Ergonomic Perspective : Driving awkward body posture cause health problem among older taxi driver's in Malaysia

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Abstract
World Health Organization (WHO) describe people who age above 60 years old falls into a category of older. Therefore, a 0lder community may continue to serve their services to others jobs after pension or looking light works accordance to their ability or do as a part-time job to support family economic financial and to sustain life in the challenging world. The alternative profession could involve with this community is to be taxi driver. Therefore, numerous factors should take part to ensure the older taxi drivers could serve their best performance and in good health condition. This paper aimed to drive awkward body posture cause health problem among older taxi drivers in Malaysia. A cross-sectional study was conducted with older taxi drivers using a self-administered questionnaire. It included questions on socio-demographic data, work characteristics and discomfort older taxi drivers seating posture relative to body parts (Likert scale). Purposive method sampling used base on inclusive criteria; age 60 years old and above, self-driving taxi more than 1 years, no disabilities and register with Land Public Transport Commission (LPTC). SPSS software version 2.0 used to analyze data. Total of 120 respondents participated in the study. Most of older taxi driver used hired car (76.7%) type of taxi and work as a permanent job (93.3%). More than half (53.7%) work as self-employed and smoking (55.0%). More than half respondents (76.7%) having feeling back pain past 12 months and 67.5% feeling back pain last seven days. The lower body parts potentially having musculoskeletal disorders (MSD's) symptom and low back pain (LBP) injuries. Inappropriate seating posture among older taxi drivers may cause to discomfort and developing to MSD's. The low awareness on ergonomics education could reflect quality lifestyle and health among older taxi drivers in Malaysia.

Keywords: older, taxi driver, awkward posture, ergonomics

1.0 Introduction
Recently, Malaysia is now facing challenge to the changing of the demographic profile of the population. Malaysia's population in year 2000 approximately 23.3 million and this number will be continued raise year by year to achieve vision 2020. Expected the ageing community may continue serve their services even though after pension, this influenced by their past an environment. Besides that, older people need specific consideration to sustain their life according to ability and capability in the challenging world. However the ageing issued should take place to discuss at the mainstream level specifically on transport manners.

The alternative professions could involve these communities are to be a taxi driver. Many factors influenced older people to choose to be a taxi drivers; to sustain life according with limited ability and capability in challenging world, light job and easy to handle, less energy, low cost, no specific requirement (standard licensed), no specific regulation (Malaysia laws) and had an experienced driving on commercial car or private car. In peninsular Malaysia at the year 2013 in total 60,472 taxi drivers which is 59,174 (98%) male driver taxi and only 1,298 (2%) female taxi drivers (SPAD, 2013). According to data in the year 2014 from Land Public Transport Commission (LPTC), approximately 64,547 registered taxi drivers in Malaysia.

