Environmental Barriers and Correlations of Self-Rated Driving Confidence among Older Malaysian Drivers

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Abstract

As population age, it is becoming more important to identify the environmental aspects of driving among the older persons. This study aims to investigate the driving confidence and the influence of environmental barriers on driving among older Malaysian drivers. The cross-sectional data was obtained via face-to-face interview protocol. A total of 400 older adults aged 50 years and above were used in the quota sampling stratified by gender and age in the states of Perak and Selangor. Multiple Linear Regression analysis showed the ten predictor variables (gender, ethnicity, employment status, self-rated health status, driving ability, psychomotor ability, driving distance, weekly driving frequency, driving knowledge, perceived environmental barriers) which accounted for 32.1 percent of variance in driving confidence ($F = 18.28$, $p < 0.05$). Information about the determinants of driving confidence and environmental factors is significant providing insights for future road planning system and as input for driving training programs.

Keywords: Driving confidence, Driving knowledge, Older drivers, Environmental barriers, Malaysia

1. Introduction: The Ageing Population

The ageing of the world population has led to increase of interest in the graying society. Average life expectancy at birth has increased by twenty years since 1950 to 66 years and is expected to extend a further 10 years by 2050. This demographic triumph and the fast growth of the population in the first half of the 21st century mean that the number of persons above 60 will increase from about 600 million in 2000 to almost 2000 million in 2050. The proportion of person defined as older is projected to increase globally from 10% in 1998 to 15% in 2025 (Madrid International Plan of Ageing, 2002). The twin effect of mortality and fertility reduction contribute to this dramatic increase in the number of older persons. By 2020, Asia will be home to 80% of the estimated 701 million older persons in the developing world (UNFPA, 2002, p.10). In fact, no other region will witness a greater surge in its proportion of older persons other than South-Eastern Asia for the next 50 years to come (United Nations, 2006).

In this context, Malaysia is no exception. Malaysia is now experiencing population ageing characterized by lowered fertility and mortality rates (United Nations, 2006; Pala, 1998). Malaysia uses the '60 years and above' demarcation "as the cut-off point in deliberating ageing trends" since the United Nations World Assembly on

Ageing in 1982 at Vienna (Pala, 1998). It is estimated in the year 2020, there will be about 9.9% or 3.44 million older persons in Malaysia. This trend is largely expected to continue and Malaysia will achieve a full "aged" nation status in 2035 when the proportion of persons aged 60 years and over reaches the 15% mark. The increase of older persons will be felt in many aspects of our life, thus making them a significant part of our society. As a result of the increasing numbers of older persons in society, the number of older drivers is increasing as well. The share of older drivers in the driver population will grow because of increasing licensing rates among the ageing population (Fridulv Sagberg, 1999).

Considerable attention has been directed towards the subject of older drivers as this age group has higher mileage adjusted crash rates as compared to other age groups. The likelihood of them being injured, hospitalized or killed as a result of a crash (Williams & Carsten, 1989) is also high. Several studies had been conducted looking at the medical conditions or functional impairments affecting driving performance or crash risk among older persons (Maratolli & Richardson, 1998). However, there are also other studies conducted which showed that older drivers do not have higher accident risks than others (Hakamies-Blomqvist, Sirθn, & Davidse, 2004). They do however have higher risk of being injured and killed in accidents because of their age and increasing physical frailty. Driving is the most preferred transport mode among the older persons as it makes them mobile (Coughlin, 2001). It is also generally agreed that there is an important relationship between mobility and quality of life of older persons (Metz, 2000); and studies have also shown that older drivers tend to continue driving as long as it is possible for them to do so and the possession of a license implies personal independence and self control over ones' life (Owsley, 2002).

