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Statistical implications of using moving violations to determine crash responsibility in young driver crashes

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ABSTRACT

Traditional methods for determining crash responsibility – most commonly moving violation citations – may not accurately characterize at-fault status among crash-involved drivers given that: (1) issuance may vary by factors that are independent of fault (e.g., driver age, gender), and (2) these methods do not capture driver behaviors that are not illegal but still indicative of fault. We examined the statistical implications of using moving violations to determine crash responsibility in young driver crashes by comparing it with a method based on crash-contributing driver actions. We selected all drivers in police-reported passenger-vehicle crashes (2010–2011) that involved a New Jersey driver <21 years old (79,485 drivers < age 21, 61,355 drivers ≥ age 21). For each driver, crash responsibility was determined from the crash report using two alternative methods: (1) issuance of a moving violation citation; and (2) presence of a driver action (e.g., failure to yield, inattention). Overall, 18% of crash-involved drivers were issued a moving violation while 50% had a driver action. Only 32.2% of drivers with a driver action were cited for a moving violation. Further, the likelihood of being cited given the presence of a driver action was higher among certain driver subgroups—younger drivers, male drivers, and drivers in single-vehicle and more severe crashes. Specifically among young drivers, those driving at night, carrying peer passengers, and having a suspended or no license were more often cited. Conversely, fatally-injured drivers were almost never cited. We also demonstrated that using citation data may lead to statistical bias in the characterization of at-fault drivers and of quasi-induced exposure measures. Studies seeking to accurately determine crash responsibility should thoughtfully consider the potential sources of bias that may result from using legal culpability methods. For many studies, determining driver responsibility via the identification of driver actions may yield more accurate characterizations of at-fault drivers.

1. Introduction

Determining crash responsibility is instrumental to understanding how driver behavior contributes to motor vehicle crash risk and for identifying high-risk driver subgroups. This is particularly relevant in the context of young drivers, as characterizing crash-contributing driver behaviors helps to target and improve interventions, policy, and other efforts to reduce the teen driver crash burden. Accurate determination of responsibility among crash-involved drivers is at the foundation for the selection and analyses of at-fault drivers. It is also a critical component of quasi-induced exposure methods. Studies utilizing this method commonly use non-responsible drivers in two-vehicle crashes to estimate relative driving exposure among subgroups in the absence of more detailed information (e.g., vehicle miles traveled), thus allowing estimates of relative crash involvement to be adjusted for driving exposure (Stamatiadis and Deacon, 1997).

Traditionally, researchers analyzing large population-level crash databases have determined crash responsibility (also referred to as "crash culpability" or "fault") based on legal culpability—that is the issuance of a citation or, more commonly, the issuance of a citation for a moving violation (DeYoung et al., 1997; Waller

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et al., 2001; Rice et al., 2003; Lardelli-Claret et al., 2011). However, such methods may not accurately characterize at-fault status among crash-involved drivers for several reasons. First, citation issuance may vary by driver characteristics that are independent of actual fault—for example, age, gender, license status, or injury status (DeYoung et al., 1997). Indeed, a recent study of Michigan crashes reported that citation issuance was associated with several factors, including the involvement of drugs and alcohol, driver gender and age, and injury severity (Jiang et al., 2012). Second, these methods likely do not capture the full range of crash-contributing driver behaviors given that drivers may operate their vehicles in ways that are not illegal but are still indicative of fault (af Wåhlberg and Dorn, 2007; Brubacher et al., 2012). For example, a substantial number of young driver crashes are attributed to teens' inattention and inadequate surveillance, behaviors that may not directly correspond to specific motor vehicle statutes (Curry et al., 2011; National Highway Traffic Safety Administration, 2013). As af Wåhlberg and Dorn (2007) observed, most previous studies using crash responsibility methods do not fully detail their methods nor do they consider how alternative criteria may affect results.

Several researchers have endorsed using the presence of a hazardous or crash-contributing driver action rather than moving violations to determine crash responsibility (af Wåhlberg and Dorn, 2007; Jiang and Lyles, 2010). If recorded, this information would be readily available on the police crash report. While the exact definition and values of driver action data field(s) may vary among jurisdictions' crash reports, in general these data may provide important information on crash contribution not adequately captured by citation data—providing a likely more valid method for determining crash responsibility in large population-level datasets. The overall objective of this study was to examine the statistical implications of using moving violation data to determine crash responsibility by comparing it with a method based on the presence of a driver action. Given our particular interest in young drivers, we focused our analysis on police-reported crashes that occurred in New Jersey (NJ) over a two-year period (2010–2011) involving NJ drivers under 21 years of age. Specifically, we aimed to: (1) assess the validity of using moving violations to determine whether a driver was responsible for his/her crash by comparing it with a method based on driver actions; (2) identify subgroups of drivers that may be over- or under-represented in samples of at-fault drivers when determination is based on moving violation data; and (3) evaluate the use of moving violations on quasi-induced exposure estimates of relative driving exposure (using non-responsible drivers) and relative crash involvement for age- and gender-specific subgroups.