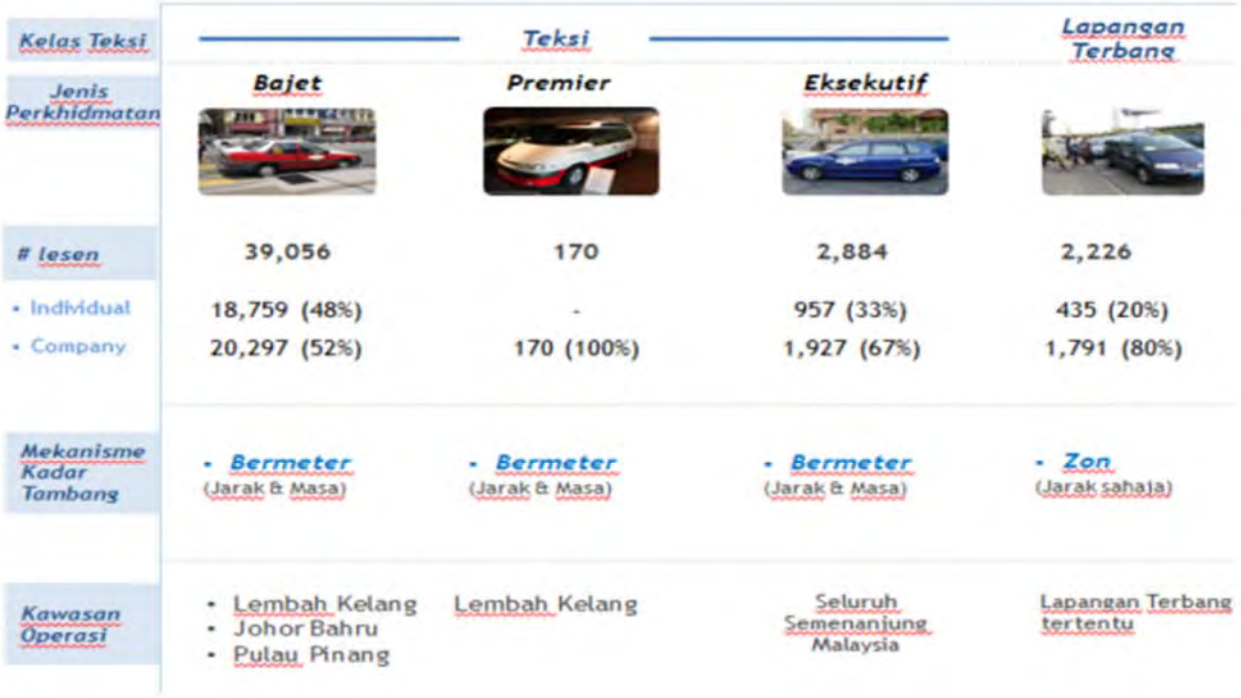
A lot of factors make elderly taxi drivers distinct from other professions in term of exposure values when working with MSD related jobs. Firstly is the time factor; the previous study stated that most of the taxi drivers spent longer time in driving compared to other driving profession -professional driver ;lorry driver, bus driver, train driver (Figà-Talamanca et al.1996). According to Yang Y. et al. 2014, average working time is 10.5 hours per day for 6.4 days per week, and individual taxi drivers spent an average of 3.5 hours waiting for passengers each day. The second factor is related to the space between a taxi and other vehicles (Chen, J. C.,et al.,2005). The confined space of taxi may develop stains on lower back posture at lumber spines, which make taxi drivers at a higher low back pain and other MSDs (Chen, J. C.,et al.,2005). Several researchers like Bovenzi and Zadini 1992; Chen et al., 2005; Funakosh et al., 2004, and SBM Tamrin et al. 2007 found other occupational factors such as whole-body vibration, long working hours, limited driving space, total mileage, long distance driving, monotonous driving, time employed as a taxi driver, job dissatisfaction, and job stress may contribute injuries on low back pain and also related to MSD in generally. The taxi drivers have a high risk of damaging the human biological clock rhythm and a risk of fatigue, depression, tension, insomnia and others diseases (Yang, Y. et al.,2014).

Ergonomics is one of the significant factors to consider in designing a seat. Drivers seat such as seat pans, seat inclination, sitting without lumber support and awkward body posture bending during driving were reported in musculoskeletal disorders (MSD's) on lower back pain. According to Kroemer et al. 2017, ergonomics is the application of scientific principles, methods, and data drawn from a variety of disciplines to the development of engineering systems in which people play a significant role. One of the most important contributions that ergonomics can provide to the automobile design process is information of the physical size of driver, and his/her preferred postures (Porter et al., 1998). A comfortable and safe driver's seat plays a very important role in car design and fabrication. As mentioned by Na et. al. (2005), drivers comfort was as important as the functional and aesthetic design of automobiles since users were more and more concerned about safety and comfortable driving. Current bundling of the knowledge on comfort and discomfort has been limited, while the need for this knowledge is crucial since people use products related to comfort every day (Vink et al., 2012). The application of ergonomics in ensuring comfortable and safe posture for older taxi drivers to ensuring better lifestyle and minimize the health problem on work-related musculoskeletal disorders (WMSD's).The main objectives of this study were to discuss on driving awkward body posture effect to health problem among older taxi drivers in Malaysia perspective through ergonomic review.