There is thus the need to identify the "older driver problems" among Malaysian older drivers and most importantly to identify and explore the relationships among the variables that contribute towards enhancing the safety while preserving the mobility of older drivers. Safe driving relies on several key skills and a clear understanding about how diminished capabilities contribute to crash risk in older drivers will help society develop strategies and efforts to enhance safe driving. It is timely that such studies be conducted in Malaysia to provide data characterizing those still driving and to formulate appropriate policies and strategies to deal with the problems faced and created by an increase in older drivers.

2. Literature Review

As one grows older, the biological abilities (e.g. vision, hearing, cognitive and psychomotor ability) are expected to decrease. The degradation of abilities could influence the results of daily activities performance especially driving. As one ages, visual procession ability decreases, glare problem increases, and the increasing difficulty to capture the object motion (Owsley, 1998; McKnight, 2003). The coordination and movements of the arms, hand and neck will also become inflexible. With regards to on-road performance, older drivers need more information processing time as their cognitive ability is on the decline (Eby, Trombley, Molnar & Shope, 1998). Previous studies also found that age-related decline in vision, cognitive, perceptual, and physical abilities are associated with an increased accident risk (Brayne et al., 2000; Owsley, 2002; Owsley, 1998).

Besides the declining biological factors affecting driving among the older persons, the design of roads is also of importance. However, the design is of low standard and is barely adequate even for the younger drivers with excellent acuity under daylight conditions (Kline, 1992). This indicates that other than the biological deficits of the older drivers, driving environments also have an impact on on-road safety (AARP, 2005). Examples of the environment factors that may impair driving for the aged individual include unclear signage with small fonts especially during the night made worse with poor lighting.

To date, relatively few studies have explored driving confidence among older drivers. Confidence is essential for driving and the reason being that drivers with similar abilities may have different levels of confidence. A study in Australia found that parallel parking and driving at night especially in the rain are the most common difficult driving situations that would lowered driving confidence among the older drivers (Baldock, Mathias, McLean, & Berndt, 2006). In another study conducted in Peninsular Malaysia showed that majority of the older respondents were not confident in making right hand turns at intersections without traffic light, merging into traffic and followed by driving during the night (Sharifah Norazizan S. A Rashid, Chan, & Yeoh, 2008).

A study in Australia was conducted to assess participants' confidence in their driving ability using adapted items from the Driving Habits Questionnaire. The findings showed that older drivers were very confident when driving alone and at freeways. They are not confident when handling parallel parking or drive at night in the rain (Baldock, Mathias, McLean and Berndt, 2006). Oxley et al. (2005) found that safe drivers are those older female drivers who are more confident in driving and they were reported to be in excellent or very good health. The lack of confidence among the older female drivers was related to an increase risk of crash involvement and more likely to be reporting

problems encountered in all driving situations. It was also argued that reduced frequency of driving will reduce driving experience and confidence level. This will eventually increase the risk of crash. Individuals who drive more miles and more frequently have rated themselves to be better drivers as shown in a study by Maratolli, R.A (1998), and they tended to have higher confidence levels. Thus, confidence was closely associated with driving frequency and mileage, but not age or education. The working status was believed to have implications on driving frequency and mileage and hence a factor influencing the levels of confidence among the aged drivers. However, the relationship of working status with confidence in Malaysia is unknown. It is also to be noted that driving confidence was known to be influenced by age-related ability deficits.

To date, there are not many studies on the impact of driving environment on the safety of older drivers; and also the understanding of relationships of confidence and self rating driving ability among the older drivers. This may provide invaluable insights into identifying older drivers at risks of driving problems and formulating intervention strategies to lower the risks. There is also limited study focusing on driving knowledge among older drivers. Thus the paper reports the study carried out with the aims to determine the perceived environmental barriers and to investigate the determinants of driving confidence among older Malaysian drivers. It is hoped that an in depth understanding of all the factors affecting driving will lead to interventions that can enhance safety and hence promote independence among older persons. It is timely that the decisions for older drivers about the need to continue, limit or stop driving be addressed.

