論文の内容の要旨

論文題目 **Initial Validation of a Sinhala Driver Behavior Questionnaire and Identification of Variables Associated with Road Traffic Crashes among Three-Wheeler Drivers in Sri Lanka**

和訳 シンハラ語版運転行動質問票の妥当性検証及びスリランカにおける三輪自動車運転手の交通事故関連因子の特定

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1. Introduction

Three-wheelers are an extensively used mode of transportation in several developing countries. However, three-wheelers involve in a higher number of road traffic crashes (RTCs) than other vehicles such as cars, buses, and trucks. Despite the high crash risk of three-wheelers, and their extensive use in several developing countries, only a few cross-sectional

studies have examined the causative factors for three-wheeler crashes.

Risky driving behaviors are a sole or a contributory factor in 95% of RTCs. Yet, studies have failed to examine the risky driving behaviors among three-wheeler drivers except for driving under the influence of alcohol and traffic law violations. Manchester Driver Behavior Questionnaire (DBQ) is a widely used tool to examine the risky driving behaviors of drivers and their association with crashes. However, so far none has used this useful tool to examine the risky driving behaviors of three-wheeler drivers. Further, none has used the DBQ in the South Asian setting.

Sri Lanka is a highly motorizing South Asian country that faces a growing burden of three-wheeler crashes. Among three-wheelers for-hire three-wheelers constitute 10% of the total vehicle population, and 90% of all the taxis in Sri Lanka. For-hire three-wheeler crashes are responsible for the second highest number of hospital admissions to the emergency departments in Sri Lanka.

We conducted this study with two objectives: 1) to develop and conduct the initial validation of a Sinhala version of the Manchester DBQ for use with for-hire three-wheeler drivers in Sri Lanka, and 2) to identify the variables associated with RTCs in that population.

This thesis consists of two main sections: 1) Sinhala DBQ: development and initial validation, and 2) the variables associated with road traffic crashes among for-hire three-wheeler drivers in Sri Lanka.

2. Sinhala DBQ: development and initial validation

The objective of this study was to develop a Sinhala version of the Manchester DBQ and conduct its initial validation for use with for-hire three-wheeler drivers in Sri Lanka.

We conducted this study in the Kandy municipal area (Kandy city), Sri Lanka between August 2008 and March 2009. Our participants were 265 for-hire three-wheeler

drivers in Kandy who were driving their three-wheelers for more than one year. We included both crash-involved and non-crash involved for-hire three-wheeler drivers in our study. We recruited the crash involved drivers from the accident registers of the Kandy police station (n=95). We recruited the non-crash involved three-wheeler drivers from two sites: from the three-wheeler parks (n=88), and from the roads (n=82) in Kandy.

We developed a Sinhala version of the Manchester DBQ. First, we translated and back translated the 50 item DBQ. Based on the back translation, we made the necessary modifications for the forward translated questionnaire. Then, an expert panel evaluated the Sinhala DBQ for its relevancy for Sri Lanka; this expert panel consisted of a bilingual community physician, a Sri Lankan injury expert, and a superintendent of the traffic police. We modified the DBQ items according to the opinion of the experts. We pre-tested the questionnaire with a sample of 25 conveniently selected three-wheeler drivers; we made further modifications to the forward translated questionnaire based on the pre-test.

We then administered the Sinhala DBQ to all our participants. We administered it at the three-wheeler parks or at the homes of each participant depending on their preference, and the availability.

We assessed the reliability of the total 50 item Sinhala DBQ using Cronbach's alpha reliability coefficients and average inter-item correlations. We conducted a factor analysis with oblique (direct Oblimin) rotation to examine the factor structure (subscales) of the Sinhala DBQ. We then assessed the reliability of the identified DBQ subscales using Cronbach's alpha reliability coefficients and average inter-item correlations. We assessed the initial criterion related validity of the Sinhala DBQ subscales by comparing the DBQ subscale scores among crash involved and non-crash involved for-hire three-wheeler drivers. Following that, we conducted a multivariate logistic regression analysis to examine the association between DBQ subscale scores and RTCs. In the multivariate model, we included

the following variables as confounders: daily distance, age of the three-wheeler, alteration of the handle-lock, carrying more than three passengers in the rear seat, mode of obtaining the driving license, drivers' age, and the number of working hours. We used the SPSS version 16 statistical software (Chicago, USA) for all the statistical analyses.