2. Methods

The design of this study was a cross - sectional survey using a questionnaire to investigate characteristics of driving background and association risk factors with awkward body posture on seat desgin among older taxi drivers in Malaysia. A purposive sampling was chosen and 120 respondents participate in the study. Criteria sample has been choose; age above 60 years old, driving experience at least 1 years to be taxi drivers, registered with LPTC, who had a history of major surgery or history of neurological problems were excluded. The taxi drivers was attended any courses or training related with occupational health and also making part time job as taxi drivers and driving less than 4 hours per-day were excluded. Types of taxi services involves only budget car and hired car. Every respondents in Malaysia age into 60 years above drive taxi budget and hired car with standard seat design without modified the seat drivers are involves directly into study (Figure 1). A small token offered as an acknowledgment in the form of gifts for those completed the survey. The survey took approximately 10 -15 minutes per- person to complete.

A self- administered questionnaire which was design for this study was distributed to the participants. The interview was conducted one to one older taxi drivers to obtain good result and minimize miss-interpreted. The question divided into three section. The first part of the questionnaire included questions on socio-demographic factors. The second part included questions on characteristics of older taxi drivers such as total pick up passenger per- day, resting time, working hours and others variables related to driving background. The third section involved questionnaire related to characteristic driver seating arrangement check list which is the questionnaire adapt and adopt from APHIS Ergonomics Work Health Loughborough University.



[Figure 1: Break down of Taxi Services] (*Source : SPAD, 2014)*

The interview was conducted in parking places of bus station, train station, shopping malls and taxi stand areas (Figure 2). All selected taxi were chosen in this study are registered with SPAD under taxi services that inclusively the budget and hired car. According to the statistic year 2014, budget taxi services (61.2%) and hired car (26.6%) that are the most highly registered with SPAD compared to other categories. Besides that, these taxi types are classified as economy taxi and the car seat design underlined in standard/normal specification compared to other taxi services (Figure 2). The analysis was performed using SPSS software version 20. Descriptive statistical were obtained for all the variables and chi-square test analysis used to review the association factors with seating awkward body posture.

Figure 2 : Sampling location - 1: bus station, 2: hypermarket, 3 : taxi station

3. Results

Table 1 showed characteristic older taxi driver, mean (±SD) age of the respondents was 64.7±4.0 years and age ranged from 60 to 77 years old. Most of elderly taxi drivers were aged between 60 to 65 years old (60%). The majority (93.3%) of respondents worked as a full-time taxi drivers and work as self-employed (56.7%). Mean income per-month RM 1383.3±874.3 from RM200 to RM4000.The smoking status almost equal between answer yes or frequent (55.0%) and no or never (45.0%). Half (52.5%) of older taxi drivers take rest in a week and majority (84.2%) of them

total hours driving per-day more than 8 hours and average hours driving more than 56 hours per-week. Distance driving in per-week more than 250km were 75.8%. Less than half (45.8%) never driving taxi until mid-night. However only 15.8% always stay until mind-night. Over than 76.7% complained having back pain last 12 months and also 67.5% reported feeling back pain in the past 7 days. The taxi drivers agreed (89.2%) the feeling back pain caused by their work environment. Most of them always (95.0%) carry passengers' luggage into trunk . The total highest driving experience as taxi drivers were 44.2% which is more than 16 years and above.

Tables 1: Characteristics older taxi driver

Factors	N (%)	Mean ±(S.D)	Min	Max
Age		64.7± 4.0	60	77
60>65	72(60)			
>66	48(40)			
Current jobs				
Full time	112(93.3)			
Part time	8(6.7)			
Jobs sectors				
Company	52(43.3)			
Self - employed	68(56.7)			
Income per-month		1383.3 ±874. 3	200	4000
Smoking status				
Yes/frequent	66(55.0)			
No/never	54(45.0)			
Take rest per-week				
Yes	63(52.5)			
No	57(47.5)			
Total hours driving per-day				
1>7hours	19(15.8)			
>8 hours	101(84.2)			
Carry luggage into trunk				
Yes	114(95.0)			
No	6(5.0)			

Factors	N (%)
Past 12 month feeling back pain	
Yes	92(76.7)
No	28(23.3)
Past 7 days feeling back pain	
Yes	81(67.5)
No	39(32.5)
Feeling back pain cause of job	
Yes	107(89.2)
No	13(10.8)
Total driving experience	
1>5 yrs	32(26.7)
6>15yrs	35(29.2)
Average hours driving per-week	
48-56 hours	15(12.5)
>56 hours	105(87.5)

