

Ergonomics Review : Identify Discomfort Seating Posture Among Elderly Taxi Drivers at Malaysia Perspective.

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Abstract World Health Organization (WHO) describes people aged above 60 years old fall under a category of elderly. The alternative profession could involve with this community is to be taxi drivers. Therefore, numerous factors should take part to ensure the elderly taxi drivers could serve their best performance and in good health condition. This study aimed to determine discomfort seating posture among elderly taxi drivers through ergonomic approach in Malaysian perspective. A cross-sectional study was conducted with elderly 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. Purposive method sampling used based on inclusive criteria; age 60 years old and above, self-driving taxi more than 1 year, no disabilities and registered with Land Public Transport Commission (LPTC). Total of 120 respondents participated in the study. Most of elderly taxi drivers used hired car type of taxi and work as a permanent job. The highest feeling discomfort on seating body posture among elderly taxi drivers are at the right hips and left buttock. At the left hips and lower back showed the highest discomfort on seating posture compared to other body parts. Inappropriate seating posture among elderly taxi drivers may cause discomfort and developing to MSD's. The low awareness on ergonomics education could reflect quality lifestyle and health among elderly taxi drivers in Malaysia.

Keywords elderly, taxi driver, seating posture, ergonomics, discomfort

1. Introduction

Malaysia's population in the year 2016 was approximately 31.7 million with 0.5 million increased as compared to the year 2015 which was 31.2 million with 1.5 per cent population growth rate (DOSM, 2016). This number will be continued rising year by year to achieve vision 2020. A statistic from Department of Statistics Malaysia (DOSM, 2016) showed population aged 65 years and above increased by 0.2 percentage points from 5.8 percentage (2015) to 6.0 percentage and equivalent to 1.9 million elderly communities in Malaysia for the year 2016. World Health Organization (WHO) described people who age above 60 years old falls into a category of elderly. Besides that, elderly people need specific consideration to sustain their life according to ability and capability in the challenging world. The characteristic of elderly people may differ to other ages in terms of

physiological, sensory, perceptual, motor and cognitive abilities that may impact on how elderly interact with task and behaviour (Herriot P. et al. 2005). These changes would decrease elderly in ability, strength, reduced ability to process information; slowed reaction and hearing loss (Smith et al., 1993). The limited ability among elderly could react to their lifestyle and health also safety on driving behaviour. The research was conducted by Smith et al. 1993, transportation is a key to a life of quality and well-being for elderly and this has come to mean access to the private car. Past research indicated that approximately one-third of pensioners are vulnerable to poor retirement and outcomes in term of life satisfactions and well-being (Van Solinge and Henkens, 2008; Wang et al. 2007).

Therefore, an elderly 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 jobs to support family economic financial and to sustainable life in the challenging world. The alternative professions could involve these communities are to be a taxi driver. Many factors influenced elderly people to choose to be a taxi driver; to sustain life due to 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 (Malaysian laws) and has driving experience on commercial or private car. In peninsular Malaysia in the year 2013 total of 60,472 taxi drivers there are 59,174 (98%) male drivers 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. This number will rise year by year and population taxi driver under category elderly also will increase. Therefore, numerous factors should take part to ensure the elderly taxi drivers could serve their services at high performance and insurance their life in good health. First is the time factor; taxi drivers spend a longer time in driving than other professions (Raanaas and Anderson 2008; Talamanca et al., 1996; Dalziel and Rob 1997). Second factor is baggage handling exceeds body limit and sleeping on the car seat in confined space during rest breaks (Raanaas and Anderson 2008).