3. Methods

3.1 Sampling

Cross sectional data was obtained by interviewing a group of 400 older adults aged 50 years and above using quota sampling stratified by gender and age. Respondents must be Malaysians over 50 years of age, and were required to have in possession of a full drivers' license for non commercial vehicles. They must be able bodied and currently driving more than once a week. Two states with the highest absolute numbers of older persons aged 60 years and above namely Perak (189,763) and Selangor (189,644) were chosen as shown in figure 1. Districts with the highest absolute number of older persons aged 50 years and above were chosen which include the district of Kinta (129,393) in the state of Perak and the district of Petaling (115,141) in the state of Selangor (refer to figures 2 and 3). A total of thirty Enumeration Blocks (EBs) from each district with the highest absolute number of older persons aged 50 years and above were selected.

3.2 Data Collection

Several instruments were used and adapted to suit an older Malaysian driver.

3.2.1 The Questionnaire

The questionnaire used in the study was based on selected questions from Driving Habits Questionnaire used by Oxley et al (1999). Questions about respondents' background information were included to set up the respondents' profile.

3.2.2 Driver Knowledge

Ten dichotomous items related to road rules and signages were adapted from the road test conducted before any Malaysian obtains their driving license. For the reliability test of the driving knowledge items, the value of KR-20 coefficient is 0.537 (Var = 2.37; SD = 1.54; Number of items = 10). The sum score of driving knowledge was obtained by summing up all the ten items. The lowest possible zero to highest ten points.

3.2.3 Driving Confidence

The instrument of driving confidence among older drivers was derived from previous research by Oxley and her colleagues (2005). In this study, driving confidence was measured by using three-point ordinal scale ranging from not confident (zero) to very confident (two points) in seven selected driving conditions which include driving (1) in the rain, (2) at night, (3) busy traffic, (4) through roundabout, (5) changing lanes, (6) merging into traffic and, (7) making right-turns at intersections without traffic lights. The highest possible score is 14 points and the lowest is zero.

3.2.4 Psychomotor Ability

Psychomotor ability was assessed by asking the respondent to perform eye-hand coordination, neck rotation to response to different stimuli using summation of two items with four-point ordinal scale varying from strongly disagree to strongly agree. The sum score ranged from two to eight, the higher the score the better psychomotor ability.

3.2.5 Data Analysis

The collected data were analyzed with using "Statistical Package for Social Science" program (SPSS) version 13.0.

4. Results and Discussions

Table 1.0 detailed out the characteristics of the older drivers. The mean age of the older drivers is 59.56 years old ($SD = 6.68$). The sample was equally distributed in gender and age group of 50 to 59 years and 60 years and above. In terms of ethnicity, majority of the respondents were Malays (45.8%) and the Chinese (45.8%). About 54% of the respondents were still working. Generally, older drivers rated themselves as in good health (53.3%) with high psychomotor ability ($M= 7.30$, $SD =1.07$) especially needed in performing eye, neck and hand coordination. This study found that older drivers drive frequently about eight times a week, averaging about less than 50 kilometers in a week (56.8%). In terms of driving knowledge, majority of older drivers answered eight items correctly in average.

4.1 Reasons to drive among Older Drivers

Figure 4 indicates that majority of the older drivers perceived driving as providing them the sense of independence (69.8%), need to convey family or friends (43.8%), and drive for social purposes (30.5%). Other reasons (13.5%) that urge older drivers to drive include for emergency purposes, more convenient, drive to the clinic, market, and to perform basic needs and exercise.

4.2 Perceived Environmental Barriers

The study also identified the perceived barriers of driving among older drivers. Table 5 illustrate that the majority of the respondents stated that the signage was not clear (61.7%), poor infrastructure (57.7%), traffic jam (54.7%), parking problem (53.4%) and glare or lighting problem (52.8%) as barriers to drive. Findings from the study will provide good information for authorities to devise strategies that can enhance safety for older drivers.

