Main factors causing health-related vehicle collisions and incidents in Japanese taxi drivers

Masahito Hitosugi1,*, Momoko Hasegawa2, Shinobu Yamauchi2, Satomu Morita1, Satoshi Furukawa1

Abstract: Objectives: To find the main factors causing drivers’ health-related vehicle collisions and to aid the search for preventive measures, we performed a cross-sectional survey of all taxi drivers in Tochigi Prefecture, Japan.

Methods: The analysis used 844 returned self-administered questionnaires on drivers’ working conditions and health status that had been sent to all 2156 company-employed taxi drivers in February 2013.

Results: Mean driver age was 60.7 (SD 8.1) years old with a mean work experience of 16.9 (SD 12.3) years. Of all participants, 69.9% had been diagnosed with a chronic disease: hypertension (38.2%), hyperlipidemia (21.8%), diabetes mellitus (16.8%), heart disease (5.9%), and gastrointestinal ulcer (3.9%). A total of 98 drivers experienced a collision or near miss incident due to their own acute health problems. The prevalence of drivers who regularly refer to the physician was significantly lower and the frequency of day and night working per month was significantly higher in drivers with a health-related collision or incident than in drivers without such event (73.7% vs. 85.6%, p=0.015; 7.5 vs. 6.1, p=0.041).

Conclusions: The results suggest the need for appropriate disease control of taxi drivers and for some organizational and policy measures, e.g., reduction of work hours and work stress. Development of pre-crash safety systems that collect video of driver incidents or collisions because of health problems might be required in future.

Key Words: traffic accident, vehicle collision, commercial driver, disease, prevention.

Road traffic injuries are a major public health issue worldwide. According to the World Health Organization, 1.3 million people die annually in road collisions worldwide. Therefore, in the field of forensic medicine, in addition to determine the cause of death and mechanism of accident, prevention of vehicle collisions should be promoted. Because the motor vehicle collision rate in Japan is higher for professional drivers than for other drivers, the prevention of professional drivers’ collisions is a nationwide problem [1]. Recently sudden illness while driving has been identified as a major cause of vehicle collision accounting for approximately one in ten collisions [2]. We previously analyzed the commercial (bus, taxi, or truck) drivers who had been ordered to stop driving because of a health problem [3]. Because taxi drivers have relatively many collisions and poor survival after collisions while driving with sudden illness, the improvement of taxi drivers’ health status is being promoted for traffic safety.

The Ministry of Land, Infrastructure, Transport, and Tourism asked the Japan Taxi Drivers Association to prevent drivers’ health-related vehicle collisions. However, little is known about which factors lead to these collisions. To find the main factors causing drivers’ health-related vehicle collisions and to perform effective preventing measures, we conducted a cross-sectional survey in one district in Japan.

1) Department of Legal Medicine, Shiga University of Medical Science, Otsu, Shiga, Japan
* Corresponding author: MD, PhD, Professor, Department of Legal Medicine, Shiga University of Medical Science, Tsukinowa, Seta, Otsu, Shiga 520-2192, Japan, Tel & Fax: +81-77-548-2200, Email: hitosugi@belle.shiga-med.ac.jp
2) Department of Legal Medicine, Dokkyo Medical University School of Medicine, Mibu, Tochigi, Japan
MATERIALS AND METHODS

We obtained data from a cross-sectional survey conducted in Tochigi Prefecture, which has a population of about 2 million, located 100 km north of Tokyo, Japan. Self-administered questionnaires were sent to all 2156 company-employed taxi drivers in February 2013. Drivers were informed that return of the questionnaire implied consent. Participants were asked to return their completed questionnaire in a sealed envelope to one of the authors (MH) directly within a month. The survey was anonymous, and participants’ privacy and confidentiality were protected. A total of 844 questionnaires were returned. The questionnaire included questions on the following:

1. General characteristics of age, sex, height, weight, and whether participant lives alone or with family;
2. Years of work experience;
3. Work pattern including (a) whether daytime only or 18 to 21 hours from morning to early morning the next day (day and night working) and (b) frequency of day and night working in a month;
4. (a) Diagnosed chronic diseases of hypertension, diabetes mellitus, hyperlipidemia, heart disease, gastrointestinal ulcer, or other medical conditions and, (b) if having a diagnosed disease, whether refer to a physician regularly;
5. Whether received annual health checkups enforced by the Industry Safety and Health Law of Japan regularly;
6. Whether ever experienced (a) a vehicle collision due to acute health problem while driving or (b) a “near-miss incident”, i.e., a situation in which a collision was prevented by braking or steering immediately after acute onset of an illness while driving.

The research protocol was approved by the Ethics Committee of the Dokkyo Medical University School of Medicine. Continuous variables were summarized by the mean ± standard deviation (SD). Unpaired t-test was used to compare the means of two groups: drivers with a collision or near-miss incident versus drivers without such experience. The chi-square test was used to compare the rates of various items between the two groups. Differences with a p-value <0.05 were considered statistically significant.

RESULTS

1. General overview
Most of the 844 drivers (97.8%) were male. Mean age was 60.7 (SD 8.1) years, and 57.9% of drivers were 60 to 69 years old. Other means were height of 167.2 (SD 6.0) cm, weight of 67.9 (SD 10.5) kg, and body mass index of 24.2 (SD 3.2). Of all drivers, 81.5% lived with their family while 18.5% lived alone. Mean work experience was 16.9 (SD 12.3) years. More than two-thirds (69.9%) of the drivers had diagnosed chronic diseases, including hypertension (38.2%), hyperlipidemia (21.8%), diabetes mellitus (16.8%), heart disease (5.9%), and gastrointestinal ulcer (3.9%). Most (83.6%) of the diagnosed drivers regularly visited physicians according to medical advice, and 91.6% of the drivers had the annual health check-up enforced by the law.

