Accident Analysis and Prevention 82 (2015) 213–219

Contents lists available at ScienceDirect

Accident Analysis and Prevention

journal homepage: www.elsevier.com/locate/aap

Can a video-based hazard perception test used for driver licensing predict crash involvement?

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ARTICLE INFO

Article history:
Received 17 December 2014
Received in revised form 19 May 2015
Accepted 28 May 2015
Available online xxx

Keywords:
Hazard anticipation
Situation awareness
Driving
Road traffic accidents

ABSTRACT

In 2008, the state of Queensland in Australia introduced a video-based hazard perception test as part of the licensing process for new drivers. A key validity check for such a test is whether scores are associated with crash involvement. We present data demonstrating that drivers who failed the hazard perception test (based on a ROC curve-derived pass mark) were 25% [95% confidence interval (CI) 6%, 48%] more likely to be involved in an active crash (defined as a crash occurring while the driver's vehicle was moving but they were not engaged in parking or reversing) during a one year period following the test (controlling for driving exposure, age, and sex). Failing drivers were also 17% (95% CI 6%, 29%) more likely to have been involved in active crashes prior to the test, in the period since obtaining their provisional license. These data support the proposal that the hazard perception test is a valid measure of crash-related driving performance.

1. Introduction

Computer-based hazard perception tests for drivers, which are designed to measure the ability to anticipate dangerous traffic situations, are widely used for both research and driver licensing purposes on the premise that they are measuring a competency that is predictive of a driver's crash risk (Horswill and McKenna, 2004). To support this assumption, researchers typically refer to significant empirical associations between crash involvement and hazard perception test scores (Horswill et al., 2010). However, nearly all of the studies demonstrating such a link are retrospective: that is, drivers complete a hazard perception test and report their crashes in the years leading up to taking the test (Pelz and Krupat 1974; Transport and Road Research Laboratory, 1979; Quimby et al., 1986; McKenna and Horswill, 1999; Darby et al., 2009; Horswill et al., 2010; Boufous et al., 2011; Cheng et al., 2011). The problem with this approach is that one cannot rule out the possibility that experiencing a crash resulted in changes to the individual's hazard perception ability (rather than hazard perception ability influencing an individual's crash involvement). One solution to this problem is to conduct a prospective study, in which drivers' hazard perception test scores are compared with their crash involvement in the time period following the test. If a significant relationship is found (i.e., hazard perception scores predict crash involvement) then it is harder to argue that the reported crash involvement is determining the hazard perception score. This provides more persuasive support for the crash-predicting properties of the test (while acknowledging that causal associations can never be definitively verified using correlational data, even if prospective, as there may be some unmeasured mediating variable). Establishing the predictive validity of computer-based hazard perception tests is crucial given that the outcomes of such tests affect hundreds of thousands of drivers when they are implemented as part of driver licensing systems.

To our knowledge, there have only been two studies to date that report prospective crash data in relation to hazard perception tests and neither of these were published in the peer-reviewed literature (Congdon, 1999; Wells et al., 2008). Wells et al. (2008) reported a significant association between scores on the hazard perception test used for driver licensing in the UK and "non-low-speed" self-reported crashes in the following year (initial sample $n = 42{,}851$; 1 year follow up sample, $n = 7450$). Congdon (1999) reports significant associations between an early version of the hazard perception test used in the state of Victoria, Australia, and certain types of police-reported crashes ($n = 99{,}326$). That is, these hazard perception tests do appear to have some predictive value but only for certain categories of crash. This seems reasonable given that we would not necessarily expect hazard perception skill to be a key factor in every type of crash (e.g., crashes in which a driver is hit from behind while stationary). However, it is not a foregone conclusion that, simply because predictive relationships have been demonstrated in these two situations, we would

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http://dx.doi.org/10.1016/j.aap.2015.05.019
0001-4575/

therefore expect such relationships to exist for all hazard perception tests. In fact, there appears to be considerable variation in the predictive properties of different tests. For instance, while some hazard perception tests have been able to distinguish between novice and experienced drivers (Quimby and Watts, 1981; Wallis and Horswill, 2007; Horswill et al., 2008; Borowsky et al., 2009, 2010; Smith et al., 2009; Wetton et al., 2010; Scialfa et al., 2011; Wetton et al., 2011), others have not (Chapman and Underwood, 1998; Crundall et al., 2003; Sagberg and Bjornskau, 2006). Various reasons have been proposed to account for these differences, mainly involving differences in test content (Wetton et al., 2011; Crundall et al., 2012) and this has generated some debate as to how hazard perception tests ought to be constructed (e.g., Wetton et al., 2011).