4.3 Driving Confidence

In this study, the mean score of driving confidence is 16.70 points ($SD = 3.492$). About 54.8% of the respondents scored higher than the mean score. Generally, older drivers in this study are confident in selected driving situations. Referring to table 2, the majority of the respondents were highly confident when driving through roundabout (74.3%), changing lanes (63.0%), followed by driving in busy traffic (54.0%). Respondents were least confident making right-hand turnings at intersection without traffic lights (20.8%). This is followed by driving at night and in the rain by 18.8% of the respondents. Relating confidence with gender, an Independent Sample T-test has proven that there is a significant difference between driving confidence and gender [t (398) = 3.29, $p < 0.05$]. The mean driving confidence score of male respondents ($M = 17.27$, $SD = 3.30$) is higher than female respondents ($M = 16.13$, $SD = 3.59$).

4.4 Driving Knowledge

Majority of the respondents answered correctly for the item of 'Good tire balance will help vehicle move smoothly' (97.5%) and 'You need to give signal when you want to change lane' (97.3%). The driving knowledge mean score is 8.49 ($SD = 1.32$). A total of 56.5% of the older drivers averagely answered eight out of ten items correctly. This indicates that older drivers in this study scored high in driving knowledge.

4.5 Relationships of driving confidence with the study variables

Table 4 shows the results of correlations between driving confidence among older drivers. A significant relationship was found between driving confidence with gender ($r = 0.18$, $p < 0.05$), ethnicity ($r = -0.15$, < 0.05), employment status ($r = 0.18$, $p < 0.05$), driving knowledge ($r = 0.18$, $p < 0.05$), self-rated health status ($r = 0.18$, $p < 0.05$), psychomotor ability ($r = 0.28$, $p < 0.05$), weekly driving frequency ($r = 0.25$, $p < 0.05$), weekly driven mileage ($r = 0.25$, $p < 0.05$), driving ability ($r = - 0.37$, $p < 0.05$) and perceived environmental barriers ($r = -0.32$, $p < 0.05$). However, age and self-reported accident involvement in the past two years were not significant statistically. The results indicated that being a male driver with better self-rated health status, good psychomotor ability, higher weekly mileage, scored high in driving knowledge, confident in their driving ability and currently working is more confident to drive.

4.6 Determinants of Driving Confidence among Older Malaysian Drivers

In this study, a total of 397 cases were used to run the analysis of Multiple Liner Regression to determine the factors determining driving confidence (Table 4). The seven variables (gender, employment status, driving knowledge, self-rated health status, weekly driven mileage, psychomotor ability and driving ability) which were

all significant at the bivariate level. Table 5 summarizes the Multiple Linear Regression Analyses for Driving Confidence.

The F statistic for the overall goodness of fit of model is 18.82, which is significant at $\alpha = 0.05$. After excluding the non-significant variables, the final regression model produced for driving confidence is:

Driving confidence = 9.318 + 1.577 driving ability + 1.274 weekly driven mileage + 0. 464 psychomotor ability - 0.834 Ethnicity (Malay) + 0.276 driving knowledge + 0.787 gender – 0.383

This model is a good descriptor of the relation between dependent variable with the predictor variables. The model explains 32.1 percent of the variance in driving confidence ($F = 18.82$, $p < 0.05$) as the R-squared obtained was 0.321. This indicates that 32.1 percent of the dependent variable (driving confidence) was explained by the linear combination of the seven-predictor variables. The corresponding p-value was lower than the significance level at 0.05. This indicates that the slope of the estimated linear regression model line is not equal to zero thus confirming the research data which fits well to the proposed ten-predictor multiple linear regression model in this study.

Among the eight significant predictors, driving ability was found to contribute more significantly towards one's driving confidence ($\beta = 0.23$), followed by perceived environmental barriers ($\beta = 0.19$), weekly driven mileage ($\beta = 0.15$) and psychomotor ability ($\beta = 0.14$). The obtained standardized beta coefficient value indicates that one standard deviation increase in psychomotor score brings about 0.14 standard deviation increase in dependent variable (Driving Confidence).

