SIGNIFICANT FACTORS FOR MALAYSIAN OLDER DRIVERS OR RIDERS TO GIVE UP THEIR KEYS

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Abstract— Driving or riding is fundamental of freedom and independence but due to degenerative changes associated with ageing, there is increasing recognition of the need for older adults to cease driving or riding. While research in developing countries on driving or riding cessation are scarce, this brings down to the objective of this study which is to identify potential factors influencing driving or riding cessation in older Malaysian current and former car drivers or motorcycle riders aged 60 years and above. A sample of 105 participants that fulfilled the inclusion criteria had given their consent and completed the questionnaires. Stepwise multiple logistic regression analyses were performed to identify significant determinant factors of driving or riding cessation by controlling for baseline characteristics and potential confounding variables. Significant factors identified in influencing the decision to stop driving or riding among older adults were comorbidity (diabetes mellitus), depression, type of road user (motorcycle rider), and self-rated level of confidence (low) in the selected driving or riding situations.

Index Terms— Older adult, Motorcycle rider, Car driver, Cessation.

I. INTRODUCTION

"I want to see road safety taken as seriously as AIDS", "It kills just like AIDS." "If roads are not made safer, road traffic crashes could double by 2030 and surpass HIV/AIDS" [1]. In Malaysia, almost 80% of injuries were due to road traffic accident (RTA) with 70% mainly involving motorcycle-related crashes [2]. The fatality rates are the highest among the young (18-20 years) and the elderly (above 65 years) [3], with very elderly group (above 75 years) were almost three times more likely to die from RTA than elderly group (below 75 years) [4].

"There are good drivers who are old and there are awful drivers who are young. It's not a question of age" [5]. In general, older drivers are considered to be cautious and safe road users but compared to younger middle-aged drivers, they are at increased risk of fatal and serious injury crashes due to various factors associated with the ageing process [6]. While frailty is the leading factor associated with injury risk, fitness to drive is also associated with crash risk. Many older adults experiencing physical changes associated with ageing and medical conditions which could
Potentially influence their driving ability [7].

As populations age [8], the most concerning issues here are the increasing number of older drivers and the associated fatalities [9]. This suggests that the ability to recognise a decline in driving ability and adopt appropriate self-regulatory driving behaviour are important skills required by all older drivers [10]. However, only some made adjustments while the rest deny the need to self-regulate and unwilling to recognize the problem even if the signs are apparent [11]. "I don't want to give up my license. Someone will have to take it before I give it up" [11]. According to Adler *et al.* [12], these groups of people are identified as "resisters" and viewed as at-risk group as they can be dangerous to themselves as well as others [12]. Their major concerns are mainly fear of losing the freedom to travel whenever they want, difficulty in using public transport and reluctance to rely on others for transportation support [13].

"Just to be behind the wheel makes you feel important. If someone takes away your car, you feel like a cripple. You lose your value of life" [11].For many older people, driving or riding not only contributes to independence and convenience in mobility, it also symbolizes autonomy and competency. While there are numerous ways to manage the safe mobility of older adults, we generally rely on older drivers themselves to make the decision whether to continue or stop driving when they are no longer capable of driving confidently and safely [14]. Nevertheless, it is uncertain how exactly the decisions were made. Therefore, it is essential that decisions by older drivers on the need to continue or cease driving are better understood.

The decision to continue or stop driving is a complex process and multifactorial. It is not just about making a choice whether to continue or stop driving but it is a timely process that gradually changes over time to compensate for declining ability by making appropriate adjustments in driving behaviour and alterations to driving pattern. There is a growing body of evidence reporting on determinants of driving status among older drivers in developed countries.Past researches have suggested a number of potential factors that can influence this outcome including demographic characteristics (gender, income,

household composition *etc.*), physical and mental health status (self-rated health condition, depression, cognitive and visual impairments), psychological changes (level of confidence and comfort), and also aberrant driving behaviour [14]-[20].

Most literatures addressing older adults travel patterns and self-regulatory behaviour have been conducted in developed countries. In addition, the instruments used for data collection have been designed specifically for these populations. To date, there is no study or instrument developed to identify the determinant factors of self-regulatory driving or riding behaviour among older car drivers and motorcycle riders in Malaysia. In order to address the gap, this study aimed to explore demographic characteristics, driving or riding patterns as well as to identify determinant factors of driving or riding cessation among older Malaysian adults.

