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Older drivers' risks of at-fault motor vehicle collisions

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ABSTRACT

In aging societies, increasing numbers of older drivers are involved in motor vehicle collisions (MVCs), and preserving their safety is a growing concern. In this study, we focused on whether older drivers were more likely to cause MVCs and injuries than drivers in other age groups. To do so we compared at-fault MVC incidence and resulting injury risks by drivers' ages, using data from Japan, a country with a rapidly aging population. The at-fault MVC incidence was calculated based on distance traveled made for non-commercial purposes, and the injury risks posed to at-fault drivers and other road users per at-fault MVCs. We used MVC data for 2010 from the National Police Agency of Japan and driving exposure data from the Nationwide Person Trip Survey conducted by a Japanese governmental ministry in 2010. The at-fault MVC incidence showed a U-shaped curve across the drivers' ages, where teenage and the oldest drivers appeared to be the highest risk groups in terms of causing MVCs, and the incidence was higher for female drivers after age 25. The injury risk older drivers posed to other vehicle occupants because of their at-fault MVCs was lower than for drivers in other age groups, while their own injury risk appeared much higher. As the number of older drivers is increasing, efforts to reduce their at-fault MVCs appear justified.

1. Introduction

Ensuring the safety of older drivers presents a growing concern because the number of such drivers and their involvement in motor vehicle collisions (MVCs) is increasing (Organisation for Economic Co-Operation and Development, 2001; Kohata and Oroku, 2011). This concern is reflected in licensing policies applied to older drivers. Many countries now set stringent policies such as shortening the license renewal interval and requiring medical examinations (Kahvedžić, 2013). In Japan, drivers aged 70 or older at the time of renewal are obligated to take a driving lesson consisting of a lecture, driver aptitude test (testing for sensory motor skills using a driving simulator, as well as for field of vision, kinetic and night vision), an on-road driving assessment, and a discussion session. Drivers 75 or older must also take a paper-based cognitive screening test before the lesson to assess whether they have adequate cognitive function for driving. Older drivers are also encouraged to surrender their licenses (Doi, 2014).

Notwithstanding the increased number of MVCs caused by older drivers, it is beneficial to examine such drivers' relative safety in terms of an "at-fault" rate that clarifies the probability of causing MVCs per unit of risk exposure. This risk exposure should be quantified in ways such as distance traveled and number of vehicular trips, rather than the number of licensed drivers. This is because license holders are not necessarily current drivers and driving patterns typically vary by driver age. Two previous studies took these aspects of risk assessment into account. Williams and Shabanova (2003) reported that fatalities in MVCs caused by young licensed drivers were the highest of all age groups, and more than half were of passengers and of occupants of other vehicles. In contrast, the large majority of fatalities in MVCs caused by older drivers were of the drivers themselves. Tefft (2008) further considered the amount of MVC risk exposure as mentioned above, and presented a U-shaped curve of the mortality rate across age groups. The rate was high among young and older drivers, but young drivers posed the highest fatal risk to their passengers, occupants of other vehicles, and non-motorists; while older drivers' greatest risk was to themselves.

While these previous studies examined mortality rates, the likelihood of causing MVCs, irrespective of fatalities, is a safety concern for older drivers, even if they were overrepresented in MVCs because of their susceptibility to injury (Li et al., 2003; Meuleners et al., 2006). Another concern for older drivers is the

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morbidity of injuries in their at-fault MVCs not only for the drivers themselves but also for other road users involved in the MVCs. In the present study, we therefore examined the incidence of at-fault MVCs including both fatal and non-fatal collisions and the morbidity of injuries for the persons involved in the MVCs. We focused on MVCs that occurred while driving for non-commercial purposes, under the assumption that older drivers less frequently engage in commercial driving. We used the at-fault drivers' ages as a means to examine the relative safety of older drivers compared with other age groups by comparing the incidence of at-fault MVCs and the morbidity of injuries.

2. Methods

2.1. Data

Japan's Institute for Traffic Accident Research and Data Analysis compiles data on all MVCs reported to the National Police Agency of Japan. The data are collected in a standardized format throughout Japan that includes the purpose of driving and driver's responsibility for the MVC. Responsibility is determined by the police investigators at the scene of the MVC. We adopt the term "at-fault driver" to indicate the driver primarily responsible for an MVC. We obtained the above-mentioned institute's data on the number of MVCs (resulting in at least one fatal or non-fatal injury to any road users) that at-fault drivers caused while driving a mid-sized or smaller motor vehicle (car, van or truck) for non-commercial purposes, separated into the age of the at-fault driver, including drivers in single-vehicle collisions. Numbers of fatal and non-fatal injuries in those MVCs were also obtained and combined for analysis. In the police data, fatal injuries or deaths are defined as deaths occurring within 24 h of the collision. As mentioned above, we targeted MVCs in non-commercial purposes. Our focus was the relative safety of non-commercial drivers by age.

