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Epidemiological Study of Low Back Pain and Occupational Risk Factors among Taxi Drivers[a]

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Abstract: A survey of taxi drivers was conducted to determine the actual situation of drivers' low back pain (LBP). The survey was carried out in October 2002, the target drivers were asked to complete a questionnaire which contains questions regarding physique of drivers, demographic features, working conditions, office environment, health conditions, the presence of low back pain, the level of low back pain based on Visual Analogue Scale and Roland-Morris Disability Questionnaire score. As a result, the total number of valid responses was 1,334 and the response rate was 71 percent, and the 1-wk prevalence of LBP was 20.5 percent of respondents. Regarding 275 subjects with LBP, Visual Analogue Scale (VAS) averaged 4.3. There was a positive weak correlation between VAS and Roland-Morris Disability Questionnaire score (R=0.41). And Logistic regression analysis was performed to examine the relationship between LBP and occupational factors, the results suggested following items as risk factors; such as history of LBP, suffering from fatigue, diseases other than LBP and smoking habit.

Key words: Epidemiology, Low back pain, Occupational risk factor, Taxi drivers, Disability questionnaire

Introduction

Low back pain is a one of the most common symptoms throughout the general population, and there have been many discussions of occupational low back pain in particular. There are many reports and monographs regarding low back pain among seated workers, standing workers, truck drivers and those performing heavy labor and so on[1–9]. Low back pain of vehicle drivers are mainly caused by long hours of driving in a restricted posture, car vibration or shocks from roads, and mental stress associated with driving. However, these possible causes have not been identified as risk factors concerting mechanisms underlying low back pain. In this study, a questionnaire survey was conducted among taxi drivers to determine the actual situation of drivers' low back pain from the perspective of their working conditions.

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Materials and Methods

Subjects

Company-employed or self-employed taxi drivers were targeted. The survey was carried out in October 2002 with cooperation from taxi companies and a self-employed taxi drivers' association; the target drivers were asked to complete a questionnaire concerning low back pain. Questionnaires using a fill-in form were distributed to 7 taxi companies and 1 self-employed taxi driver's association.

Questionnaire

Table 1 shows the questionnaire, which contains questions regarding: physique of drivers, demographic features (age, gender and marital status): the length of time as a driver or the length of service; working conditions such as working hours and the frequency of night shifts; average mileage, car seat condition, space for the driver, whole-body vibration and car weight; office environment such as human relationships or the existence of a place to rest; and daily life outside work. The questionnaire

Table 1. Questions included in the questionnaire

- Gender, age and physique of drivers
- Length of service as a taxi driver
- Working conditions such as working hours and night-shift frequency
- Average mileage, car seat space and condition, whole-body vibration and car weight
- Office environment such as human relationships or the existence of a place to rest
- Daily life outside work such as sleep, habit of smoking or exercise
- Health conditions such as diseases other than low back pain
- Existence of low back pain, VAS and Roland-Morris Questionnaire score
- History of diseases causing low back pain

also included questions regarding: health conditions such as diseases other than low back pain; history of treatment and sick-leave due to low back pain and; the presence of low back pain in the past one week. We defined the incidence rate of subjects who experienced LBP (low back pain) in the past one week as the prevalence of the LBP; the level of low back pain based on Visual Analogue Scale (the levels of LBP/VAS) and; Roland-Morris Disability Questionnaire score to assess physical disability due to low back pain (the disability level of ADL/RMDQ score)[1)].

Statistical analysis

The questionnaire results were used to conduct the following analyses: the prevalence of LBP and the correlation between the levels of LBP and the disability level of ADL (activities of daily living): the relationship between the LBP incidence and occupational factors. For the latter analyses, we compared the subjects with LBP from those without LBP by Mann-Whitney test for numerical data or by χ-square test for categorical data. Furthermore, to identify LBP-related occupational factors, we used multiple logistic regression and obtained estimates of the prevalence odds ratio (POR).

The responses from respondents with a history of diseases causing low back pain were excluded at the time of analysis in order to focus simply on the low back pain that was associated with work as drivers.

All these statistical analyses were carried out by SPSS 10.0 statistical software, and significance was accepted at the 5 % level.