In the present study, we will be examining the Queensland Transport hazard perception test, which is currently being used for driver licensing in the state of Queensland, Australia (Wetton et al., 2011). While this test has similarities to computer-based hazard perception tests used for driver licensing in other jurisdictions (e.g., the UK and some other Australian states), it also has some key differences (see below). This means that it is particularly important to establish the validity of this test as a predictor of crash risk.

In contrast to the early VicRoads test described in Congdon's (1999) predictive crash study, the Queensland Transport hazard perception test has much higher internal consistency (α between .73 and .81, Wetton et al., 2011), which one would expect to have a knock-on effect on validity estimates. It also measures a more specific construct, namely drivers' ability to predict potential traffic conflicts (i.e., situations where they will have to slow down or change course to avoid a collision). The early VicRoads test included additional elements, such as gap acceptance propensity, which some have argued is more likely to be about risk-taking than hazard perception skill (Wetton et al., 2011), meaning that the test measures more than one underlying construct, which might partially account for its poor internal consistency. Also, it could be argued that if gap acceptance is a measure of risk-taking then it might be more prone to task demand effects in a driver licensing situation (that is, risk-seeking drivers can choose to present themselves as risk averse but skill-deficit drivers might struggle to present themselves as being skilled at detecting hazards). This may also have implications for test consistency.

In contrast to the UK hazard perception test reported by Wells et al. (2008), the Queensland Transport hazard perception test requires a location and time-based response, where participants must identify a particular road user on the screen (in the UK Hazard Perception Test, respondents only have to indicate when they have detected a hazard but not its location on the screen). The use of location-based responding has been argued (Wetton et al., 2011) to

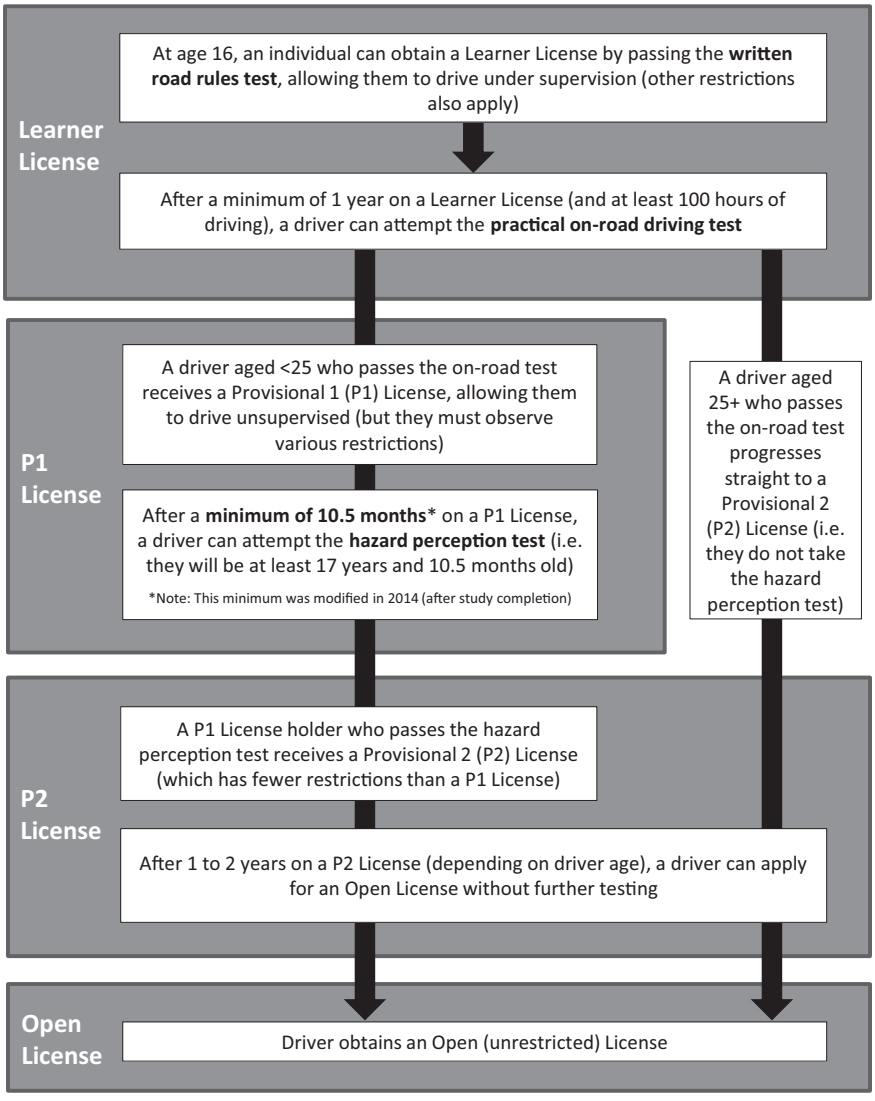

Fig. 1. Overview of the Queensland Government's Graduated Licensing System.