Comparison of older and younger novice driver crash rates: Informing the need for extended Graduated Driver Licensing restrictions

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ABSTRACT

Background: Few previous studies have directly compared crash rates of older and younger novice drivers. To inform discussion about whether Graduated Driver Licensing (GDL) policies that are applied in the US for younger novice drivers should be applied to older novice drivers, we conducted a longitudinal study to examine overall, nighttime, and multiple passenger crash rates over the initial four years of licensure differ for novice drivers licensed at different ages.

Methods: Using data from the New Jersey Traffic Safety Outcomes (NJ-TSO) data warehouse, we selected all NJ drivers who obtained their initial intermediate driver's license from 2006 through 2014 and had at least one month of follow-up from the date of licensure to study end or death (n = 1,034,835). Novice drivers were grouped based on age at licensure: age 17; 18–20; 21–24; and 25 or older. We estimated monthly rates for overall crashes (per 10,000 licensed drivers) as well as: late night crashes (11:01 p.m.–4:59 a.m.); early night crashes (9:00 p.m.–11:00 p.m.); and multiple passenger crashes (two or more passengers). Average monthly rates were calculated for specific relevant time periods and Poisson regression models were used to compare rates: (1) between novice driver groups with the same time since licensure; (2) over the first 48 months of licensure within each novice driver group; and (3) between same-aged 21-year-old drivers with varying lengths of licensure.

Results: Although initial (three months post-licensure) overall crash rates of novice NJ drivers age 21 and older were higher than rates of same-aged experienced drivers, they were substantially lower than initial rates for 17- to 20-year-old novice drivers, who are licensed under GDL policies. Moreover, older novice drivers experience much less steep crash reductions over the first year of licensure than younger novice drivers. Nighttime crash rates among the 21- to 24-year old and aged 25 and older novice driver groups were stable over the first year of licensure. For novice drivers under age 21, early night crash rates declined rapidly over the course of licensure, while changes in late night crashes were much smaller. First-year multiple passenger crash rates were highest for drivers licensed at age 18–20, and novice driver groups experienced varying amounts of reduction in multiple passenger crashes over time.

Conclusions: Study findings support NJ's current GDL policies for 17- to 20-year-old novice drivers and the potential for added benefits from beginning the nighttime restriction at 9:00 p.m. Conversely, there was a lack of compelling evidence for additional policies for drivers licensed at age 21–24 and no evidence to indicate a need for additional GDL policies for NJ novices aged 25 years and older.

1. Introduction

Most countries with Graduated Driver Licensing (GDL) systems include either a subset of or all drivers who first get licensed at age 18 or older. However, only six US states (Connecticut, Indiana, Maine, Maryland, Minnesota, and New Jersey) and the District of Columbia currently extend some GDL restrictions to these drivers. Only New Jersey, Indiana, and DC apply full GDL rules—including passenger and nighttime restrictions—to all newly licensed 18- to 20-year-old drivers. In addition, newly licensed NJ drivers aged 21 or older have a minimum three-month learner permit period and one-year intermediate license period. Given that GDL was originally designed to primarily

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target the issue of driver inexperience—and not necessarily age—there is some discussion in the traffic safety community as to whether standard US GDL policies that are applied for younger novice drivers should be extended to newly licensed drivers aged 18 and older.

This discussion is timely, as recent studies have indicated that many drivers are getting licensed at older ages and further that the characteristics of those who do get licensed at older ages are different from those licensed earlier in ways that may affect crash risk (Tefft et al., 2013; Curry et al., 2015a; Shults et al., 2016). National surveys conducted by the Centers for Disease Control and Prevention and the AAA Foundation for Traffic Safety as well as an analysis of NJ's statewide licensing database all indicate that a substantial proportion of teens (i.e., one in three) now get licensed at age 18 or older (Tefft et al., 2013; Curry et al., 2015a; Shults et al., 2016), patterns that have largely emerged in the wake of the recent recession (Shults and Williams, 2013). Further, all three studies reported that later licensure occurs disproportionately higher among lower-income and minority teens. These findings have raised concern that teens in lower-income households in the US are licensed without the benefits of GDL.

Central to this discussion is an understanding of the extent to which US GDL systems—if applied to older novice drivers—might reduce the burden of crashes among these drivers. Ideally, this should include examination of how crash rates of older novice drivers compare with younger novice drivers, how crash rates of older novice drivers change over time, and how crash rates of older novice drivers compare with same-aged drivers with more driving experience (Curry et al., 2017a). However, the current body of literature that directly addresses these questions is limited to a handful of studies (McCartt et al., 2009; Vlakveld, 2004; Chapman et al., 2014; Curry et al., 2015b). These include a study of self-reported crashes in Europe, a study of older novices of various ages in California, and a study focused on 17- to 20-year old novices in New Jersey. Collectively, these studies found high initial crash rates that declined over the first year of driving for newly licensed drivers; rates of reduction varied based on drivers' age at licensure. This suggests that the first year of unsupervised driving may be a learning period for all novices, although much less is known about crash trajectories of novice drivers aged 21 and older.