Over exposed driving in term of distance and hours to elderly taxi drivers caused many negative impacts. Hence, the characteristic of elderly taxi driver it so crucial to understand, it may causes of the aging process make elderly people more vulnerable to injury. Structure body elderly is too fragile compared to an adult, it takes less energy to produce tissue damage and disruption, and their skeletal structures are more easily damaged through bone loss. Due to that, sitting which is the work posture of a driver should be properly done to avoid injuries among elderly taxi drivers. A previous study found on driver fatigue and low back pain disorders as a matter of research and development, however, the need for users assessment of seat design is inevitable (Park et al. 1998). Car seat design and arrangement seat play important to human body specifically on health. Numerous of complaints obtained from past researchers, taxi drivers are related to musculoskeletal disorders (MSD's) especially on low back pain (Sami Abdo Radman Al Dubai et al., 2012; Burgel et al., 2012; Yang Y et al., 2014; Nahar et al., 2012; M.A Machin & J.M.D. De Souza, 2004). Seated posture as potentially unhealthy and considered as one of the major contributing factors for several MSD's such as pain in the lower back part (Ebe and Griffin, 2001, neck (Schneider an Ricci, 1989) and shoulder (Magnusson and Pope, 1998). Due to increased exposures to seated posture in the car, the proper sitting adjustment has become an important issue that demands adequate ergonomic interventions (Dunk and Callaghan, 2005). The sitting

while driving needs to be differentiated from the comfort of sitting on a chair at various of an environment such as at home, in the office or at the workplace and factory or others industry. According to Andreono et al. (2002), driver's seat comfort in a car has distinctive comfort value compared to others types of seats. The drivers can show naturally discomfort if his/her body feel pressured, burdened and emotion destruction. Research conducted by Baba Md Deros et al. 2015, adjustability of the driver's seat was the most cited parameter to increase the safety and comfort level. At the worst situation, elderly drivers will feel pain and injury at upper torso body part especially lower back body part. The elderly body muscle fragile and easy to obtain injury and takes time to recover compared to younger people. Emphasizing the ergonomic principles on car seat design would minimize potential MSD's and increased health level between elderly taxi driver.

Ergonomics is basically the applications of science in human life for comfort and safety. The most important contribution 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. 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 ergonomics of seat comfort has been studied from a number of different perspectives (Zhang et al., 1996; Yamazaki, 1992). According to Baba Md Deroes et al. 2015, the comfort and safety level of the present driver's seat by identifying and determining parameters which influence the comfort level and safety system of the driver's seat. The application of ergonomics in ensuring comfortable and safe posture for elderly taxi drivers to ensuring better lifestyle and safety and health improving.

One of the frequent injuries related on MSD's occurs among professional driver are back pain, neck and related on upper torso body part. About 80% of drivers will experience back pain at some stage in lives (Robb et al., 2007). A number of work and leisure activities can contribute to back pain and spend long hours driving on static posture may suffer from prolonged discomfort of pain in the back body part and upper torso body part. Sitting in the same position for long hours gripping the steering wheel and being exposed to vibration from the road can contribute to the wear and tear on the back body part. Driving creates significant stress to the neck and the upper and lower back.

2. Objectives

This study aimed to explore the discomfort seating posture among elderly taxi drivers at Malaysian perspective through ergonomic review.

3. Methods

The design of this study was a cross - sectional survey using a questionnaire to investigate characteristics of driving background and prevalence of discomfort on seating posture among elderly taxi drivers in Peninsular Malaysia. The study was conducted around rural and urban area at four regions of peninsular 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 involve only budget car and hired car. Every respondents in peninsular 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. 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. The participants were asked kindly and if they agree, then complete information related to work characteristics, some health issues of taxi drivers and seating posture was given.