II. METHODS

A. Ethics Approval

This study had been approved by Monash University Human Research Ethics Committee (MUHREC) (CF16/1326 - 2016000705).

B. Study Materials

Structured and rigid questionnaire technique was used to obtain a broad understanding of the characteristics of this elderly population. Therefore, prior to the actual study, questionnaire was developed and translated into Malay language (the official language in Malaysia). The psychometric properties of the translated questionnaire was subsequently being assessed in a pilot study [21].

Table I: Components of the questionnaire

Materials	Descriptions
Driver Behaviour Questionnaire (DBQ) [22], [23]	• To evaluate driver's behaviour in detecting any human errors, lapses and violations • 27 items comprising of four subscales measuring errors, lapses, ordinary violations and aggressive violations • Rate using 6-point Likert scale
Short Geriatric Depression Scale (SGDS) [24], [25]	• To measure depression in older adults with 15 items • Rate using dichotomous respond ("Yes" or "No")
Driving or riding confidence, difficulty and reduction [15], [17], [26]	• To determine level of difficulty, confidence and avoidance in 10 selected driving or riding situations • Rate using 3-point Likert scale

C. Inclusion criteria

Participants recruited for this study were Malaysian citizens, current and former car drivers and motorcycle riders, aged 60 years and above who reside in the state of Selangor or Kedah.

D. Recruitment methods

Recruitment was done via advertisement posted on social media sites and notice boards of senior citizen organizations, clubs or activity centers. Participants were recruited through either snowball sampling or in-person approach. The participation of this study was on voluntary basis. Consent was obtained from each participant prior to the commencement of this study.

E. Data collection

Participants were given a choice to answer the paper-based or online questionnaire (Qualtrics) in either English or Malay language. Each participant spent approximately 30 minutes in completing all sections in the questionnaire. A token of appreciation (such as notepad or pen) was given to each participant at the conclusion of his or her participation.

F. Statistical Analyses

Descriptive statistics were used to describe the characteristics and travel patterns of participants. Stepwise multiple logistic regression analyses were performed to identify significant determinant factors of driving or riding cessation by controlling for baseline characteristics and potential confounding variables. Level of significance was set at 0.2 and 0.05 respectively for univariate and multivariate logistic regression analyses. All statistical analyses were performed using Stata version 13.0 software (Stata Corp., College Station., Texas, USA).

III. RESULTS

A. Characteristics and travel patterns of participants

Majority of participants aged between 60 to 74 years (83.8%, n=88) with a median age of 66 years (60-86). More than half of the participants were male (54.3%, n=57), of Chinese ethnicity (60%, n=63), married (80.9%, n=85), and living in urban area (93.3%, n=98). Almost all participants received formal education (95.2%, n=100), they were retired or not working (78.1%, n=82), with monthly household incomes ranging from no income (41.9%, n=44) to more than RM5000 (4.8%, n=5). Majority of the participants rated themselves as having good general health and eyesight conditions, and having at least one comorbidity (82%, n=86). Among those participants who reported having comorbidity, arthritis (43.8%, n=46), high blood pressure (36.2%, n=38), cataract or glaucoma (32.4%, n=34), and diabetes mellitus (21%, n=22) were revealed to be the most common medical conditions. The scores from Short Geriatric Depression Scale (SGDS) suggests majority of the participants were not experiencing any symptoms of depression (81%, n=85).

There were 83 (79%) current drivers or riders and 22 (21%) former drivers or riders with majority being car drivers (78.1%, n=82). Most of the current drivers or riders reported that they drove or rode frequently (74.7%, n=62) and most trips were short distances (89.2%, n=74). When participants were asked for the reason on driving or riding via an open-ended question, the top three answers were to reach a certain

destination, for work, and for convenience. Interestingly, almost two-thirds of the participants had no crash history in the past (63.8%, n=67). Common barriers of driving or riding reported were traffic jams, parking problems, poor lighting, and signage not clear. For those participants who gave up their keys, decision to stop driving or riding were mostly personal (81.8%, n=18). Medical conditions and accident experience were found to be the most common reasons provided for driving or riding cessation. Although most of the former drivers or riders rated that the accessibility of public transports were moderate to excellent (77.3%, n=17), only a few of them actually used the public transports. Majority of them were highly depending on family members for transportation support (45.5%, n=10).