Results

The prevalence of LBP

The total number of valid responses was 1,334 and the percentage of participation was 71 percent. The fundamental attributes of the investigated subjects are presented in Table 2. The average age of respondents was 51.5 yr old and the average length of service was 14.1 yr. The prevalence of LBP was 20.5 percent of respondents.

Table 2. Work conditions and the characteristics of the subjects (n=1,344)

	Mean	Min	Max	SD
Age (yr)	51.5	24	79	9.5
Height (cm)	167.1	146	185	6.1
Weight (kg)	66.1	42	100	9.8
BMI (kg/m^2)	23.7	16.0	37.2	3.0
The length of service	14.1	0	52.0	12.1
Daily working hours	12.3	1.0	24.0	5.2
Monthly mileage	3,416.4	200	11,800	1,115.7

The levels of LBP and the disability of ADL

Regarding 275 subjects with LBP, the level of LBP/VAS averaged 4.3. The response rate of each item in RMDQ is presented in Table 3. High positive responses were found in the following questions; I change position frequently to try to get my back comfortable; I avoid heavy jobs around the house because of my back; Because of my back, I lie down to rest more often; and the RMDQ score averaged 3.5. Figure 1 shows the relation between the level of LBP and the RMDQ score. There was a positive weak correlation between the two, and the correlation coefficient was 0.41.

Comparison between the subjects with LBP (LBP group) and without LBP (without LBP group)

Concerning items in the questionnaire showing significant differences between the groups with and without LBP by χ-square test, the highest odds ratio was 5.35 for the question; "I had a history of low back pain before working as a driver"; the next highest odds ratio was 2.77 on the question "I seldom feel energetic"; and the next was 2.60 for two questions: "I suffer from diseases other than low back pain" and "I do not have enough time to relax at home", 2.21 for "I do not sleep well", 1.93 for "narrow space for drivers", and "feel strong car vibration" had an odds ratio of 1.90 (Table 4).

However, there were no differences between variables from those either with or without LBP concerning following questions such as age, gender, height, weight and BMI, the length of service, daily working hours, monthly mileage and frequency of night-shift work (Table 5).

The result of the multiple logistic regression analysis and prevalence odds ratio (POR)

Logistic regression analysis using the existence or nonexistence of low back pain as a dependent variable was performed. Table 6 shows that responses to four items were significant: 1) I had a history of low back pain

Table 3. The response rates among respondents with LBP by Roland-Morris Disability Questionnaire (n=190)

	%
I stay at home most of the time because of my back.	11.3
I change position frequently to try and get my back comfortable.	69.2
I walk more slowly than usual because of my back.	12.7
Because of my back I am not doing any of the jobs that I usually do around the house.	3.6
Because of my back, I use a handrail to get upstairs.	5.9
Because of my back, I lie down to rest more often.	41.6
Because of my back, I have to hold on to something to get out of an easy chair.	6.3
Because of my back, I try to get other people to do things for me.	0.9
I get dressed more slowly then usual because of my back.	3.5
I only stand for short periods of time because of my back.	22.6
Because of my back, I try not to bend or kneel down.	22.6
I find it difficult to get out of a chair because of my back.	4.1
My back is painful almost all the time.	20.4
I find it difficult to turn over in bed because of my back.	5.9
My appetite is not very good because of my back pain.	1.8
I have trouble putting on my socks (or stockings) because of the pain in my back.	10.9
I only walk short distances because of my back.	16.7
I sleep less well on my back.	13.1
Because of my back pain, I get dressed with help from someone else.	0.5
I sit down for most of the day because of my back.	11.3
I avoid heavy jobs around the house because of my back.	48.0
Because of my back pain, I am more irritable and bad tempered with people than usual.	5.4
Because of my back, I go upstairs more slowly than usual.	14.9
I stay in bed most of the time because of my back.	4.1

before working as a driver, 2) I suffer from fatigue, 3) I have diseases other than low back pain, and 4) I have a habit of smoking.

Discussion

Many researchers have already reported the high risk for LBP and various spinal disorders among professional drivers of vehicles, such as bus, truck, tractor and so on[2–6]. It is thought that specific factors related to vehicle driving and work environments might influence the occurrence of LBP. Though there have been only several reports regarding taxi drivers, a significantly elevated 1-yr prevalence of LBP (51%) was reported in Taipei taxi drivers[7], and rate of 59% for men and 66% for women were reported in Norway[8]. In investigations of Japanese taxi drivers, the 1-yr prevalence of LBP was 45.8%, which was slightly lower than the values reported from other countries[9].