5. Conclusions

The study found that those older drivers with good psychomotor ability, confident of their driving ability, high score in driving knowledge, better self-rated health, higher weekly mileage driven, perceived less environmental barriers, being male or non Malay were more confident in their driving. Among the significant determining factors, environmental factor was the second important factor influencing driving confidence. This implies that driving environment is able to influence the psychological aspects of driving. For the most part, the findings from the study are consistent with earlier studies. The study is a preliminary step in understanding the role of confidence and other factors that contribute towards safe driving. The gathered information in determining driving confidence and environmental factors is significant providing insights for future road planning system and input for driving training programs.

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Table 1. Older drivers' characteristics

Characteristics		N, *M*	%, *SD*
Age		*59.56*	6.683
Ethnicity	Malay	183	45.8
	Chinese	183	45.8
	Indian	31	7.8
	Others	3	0.8
Employment status	Employed	183	45.8
	Unemployed	217	54.3
Self-rated health status	Very Good	144	36.0
	Good	213	53.3
	Poor	42	10.5
	Very Poor	1	0.3
Weekly driven mileage	<50km	227	56.8
	51-100km	94	23.5
	100-150km	22	5.5
	>150km	57	14.3
Psychomotor Ability		7.30	1.070
Weekly driving frequency		*8.12*	*6.299*

Table 2. Confidence of Driving in Different Driving Situations.

Driving situations	Not Confident		Somewhat Confident		Very Confident	
	n	%	n	%	n	%
Driving in the rain	54	13.5	173	43.3	173	43.3
Driving at night	75	18.8	165	41.3	160	40.0
Driving in busy traffic	40	10.0	144	36.0	216	54.0
Driving through roundabouts	9	2.3	94	23.5	297	74.3
Changing lanes while driving	16	4.0	132	33.0	252	63.0
Merging into traffic	75	18.8	157	39.3	168	42.0
Making right-hand turns at intersection without traffic lights	83	20.8	152	38.0	165	41.3

Cronbach's Alpha = 0. 863; Var= 12.196; SD = 3.49; Number of items = 7

Table 3. Driving Knowledge Items Answered Correctly by the Respondents

Statements	Total	
	n	%
Entrance is prohibited	237	59.3
One way street	322	80.5
Slippery road	343	85.8
Parking area	354	88.5
You are allowed to overtake vehicle at double line	373	93.3
Driver need to use low gear when going down a hill	362	90.5
Emergency signal is used when driving in high speed	323	80.8
Good tire balance will help vehicle move smoothly	390	97.5
You need to give signal when you want to change lane	304	76.0
When smoke emitted in the front part of your car and temperature indicator is on, turn off the engine and add water immediately	389	97.3

Cronbach's Alpha = 0.364; Var = 1.729; SD = 1.33; Number of items = 10

Table 4. Correlations between Driving Confidences among Older Drivers

No	Variables	Strength of Correlation (r)
1	Gender (Male = 1)	0.18**
2	Ethnicity (Malay = 1)	-0.15
3	Employment status	0.18**
4	Self-rated health status	0.18**
5	Psychomotor ability	0.28**
6	Weekly driving frequency	0.25**
7	Weekly driven mileage	0.25**
8	Driving knowledge	0.18**
9	Driving ability	0.37**
10	Perceived environmental barriers	-0.31

* Correlation is significant at the 0.05 level of significance (2-tailed)