Overall, most of the ratings for the aberrant driving behaviour score were between never (0) and hardly ever (1) with almost half (49.5%, n=51) had scores lower than the median score (median=19) suggesting that participants in this sample were safe and cautious drivers or riders. Among the 4 types of aberrant driving behaviours, lapses and ordinary violations were found to be the most common. Participants in this sample had relatively high level of difficulty (47.6%, mean=18.13), low level of confidence (56.2%, mean= 20.54), and high level of avoidance (55.2%, mean=18.64) in the selected driving or riding situations with majority of them had scores above the average values. Driving or riding during raining condition at night was perceived as a situation with high level of difficulty, low level of confidence, and high tendency of avoidance. Most of them were not confident and found driving or riding at night during rainy day to be very difficult and thus, they always chose to avoid such situation. On the other hand, driving or riding through roundabouts, changing lanes and alone were rated as situations with low level of difficulty, high level of confidence, and low tendency of avoidance. Most of them were very confident and do not regard these driving or riding situations as difficult that will require them to avoid.

B. Subsample analyses by type of road user and driving or riding status

Table II: Comparison between motorcycle riders and car drivers

Variables	Motorcycle riders (n=23)	Car drivers (n=82)	P-value[a]
Gender			
Male	19 (82.6)	38 (46.3)	**0.002**[b]
Female	4 (17.4)	44 (53.7)	
Ethnicity			
Malay	7 (30.4)	6 (7.3)	**0.001**[b]
Chinese	6 (26.1)	57 (69.5)	
Indian	10 (43.5)	18 (22)	
Others	-	1 (1.2)	
Urbanization			
Urban	19 (82.6)	79 (96.3)	**0.040**[b]
Rural	4 (17.4)	3 (3.7)	
Level of education			
No schooling	3 (13.1)	2 (2.4)	**<0.001**[b]
Primary	5 (21.7)	3 (3.7)	
Secondary	15 (65.2)	50 (61)	
Tertiary	-	27 (32.9)	
Work status			
Full-time	3 (13)	9 (11)	**0.027**[b]
Part-time	2 (8.7)	9 (11)	
Retired	10 (43.5)	56 (68.3)	
Not working	8 (34.8)	8 (9.7)	
Eye sight condition			
Excellent	1 (4.4)	1 (1.2)	**0.002**[b]
Good	6 (26)	52 (63.4)	
Moderate	15 (65.2)	23 (28.1)	
Poor	1 (4.4)	6 (7.3)	
Driving or riding status			
Yes	12 (52.2)	71 (86.6)	**<0.001**[c]
No	11 (47.8)	11 (13.4)	
Possession of valid license			
Yes	12 (52.2)	76 (92.7)	**<0.001**[c]
No	11 (47.8)	6 (7.3)	
Accident involvement			
No	10 (43.5)	57 (69.5)	**0.022**[c]
Yes	13 (56.5)	25 (30.5)	

Based on Table II, motorcycle riders were more likely to be male, of Indian or Malay ethnicity, from rural area, with lower education qualification, unemployed, have poorer eyesight condition, less likely to possess valid riding licenses with greater involvement in accident, and higher tendency to stop riding than car drivers.

Table III: Comparison between current and former drivers or riders

Variables	Current drivers or riders (n=83)	Former drivers or riders (n=22)	P value[a]
Work status			
Full-time	11 (13.3)	1 (4.6)	**<0.001**[b]
Part-time	11 (13.3)	-	
Retired	55 (66.2)	11 (50)	
Not working	6 (7.2)	10 (45.4)	
Diabetes mellitus			
No	70 (84.3)	13 (59.1)	**0.010**[c]
Yes	13 (15.7)	9 (40.9)	
Eye sight condition			
Excellent	2 (2.4)	-	**0.041**[b]
Good	50 (60.3)	8 (36.4)	
Moderate	28 (33.7)	10 (45.4)	
Poor	3 (3.6)	4 (18.2)	
SGDS score			
Normal	74 (89.2)	11 (50)	**<0.001**[c]
Depress	9 (10.8)	11 (50)	
Type of road user			
Motorcycle rider	12 (14.5)	11 (50)	**<0.001**[c]
Car driver	71 (85.5)	11 (50)	
Valid license			
Yes	81 (97.6)	7 (31.8)	**<0.001**[b]
No	2 (2.4)	15 (68.2)	
Accident involvement			
No	57 (68.7)	10 (45.5)	**0.044**[c]
Yes	26 (31.3)	12 (54.5)	
Level of confidence Mean (SD)	21.52 (4.78)	16.86 (3.55)	**<0.001**[d]
Level of avoidance Mean (SD)	18.05 (4.27)	20.82 (4.70)	**0.009**[c]

Based on Table III, former drivers or riders were more likely to be unemployed, suffer from diabetes mellitus, have poorer eyesight condition, develop depression symptoms, ride a motorcycle, less likely to possess valid driving or riding license, more likely to be involved in an accident, have lower level of confidence, and higher level of avoidance than current drivers or riders.