In our survey, we surveyed the 1-wk prevalence of LBP, which was 20.5%. We adopted the prevalence of LBP during the previous week in this study because the period of 1 yr was considered too long for subjects to remember accurately, and RMDQ also asks about the pre-

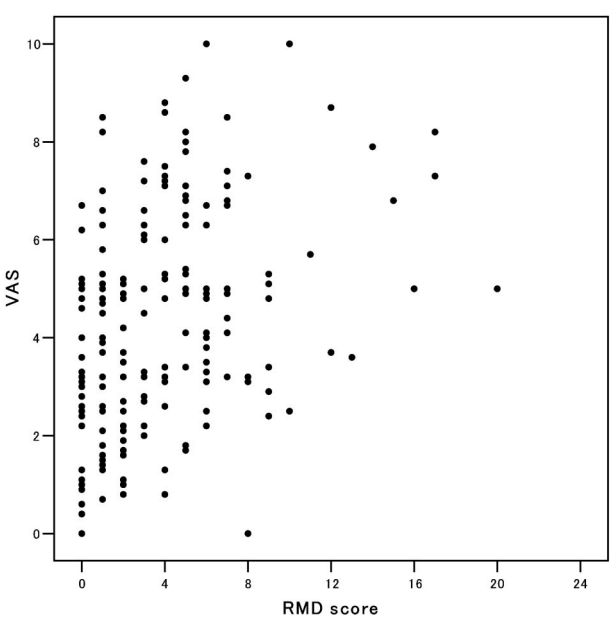

Fig. 1. The relationship between the level of LBP and RMDQ score (n=190).
There is a positive weak correlation between VAS and Roland-Morris Disability score, and the correlation coefficient was 0.41.

Table 4. The comparison between the groups with and without LBP tested by χ-square test

	Odd Ratio	95%C.I.	*p*
I had a history of low back pain before working as a driver			
	5.35	3.87–7.37	<0.001
I seldom feel energetic	2.77	1.99–3.86	<0.001
I suffer from diseases other than low back pain			
	2.60	1.91–3.53	<0.001
not have enough time to relax at home			
	2.60	1.51–3.00	<0.001
not sleep well	2.21	1.61–3.01	<0.001
narrow space for drivers	1.93	1.39–2.68	<0.001
strong car vibration	1.90	1.38–2.62	<0.001
smoking	1.78	1.29–2.45	<0.001
mental stress with customers	1.76	1.30–2.38	<0.001
Too long working time	1.73	1.28–2.33	<0.001
My work is not challenging	0.58	0.43–0.78	<0.001
Lack of physical exercise	0.60	0.400–0.91	0.015
I feel a heavy burden of responsibility in my work			
	1.34	1.00–1.186	0.051
Married	0.85	0.61–1.19	0.350

Table 5. The comparison between the groups with and without LBP

	LBP group (n=138)		without LBP group (n=543)	
	Mean	SD	Mean	SD
age	50.2	8.1	50.7	9.9
height	168.6	6.2	167.2	6.0
weight	67.0	10.1	65.9	9.7
BMI	23.5	3.1	23.5	3.0
the length of service	12.5	10.7	13.7	12.0
monthly working day	19.1	4.8	18.9	4.9
monthly average mileage	3,758.4	2,512.0	3,450.0	1,038.9
frequency of night shifts	12.1	8.0	11.3	7.7

Table 6. The result of the multiple logistic regression analysis and the prevalence odds ratio (POR)

	Exp (B)	95%C.I.	significance probability
I have a history of LBP before working as a driver			
	4.95	3.32–7.37	<0.01
I suffer from fatigue	3.34	2.08–5.36	<0.01
I have diseases other than low back pain	1.65	1.09–2.49	0.02
I have a habit of smoking	1.65	1.07–2.53	0.02
I often feel sleeplessness	1.52	0.98–2.39	0.06
I take regular exercise	1.13	0.65–1.96	0.68
Driving seat is too narrow	1.12	0.71–1.79	0.62
Working hours are too long	1.07	0.70–1.63	0.74
I feel burdensome on my responsibility	0.97	0.63–1.48	0.89
I feel vibration in the driving seat	0.99	0.63–1.56	0.97

Cox & Snell R^2=0.202 P<0.001.

vious one week.

