered in regards to deterrence nor those who have a tendency to devalue future consequences of behaviour (Nagin & Pogarsky, 2001). In fact, criminological-based research has demonstrated that lower self-control positively correlates with higher perceptions of offending benefits (Piquero & Tibbetts, 1996). Criminological researchers have actually developed a discount rate for expected utility models of deterrence (Nagin & Pogarsky 2001, 2004), which may hold considerable merit if applied to road safety analyses (e.g., benefits of speeding versus risk of being caught). An extension of impulsivity-based research has been directed towards levels of arousal (Zimring & Hawkins, 1973), which has revealed that arousal levels are not mediated by deterrence constructs (Bouffard, 2002). Additionally, levels of anger influence how rational choice factors are interpreted. This has clear implications for a range of driving tasks (not least understanding aggressive violations and hooning behaviours), although such research has yet to be undertaken.

Table 1. Individual Differences-based Research in the Criminological Deterrence Paradigm

Factor	Findings
Social Bonding	<ul style="list-style-type: none"> - Being well bonded to society (e.g., marriage and employment) enhances the impact of sanctions (Sherman & Berk, 1984); - Poor social bonds and ties enhance the effects of sanctions (Sherman, 1993)
Morality and Respect for the Law	<ul style="list-style-type: none"> - Moral commitment to the law restrains offending behaviours (Paternoster & Simpson, 1996); - Disrespect for the sanctioning body can lead to self-righteousness and further offending behaviour (Scheff & Retzinger, 1991); - Increased levels of sanctions and/or incentives are required when moral attachment is low (Etzioni, 1988).
Deviance	<ul style="list-style-type: none"> - Tittle (1995) identified six different categories of nonconformity that vary in levels of deviance and social acceptability; - Deviance becomes a way of life that is a defensible lifestyle and subculture (Braithwaite, 1989); - Those less bonded to society and the norm will align with social and cultural outgroups (Sanson et al., 1996).
Impulsivity and Discounting the Future	<ul style="list-style-type: none"> - Offending is increased among those who devalue future consequences (Wilson & Herrnstein, 1985); - Informal sanctions interact with impulsivity (Nagin & Paternoster, 1994); - Sanction severity diminishes with more presented orientated individuals (Nagin & Pogarsky, 2001).
Emotional and Pharmacological	<ul style="list-style-type: none"> - Individuals may perceive the threat of sanctions differently under different

Arousal	states of emotional arousal (Loewenstein et al., 1997); - Arousal levels are not mediated by deterrence constructs (Bouffard, 2002).
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Unanswered Questions: Directions for Future Research

In addition to the lack of theoretical progression within the road safety arena (outlined above), a number of outstanding questions remain. The most controversial feature of deterrence-based research has been the chronological order of measuring aspects of perceptual deterrence and actual involvement in illegal behaviours (Hommel, 1988), otherwise known as *causal ordering*. That is, the majority of previous research has correlated individuals' *present* perceptions of apprehension and sanction risk with self-reported *past* criminal behaviour (Minor & Harry, 1982; Paternoster, Saltzman, Waldo, & Chiricos, 1982; Saltzman et al., 1982). A limitation of this approach is that the criminal behaviour occurred before the measurement of present perceptions, and thus, these criminal behaviours may be affecting such perceptions, when in fact deterrence theory proposes that perceptions should affect subsequent criminal behaviours. As a result, researchers have argued that deterrence findings have only reported an "experiential" effect, as behaviours ultimately impact upon perceptions rather than perceptions influencing behaviours (Minor & Harry, 1982; Paternoster et al., 1982; Saltzman et al., 1982). Few attempts have been made to accommodate for such conceptual difficulties (Freeman & David, 2005), despite preliminary evidence indicating that perceptions of risk do fluctuate over time (Minor & Harry, 1982; Paternoster et al., 1982; Saltzman et al., 1982).

The lack of theoretical progression is not limited to causal ordering, but rather, a number of unanswered questions remain (briefly summarised below). These include:

- a. The precise circumstances under which sanctions (or the threat of sanctions) influence or change a person's behaviour is still not well known (Davey & Freeman, 2011). In particular, further research is required to determine the conditions under which sanctions affect compliance (Piquero et al., 2011);
- b. The deterrence literature generally lacks research that has examined convicted offenders (particularly repeat offenders), thus skewing scientific knowledge;
- c. The bulk of published deterrence-based studies are from a small number of highly industrialised countries such as Australia, United States and Canada (Davey & Freeman, 2011). It remains unknown how deterrent forces fluctuate across environments and cultures that are rapidly embracing automobile usage;
- d. Questions remain regarding the best method to isolate the degree of change from a single enforcement mechanism as well as determine an individual's knowledge of enforcement mechanisms (DeAngelo & Charness, 2012);
- e. It has yet to be proven the level of rationality associated with decisions to engage in an offending behaviour (or whether they are more impulsive in nature);
- f. It has long been proposed that drivers need to be constantly exposed to deterrence-based messages in order for a strong deterrent effect to be sustained, otherwise the effect is weakened (Hommel, 1988). Despite the widespread use of deterrence-based enforcement approaches, it remains unknown how much exposure to roadside police enforcement techniques (and what type) is required to create a strong deterrent effect e.g., exposure to speeding cameras;
- h. Questions remain how deterrence initiatives can be incorporated within a larger systems-based approach, or integrated within a broader multi-modal approach.