** Correlation is significant at the 0.01 level of significance (2-tailed)

Table 5. Summary of Multiple Linear Regression Analyses for Driving Confidence

Variables	Standardized Coefficient	T	Sig.
(Constant)		6.438	0.000
Gender (Male =1)	0.114	2.562	0.011
Ethnicity (Malay = 1)	-0.120	-2.771	0.006
Employment status (Working = 1)	0.086	1.957	0.051
Self-rated health status (Good = 1)	0.117	2.664	0.008
Driving ability (Confident = 1)	0.226	4.844	0.000
Psychomotor ability (Good = 1)	0.144	3.027	0.003
Driving distance (100km or more = 1)	0.152	3.370	0.001
Weekly driving frequency	0.027	0.584	0.559
Driving knowledge	0.104	2.429	0.016
Perceived environmental barriers	-0.191	-4.303	0.000

$R = 0.567$, R square $= 0.321$, Adjusted R square $= 0.304$, $F = 18.281$, $p = 0.000$, $df = 10$
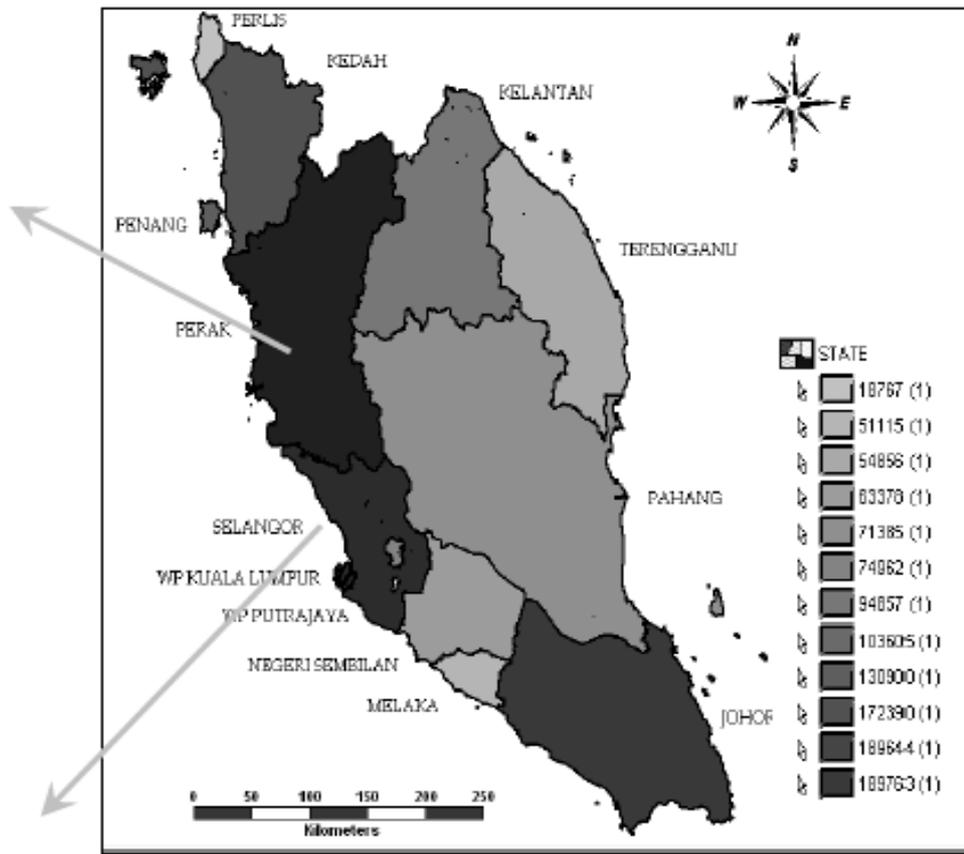
Figure 1. Distribution of older persons aged 60 years and above in Peninsular Malaysia