C. Determinant factors of driving or riding cessation

Table IV: Multivariate logistic regression for identification of factors influencing driving and riding cessation

Variables	Odds ratio	*P*-value[a]	95% Confidence Interval
Diabetes mellitus			
No	*Reference group*	-	-
Yes	5.6397	**0.012**	1.469 – 21.651
SGDS score			
Normal	*Reference group*	-	-
Depress	7.3150	**0.004**	1.868 – 28.647
Type of road user			
Car driver	*Reference group*	-	-
Motorcycle rider	5.4672	**0.012**	1.461 – 20.466
Level of confidence	0.7808	**0.001**	0.671 – 0.909
Constant	33.7319	0.023	1.629 – 698.458

A total of 35 variables were included in the stepwise logistic regression analyses. These variables comprising of demographics, health and well-being, driving or riding history, and behavior. Among these 35 variables analyzed at univariate level (P<0.2), 14 of them were found to be significant and they were included in the subsequent multivariate logistic regression analysis (P<0.05). Age, work status, number of comorbidity, medical conditions (diabetes mellitus, stroke and arthritis), type of road user, accident involvement, presence of barriers, depression, level of difficulty, confidence, and avoidance were found to be significantly associated with driving or riding cessation at P=0.2. Based on Table IV, older adults with diabetes mellitus, depression, and lower level of confidence were more likely to stop driving or riding. Older motorcycle riders in this sample were almost 6 times more likely to stop riding than older car drivers.

IV. DISCUSSIONS AND IMPLICATION

At some point in life, ceasing to drive or ride is a decision to be considered by many older adults. Driving or riding private vehicle offers older adults the mobility needs ranging from primary (necessity) to tertiary (luxury) needs, feeling of independence and also sense of control over their life. Because of age related changes, many older adults may choose or forced to stop driving or riding. Older adults may reach such decision owing to health problems, anxiety or discomfort while driving or riding, involvement in an accident, financial constraint or even failure to renew license. Although reasons for driving cessation for older drivers have been documented extensively in developed countries, relatively little or almost nothing is known about the older car drivers particularly, older motorcycle riders in developing countries.

In general, participants in this study can be considered as safe and cautious road users with low aberrant driving behaviour score and low accident rate. Most of them were in good health condition and had access to public transportation to sustain their mobility needs. With declining physical abilities and psychological changes, older drivers become more defensive and alert, drive at slower speed with greater caution, pay more attention, and pre-plan trips to avoid traffic jams which serve as strategy to gain or build confident while being behind the wheel [9], [27]. Parker *et al.*[28] found that lapses were the most common type of poor driving reported by older drivers. As expected, unintentional aberrant driving behaviours (lapses) were more common than intentional aberrant driving behaviours (violations). For instance, older adults tend to forget where they left their vehicle in parking area, reach a wrong destination, misread signage, and get into the wrong lane when approaching junctions or roundabouts. Therefore, good cognition ability and vision are crucial for being a safe road user [14], [16]. In this sample, there were no extreme cases of memory problem or cognition impairment but most of them reported to have cataract, a medical condition that impairs vision. This could be a potential reason why reading signage was reported to be one of the most common barriers of driving or riding and vast majority avoided driving or riding at night or during rainy condition when visibility is greatly reduced.

This study revealed there were some statistical differences observed between older motorcycle riders and car drivers in terms of demographics, health and well-being as well as driving or riding history and behaviour suggesting motorcycle riders should be managed independently from car drivers, especially in countries with high motorcycle ownership and usage (Table II). Nevertheless, analysis based on a larger sample of motorcycle riders will be needed before drawing any conclusion. However, it is interesting to note that there was a greater tendency of accident involvement among motorcycle riders compared to car drivers which is very true in Malaysian context since 70% of all RTA involved motorcyclists [2]. Aside from motorcycle riders, a significant proportion of former drivers or riders in this sample had also encountered accident at least once (Table III) and such traumatic experience had greatly influenced their decision to stop driving or riding.