The factor analysis of the Sinhala DBQ revealed three DBQ subscales (factors). They were "intentional violations", "inattention to immediate surroundings", and "violations due to drivers' hurry". Of those three subscales, the two violation subscales ("intentional violations" and "violations due to drivers' hurry") showed reasonable reliability and validity to examine the risky driving behaviors of for-hire three-wheeler drivers that might be associated with RTCs. The Cronbach's alpha reliability coefficients were 0.88 and 0.78 for the two violation subscales "intentional violations" and "violations due to drivers' hurry" respectively; similarly, their inter item correlations were 0.44 and 0.48 respectively. Further, those two subscales showed significant association with RTCs in the multivariate regression analysis: "intentional violations" (Adjusted odds ratio (AOR)=2.23, 95% confidence interval(CI)=1.43-3.45), "violations due to drivers' hurry" (AOR=1.98, 95% CI=1.36-2.90). The total 50 item Sinhala DBQ or the subscale "inattention to immediate surroundings" did not show adequate reliability and validity to examine the risky driving behaviors of for-hire three-wheeler drivers that might be associated with RTCs.

3. The variables associated with road traffic crashes among for-hire three-wheeler drivers in Sri Lanka

The objective of this study was to identify the variables associated with road traffic crashes among for-hire three-wheeler drivers in Sri Lanka.

We conducted a matched case-control study in Kandy, Sri Lanka between August 2008 and March 2009. Cases were all the professional (or for-hire) three-wheeler drivers who

were involved in crashes in Kandy between 01 January and 31 December 2007, and reported to the police (n=95). We included two control groups in our study: a control group matched to the ages of the cases (n=88), and a control group matched to the sites of the crashes (n=82). We did this matching because drivers' age and the driving environments are significant confounders for RTCs. We collected data using an anonymous self-administered questionnaire. We used the SPSS version 16 statistical software (Chicago, USA) for the statistical analyses. We conducted a conditional logistic regression analysis to examine the variables associated RTCs among for-hire three-wheeler drivers. We categorized the continuous variables by the median of all the participants (cases and controls) before entering them in to the conditional logistic regression model. We included all the predictor variables in to the model in one step.

Among the cases and age-matched controls, obtaining driving license through private driving schools (AOR=3.04, 95% CI=1.01-9.18), and daily distance above 80 Km (AOR=9.03, 95% CI=2.69-30.27) showed significant associations with RTCs. Among the cases and site-matched controls, the following variables showed significant associations with RTCs: obtaining driving license from private driving schools (AOR=5.60, 95% CI=1.65-19.00), taking more than three passengers in the passenger seat (AOR=2.96, 95% CI=1.05-8.33), daily distance above 80 Km (AOR=3.06, 95% CI=1.05-8.92), and age less than 35 years (AOR=4.39, 95% CI=1.46-13.24).

4. Conclusions

This study identified two Sinhala DBQ subscales that showed reasonable reliability and validity to examine the risky driving behaviors of for-hire three-wheeler drivers that might be associated with RTCs. They were "intentional violations" and "violations due to

drivers' hurry". In contrast the total 50 item Sinhala DBQ might not be useful to identify such risky driving behaviors.

Sri Lankan policy makers might be able to use these two Sinhala DBQ subscales to identify the for-hire three-wheeler drivers who perform risky driving behaviors that might be associated with RTCs. The drivers who score high on these two subscales might be closely monitored by the traffic police to prevent RTCs.

Further, we identified four variables that were associated with RTCs among Sri Lankan for-hire three-wheeler drivers. They were carrying more than three passengers in the passenger seat, obtaining driving license through private driving schools, higher daily distance above 80 Km, and younger age less than 35 years. Of those four variables, three might be the modified with proper interventions such as law enforcements or alteration of existing policies. Drivers' age, however, is not a modifiable variable. Yet, policies might be introduced to monitor the driving skills of young drivers by the traffic police.

To the best of our knowledge, these findings have not been identified in the previous studies with for-hire three-wheeler drivers. Therefore, these findings will be important for the policy makers during the policy formation to prevent RTCs among for-hire three-wheeler drivers in Sri Lanka. These findings will be also important for the other developing countries with similar road infrastructure.

Keywords: Driver, driver behavior questionnaire, motor vehicle crashes, public transportation, risky driving behaviors, Sri Lanka, three-wheeler.