N=120

Table 2 result showed awkward body posture on seat design among older taxi drivers risk factors, analysis socio-demographic elderly taxi driver has significant relationship with BMI- 25≥ 40 (X^2:4.31, *p*: 0.03) and smoking status – yes (X^2:4.22, *p*:0.04). However, analysis characteristic older taxi drivers has significant relationship with driving until mid-night – always (X^2:5.97, *p*: 0.01), past 12 month feeling back pain- yes (X^2:5.64, *p*: 0.01), past 7 days feeling back pain- yes (X^2:14.10, *p*: 0.00), feeling back pain cause of job-yes (X^2:5.10, *p*: 0.02), carry luggage into hood-yes (X^2:16.44, *p*: 0.00), Back rest provide support along the length of back- yes (X^2:5.40, *p*: 0.02), Head restraint height near the top of head- yes (X^2:4.28, *p*: 0.03) and Size of seat design influence to driving comfort- yes (X^2:10.74, *p*: 0.00). Only a few variable; average hours driving per-week, average distance driving per-week, total driving experience, Seat adjustment easy to control and Seat length put pressure on the back of knee or calves not contributed to discomfort body posture on seat design among elderly taxi drivers in Malaysia.

Variables	Awkward body posture on seat design		Chi Square value (X^2)	*P* value
	Yes (%)	No (%)		
Past 7 days feeling back pain			14.10	**0.00****
No	25.8	6.7		
Yes	66.7	0.8		
Feeling back pain cause of job			5.10	**0.02****
No	8.3	2.5		
Yes	84.2	5.0		
Carry luggage into hood			16.44	**0.00****
No	2.5	2.5		
Yes	90.0	5.0		
Total driving experience			0.22	0.63
<5 years	24.2	2.5		
>5 years & above	68.3	5.0		
Seat adjustment easy to control			2.16	0.14
No	32.5	0.8		
Yes	60.0	6.7		

Tables 2: Risk factors with discomfort body posture on seat design (Chi Square test)

Variables	Awkward body posture on seat design		Chi Square value (X^2)	*P* value
	Yes (%)	No (%)		
BMI			4.31	**0.03****
≤15 ≥ 25	43.3	0.8		
25≥ 40	49.2	6.7		
Smoking status			4.22	**0.04****
Yes/frequent	53.3	1.7		
No/never	39.2	5.8		
Average distance driving per-week			1.82	0.17
≤150km	2.5	0.8		
≥151km	90.0	6.7		
Driving until mid-night			5.97	**0.01****

Not frequent & never	80.0	4.2		
Always	12.5	3.3		
Past 12 month feeling back pain			5.64	**0.01****
No	19.2	4.2		
Yes	73.3	3.3		
Back rest provide support along the length of back			5.40	**0.02****
No	79.2	4.2		
Yes	13.3	3.3		
Lumber curve supported without any points of pressure or gaps			0.56	0.45
No	72.5	6.7		
Yes	20.0	0.8		
Size of seat design influence to driving comfort			10.74	**0.00****
No	4.3	2.6		
Yes	88.0	5.1		

Variables	Awkward body posture on seat design		Chi Square value (X^2)	*P* value
	Yes (%)	No (%)		
Seat length put pressure on the back of knee or calves			0.87	0.77
No	46.7	4.2		
Yes	45.8	3.3		
Head restraint height near the top of head			4.28	**0.03****
No	30.0	5.0		
Yes	62.5	2.5		

N = 120

**Significant p <0.05

4. Discussion and conclusion

In this study, more than half age of respondents ranged between 60 to 65 years old and previous study conducted by Welch et al.2009, low back pain occurs between 30 to 50 years old and approximately cost 30 percent of expenditure due to soft tissue damaged. According to Pruesser et al.(1998), ages within 65 to 69 years old driver were 2.26 times higher at risk of a fatal multi-vehicle crash compared to 40- 49 old drivers. Almost equal older taxi drivers work as full time and self-employed to sustain their life and family well-being, compared to previous studies taxicabs in Nigeria which are 85% of taxi drivers engaged in business driving as means of living (Onawumi et al. 2012). Results of income per month for elderly taxi drivers in Malaysia was RM 1383.00 have showed different that a study by AL- Dubai et al. 2012, that taxi drivers income in Malaysia are more than RM 2000.00. The smoking results are not significantly different with the previous study by AL-Dubai et al. (2012). In addition, socio-demographic and individual factors as age, gender, smoking status, sleeping disorders, lack of exercise and health status (BMI) were found to be associated with MSD problem on LBP among taxi drivers (Magnusson et al., 1996; Miyamoto et al., 2008; Hulshof et al., 2006). However, result showed significant relationship between smoking status and BMI (obese) with discomfort body posture on seat design compared to others variables.

