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Reducing young drivers' crash risk: Are we there yet? An ecological systems-based review of the last decade of research

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ABSTRACT

The involvement of young novice drivers in road crashes and violations has remained a significant transport and public health issue worldwide. Despite extensive evidence that multiple individual, social, and environmental factors contribute to risk while driving, crashes among young novice drivers have decreased only marginally. There is a need to define clear indicators of risk as well as develop effective interventions.

The current study reviews the literature on young novice drivers, including empirical studies, systematic reviews, and crash reports published over the past ten years to provide a synthesis of risk and protective factors across multiple domains, from individual characteristics, to social influences, to behavioural and social interventions, to the car and road environment. Adopting an ecological systems perspective, we discuss links between these domains to clarify the strongest indicators of risk for young novice drivers as compared to experienced drivers, and we collate the available evidence on social and environmental factors that can improve young drivers' behaviour so to reduce the rate of their road crashes.

Among the factors discussed, the incomplete maturation of cognitive skills crucial to safe driving (visual scanning, hazard anticipation, handling of in-vehicle distractions) and the higher susceptibility to social influences (especially peers and parents) emerged as the strongest determinants of discrepancies in performance between young novice and experienced drivers. Growing awareness of the complex array of factors intervening synergistically in young drivers' risk, as well as technological advancements have led to the design of interventions with some level of effectiveness, however, further research and more robust programmes adopting ecological and holistic approaches are needed to fully address the young driver problem.

1. Introduction

Although reductions in young novice drivers' crash rates have been reported in the literature, for example in the U.S. (Ferguson, Teoh, & McCartt, 2007), this demographic group continues to be over-represented in car crashes and road fatalities worldwide, especially if male (Al-Aamri, Padmadas, Zhang, & Al-Maniri, 2017; Brown, George, Rickwood, & Frost, 2016; Curry, Pfeiffer, Durbin, & Elliott, 2015; Elvik, 2010; Lee, Simons-Morton, Klauer, Ouimet, & Dingus, 2011; Sheridan, Howell, Mckeown, & Bedford, 2011; Shope & Bingham, 2008; Spoerri, Egger, & Von Elm, 2011; Toroyan & Peden, 2007). Extensive literature has demonstrated that multiple internal and external factors contribute to crash risk for young novice drivers,

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and a number of contributions have attempted to synthesise intervening factors (Bates, Davey, Watson, King, & Armstrong, 2014; Shope & Bingham, 2008). However, many studies have focused on specific determinants of crash risk or prevention rather than exploring synergies between factors, which reflects the difficulty of addressing such a multifaceted topic. Using a more holistic approach, recent publications have adapted ecological perspectives to consider the complex interaction of risk and protective factors associated with crashes or injuries (Buckley, Chapman, & Sheehan, 2014; Scott-Parker, Goode, & Salmon, 2015; Scott-Parker, Goode, Salmon, & Senserrick, 2016). Ecological systems theory was first developed by Bronfenbrenner (1979) and maintains that human development depends on the synergistic interplay of different systems of individual and socio-environmental influences across different systems: (1) the individual and their cognitions, attitudes, and personalities; (2) the micro-system of proximal social and environmental influences; (3) the macro-system of the cultural and geographical context.