A self- administered questionnaire which was designed and distributed to the participants. The interview was conducted one to one elderly taxi drivers to obtain good result and minimize miss-interpretation. The question divided into three sections. The first part of the questionnaire included questions on socio-demographic factors (age, race, marital status, education level, status jobs, income, smoking and etc.) and past medical history. The second part included questions on characteristics of elderly taxi drivers such as total pick up passenger per-day, resting time, working hours, years as a taxi driver, type employment, total distance driving per-week, regular time start driving, working until late night, competency confident level of driving, feeling back pain last 12 month and past 7 days and type of activities on leisure time. The third part includes questions on the body part discomfort map from each body part on the sitting driving position. The modified questions adapt and adopt from the United States driving ergonomics program. A body part discomfort map diagram of 28 body parts divided into neck, upper back, middle back, left elbow, right elbow, lower back, left buttock, right buttock, left hip, right hip, left thigh, right thigh, left knee, right knee, left calf, right calf, right foot, left foot, stomach, right forearm, left forearm, right wrist, left wrist, chest, right upper arm, left upper arm, right shoulder and left shoulder to assist the elderly taxi drivers in identifying the correct body parts in answering the questions. The questions utilized a simple

phrase such as “Within last week did you feel any discomfort on any body parts during driving (works); 1) very uncomfortable; 2) less uncomfortable; 3) uncomfortable; 4) comfortable; 5) very comfortable ” and score value begin from 1 to 5 as shown in Figure 1.

1 = very uncomfortable, 2 = less uncomfortable, 3 = uncomfortable, 4 = comfortable, 5 = very comfortable

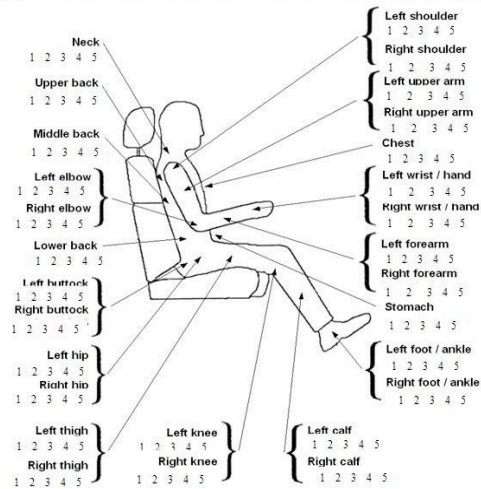


Figure 1. Discomfort body parts maps - adopted from United States driving ergonomics program.

Interview were conducted in parking places bus station, train station, shopping malls, taxi station and business centre area in rural and urban attraction to the public area or main city or town. The analysis was performed using Social Package for Social Sciences (SPSS) software version 20. Descriptive statistics were obtained for all the variables in the study.

3. Results

The Background of elderly taxi drivers

Majority (76.7%) elderly drivers used hired car as a type of taxi. All respondents were male. Mean (\pm 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%). Mean (\pm SD) weight and height respondents was 72.9 ± 12.2 ; 168.0 ± 6.7 and BMI was overweight (42.5%). The majority was Malay (78.3%) second was India (13.3%), married (98.3%), secondary school (60.8%) for education level. The majority (93.3%) of respondents work as full-time taxi drivers and self-employed (56.7%). Mean income per-month RM 1383.3 ± 874.3 from RM200 to RM4000. Health status was just average (45.0%) condition. The smoking status almost equal between answer yes or frequent (55.0%) and no or never (45.0%). The details background elderly taxi drivers are showed in Table 1.

Characteristics elderly taxi drivers.

Average mean driving per- week was 30.5 ± 21.0 from 8 times to 200 times per week. Half (52.5%) of elderly 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. More than half (67.5%) elderly taxi drivers not prefer taking nap during waiting turn to obtain passenger and 50.8% spend within two to three hours and 41.7% spent more than four hours per-day to obtain customer. Distance driving in per-week more than 250km was 75.8%. Less than half (45.8%) never drive taxi until mid-night. However, only 15.8% will stay until mind-night. Over than 76.7% complained having back pain last 12 months and also 67.5% reported feeling back pain past 7 days. The taxi drivers agreed (89.2%) that the feelings of back pain were caused by their work environment. Most of them always (95.0%) carry passengers' luggage into car and luggage carried was more than 11kg (60.8%) . Table 2 reported total highest driving experiences as taxi drivers were 44.2% which is more than 16 years. 59.2% reported that they obtained more passengers five years ago than the current year.