Even though both poor eyesight condition and accident involvement were potential factors of driving or riding cessation but none of these were significant in logistic regression analyses. While, medical condition such as diabetes mellitus, presence of depression symptoms, type of road user, and level of

confidence were identified as determinant factors of older drivers or riders in our sample choosing not to drive or ride (Table IV). Presence of chronic medical conditions such as cardiovascular diseases, arthritis, cerebrovascular diseases (stroke), diabetes mellitus as well as any other age-related diseases are constantly associated with driving ability and decision to stop driving among older drivers [29]. Stroke, arthritis, and diabetes mellitus were found to be independently associated with having stopped driving, but only diabetes mellitus remained significant after controlling for other potential determinant factors. Being a diabetic patient alone does not influence one's decision to stop driving butshort and long term complicationsofthis medical conditionwere reported to influence one's driving ability and pattern, including, visual impairment, hypoglycaemia (very low glucose level),and cardiovascular diseases [30], [31]. Aside from physical health, mental health condition also plays important role in the decision making. Depression was found to be significantly high among former drivers or riders but what remains unanswered is whether the depression was developed before or after the cessation. Similar findings by Segal-Gidan *et al.*[16], driving cessation was associated with increase in level of depression but it is still unclear whether it is antecedent or consequence of driving cessation. This is because past studies had found that depression is one of the most common negative consequences reported after cessation [32]. It is possible to identify whether the depression is antecedent or consequence of cessation by conducting a longitudinal study over a certain period of time to observe the change in emotion experienced by older adults throughout the transition process [14]. Another interesting finding worth noting is that motorcycle riders were more likely to stop riding than car drivers and this was expected since motorcycle is among the least protected mode of transportation and highly vulnerable to fatal accident especially for those living in urban area whereby there are more vehicles on the road and prone to traffic congestion.Having said that, there is not one mode of transportation that can be considered as 100% safe, yet driving in a four-wheel car is safer than two-wheel motorcycle. Lastly, level of confidence perceived by older drivers or riders in the selected driving or riding situations is also one of the important factors of driving or riding cessation [10], [33]. Consistent with past research [15], [34], driving at night during raining condition was perceived as situation that they were not confident. Studies revealed that older drivers with low confidence in driving are more prone toconduct errors and had higher risk of crash involvement than those with high confidence in driving [35], [36]. Therefore, feeling confident is pertinent as it allows drivers to feel safe while being on the road. This is because older drivers feel safest in situations which they feel most confident [16].

Even though, significant differences were observed between older motorcycle riders and car drivers (Table II), small sample size particularly lower number of motorcycle riders than to car drivers limits further in-depth regression analyses. In general, most of the factors identified were consistent with past findings, including level of confidence, medical condition, and depression [10], [14], [16],[29]-[31]. Type of road user is a unique factor identified in this preliminary study. Collectively, findings from this preliminary study imply that determinant factors of driving or riding cessation may differ between motorcycle riders and car drivers. Hence, it is worth exploring further to identify the potential differences among the riders and drivers.

V. LIMITATIONS

This study has several limitations including, lack of representativeness of study sample of the general population considering the nature convenience sampling from only two states in Malaysia with data gathered mostly from urban areas and high proportion of car drivers, relatively small sample size for quantitative analyses and lastly, analyses were solely conducted based on self-report which can potentially lead to under- or over-report of self-regulatory driving or riding behaviour.

CONCLUSION

Increased in susceptibility to both incidence and ill effect of RTA and negative consequences of premature driving cessation underscore the need for research examining on how prevention strategies can best serve the mobility and quality of life needs of this cohort. Findings of this project will provide an enhanced understanding about the travel patterns and characteristics of older Malaysian current and former drivers including car drivers and motorcycle riders and also serve as a platform to examine and propose enhancements to the relevant policies, programs, and supporting initiatives in the country contextto assist senior citizens in sustaining safe mobility.

FUTURE WORKS

Future research plan includes continuation of the survey to recruit more participants from rural area especially motorcycle riders and also further exploration on potential factors through in-depth interviews among older couples and former car drivers and motorcycle riders for more flexible information that can provide better insight into respondent's perceptions, feelings, and experiences.

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