



Sensitivity to reward and risky driving, risky decision making, and risky health behaviour: A literature review



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ABSTRACT

Young driver road safety has persisted as a global problem for decades, despite copious and diverse intervention. Recently the influence in reward sensitivity, which refers to the individual's personal sensitivity to rewards, has received attention in health-related research, including more generally through decision making in risky circumstances, and in risky driving behaviour specifically. As such, a literature review and synthesis of the literature regarding reward sensitivity in relation to risky driving, risky decision making, and risky health behaviour, with a focus on literature in which adolescents and young adults feature, is timely. Thirty-one papers were identified, and the literature revealed that young drivers with greater reward sensitivity engage in more risky driving behaviours including speeding, crashes and traffic violations; and that individuals with greater reward sensitivity engage in more risky decision making and other risky health-related behaviours (such as drinking and drug use). Adolescents and young adults exhibit heightened sensitivity to rewards in the presence of peers, which has considerable implications for young driver road safety as research consistently demonstrates that carrying peer passengers places all vehicle occupants at greater risk of being involved in a road crash. Consideration of the influence of reward sensitivity in young driver road safety, and other adolescent/young adult health-related safety, appears to be a promising avenue of intervention, with gain-framed messages more likely to be accepted by young drivers with greater reward sensitivity. Future research in jurisdictions other than Australia and Europe will increase our understanding of the influence of reward sensitivity, and exploration of the differential impacts of reward-responsiveness and fun-seeking specifically are warranted.

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1. Introduction

Despite interventions encompassing the three E's of education and training, enforcement, and engineering, young drivers continue to be overrepresented in the road crash fatality and injury statistics. To demonstrate, in Queensland, Australia, young drivers aged 17–24 years comprise 12.6% of the licensed population (Department of Transport & Main Roads (DTMR), 2016); however for the 2016 calendar year, persons aged 17–24 years contributed 17.9% of the fatally-injured road

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users, and 24.7% of the state's fatalities involved a driver aged 17–24 years (Department of Transport & Main Roads (DTMR), 2017). Similarly, in the United Kingdom road deaths account for 0.5% of all deaths, but 25% of deaths among 15–19 year old drivers and their passengers (Box & Wengraf, 2013). Interestingly, in Australia, as in other countries like the United Kingdom, in recent years there has been a notable reduction in the overall road toll (eg. DTMR, 2013). Notwithstanding this, the proportion of fatalities involving young drivers appears to be relatively constant, and indeed the proportion of life-threatening injuries sustained by adolescents and young adults in road crashes is increasing, particularly among males (eg. Berry & Harrison, 2008). As such, there has been considerable interest in identifying factors which contribute directly to, or increase the risk of, road crashes. One particular factor which has received attention is the psychological characteristics of the young driver.

The psychological characteristics of the young driver include relatively unstable states such as anxiety and depression (Marengo, Settanni, & Vidotto, 2012), and relatively stable traits such as sensation seeking propensity and impulsivity (Marengo et al., 2012; Ulleberg, 2001). Of relevance to young driver road safety, and other adolescent and young adult health-related behaviours, is the trait of reward sensitivity. The role of rewards in learning and repeating behaviour is well recognised (Beck, 1990). Rewards are motivating, and can be external (such as gaining 'cool' status within the friendship group, eg. Scott-Parker, Watson, & King 2009; Weston & Hellier, *in press*) or internal (such as 'feeling good' when traversing a corner at high speed, eg. Scott-Parker et al., 2009; or 'enjoying the risk' of drinking and driving, e.g. Greening & Stoppelbein, 2000). In contrast, whilst punishments can also be motivating, they can also be external (such as a traffic infringement, eg. Scott-Parker & Bates, *in preparation*; Freeman et al., 2006) or internal (eg. anxiety experienced in response to risky driving behaviour, eg. Scott-Parker, *in press*; or the negative feeling that they are breaching the trust of their passengers, e.g. Fleiter, Lennon, & Watson, 2010). Behaviours which are perceived to be punishing are less likely to be repeated, whilst behaviours which are perceived to be rewarding – of particular interest for this literature review – are more likely to be repeated.

Whilst the level of risk – and arguable the punishments and the rewards – that individuals accept in any given situation differs substantially from individual to individual, the young driver's sensitivity to reinforcement exerted by rewards and punishments appears to be regulated by the two neurological systems central to reinforcement sensitivity theory (Corr, 2009): the behavioural activation system (BAS) which influences the individual's sensitivity to rewards; whilst conversely the individual's response to punishments – effectively the opposite of a reward – appears to be regulated by their behavioural inhibition system (BIS) of motivation. It is suggested that these two systems mediate an individual's response to any given event in his or her environment (Genovese & Wallace, 2007). That is, differing levels of activity within these two systems are displayed behaviourally as the personality traits of sensitivity to reward and sensitivity to punishment. BIS is responsible for avoidance of an action in response to punishment, frustrative non-reward and novel stimuli. When the BIS is activated inappropriate behaviours are suppressed and response choice becomes more selective (Avila, 2001). In contrast, BAS controls approach behaviour and is activated only by conditioned signals of reward or non-punishment – of particular interest for this literature review. Thus these signals determine approach or active avoidance behaviour (Avila, 2001). An individual with an overactive BIS is likely to display high sensitivity to punishment, and is thus more prone to response inhibition when faced with punishment cues. In contrast, an individual with an underactive BIS will be less likely to be deterred from an action by a punishment cue. Similarly, individuals with an overactive BAS will display high sensitivity to reward and thus have trouble with inhibitory learning due to this strong motivation towards rewards. In contrast, individuals with an underactive BAS are less likely to be affected by temptation of a reward, with them being primarily concerned with predicting and avoiding the aversive consequences experienced as a result of a particular event (Avila, 2001; Avila & Torrubia, 2004).

The concept of reward sensitivity as a factor implicated in young drivers' behaviour is relatively novel in terms of terminology and formal investigation; however rudimentary versions of the notion date further back in time. For example Hagenzieker (1992) surveyed young male drivers and found differing opinions on the efficacy of incentives versus enforcement for promoting seat belt usage. Similarly in a later meta-analytic study Hagenzieker, Bijleveld, and Davidse (1997) evaluated the effect of different incentive programmes, finding that the immediacy of the incentive, and whether the incentive used was based on individual or group behaviour, influenced the magnitude of the reported effect of the programme. These studies illustrate how the use of incentives to encourage safe driving has been investigated by researchers in the past. However it is only relatively recently that reward sensitivity as a factor implicated in the risky driving behaviour of young drivers has started to be investigated in any depth.

The purpose of this paper is to review the literature on (a) the relationship between reward sensitivity and risky driving, (b) the relationship between reward sensitivity and risky decision making, and (c) the relationship between reward sensitivity and risky health behaviours *per se*. In this way promising and heretofore unrealised avenues of effective intervention in young driver road safety, and adolescent and young adult health risk behaviour, may be identified.

2. Method

Search terms including 'reward sensitivity', 'sensitivity to reward', 'risk', 'reward AND behaviour' and other variations (e.g., 'behaviour') were used in database searches of PsychINFO and Science Direct with a (paper and/or online) publication date up to and including 15 September 2014. For the purposes of this review, Avila's (2001) definition of reward sensitivity was used, namely that: reward sensitivity is the behavioural trait of BAS, representing approach behaviour in response to

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