Tables 1, Background elderly taxi drivers.

Factors	N(%)	Mean \pm (S.D)	Min	Max
Category taxi				
Hired car	92(76.7)			
Budget	28(23.3)			
Gender - Male	120(100)			
Age		64.7 \pm 4.0	60	77
60>65	72(60)			
>66	48(40)			
Weight		72.9 \pm 12.2	49	105
Height		168.0 \pm 6.7	154	188
BMI				
Underweight	3 (2.5)			
Normal	50(4.7)			
Overweight	51(42.5)			
Obese	16(13.3)			
Ethnicity				
Malay	94(78.3)			
India	16(13.3)			

Chinese	10(8.3)			
Marital status				
Married	118(98.3)			
Divorce	2(1.7)			
Education				
None	8(6.7)			
Primary school	39(32.5)			
Secondary school	73(60.8)			
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 \pm 874.3	200	4000	
Health status				
Good	47(39.2)			
Very good	2(1.7)			
Average	54(45.0)			
Not good	17(14.2)			
Smoking status				
Yes/frequent	66(55.0)			
No/never	54(45.0)			
N=120				

Tables 2, Characteristics elderly taxi drivers.

Factors	N(%)	Mean \pm (S.D)	Min	Max
Average driving per-week		30.5 \pm 21.0	8	200
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)			

Tables 2, Cont.

Average hours driving per-week	
48-56 hours	15(12.5)
>56 hours	105(87.5)
Sleep nap waiting passenger	
Yes	39(32.5)
No	81(67.5)
Waiting hours passenger per-day	
<1 hours	9(7.5)
2>3hours	61(50.8)
>4hours	50(41.7)
Average distance driving per-week	
51>150km	4(7.5)
151>250km	25(20.0)
>250km	91(75.8)
Driving until mid-night	
Always	19(15.8)
Not frequent	46(38.3)
Never	55(45.8)
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)
Carry luggage into boot	
Yes	114(95.0)
No	6(5.0)
Load luggage weight	
1>5kg	7(5.8)
6>10kg	34(28.3)
>11kg	73(60.8)
Never	6(5.0)
Total driving experience	

Tables 2, Cont.

1>5 yrs	32(26.7)
6>15yrs	35(29.2)
>16yrs	53(44.2)
Compare 5 years driving and current	
More driving	9(7.5)
No changes	40(33.3)
Less than before	71(59.2)
N=120	

Result from table 3 showed, the highest body part complaints received are the very uncomfortable on driving posture among elderly taxi drivers were left hips (25.0%) second highest were right buttock (24.2%) followed by lower back and right hips (23.3%) and body part likes left buttock (16.7%), right calf (14.2%), upper back and left calf (12.5%) but still showed higher complaints under the category of very uncomfortable compared to others body parts. However, 48.0% feel uncomfortable at body part left buttock second highest on same category are right hips (47.5%) followed by left hips (44.2%), lower back (40.0%), right buttock (38.3%) and also upper back and left calf (33.3%) and center back and right calf (32.5%) received complained with same category. Meanwhile, others body part also reported higher from 35.0% to 30.0% by elderly taxi drivers feeling uncomfortable are upper back, center back, neck, left knee, right knee and right shoulder compared to others body parts under same category. In other words, the majority of elderly taxi drivers agreed (92.5%) the discomfort at body parts happen cause of car seat design. Other body parts complained are showed in Table 3.

Tables 3, Characteristics elderly taxi drivers.

Factors	N(%)	Percentage (%)
Neck		
very uncomfortable	13	10.8
less uncomfortable	22	18.3
uncomfortable	42	35.0
comfortable	31	25.8
very comfortable	12	10.0
Upper back		
very uncomfortable	15	12.5
less uncomfortable	40	33.3
uncomfortable	43	35.8
comfortable	17	14.2
very comfortable	5	4.2

Tables 3, Cont.
Tables 4, Cont.