Discussion

This study involved a systematic review of the literature to identify theoretical advancements within deterrence theory both in regards to road safety and the wider criminological domain. The

review indicated that: (a) scientific efforts to understand deterrence processes were most intense during the 1970s and 1980s, (b) the impact of deterrent approaches remains unclear and (c) criminological theorists have continued to expand deterrence knowledge, but this scientific effort is not reflected in the road safety literature. Rather, there has been little consideration of the practical application of deterrence models, not least the relationship between perceived and objective certainty of apprehension. Currently, outstanding questions remain regarding what aspects of deterrence models (e.g., legal and non-legal sanctions) create the strongest deterrent effect and should be the focus of enforcement regimes and associated media campaigns. Arguably of most importance in regards to deterring traffic violations, it remains unknown: (a) what enforcement techniques (and how much) produces the greatest deterrent effect and (b) how these enforcement techniques can be maximised (and combined with other initiatives) to improve road safety. While it may be argued that individual difference-based research is limitless within deterrence theory and the inclusion of too many factors may dilute or confuse the central aim, addressing some of these outstanding questions can only assist in attempts to reduce the personal and social burden of road crashes.

References

- Akers, R. (1977). *Deviant Behaviour: A Social Learning Approach* (2nd Ed). California: Wadsworth Publishing Company.
- Andenaes J. Punishment and deterrence. Ann Arbor: The University of Michigan Press, 1974.
- Armstrong, K., Wills, A., & Watson, B. (2005). Psychosocial influences on drug driving in young Australian drivers. Proceedings of the Australasian Road Safety Research Policing Education Conference, Wellington, New Zealand.
- 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.
- Baum, S. (1999). Self-Reported drink driving and deterrence. *Australian and New Zealand Journal of Criminology*, 32, 247–61.
- Berger D, & Snortum J. (1986) A structural model of drinking and driving: alcohol consumption, social norms, and moral commitments. *Criminology*, 24, 139–53.
- Bouffard, J. (2002). The influence of sexual arousal on rational decision making in sexual aggression. *Journal of Criminal Justice*, 30(2), 121-134.
- Braithwaite, J. (1989). *Crime, Shame and Reintegration*. Cambridge: Cambridge University
- Davey, J., & Freeman, J. (2011). Improving road safety through deterrence-based initiatives : a review of research. *Sultan Qaboos University Medical Journal*, 11(1), pp. 312-320.
- DeAngelo, G., & Charness, G. (2012). Deterrence, expected cost, uncertainty and voting: experimental evidence. *Journal of Risk and Uncertainty*, 44, 73-100.
- Decker S, Wright R, Logie R. (1993). Perceptual deterrence among active residential burglars: a research note. *Criminology*, 3, 135–47.
- Etzioni, A., (1988). *The Moral Dimension: Toward a New Economics*. New York: Free Press.
- Fleiter, J., & Watson, B. (2006). The speed paradox: the misalignment between drivers attitudes and behaviours. *Journal of the Australasian College of Road Safety*, 17(2), 23-30.
- Fleiter, J. J., Watson, B., & Lennon, A. (2013). Effective punishment experiences – a novel approach to conceptualising behavioural punishers and reinforcers in a road safety context. In N. Castro (Ed.), *Psychology of Punishment: New Research* (pp. 1-30): Nova.
- Fleiter, J., Watson, B., Lennon, A., King, M., & Shi, K. (2009). Speeding in Australia and China: a comparison of the influence of legal sanctions and enforcement practices on car drivers. *Australasian Road Safety Research, Policing and Education*, Sydney.