Vehicle kilometers traveled (VKT) made by driving for non-commercial purposes were estimated in each age stratum using the data of the Nationwide Person Trip Survey conducted in 2010 by the Japanese Ministry of Land, Infrastructure, Transport and Tourism, as well as the Japanese population census conducted for the same year, to weight the data. The survey involved approximately 38,000 households in 70 cities and 60 towns and villages. To clarify average trip patterns, survey respondents recorded travel information such as the purpose, mode, time, distance and destination of each trip on a given weekday (Tuesday, Wednesday or Thursday) or on Sunday in October or November 2010. The survey was not designed to estimate driving exposures throughout the year; i.e., possible variations in exposures by month and day cannot be adjusted with the survey data to extrapolate total driving exposures in 2010. The number of licensed drivers by age in 2010 was obtained from Driver's License Statistics (National Police Agency, 2010). The data are shown in Table 1.

2.2. Analysis

In line with the exposure measurement, we analyzed the data of MVCs that occurred on the aforementioned days in October and November 2010. The number of at-fault MVCs and their resultant fatal and non-fatal injuries were stratified by the sex and age group of the at-fault drivers. The at-fault MVC incidence of drivers of a given age group was expressed as the number of at-fault MVCs per million VKT. This measure was calculated separately for MVCs with any type of motor vehicles (excluding motorcycles) or single-vehicle collisions, and for MVCs with motorcycles, bicycles or pedestrians. Single-vehicle collisions were combined with collisions with any type of motor vehicles because they share only 4.5% of the total of those.

The morbidity of injuries for the persons involved in the MVCs caused by drivers of a given age group was expressed as the number of fatal and non-fatal injuries per 100 at-fault MVCs. This measure was calculated separately for at-fault drivers; for at-fault drivers' passengers; for the occupants of other vehicles struck (other vehicle occupants); and for motorcyclists, cyclists and pedestrians.

Table 1
Numbers of licensed drivers and vehicle kilometers travelled (VKT) by sex and age, and numbers of at-fault motor vehicle collisions (MVCs) and fatal or non-fatal injuries by sex and age of at-fault drivers, 2010.

Driver sex	Driver age	Licensed drivers	VKT	At-fault MVCs involving:		Injuries to:			
				Motor vehicle/ single collision	Motorcycles, bicycles and pedestrians	At-fault drivers	At-fault drivers' passengers	Other vehicle occupants	Motorcyclists, bicyclists and pedestrians
Male	18–19	452,028	29,648,455	839	214	99	87	964	218
	20–24	2,720,151	350,750,891	2425	978	216	139	2977	989
	25–29	3,504,129	958,856,900	2046	1048	143	83	2464	1058
	30–39	8,875,628	3,435,190,583	3198	2376	265	109	3874	2403
	40–49	8,249,240	3,654,768,820	2275	2074	203	80	2774	2102
	50–59	7,625,232	3,607,362,877	1986	1929	166	93	2389	1953
	60–69	7,950,356	3,587,826,314	2201	2158	221	123	2569	2184
	70–79	4,193,244	1,105,392,109	1890	1387	275	182	2112	1397
	80–84	805,263	101,711,336	511	311	95	38	551	314
	85–	246,825	17,946,823	154	114	37	14	152	113
Female	18–19	360,703	20,199,256	443	94	68	38	499	93
	20–24	2,320,590	269,515,529	1554	530	204	58	1793	539
	25–29	3,128,187	516,023,350	1260	653	143	39	1478	653
	30–39	8,093,054	1,332,330,352	2195	1616	275	98	2502	1624
	40–49	7,449,975	1,476,490,493	1900	1702	262	86	2224	1721
	50–59	6,325,789	1,262,979,145	1527	1336	235	48	1746	1343
	60–69	5,068,700	869,622,560	1422	1256	251	96	1574	1266
	70–79	1,304,998	143,775,384	573	463	129	40	612	466
	80–	125,623	3,616,495	64	43	16	8	67	43

No. of licensed drivers is as of the end of 2010.
No. of VKT is an estimate for Tuesdays, Wednesdays, Thursdays and Sundays of October and November 2010.
No. of MVCs and injuries occurred on Tuesdays, Wednesdays, Thursdays and Sundays of October and November 2010.
For female drivers, age groups 80–84 and 85 or older were combined because of the small number of at-fault MVCs and injuries.