Center back			very comfortable	2	1.7
very uncomfortable	14	11.7	Right buttock		
less uncomfortable	39	32.5	very uncomfortable	29	24.2
uncomfortable	43	35.8	less uncomfortable	46	38.3
comfortable	22	18.3	uncomfortable	28	23.3
very comfortable	2	1.7	comfortable	15	12.5
Left elbow			very comfortable	2	1.7
very uncomfortable	6	5.0	Left hips		
Less uncomfortable	14	11.7	very uncomfortable	30	25.0
uncomfortable	12	10.0	less uncomfortable	53	44.2
comfortable	78	65.0	uncomfortable	21	17.5
very comfortable	10	8.3	comfortable	16	13.3
Right thighs			very comfortable	0	0
very uncomfortable	7	5.8	Right hips		
less uncomfortable	37	30.8	very uncomfortable	28	23.3
uncomfortable	27	22.5	less uncomfortable	57	47.5
comfortable	37	30.8	uncomfortable	19	15.8
very comfortable	12	10.0	comfortable	14	11.7
Left knee			very comfortable	2	1.7
very uncomfortable	8	6.7	Left thighs		
less uncomfortable	27	22.5	very uncomfortable	13	10.8
uncomfortable	37	30.8	less uncomfortable	34	28.3
comfortable	40	33.3	uncomfortable	30	25.0
very comfortable	8	6.7	comfortable	33	27.5
Tables 4, Characteristics elderly taxi drivers. (back)			very comfortable	10	8.3
Factors	N(%)	Percentage (%)	Right knee		
Lower back			very uncomfortable	8	6.7
very uncomfortable	28	23.3	less uncomfortable	29	24.2
less uncomfortable	48	40.0	uncomfortable	36	30.0
uncomfortable	24	20.0	comfortable	39	32.5
comfortable	19	15.8	very comfortable	8	6.7
very comfortable	1	.8	Left calf		
Left buttock			very uncomfortable	15	12.5
very uncomfortable	20	16.7	less uncomfortable	40	33.3
less uncomfortable	54	45.0	uncomfortable	24	20.0
uncomfortable	25	20.8	comfortable	28	23.3
comfortable	19	15.8	very comfortable	13	10.8

Tables 4, Cont.

Right calf		
very uncomfortable	17	14.2
less uncomfortable	39	32.5
uncomfortable	20	16.7
comfortable	31	25.8
very comfortable	13	10.8
Left shoulder		
very uncomfortable	9	7.5
less uncomfortable	13	10.8
uncomfortable	34	28.3
comfortable	26	21.7
very comfortable	38	31.7
Right shoulder		
very uncomfortable	6	5.0
less uncomfortable	12	10.0
uncomfortable	36	30.0
comfortable	23	19.2
very comfortable	43	35.8

Tables 5, Characteristics elderly taxi drivers. (sides)

Factors	N(%)	Percentage (%)
Upper wrist left side		
very uncomfortable	6	5.0
less uncomfortable	14	11.7
uncomfortable	27	22.5
comfortable	29	24.2
very comfortable	44	36.7
Upper wrist right side		
very uncomfortable	6	5.0
less uncomfortable	14	11.7
uncomfortable	20	16.7
comfortable	32	26.7
very comfortable	48	40.0
Chest		
very uncomfortable	12	10.0
less uncomfortable	6	5.0
uncomfortable	12	10.0
comfortable	31	25.8

Tables 5, Cont.

