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The overall program effects of California's 3-Tier Assessment System pilot on crashes and mobility among senior drivers ☆,☆☆,★

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ABSTRACT

Introduction: In 2007, the California Department of Motor Vehicles (DMV) undertook a pilot study of the 3-Tier Assessment System, the purpose of which was to examine, in a large-scale real-time public agency setting, the effectiveness of this method for both reducing the crash risk of individual drivers and for extending the safe driving years of Californian drivers of all ages. *Method:* The 3-Tier Assessment System consisted of tiered series of screening tools incorporated into the in-office driver's license renewal process. These screening tools identified drivers with various kinds of functional limitations (physical, visual, and cognitive/perceptual), that might impact safe driving. Paired with the screening tools were educational materials designed to improve drivers' knowledge of their own limitations, including compensating techniques. The present study is a population-based evaluation of the effects of the pilot on subsequent crash risk and mobility outcomes (including delicensure) of participating drivers age 70 and older. Pilot participants were compared with two control groups processed according to standard California DMV license renewal procedures. Because the 3-Tier Assessment System was designed to identify limitations normally associated with aging, the present analyses focus on drivers age 70 and older. However, it should be emphasized that during the 3-Tier pilot the screening tools were applied to drivers of all ages. *Results:* There were two main findings. First, there were no consistent, statistically significant differences between the pilot and control groups in crash risk in the two years following screening. Second, pilot participants experienced statistically significant effects on mobility. These effects included delays in time to complete their license renewal, an increase in the number of assigned license restrictions, and an increase in the number of customers failing to renew their driving privilege. *Conclusions:* Based on these findings, suggestions for further research are made. *Impact on industry:* None.

1. Introduction

1.1. Statement of the problem

The driving population of California, and of the United States as a whole, is shifting. Over the next 20 years, the number of seniors (those age 65 or older) in California is expected to increase by approximately 100%, while their share of the population will rise from just over 11% to almost 18% (State of California Department of Finance, 2007). This shift will likely involve a substantial increase in the number of older road users of all types, including an increase in their share of California's driving population. This expected shift in the age demographics of California's driving population has a number of implications in different areas of traffic safety. For licensing authorities such as California DMV, some of these implications include identifying methods for providing for the safety of all road users, while at the same time providing drivers with appropriate opportunities to manage their own individual mobility.

As part of a long-standing stream of research at California DMV on the subjects of medically at-risk drivers (Janke, 1994; Janke & Eberhard, 1998) and driving-relevant functional limitations (Hennessy, 1995; Hennessy & Janke, 2005, 2009; Janke, 2001), the department undertook in 2006–2007 a pilot study of the 3-Tier Assessment System. On the basis of this research, as well as the findings of scholars outside California DMV, the 3-Tier Assessment System was shaped according to three directives: (a) that screening for driving-relevant limitations to functionality should apply to drivers across the age spectrum (rather than only being applied at a given age cutoff); (b) that screening should incorporate tests across a range of domains, including vision, cognition/

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perception, and physical function; and (c) that screening must be accompanied by educational and/or therapeutic components, so that drivers may take advantage of opportunities to improve their skills, compensate for identified limitations, or access professional services, all so that individuals may retain the driving privilege as long as they may safely do so.

1.2. Description of the 3-Tier Assessment System

The 3-Tier Assessment System consisted of a series of screening tools and educational materials, applied to drivers of any age, who were applying in person at a DMV field office for the renewal of their non-commercial driver's license. The screening tools were chosen on the basis of their demonstrated utility in prior studies (Hennessy & Janke, 2009) for identifying customers in need of further assessment of the safety of their driving. The educational materials were designed for those customers who had been screened as possessing some functional limitation, and were intended to inform them of the nature of the identified limitation as well as potential methods for safely compensating for that limitation when driving. The educational materials also included information regarding the on-road drive test, and how customers might prepare for their examination. During the pilot, these educational materials proved quite popular, and likely served to demonstrate for customers a degree of face validity for the pilot (see Camp, 2010a).

The 3-Tier Assessment System was designed as a series of tiered screening tools for the identification of customers at risk of crashing due to some impairment in one or more functional domains. The design of 3-Tier was predicated on the notion that, in many cases, individuals can potentially compensate for identified limitations, given proper education about tools and techniques for safe driving. At Tier 1 the screening tools were relatively simple and brief, covering the functional domains of cognition/perception, physical function, and vision. There were four component screening tools: a simple memory recall task, a checklist for the observation of specific physical limitations (both upper- and lower-body) that might affect driving, and two vision screens. The vision screens measured distance acuity (using California DMV's current Snellen standard) and contrast sensitivity (using the Pelli–Robson chart). These tests were applied to all customers (regardless of age) who were enrolled in the 3-Tier pilot through the license renewal process ("renewal" customers).