- Freeman, J., Liossis, P., & David, N. (2006). Defiance, deviance and deterrence: an investigation into a group of recidivist drink drivers' self-reported offending behaviours. *Australian and New Zealand Journal of Criminology*, 39(1), 1-20.
- Freeman, J., and Watson, Barry C. (2009) Drink driving deterrents and selfreported offending behaviours in a sample of Queensland motorists. *Journal of Safety Research*, 40(2). pp. 113-120.
- Freeman, J., Liossis, Poppy, Schonfeld, Cynthia C., Sheehan, Mary C., Siskind, Victor, & Watson, Barry C. (2006) The self-reported impact of legal and non-legal sanctions on a group of recidivist drink drivers. *Transportation Research Part F: Traffic Psychology and Behaviour*, 9(1), pp. 53-64.
- Grasmick H, Jacobs D, McCollom CB. (1983) Social class and social control: an application of deterrence theory. *Social Forces*, 62, 359–74.
- Grosvenor D, Toomey TL, & Wagenaar AC. (1999). Deterrence and the adolescent drinking driver. *Journal of Safety Research*, 30, 187–91.
- Harrison W, Newman S, Baldock M, McLean J. (2003). Issues in developing better practice in enforcement targeting drink driving. Draft Contract Report for AustRoads. Melbourne, Australia: Monash University Accident Research Centre.
- Henstridge J, Homel R, Mackay, P (1997). 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.
- Homel J. Policing and punishing the drinking driver. A study of specific and general deterrence. New York: Springer-Verlag, 1988.
- Howe, E., & Loftus, T. (1996). Integration of certainty, severity, and celerity information in judged deterrence value: further evidence and methodological equivalence. *Journal of Applied Social Psychology*, 26, 226-242.
- Katz, J. (1988). *Seductions of Crime*. New York: Basic Books.
- Kennedy, D. (2009). *Deterrence and Crime Prevention*. New York: Routledge.
- Klepper S, Nagin D. (1989). The deterrent effect of perceived certainty and severity of punishment revisited. *Criminology*, 27,721–46.
- Lenton, S., Fetherston, J., & Cercarelli, R. (2010). Recidivist drink drivers' self-reported reasons for driving whilst unlicensed – a qualitative analysis. *Accident Analysis and Prevention*, 42, 637-644.
- Liberati, A., Altman, D., Tetzlaff, J., Mulrow, C., Gotzsche, P., Loannidis, J., Clarke, M., Devereaux, P., Kleijnen, J., & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *Annals of Medicine*, 151, 65-94.
- Loewenstein, G., Nagin, D., & Paternoster, R. (1997). The effect of sexual arousal on expectations of sexual forcefulness. *Journal of Research Crime and Delinquency*, 34, 443-473.
- Mann RE, Vingilis ER, Gavin D, Adlaf E, Anglin L. (1991). Sentence severity and the drinking driver: relationship with traffic safety outcome. *Accident Analysis and Prevention*, 23, 483–91.
- Nagin, D., Paternoster, R. (1994). Personal capital and social control: the deterrence implications of a theory of individual differences in offending. *Criminology*, 32, 581-606.

- Nagin, S, Pogarsky G. (2001). Integrating celerity, impulsivity, and extralegal sanction threats into a model of general deterrence: theory and evidence. *Criminology*, 39, 865–89.
- Paola, M., Scoppa, V., Falcone, M. (2010). The deterrent effects of penalty point system in driving licenses: a regression discontinuity approach. *Empirical Economics*, 1-18.
- Paternoster R, Iovanni L. (1986). The deterrent effect of perceived severity: a reexamination. *Social Forces*, 64, 751–77.
- Paternoster, R., and Piquero, A. (1995). Reconceptualizing deterrence: an empirical test of personal and vicarious experiences. *Journal of Research in Crime and Delinquency*, 32(2): 251-286.
- Paternoster, R., & Simpson, S. (1996). Sanction threats and appeals to morality: testing a rational choice model of corporate crime. *Law and Society Review*, 30(3), 549-583.
- Piquero, A., R., & Paternoster, R. (1998). An application of Stafford and Warr's reconceptualization of deterrence to drinking and driving. *Journal of Research in Crime and Delinquency*, 35, 3-39.
- Piquero, A., R., Pogarsky, G. (2002). Beyond Stafford and Warr's reconceptualization of deterrence: personal and vicarious experiences, impulsivity, and offending behaviour. *Journal of Research in Crime and Delinquency*, 39, 153-186.
- Piquero, A., Paternoster, R., Pogarsky, G., Loughran, T. (2011). Elaborating the individual difference component in deterrence theory. *Annual Review of Law and Social Science*, 7, 335-360.
- Pogarsky, G., & Piquero, A. (2003). Can punishment encourage offending? Investigating the "resetting effect". *Journal of Research in Crime and Delinquency*, 40, 95-120.
- Pratt, T., Cullen, F., Blevins, K., Daigle, L., & Madensen, T. (2006). The empirical status of deterrence theory: a meta-analysis. In F. Cullens, J. Wright & K. Bevins (Eds) *Taking Stock: The Status of Criminological Theory – Advances in Criminological Theory*, 15, 367-395. New Brunswick: Transaction.
- Ross HL. (1982). *Deterring the drinking driver. Legal policy and social control*. Lexington, MA: Lexington Books.
- Sanson, A., Montgomery, B., Gault, U., Gridley, H., & Thomson, D. (1996). Punishment and behaviour change: an Australian psychological society paper. *Australian Psychologist*, 31, 157-165.
- Scheff, T., Retzinger, S. (1991). *Emotions and Violence: Shame and Rage in Destructive Conflicts*. Lexington, MA: Lexington Books.
- Scott-Parker, Bridie, Watson, Barry, King, Mark J., & Hyde, Melissa K. (2013) A further exploration of sensation seeking propensity, reward sensitivity, depression, anxiety, and the risky behaviour of young novice drivers in a structural equation model. *Accident Analysis & Prevention*, 50, pp. 465-471.
- Sherman LW. Defiance, deterrence, and irrelevance: a theory of the criminal sanction (1993). *Journal of Research in Crime and Delinquency*, 30, 445–73.
- Sherman, L., & Berk, R., (1984). The specific deterrent effects of arrest for domestic assault. *American Sociological Review*, 49(1), 261-272.
- Silberman M. Toward a theory of criminal deterrence (1976). *American Sociological Review* 41, 442–61.
- Siskind V. (1996). Does license disqualification reduce reoffence rates? *Accident Analysis and Prevention*, 28, 519–24.