very comfortable	59	49.2
Left wrist		
very uncomfortable	9	7.5
less uncomfortable	9	7.5
uncomfortable	25	20.8
comfortable	28	23.3
very comfortable	49	40.8
Right wrist		
very uncomfortable	10	8.3
less uncomfortable	9	7.5
uncomfortable	27	22.5
comfortable	28	23.3
very comfortable	46	38.3
Left arm		
very uncomfortable	12	10.0
less uncomfortable	7	5.8
uncomfortable	18	15.0
comfortable	34	28.3
very comfortable	49	40.8
Right arm		
very uncomfortable	14	11.7
less uncomfortable	7	5.8
uncomfortable	13	10.8
comfortable	38	31.7
very comfortable	48	40.0
Left ankle		
very uncomfortable	10	8.3
less uncomfortable	17	14.2
uncomfortable	13	10.8
comfortable	48	40.0
very comfortable	32	26.7
Right ankle		
very uncomfortable	12	10.0
less uncomfortable	15	12.5
uncomfortable	14	11.7
comfortable	47	39.2
very comfortable	32	26.7

Table 6. Discomfort body part cause of seat design

Factors	N (%)	Percentage(%)
Yes	111	92.5
No	9	7.5

N=120

4. Discussion and Conclusion

This study found the ethnicity population may have different genetics factors, these theory supported from previous study among tractor drivers in Brazil (Andrusaitis et al., 2006), bus drivers (Rozali et al., 2009) and military armoured vehicles drivers in Malaysia (Tamrin et al., 2007) found no significant association between ethnicity and MSD's problem. Majority elderly taxi drivers work as full time and self-employed to sustain their life and family well-being, similar to previous studies taxicabs in Nigeria which are 85% of taxi drivers engaged in business driving as means of living (Onawumi et al. 2012). Result income per month elderly taxi drivers in Malaysia RM 1383.00 showed different study AL-Dubai et al. 2012, taxi drivers income in Malaysia more than RM 2000.00. The smoking result not much different with the previous study (AL-Dubai et al., 2012).

In this study, higher developing of body posture risk was found among those who worked more than eight hours daily compared to those driving less working hours. This finding was consistent with that found by Miyamoto et al. 2008, driving long hours. 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 others injury related to MDS's which means this result showed 75.8% elderly taxi drivers driving more than 250km per week it may potentially lead to developing body muscle problem. The study found that the past 12 month 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). Long experiences of working as taxi drivers related to discomfort in this study as elderly drivers within 6 years to 15 years driving may potential to have a problem 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).

In this study, discomfort on driving sitting body posture among elderly taxi drivers showed right buttock, left buttock, lower back, neck, center back and upper back, left hips, left thighs falls under category very uncomfortable and uncomfortable. It describes all body parts at back side which contact to the seat potentially has the problem on MSDs and lead to developing injury on low back pain. According to Mohammad D. et al. 2016, comfortable car seat driving able to achieve through dimensioning of car set design and should appropriate with anthropometry dimension of the user. In others word, comfortable sitting driving could reduce health problem and develop MSDs on cumulative. Previous studies found a significant association between low back parts and certain ergonomics factors such as the use of backrest support and driving in forward bending sitting posture (Chen at al., 2005; Romli et al., 2009).

Majority elderly taxi drivers agree that this discomfort attributed of mismatch between anthropometry measurement and car seat dimensions and also selective design factors. The previous study was done by Baba Md Deros et al. 2015, driver's seat design awareness which influenced the perception of drivers comfort and discomfort. In general, this study give us the preliminary perspective of characteristics taxi drivers among elderly especially to identify which body parts potentially may cause to injury or pain on sitting posture among elderly taxi drivers in Malaysian. It also help us in the beginning to prevent MSDs or developing body parts injury through determining which body part potentially may develop the cumulative injury. However, this result only can use a baseline to investigate more details and give us some concrete base to do further study on this topic. The insufficient sample size may effect to the result for represent population elderly taxi driver in Malaysia. More explore to investigate this topic will benefit to taxi drivers especially elderly community to improve their life and safety and also reduce problem-related to work MDS's through ergonomics intervention approach in the further study.

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