The goal of this study is to evaluate whether there is epidemiologic evidence to support—from a crash reduction perspective—adoption of passenger and nighttime restrictions. To this end, we conducted a longitudinal study to examine how overall, nighttime, and passenger crashes differ for novice drivers licensed at different ages over the initial few years of licensure. Given that 18- to 20-year-old novice drivers in NJ are already covered under NJ's GDL system, this study will be unique in its ability to address the existing benefit of current restrictions among these drivers. Examination among novice drivers age 21 and older will address whether there could be a benefit from implementing these restrictions among these drivers.

2. Methods

2.1. New Jersey GDL system

The NJ GDL system, which was implemented in 2001, requires all new drivers (i.e., those who have never held a full license in any jurisdiction) to progress through three licensing stages. Drivers can obtain a *learner's permit* at a minimum age of 16 with a six-month minimum holding period during which the new driver must be accompanied by an adult supervising driver. Notably, those who initiate GDL at age 21 or older have a three-month holding period. Drivers can obtain an *intermediate license* at a minimum age of 17 with a one-year minimum holding period and several restrictions, including a one-passenger limit unless a parent/guardian is in the vehicle and a ban on driving from 11:01 p.m. through 4:59 a.m. Those who initiate the licensing process at age 21 or older also have a minimum one-year intermediate period but are not subject to these restrictions. Drivers must visit a NJ Motor

Vehicle Commission location to obtain an *unrestricted (full) license*. Note that drivers age 18 and older who have a full license in another jurisdiction and move to NJ are issued a full license. Details regarding NJ's GDL policy are available elsewhere (State of New Jersey Motor Vehicle Commission, 2016).

2.2. Data source and study population

The data source for this study is the New Jersey Traffic Safety Outcomes (NJ-TSO) Program data warehouse, which linked data from two administrative sources—the NJ Motor Vehicle Commission's Licensing Database and the NJ Department of Transportation's Crash Database. Details on the linkage and data management processes are available elsewhere (Curry et al., 2015a, 2015b). Briefly, we linked these two databases via a five-step hierarchical deterministic linkage, and in total 98% of crash-involved NJ drivers matched to a unique licensing record. Thus, the resulting data warehouse includes for virtually every NJ driver (n ≈ 10 million): (1) a rich description of their progression through the licensing process through December 2014; and (2) detailed, in-depth data for all police-reported crashes occurring in NJ from January 2006 through December 2014.

We constructed an analytic dataset of NJ drivers who obtained their initial intermediate driver's license from January 2006 through December 2014. In order to further ensure that we selected only true novice NJ drivers—and not those who migrated from another jurisdiction—we also: (1) limited the study only to intermediate drivers who also obtained a learner's permit in NJ (n = 1,120,030); and (2) excluded drivers whose date of intermediate license was listed to be the same day or prior to the date of their learner's permit (n = 2445, 0.2%) or was 24 months or more after their permit date (n = 73,257, 6.5%). Finally, we excluded 9493 (0.9%) drivers with less than one month of follow-up from their date of licensure to the end of the study period (12/31/2014) or death, whichever came first. The final analytic dataset for this study includes a fixed cohort of 1,034,835 novice drivers who obtained an intermediate license in NJ during the nine-year study period. Exact age at licensure and sex were ascertained from the licensing record, and each driver's age at each crash was derived from exact dates on the licensing and crash reports.

We defined licensing age cohorts—hereafter referred to as "novice driver groups"—as follows: (1) *licensed at age 17*—the majority of US GDL systems cover this age group; (2) *licensed at age 18–20*—this group is subject to full GDL restrictions in NJ but not in other US states; (3) *licensed at age 21–24*—this group is not covered by US GDL systems but is covered under GDL in international jurisdictions; and (4) *licensed at age 25 or older*—this group is not covered by US GDL systems but is covered under GDL in some international jurisdictions. The study's selection procedure and novice driver groups are summarized in Fig. 1.

2.3. Main outcome measures

The primary outcome was the monthly rate of police-reported crashes per 10,000 drivers. A crash is reportable in NJ if it results in an injury or over $500 in damage to any person's property. To calculate monthly overall crash rates for each age cohort, we determined for each month after intermediate licensure: (1) the number of drivers with a valid driver's license (denominator); and (2) the number of police-reported crashes that occurred among those drivers with a valid driver's license (numerator). If a driver crashed more than once in a given month (a rare occurrence), both crashes were included in the numerator. Notably, out-of-state emigrations that might have occurred prior to license expiration were not reliably recorded in the NJ licensing database and thus could not be taken into account.

We also examined monthly crash rates for several specific types of crashes. *Late night crashes* were defined as crashes that occurred from 11:01 p.m. through 4:59 a.m., the restricted period in NJ. In order to be able to speak to the time period that is currently not covered by NJ's