- Stafford MC, & Warr M. (1993). A reconceptualisation of general and specific deterrence. *Journal of Research in Crime and Delinquency*, 30, 123–35.
- Snortum, J., and Berger, D. E. (1989). Drinking-driving compliance in the United States: perceptions and behavior in 1983 and 1986. *Journal of Studies on Alcohol*, 50: 306-3019.
- Teevan J. (1976). Subjective perception of deterrence (continued). *J Res Crime & Delinquency* (13), 155–64.
- Tittle CR. (1980). Evaluating the deterrent effects of criminal sanctions. In: Klein MW, Teilmann KS, Eds. *Handbook of criminal justice evaluation*. Beverly Hills: Sage Publications.
- Voas, R.B. (1982). Drinking and driving: Scandinavian laws, tough penalties and United States alternatives. National Highway Traffic Safety Administration Report No.DOT-HS-806-240. Springfield, Virginia: National Technical Information Center.
- Taxman S, Piquero A (1998). On preventing drunk driving recidivism: an examination of rehabilitation and punishment approaches. *J Crim Justice*, 26, 129–43.
- Tyler, T. (1990). *Why People Obey the Law*. New Haven: Yale University Press.
- Voas RB, Tippetts AS, Lange JE. (1997). Evaluation of a method for reducing unlicensed driving: the Washington and Oregon license plate sticker laws. *Accident Analysis and Prevention*, 29, 627–34.
- Von Hirsch A, Bottoms A, Burney E, Wikstrom P. (1991). *Criminal deterrence and sentence severity: an analysis of recent research*. Oregon: Hart Publishing.
- Watson, B. (2004) *The psychosocial characteristics and on-road behaviour of unlicensed drivers*. PhD thesis, Queensland University of Technology.
- Watson B & Freeman J (2007). Perceptions and experiences of Random Breath Testing in Queensland and the self-reported deterrent impact on drunk driving. *Traffic Injury Prevention*, 7, 11–19.
- Watson, Barry C. & Freeman, James E. (2007) Perceptions and experiences of random breath testing in Queensland and the self-reported deterrent impact on drink-driving. *Traffic Injury Prevention*, 8(1), pp. 11-19.
- Watson B, Hart S, Freeman J, Tay R, Davey J, Madden J, Goff. (2005). *A Review of Random Breath Testing (RBT) in Queensland*. Queensland: Queensland University of Technology.
- Watson, B., Siskind, V., Fleiter, J., & Watson, A. (2010). Different approaches to measuring specific deterrence: some examples from speeding offender management. *Australasian Road Safety Research, Policing and Education*, Canberra.
- Watson B, Hart S, Freeman J, Tay R, Davey J, Madden J, Goff. (2005). *A Review of Random Breath Testing (RBT) in Queensland*. Queensland: Queensland University of Technology.
- Wilson J., Herrnstein, R. (1985). *Crime and Human Nature*. New York: Free Press.
- Weatherburn, D., Moffatt, S. (2011). The specific deterrent effect of higher fines on drink-driving offenders. *British Journal of Criminology*, 51, 789-803.
- Williams, K., & Hawkins, R. (1986). Perceptual research on general deterrence: a critical review. *Law and Society Review*, 20, 545-572.
- Yu, J. (2000). Punishment and alcohol problems recidivism among drinking-driving offenders. *Journal of Criminal Justice*, 28, 261-270.