2. Material and methods

2.1. Study design

This analysis was part of a larger study examining crash- and citation-related outcomes among NJ teen drivers. A detailed description of study data is available elsewhere (Curry et al., 2013). Briefly, we conducted a hierarchical deterministic linkage to link the crash records of all NJ drivers involved in a NJ police-reported crash from January 1, 2010 through December 31, 2011 to their corresponding records in the NJ licensing database. Over 98% of crash-involved NJ drivers matched to a unique record in the licensing database. We then ascertained the license status of each NJ driver on the date of their crash (i.e., learner's permit, intermediate or restricted license, full unrestricted license, suspended/unlicensed) using data on the start dates of the learner's permit and intermediate license, license transactions (to ascertain the date of full licensure), and dates of license suspension, restoration, and death (if applicable). For this analysis, we selected all police-reported crashes that involved a NJ driver under 21 years old and included all drivers (regardless of age) involved in those crashes. Hit-and-run crashes were excluded, as were crashes involving a pedestrian, pedalcyclist, or vehicle other than a passenger vehicle (e.g., bus, truck, motorcycle) (Jiang and Lyles, 2010).

2.2. Variable definitions

Crash responsibility was determined for each driver using two alternative methods. For the first, drivers were determined to be responsible if issued a citation for one or more NJ moving violations by the responding police officer; we henceforth refer to this as the moving violation method. Citations for offenses that were not moving violations – such as unlicensed driving, no insurance or registration, and seat belt non-use – as well as citations for leaving the scene of an accident (New Jersey Statutes Annotated [NJSA] 39:4-129) were not included as they are not intended to indicate fault. The officer noted moving violations issued to each crash-involved driver in a qualitative field on the police crash report. We confirmed the complete list of NJ moving violations with a NJ law enforcement official, and systematically coded entries in this field to ascertain the specific statute(s) each driver violated, if applicable. For the second method, a driver was determined to be responsible if noted to have committed one or more driver actions that contributed to the crash; we henceforth refer to this as the driver action method. New Jersey's *Police Guide for Preparing Reports of Motor Vehicle Crashes* instructs the officer to determine the most prominent proximate factors (at least one per crash and up to two per driver) that contributed to the crash, regardless of whether a citation was issued (Rutgers University Police Technical Assistance Program, 2009). Possible factors include driver actions, vehicle factors, and road/environmental factors. There are 14 specific driver actions listed on the NJ crash report – including unsafe speed, failure to obey traffic control device, failure to yield to vehicle/pedestrian, and inattention – as well as a designation for "other driver action" and a distinct code to indicate that no driver action occurred (New Jersey Department of Transportation, 2006). Some of these driver actions are closely tied to specific moving violations while others (e.g., inattention) are not. Note that for both methods, any number of crash-involved drivers – including none – could have been determined to be responsible for the crash.

Other crash- and driver-specific variables were obtained from the crash report, including driver gender, number of vehicles involved in the crash (single- vs. multi-vehicle), moderate or greater injury (yes vs. no), and fatalities. For drivers under age 21, we also ascertained the presence of passengers (driving alone, driving only with peer passengers 14–20 years of age, driving with passengers of other age combinations) and time of the crash (5:00 am–4:00 pm, 4:01 pm–11:00 pm, 11:01 pm–4:59 am [restricted hours for young NJ drivers with permits and intermediate licenses]).

2.3. Statistical analysis

We estimated the frequency and proportion of drivers determined to be responsible for his/her crash using each of the two alternative methods and used chi-square tests to examine differences in citation issuance among those with a crash-contributing driver action. Although our data reflect the entire population of 2010–2011 police-reported passenger-vehicle crashes involving a young NJ driver, we desired to make inference to a more general population. Hence we adopted a superpopulation perspective by treating our data as a sample from an essentially infinite population of potential crashes, which allowed us to compute two-sided *P*-values and confidence intervals for comparisons of interest. To