The second and third tiers incorporated more complex screening tools, paired with educational materials about techniques of safe driving. At Tier 2, the screening tools included California's standard 18-question written test of the law and rules of the road (for renewal customers)[1] and the Perceptual Response Test (PRT), one of the sub-tests of the Useful Field of View (UFOV) battery. All renewal customers took the written test; only those customers who failed one or more Tier 1 tests (or who failed the written test twice) were required to take the PRT. At Tier 3, the screening tools included California DMV's Supplemental Driving Performance Evaluation (SDPE), the standard road-test given to many drivers referred to the Driver Safety Branch by a medical professional or law enforcement official. In some rare cases, customers took an Area Driving Performance Evaluation (ADPE), a road test associated with the assignment of area/route restrictions on the driving privilege. It was also at Tier 3 that educational materials were distributed to customers regarding their specific limitations, and how to prepare for their on-road drive test (the SDPE or ADPE). Only those customers identified at Tier 1 or Tier 2 with serious and/or multiple driving-relevant limitations were required to take an on-road drive test. A small group of additional study subjects were enrolled in the 3-Tier pilot as a result of a referral to California DMV's Driver Safety Branch ("referral" customers); these participants were not necessarily given the Tier 1 or Tier 2 screening tests; instead, data regarding their drive test results (Tier 3) were retained.

The 3-Tier Assessment System was deliberately designed as an integrated whole, with each component screening test contributing to an overall score — "Pass," "somewhat functionally limited" (or SFail, for short), and "extremely functionally limited" (or XFail). Customers with no identified limitations on any screening test were categorized as "Pass." Customers identified as failing a single screening test were generally categorized as "SFail." Customers identified as failing multiple screening tests, or failing a single test multiple times, were categorized as "XFail." Only those customers identified as "XFail" were required to take an on-road drive test. All customers identified as "XFail" were given educational materials regarding their limitations; some customers identified as "SFail" (especially those who failed the contrast sensitivity screening) were also given educational materials. For more details on the choice of component screening tests, the development of the scoring cut-points, and the screening test combinations that led to the overall designations of "Pass," "SFail," and "XFail," see Hennessy and Janke (2009). For details on how these categories were used in the actual pilot, see Camp (2010a, 2010b, 2011).

A critical component of the 3-Tier Assessment System involved the distribution of educational materials designed (a) to prepare participants for an on-road test of driving skill, and (b) to familiarize participants with driving methods that can help to compensate for limitations associated with contrast sensitivity or perceptual speed. As noted in a prior publication (Camp, 2010b), it was originally intended that these educational materials be distributed according to a randomizing protocol, so that their effectiveness at improving safety outcomes might be measured with some statistical precision. In the actual pilot, these materials turned out to be somewhat popular with participating customers, and so were distributed quite freely. Therefore, no descriptive statistics are calculable regarding who received these materials, and who did not. For the same reason, no post facto determination can be made as to their effectiveness for improving the safe driving of those who received them.

2. Materials and methods

2.1. Data collection

The pilot was conducted in six California DMV field offices from June through October of 2007. For a variety of reasons, it was determined to be operationally infeasible to assign customers randomly to experimental and control groups (for further details, see Camp, 2010b). Therefore, a quasi-experimental design was adopted, whereby the main group of interest (the Pilot cohort) consisted of customers required to renew their Class C (non-commercial) license in person in a DMV field office and to take the written renewal test when doing so, who possessed no additional licenses (e.g., for driving commercial vehicles or motorcycles) or additional certificates or endorsements (e.g., for driving an ambulance or housecar). For reasons of operational feasibility, the pilot was limited to those customers who chose to take the written renewal test in the English language. These criteria included all drivers age 70 and older; such drivers are, according to current DMV policy, ineligible for renewal-by-mail, and so must renew their license in person and take the written renewal test when doing so. These criteria also included some drivers younger than age 70 who, because of recent at-fault accidents or the accumulation of recent traffic violations, were also ineligible for renewal-by-mail. In addition to these license renewal customers, an additional group of drivers was identified ("referrals") who had been referred to DMV's Driver Safety Branch (typically by a medical or law

[1] In California, novice drivers and original applicants take a 36-question written test, usually administered on a two-sided test form. Renewal customers take only one side of the test, and thus are only graded on their performance on 18 questions.