Influence of Pedestrian Demographic Factors on Implementation of Road Safety Rules in the City of Kisumu, Kenya

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Abstract

The study assesses the influence of pedestrian demographic factors on implementation of road safety rules with a focus on the City of Kisumu in Kenya. Drawing from an estimated population of 500,000 residents, the study sampled 384 road users out of which 300 were administered with questionnaires while 84 were interviewed for qualitative data. The study adopted mixed methods approaches using both descriptive and ex post facto designs. The findings revealed a statistically significant relationship between pedestrian demographic factors and implementation of pedestrian safety rules (R^2 = 0.713; p <0.001). All the coefficients of the regression model were statistically significant. Road infrastructure interventions should be designed with special consideration to pedestrian demographic characteristics to enhance implementation of pedestrian safety rules. Age should be considered in design while road safety education should be tailored to meet the gender- specific needs of various categories of the population.

Key words: *Implementation of road safety rules, Pedestrian demographic factors, Age, Gender, Level of education*

1. INTRODUCTION

Globally, research on road safety tends to focus more on other road users such as motorists but ignores pedestrians, yet more than one fifth of people killed on the world's roads each year are not travelling in a car, on a motorcycle or on a bicycle, but pedestrians (Ameratunga, Hijar and Norton, 2006). Pedestrians accounted for 22% of road fatalities worldwide. In Africa, this proportion however rose to 38% (WHO, 2012), with 46% of pedestrian accidents occurring in Kenya (Ogendi, Odero, Mitullah and Khayesi, 2013) and 45% in the City of Kisumu (Opiyo, 2002). The terms accident, collision and crash mean conflict between a pedestrian and a motor vehicle (Campbell et al., 2004) and is the meaning this study adapts.

Pedestrian demographic factors are likely to influence implementation of pedestrian safety rules due to the projected rise in influence of such characteristics. The United Nations estimates that the world's population would exceed 9 billion by 2050, with 70% of these people residing in urban areas (Black, 2010). These people are likely to comprise pedestrians who are the majority in urban areas thus necessitating the need for a road transport system which reduces traffic related injuries and death to enhance safety while providing mobility as well. For efficiency and in line with technological growth, a sustainable road transport system ensures safety of users despite majority being automobile dependant. In the world today, the rise in population and increasing motorization level especially in urban areas has resulted into increased likelihood of crash leading to severe injuries. The risks of crash and pedestrian deaths and injuries have exponentially increased. From the economic perspective, the road transport sector appears to be the only sector with inverse relationship between level of service and income. Whereas the quality of service offered in the road transport sector has been on a decline, the income has steadily been on the rise. This therefore articulates the need to focus on pedestrian safety to avoid the negative effect of the transport sector so as to achieve sustainable growth and development.

By definition, pedestrian demographic factors refer to the characteristics or attributes of pedestrians. According to this study, pedestrian demographic factors were confined to gender, age and pedestrian education level. According to a report by Maryland State Highway Administration (2008), pedestrians between age 15 and 24 and older are vulnerable to road traffic injury with at least 30 percent of this age group having been involved in road crashes. This indicates pedestrians in the productive age group are more prone to injuries. Road crashes involving pedestrians older than 35 years lead to fatality or serious injuries, most of the time (WHO, 2007).

On gender, studies have shown that young males are more likely to be involved in road crashes than females (Martin, 2006; Department of Transport 2004). Based on the statistics from the Road Crash Fact Sheet (2006 – 2010), more males than females were involved in serious casualties on the road. Male pedestrians were involved in more fatal and serious injuries than females accounting for 61%. However, above age 70, females are more frequently involved in road collision casualties than males (Road Crash Fact Sheet, 2006 – 2010).

Admittedly, pedestrians do not need academic education to walk on the roads. As a factor, pedestrian level of education may inform road user behavior in terms of decisions and choices made on the road. According to Dupperex, Roberts and Bunn (2002), there is a variation between pedestrian education and behavior. Various studies and outcomes point to the direction that education on pedestrian safety could improve how pedestrians behave while using the road, but are not clear as to whether

education reduces road accidents. However, Dupperex, Roberts and Bunn (2002) concluded that there is little evidence that safety education is effective on adult pedestrians especially, the old.

Gender as a demographic factor influences the implementation of pedestrian safety rules as discussed by Holland and Hill (2007) who focused on age, gender and driver status. Younger adults especially men have positive attitude than women and are more careful when crossing risky roads. The study confirmed that the aged are keen on safe crossing than younger people though the limitation of the study had stated that intending to cross and actually crossing are different behaviour (NJTPA, 2011). The study suggested that road safety interventions should target groups and what the groups identify as the most effective ways of communicating written and multimedia road safety messages (NJTPA, 2011).