Regarding LBP-related occupational factors, multiple logistic regression analysis using all question items as evaluate variables was performed in stepwise method and we obtained estimates of the prevalence odds ratio. It was suggested that certain factors were related to low back pain. As factors related to work details, narrow space for drivers and whole-body vibration were suggested.

The relatively confined space within taxicabs may put taxi drivers at great risk for LBP, as biomechanical studies have shown that driving activities within automobiles can impose postural strain on lumbar spines[10].

However, various studies have already reported that whole-body vibration might be one of the causes of low back pain among various types of occupational drivers. In 1982, Wilder *et al*. identified that 3 frequencies cause the spine to resonate and that the greatest transmissibility of vibratory input occurs at the first resonant frequency of 5 Hz[11].

Bovenzi reported that bus driving is associated with an increased risk for low back problems that may be due to both whole-body vibration exposure and prolonged sitting in a constrained posture, and the average vertical whole-body vibration magnitude measured on the seat pan of buses was 0.4 m/s^2 [2]. Chen has recently documented that urban taxi drivers are regularly exposed to lower levels of whole-body vibration (with a mean vertical vibration 0.31 m/s^2)[12].

Harrison reported a thesis proposing the optimal seat to reduce the prevalence of LBP, which would be seat with shock absorbers to dampen whole-body vibration of frequencies in the 1 to 20 Hz range, with a seat back, seat bottom, lumbar support, arm rests and head restraint that are adjustable to the individual needs of drivers[13].

Based on the findings of this survey, there are certain work environment factors suggested to be related to LBP, such as prolonged driving time and mental stress and so on. Regarding the length of working time, Chen reported that taxi drivers have OR of 1.79 for 1-yr prevalence of LBP when driving more than 4 h a day[7]. Pietri *et al*. reported that drivers have OR of 2.0 for LBP when driving more than 20 h a week[14]. Porter and Gyi also found that driving more than 20 h a week for work was associated with a high frequency of low back problems and related sickness absence[15]. In this study, almost all drivers drove more than 40 h a week.

It was suggested that mental stress might be related to LBP based on the significantly different response rates between respondents with or without LBP for the items: "I feel mental stress from customers"; "My work is not challenging." Chen reported that mental factors were significantly associated with higher LBP prevalence, especially for drivers who felt moderate-to-severe job stress, the crude POR was 2.19 (CI 1.57–3.04), and who reported a high degree of job dissatisfaction, the crude POR was 1.48 (CI 1.11–1.96)[7]. Funakoshi pointed out the relation between work stress and low back pain in his research on taxi drivers, for drivers who work long hours, the age adjusted odds ratio was 2.19 (CI 0.98–5.16)[9]. Bongers reviewed the relationship between psychosocial work factors and musculoskeletal disease, and concluded that monotonous work, high perceived work load, time pressure, low control on the job and lack of social support by colleagues are related to or positively associated with musculoskeletal disease including LBP.

Based on the results of this survey some other points were suggested to be related with LBP; prior health conditions such as having a history of LBP before working as a driver or suffering from diseases other than LBP; poor life style issues such as fatigue, insomnia, lack of time to relax at home, habitual smoking or lack of physical exercise.

Therefore possible measures for the prevention of low back pain are thought to include: counseling for psychological problems; implementation of medical examinations and guidance for consulting medical institutions; promotion of a better lifestyle; improvement of car structures, such as the improvement of car seat comfort and the absorption of vibration; check for low back pain through medical examination prior to working as a driver, guidance for drivers with a previous history of low back pain, the provision of medical examination and necessary guidance for those who have already started working as drivers.

Conclusions

A survey of taxi drivers was conducted to determine the actual situation of drivers' low back pain, and the 1-wk prevalence of LBP was 20.5 percent of respondents.

For the prevention of low back pain, the following measures might be suggested: improvement of car seat comfort, treatment for coexisting diseases other than low back pain, psychological counseling, guidance for a better lifestyle, a check for previous history of low back pain prior to working as a driver, and appropriate guidance.

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