2. Drivers health-related vehicle collision
Because 62 drivers had not answered to this question as not in the memory, remained 782 drivers are analysed below. Three drivers (0.3%) had collided with a motor vehicle because of acute health problems while driving, and 95 other drivers (11.9%) had experienced a health-related, near-miss incident. We divided the study drivers into two groups: 98 drivers with and 684 drivers without a health-related collision or incident (Table 1). The prevalence of chronic disease was recalculated as having at least one of five diseases shown in above. The prevalence of chronic disease was significantly (p=0.015) higher in the group without

| Table 1. Comparison of the health status and working conditions between the drivers with and without a health-related vehicle collision or near-miss incident |
|-----------------|-----------------|-----------------|
| Vehicle collision or near-miss incident | + (n=98) | - (n=684) | P value |
| mean | SD** | % | mean | SD** | % |
| Work experience (in years) | 17.5 | 11.0 | 16.3 | 12.3 | 0.564 |
| Age (years old) | 60.6 | 7.9 | 60.5 | 8.1 | 0.939 |
| Body mass index (kg/m²) | 24.3 | 3.5 | 24.2 | 3.2 | 0.809 |
| Prevalence of having chronic disease * | 72.4 | 63.9 | 0.096 |
| Frequency of drivers regularly refer to the physician | 73.7 | 85.6 | 0.015 |
| Frequency of drivers undergone annual health check-up | 96.8 | 91.2 | 0.063 |
| Frequency of day and night working per month | 7.5 | 5.6 | 6.1 | 5.8 | 0.041 |

* Having hypertension, hyperlipidemia, diabetes mellitus, heart disease or gastrointestinal ulcer.
** SD: standard deviation.
health-related collision or incident, 85.6%, than in the group with collision or incident, 73.7%. The frequency of day and night working in each month was significantly (p=0.041) higher in the drivers with health-related collision or incident, 7.5 (SD 5.6), than in drivers without collision or incident 6.1(SD 5.8).

![Figure 1. Prevalence of the diagnosed diseases of the drivers.](image)

**DISCUSSION**

Sudden deaths while driving are often seen in the vehicle collisions. Even considering the fact that forensic autopsies are usually conducted only when the cause of death is not obvious, this indicates that collisions involving sudden illness occur more often than is currently believed.

According to an autopsy study, 79.4% of victims had not taken avoidance manoeuvres, breaking or steering, immediately after the occurrence of an acute pathology while driving [4]. Therefore, to avoid subsequent vehicle collisions, prevention of sudden illness while driving is required.

In Japan aging of taxi drivers has influenced safety. The average age of taxi drivers in 2013 was 58.4 years, which was higher than the average age of 42.8 years of all industry workers [5]. The average age of our study drivers was 60.7 years. Because driving is a complex task involving physical, cognitive, and perceptual functions in a dynamic traffic situation, age-related decline in these functions increases the crash risk [6]. Risk also increases because of the combined effects of multiple medical conditions and age [7]. Therefore, keeping drivers’ health status in good condition is required for safety.

Work stress is also a serious problem. The average working time of taxi drivers per one month in 2013 was 196 hours, more than the average 180 hours of all industry workers (yearly 2160 hours) [5]. However, the salary of taxi drivers in 2013 was 2,980,000 Japanese Yen, lower than the salary of 5,240,000 Japanese Yen of all industry workers [5]. Economic demands may lead taxi drivers to work long hours without enough rest. Hitosugi, et al. previously suggested that a few taxi drivers voluntarily stopped their vehicle to prevent a major attack and subsequent collision [3].

According to our results, a lower rate of regular referral to physicians was shown in drivers with health-related vehicle collision or incident. Inadequate control of the chronic disease may lead to the unusual symptoms and onset of major attacks. In our study hypertension, which is the major risk of the ischemic heart disease or stroke, is the most common chronic pathology found in taxi drivers. This trend is in accordance with previous reports [8-10]. Medical intervention, control of lifestyle and relief of mental stress are required, especially for taxi drivers.

Significantly frequent day and night working was also identified in = drivers with health-related vehicle collisions or incidents. For professional drivers, night work is a risk factor for circulatory diseases [11, 12]. Also, taxi drivers have to work continuously in a stationary position. Long driving time is positively associated with the number of haematocrit and platelets [13]. Furthermore, 2 hours of sitting causes significant increase of blood viscosity of the leg vein [14]. Therefore, decreasing night-time work hours may prevent sudden illness while driving.

There are some limitations in this study. First, as data were based on voluntary reports by the drivers, objective measures of disease severity or extent were not included. Second, we did not assess daily lifestyle factors. In addition to the diagnosed chronic diseases, numerous factors, including stress, alcohol abuse, short sleep duration, excessive smoking, and lack of exercise, may influence disease attack while driving. In future, with reliable medical, lifestyle, and official vehicle collision data, logistic regression analysis could be performed to find more risk factors. A strength of the present study is that the questionnaires were sent to all company-employed, taxi drivers in Tochigi Prefecture. Additionally, because the completed forms were returned directly to one of the study authors without employer’s interference, the data have high reliability.

We speculate that low rates of regular referral to physicians and frequent day and night working increase taxi drivers’ risk of health-related vehicle collision or incident. Our results suggest the need for an appropriate disease control in taxi drivers and for some organisational and policy measures, e.g., reduction of work hours and work stress. Furthermore, analysis of video from drive recorders in taxis contributes to the development of vehicle safety devices, such as the Collision Damage Mitigation Braking System [15]. We propose the development of pre-crash safety systems that collect video on incidents or collisions caused by drivers’ health problems.

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References