Pedestrian education level as a demographic factor determines the pedestrian behaviour along and across the road. Safety education for prevention of pedestrian injury was cited by Dupperex, Roberts and Bunn, (2002). The study identified how pedestrian safety education is affected by behaviour, attitude, injuries, knowledge and motor-vehicle collisions (Dupperex, Roberts and Bunn, 2002). The quality of trials included methods of randomization and numbers lost during follow up as the main outcome measures (Reading, 2002). 14 out of 15 randomized controlled trials based on safety education focused on child pedestrians while one trial focused on institutionalized adults (Reading, 2002).

The reviewed studies investigated various populations, especially children on road safety. However, pedestrian demographic factors were not considered as variables in explaining implementation of pedestrian safety rules. This research therefore investigated the influence of age, gender and pedestrian education level as pedestrian demographic factors on implementation of pedestrian safety rules.

2. RESEARCH METHODOLOGY

2.1 Purpose of the study

The purpose of this study was to determine how pedestrian demographic factors influence implementation of pedestrian safety rules in the City of Kisumu.

2.2 Hypothesis

Hypothesis: There is a statistically significant relationship between pedestrian demographic factors and implementation of pedestrian safety rules in the City of Kisumu.

2.3 Study Population

The study targeted road users in the City of Kisumu drawn from an estimated of population 409,928. The pedestrians were assumed to have either walked along or crossed the roads. The study population included both pedestrians and drivers.

2.4 Study design

For the purposes of this study, the researcher employed a combination of Ex post facto and descriptive study designs. Ex Post facto design, considered explorative, was used in setting the premise for the study through piloting, document analysis from previous studies, theoretical basis for the research, use of observation as well as open ended questions to explore on the pedestrian demographic indicators. Using descriptive survey design, sub category of cross-sectional survey design was adopted as the research narrowed down on a sample rather than the entire population to make conclusions. Descriptive survey allowed numeric quantification of the variables using data from the closed ended questions in the

questionnaire. Quantitative data was also used to establish the relationship between the independent and dependent variable using regression. The two design methods were employed concurrently due to the need to use both descriptive and inferential statistics in the analysis. The two methods and designs blended while complementing each other to adequately describe the phenomena under investigation.

2.5 Sample Size and Sampling Method

Krejcie and Morgan (1970) table with alpha set at 0.05 was used to estimate the sample size from the target population of 409, 928 residents of the City. As such, 384 road users were considered a representative sample of the study population. Due to the overlapping challenges in the pedestrian classification and definition which depends on times and moments, the road users were purposively and conveniently classified into pedestrians, drivers and key informants. The road users were proportionately distributed across the roads in the City of Kisumu with 200 responding to questionnaire as pedestrians, 100 responding to questionnaire as drivers, 50 filling in the observation check list while 34 being interviewed through the interview guides. The study used both probability and non probability sampling techniques. Stratified random sampling was used to factor in gender and urban roads on the sampled roads. The roads were grouped into cluster and respondents obtained through convenient sampling.

2.6 Data Collection

Four instruments were used to collect the data: Self Administered Questionnaire (SAQ), key informant interview guides, walkability observation checklist (WOC) and document analysis guide (DAG). The self administered questionnaire was based on iRAP star rating to be filed by drivers and pedestrians. The questionnaire had elements of pedestrian demographic factors (PDFs) and implementation of road safety rules (IRSR) measured as LIKERT items in summated scales. The reliability of the questionnaires was ascertained through Cronbach's alpha while expert judgment was used to establish the validity of interview guides. Necessary authorization was obtained from the appropriate bodies and organization before conducting the research. Subsequently, questionnaires were administered to conveniently selected road users (pedestrians and drivers). Face to face interviews were also conducted with key informants including engineers, educators, planners, traffic law enforcement officers and parents for additional relevant information.

2.7 Data Analysis

Upon data collection, the quantitative data collected was summarized, coded and entered into SPSS v 22.0 which was used as the analysis platform. Quantitative data was analyzed using both descriptive and inferential statistics. Using descriptive analysis, data was quantified and summarized using frequency distribution (percentages), standard deviation and item means. Qualitative data obtained from the key informant interviews were then analyzed based on themes. The data was summarized and grouped into emerging trends and themes. This was used to corroborate the findings of the quantitative data. To establish relationship, simple linear regression was used as the inferential statistic where pedestrian demographic factors were considered as the predictor variable explaining the outcome variable which was implementation of road safety rules. Pedestrian demographic factors, as a variable, were hypothesized to be related to implementation of pedestrian safety rules using the following linear equation:

$$\hat{Y} = \beta_0 + \beta X + \varepsilon$$

Where: $\hat{Y}$ is implementation of pedestrian safety rules

β_0 is the constant term

β, is the coefficient of pedestrian demographic factor

X, is pedestrian demographic factors

For hypothesis testing, the model was considered to include variables with coefficients which were statistically significant at $p < .05$.