This study also found risk factors of discomfort body posture on seat design those who worked more than eight hours daily compared to those driving less working hours has no significant relationship. This finding was consistent with that found by Miyamoto et al. (2008), driving long hours and driving until late night has significant relationship with discomfort body posture on seat design. The result has similarity previous research, driving taxi for more than 12 hours per day and driving with continues mode at least 5 days per week were contributes to increasing prevalence health problem (Abledu JK and Offei EB,2014).More times spend to pick-up and waiting for passenger daily or per-week lead to low back pain injury (Miyamoto et al. 2008). Researcher Tamrin et al. (2007) stated, monotones in long distance driving influenced to factors lower back pain and other injuries related to MDS which means that results showed (75.8%) older taxi drivers driving more than 250km per week may potentially lead to developing of body muscle problem. However this showed no significant relationship between driving taxi more than 150km per week with awkward body posture on seat design compared to previous study from Diamantopoulou K et al. 1996, older drivers aged over 75 years old are more likely to be involved to serious injury per kilometer compare to other age groups.The study found that the past 12 months having back pain among taxi drivers in Malaysia was 76.7% and the past seven days 67.5% and discomfort body part maps showed back body parts have higher complaints with pain and very discomfort compared to others parts. Similar to that was also found in previous research in Japan and Taiwan, which the prevalence of lower back parts among taxi drivers was 45.8% and 51% respectively (Funakoshi et al., 2003 Chen et al. 2005). According to Peter and Ullrich MD (2009), 51% of taxi drivers found low back pain in the past 12 months and the result showed similarity older taxi driver having back pain past 12 month has significant relationship with awkward body posture on seat design.There are no different from the result showed significant relationship with discomfort body posture on seat design. Longer years working experience as taxi drivers are related to discomfort in this study. Elderly drivers within 6 years to 15 years driving may potential to have problems on body parts. The previous study among professional drivers found a significant association between low back parts and duration of employment as a bus driver (Tamrin et al., 2007). However, some author studies on taxi drivers did not find such relationship (Chen et al., 2005) and have similarity from the result that was no relationship for duration of driving as a taxi driver. The older taxi drivers have relationship between discomfort body posture on seat design and feeling back pain because of their work and carry luggage into the trunk. Most of taxi drivers suffer from the work-related disease, these users have a high risk

of damaging the human biological clock rhythm and are at risk of body injuries; low back pain, neck disorder, carpal tunnel syndrome, and depression, tension, fatigue, insomnia and other diseases (Yang Yet al. 2014). The previous study reported that taxi drivers spent longer time in driving than other professions (Raanaas and Anderson 2008; Talamanca et al., 1996; Dalziel and Rob 1997). The characteristic car seat design showed significant relationship on back rest provide support along the length of back, head restraint height near the top of head and size of seat design influence to driving comfort with awkward body posture on seat design among older taxi drivers. The result supported from previous researcher, Grandjean E (1989) car seat comfort has a strong relationship with the postural support characteristic of the driver's car seat; therefore, it is important to design a car seat that can contribute towards com-fort and seating adjustability. Other occupational factors such as whole-body vibration, long working hours, cramped driving space, shocks due to road surface, total mileage, experienced taxi driver, job dissatisfaction and job stress have been found as additional important determinants of low-back pain among taxi drivers (Bovenzi and Zadini 1992; Chen et al., 2005a; Funakosh et al. 2004).

In general, this study give us the preliminary characteristic perspective among elderly taxi drivers especially to identify relationship and risk factors that may cause to injury or pain on sitting posture due to discomfort seat design in Peninsular Malaysia. The insufficient sample size may effect to the result for representing population of elderly taxi driver in Malaysia. More exploration needed to investigate this topic that will benefit to taxi drivers especially the elderly community to improve their life and safety. Through ergonomics intervention approach shall reduce MSD related problems that give us some concrete base to do further research on this topic.

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