Applying ecological systems theory to young drivers' crash risk is useful for a number of reasons. Firstly, it enables to categorise factors of development based on how immediate and direct their impact on the development is (i.e., it distinguishes proximal and distal factors). Secondly, it stimulates to investigate interconnections between factors: Individual circumstances (e.g., experience or attitudes) can affect young drivers' performance in different social or environmental circumstances, but on the other hand, social and environmental factors (e.g., parents, training, or a safe car and road environment) can moderate the effect of individual characteristics on crash risk. Furthermore, applying ecological systems theory to young drivers has the advantage of taking into account developmental circumstances that may influence their risk (Johnson & Jones, 2011). Teenagers and young adults experience considerable physical, mental, and social changes that, together with inexperience behind the wheel, can impact negatively on driving performance (Glendon, 2011; Scott-Parker, 2017). Parts of the brain that are crucial to safe driving, particularly the prefrontal cortex which is involved in attention and decision-making, may not be fully developed up to the age of 25, limiting a young motorist's ability to deal with complex road situations (Glendon, 2011; Romer, Lee, McDonald, & Winston, 2014; Underwood, 2007). Furthermore, brain and emotional development can limit the level of psychosocial maturation and behavioural control displayed by young individuals, making them more prone to unsafe driving behaviours which exacerbate the risk of road crashes. Speeding, drink-driving, distracted driving, not wearing seat belts, and aggressive driving have been indicated as the most common causes of road crashes in young adulthood (Begg, Brookland, & Connor, 2017; Bingham, 2014; Russo, Kay, Savolainen, & Gates, 2014; Sarma, Carey, Kervick, & Bimpeh, 2013; Scott-Parker, Watson, King, & Hyde, 2014a; Weiss, Kaplan, & Prato, 2014; Zhang & Chan, 2016). Because developmental processes can affect driving performance and behaviour, comparing young novice and experienced motorists can help to identify determinants of risk that specifically apply to young novice drivers. However, the development that young adults are undergoing is also more positively associated with mental fluidity, enabling them to improve their driving performance and behaviours if exposed to positive learning and social experiences (Glendon, 2011; Keating & Halpern-Felsher, 2008). Thus, identifying programmes and interventions that have been effective in reducing young drivers' risk across the individual, social, and environmental domains is useful to clarify which factors best enhance the learning process. Ecological perspectives have been proposed in relation to young peoples' risk of injury (Johnson & Jones, 2011) and in terms of specific driving-related issues such as distractibility (Buckley et al., 2014). However, to our knowledge, there are no overviews of recent research on young drivers' crash risk that adopt ecological systems theory. By adopting Bronfenbrenner's model, and building upon previously developed frameworks (Bates et al., 2014; Buckley et al., 2014; Scott-Parker et al., 2015; Shope & Bingham, 2008), the present review provides an overview of the past ten years of evidence on factors of young novice drivers' crash risk as well as, crucially, the links between factors. The key unique contribution of adopting an ecological systems approach is that the many levels of factors, as well as the interactions between factors, can be more clearly understood and examined. There is a wealth of research on young driver crash risk, making it difficult to clearly visualise and structure the many intervening factors, for both researchers in the field and those who may be new to the area (e.g., policy makers, insurance providers). The ecological systems model has proven useful for understanding development and we feel it is well placed to aid our understanding of young driver crash risk.

The aim of this review is to: (1) Identify the most important indicators of crash risk in young novice drivers as compared to experienced drivers, considering individual, social, and environmental circumstances; (2) Highlight the most effective preventive factors for young drivers; (3) Note gaps in current knowledge that will need to be addressed in future research.

2. Search method

The review aimed to synthesise the evidence on risk and protective factors of young drivers' crashes published after a previous contribution (Shope & Bingham, 2008) that provided a comprehensive account intervening factors. For this reason, our search focused on papers published between 2007 and 2017, and for which the full-text was available in English language. The search included empirical studies (qualitative and quantitative), systematic reviews, meta-analyses, doctoral dissertations, and government or police records on crashes. Searches were conducted on PubMed and PsycInfo. Search words included ("young driver" OR "novice driver") AND ("risky driving" OR "crash*" OR "accident*") AND ("age" OT "experience*") present in the title or abstract. Specific driving-related journals (Transportation Research Part F: Psychology and Behaviour; Accident Analysis and Prevention; Traffic Injury Prevention) were also hand-searched for the period 2007–2017. Google scholar was hand searched for government or police records. The search took place between June and November 2017. A total of 370 abstracts were screened by both authors for inclusion, with 98 titles being removed as duplicates.