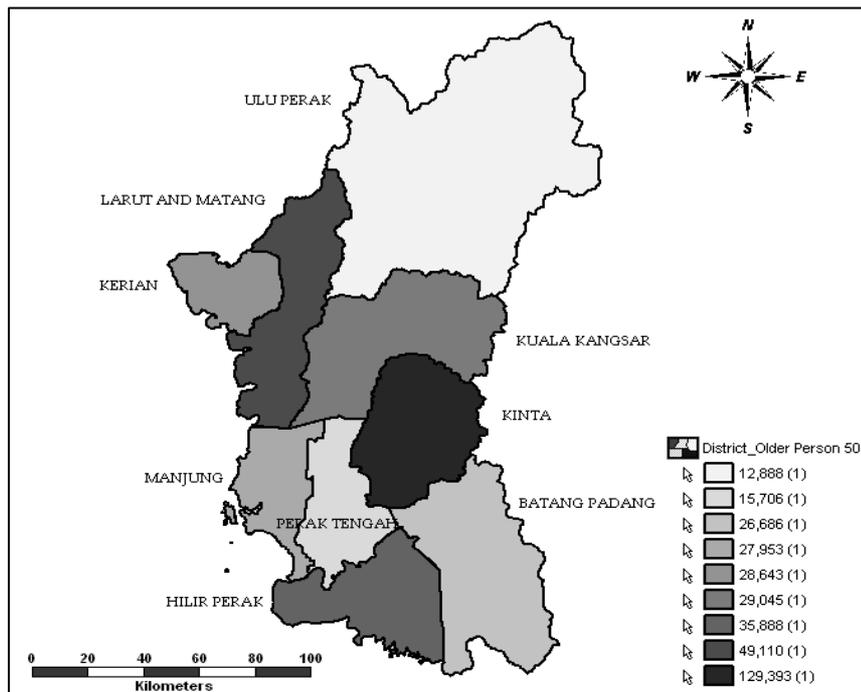
Figure 2. Distribution of older persons aged 50 years and above by district in Perak
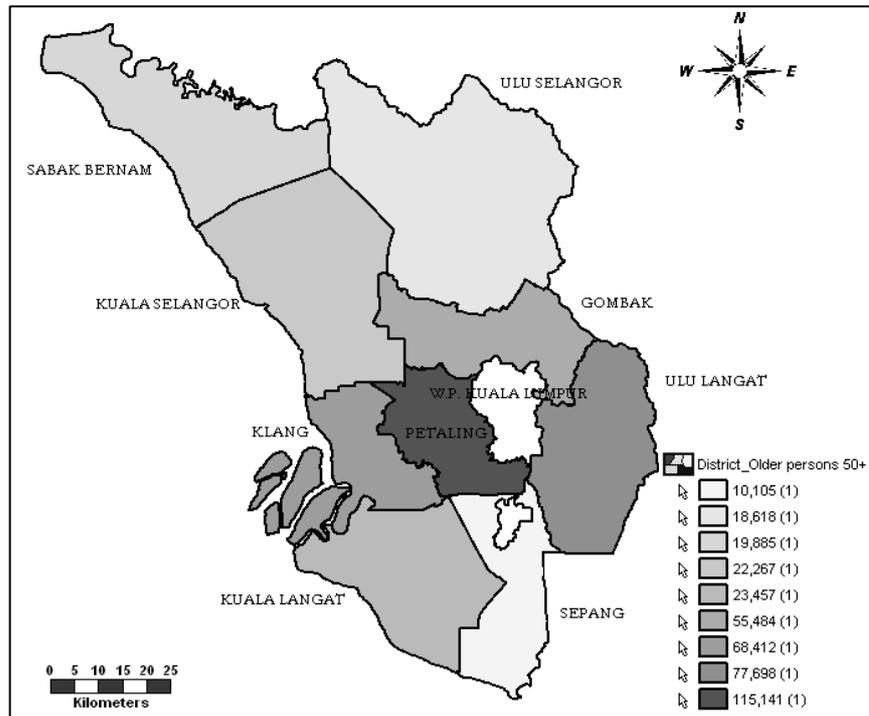
Figure 3. Distribution of older persons aged 50 years and above by district in Selangor
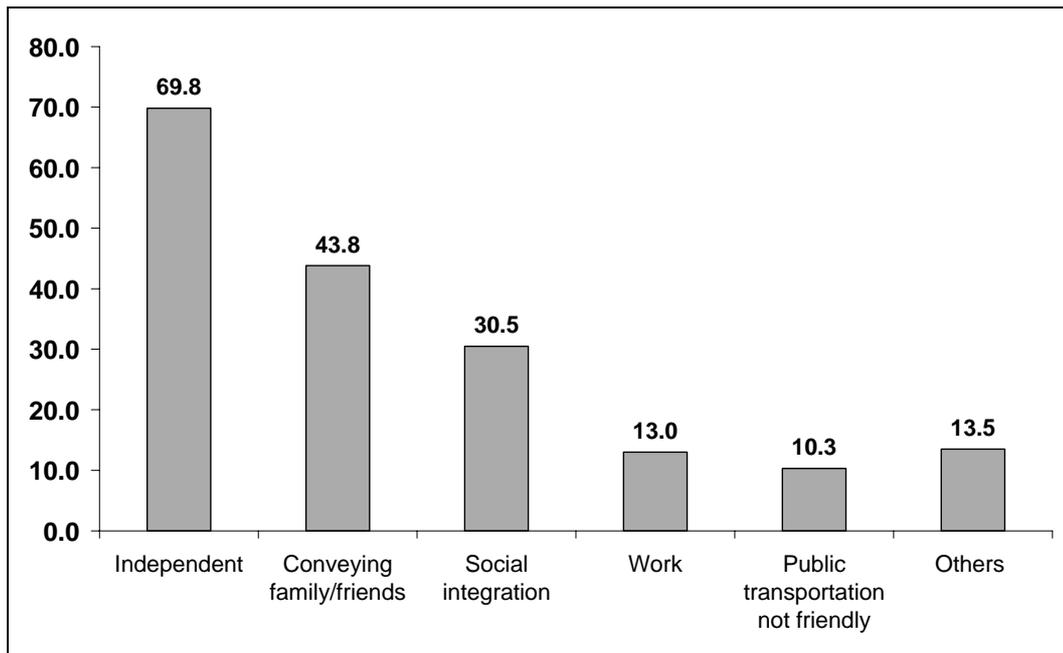
Figure 4. Percentage of Older Drivers for Different Purposes for Driving
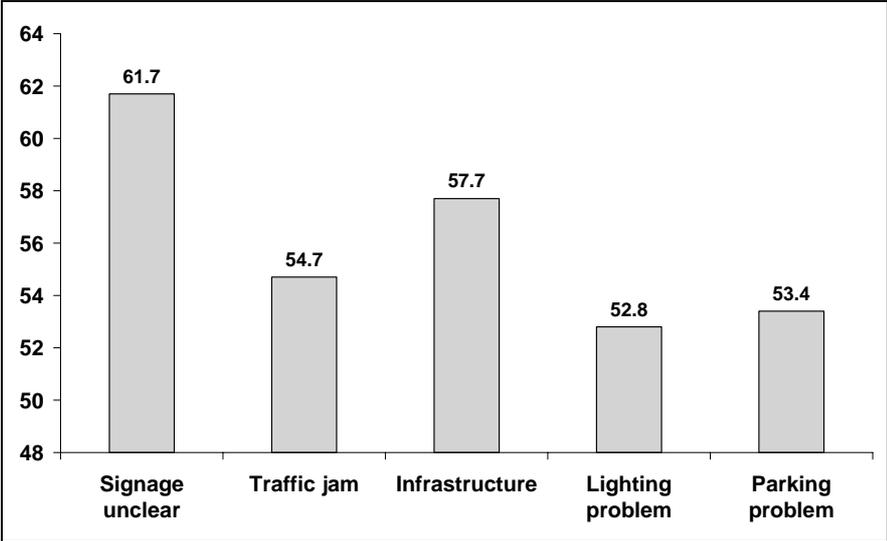
Figure 5. Percentage of the perceived environmental barriers by the respondents