3. FINDINGS

3.1 Reliability of the instruments

Cronbach alpha was used to determine the reliability for both the drivers and pedestrian questionnaires. The analysis returned alpha coefficient of 0.69 for pedestrian questionnaire and alpha coefficient of 0.72 for drivers' questionnaire. Since for social sciences, alpha = 0.7 is used as the threshold for determining reliability, the instruments were considered to be reliable in measuring the study variables and their indicators (Oso & Onen, 2009).

3.2 Socio-Demographic Characteristics of the road users

The socio-demographic features of the study respondents was evaluated and presented using frequency distribution and their corresponding percentages.

Based on the findings, majority of pedestrian respondents (56%) were males, with driver respondents also being mainly males (77%). Driver respondents were overly dominated by males representing the general population characteristic. Pedestrian age indicated that majority were of age 30 to 40 years (30%) with majority of drivers being aged between 30 and 40 years (38%). With reference to their place of residence, majority of the study respondents lived in peri-urban areas reflective of the city's residential pattern with 59.5% of pedestrians and 46% of drivers reporting living in peri-urban areas.

3.3 Pedestrian demographic factors

Pedestrian demographic factors were measured using four items on 5-point LIKERT scale with ratings from 1 to 5 where strongly agree (SA) = 5, agree (A) = 4, neutral (N) = 3, disagree (D) = 2 and strongly disagree (SD) = 1. Descriptive analysis of pedestrian demographic factors is presented in table 1.

Pedestrians belief that you just need your feet to walk and not academic education had a mean = 3.40 and standard deviation = 1.463. However, the pedestrians also agreed that level of education determined the decisions made while using the road (Mean = 3.52; standard deviation = 1.360). As for gender determining the ability to use the road appropriately and with keenness, the study found that the respondents were neutral with a mean = 3.36 and standard deviation of 1.375. This indicates that there is no significant gender difference in road usage. Although gender was not found to influence road usage, the study found that age was a factor especially when crossing the roads as pedestrians agreed that age makes it easy to use pedestrian crossing (Mean = 3.53; standard deviation = 1.232).

3.4 Implementation of pedestrian safety rules

Implementation of pedestrian safety rules was also measured on a 5-point LIKERT scale of 3 items. The items were rated on a scale of 1 to 5 where 1 = strongly disagree (SD), 2 = disagree (D), 3 = neutral (N), 4 = agree (A) and 5 = strongly agree (SA). The findings are presented in table 2.

The pedestrians strongly agreed that road safety awareness (education) improves implementation of pedestrian safety rules (Mean = 4.53). The pedestrian respondents also agreed that age was critical in

implementation of pedestrian safety rules (Mean = 3.70). However, the pedestrian respondents were relatively neutral on the role of gender in implementation of pedestrian safety rules. Based on this, the respondents scored a mean of 3.19 with standard deviation of 1.342 indicating an average score.

3.5 Pedestrian demographic factors and implementation of pedestrian safety rules

For hypothesis testing, individual pedestrian scores on the pedestrian demographic scale and implementation of pedestrian safety rules were used. For the 200 pedestrian respondents, scores on each scale were used giving continuous data suitable for regression analysis. The output of simple linear regression with pedestrian demographic factor as the predictor and implementation of safety rules as the outcome is shown in table 3.

The study found that there is a statistically significant linear relationship between pedestrian demographic factors and implementation of pedestrian safety rules. The model showed that pedestrian demographic factors account for 17.3% of variance in implementation of pedestrian safety rules. The ANOVA shows that the model is a good fit for the data with $F(1, 198) = 41.510$ at $p = 0.000$ ($p < 0.05$). Considering the proposed linear regression model $\hat{Y} = \beta_0 + \beta X + \varepsilon$, the equation relating pedestrian demographic factors and implementation of road safety rules is written as:

$Y = 2.988 + 0.297X$ with 'Y' being implementation of pedestrian safety rulers and 'X' being pedestrian demographic factors since both the coefficients are statistically significant ($p = 0.000$ which is $p < 0.05$). This implies that improving the level of pedestrian demographic factors by 1 unit results into an improvement of 0.297 in implementation of road safety rules. From the findings, the null hypothesis was rejected since there is a statistically significant relationship between pedestrian demographic factors and implementation of road safety rules.

4. DISCUSSION

The study investigated the influence of pedestrian demographic factors on implementation of pedestrian safety rules. Data was collected from 200 pedestrians (56% males, 44% females) and 100 drivers (77% males; 23% females). The modal age of pedestrian was between 30 to 40 years indicating that they were physically active. Similarly, Holland and Hill (2007) researching on age, gender and driver status found that younger adults, with men having positive attitude than women were more careful when crossing risky roads.

The findings show that education is not considered a key factor in using the road by pedestrians as majority believe one just needs their feet and not education to use the road. However, the level of education is considered to be significant to pedestrians while making decisions on the road while gender does not have a significant influence on road usage. Age, according to findings determines safe usage of the road while crossing. Tom and Granie (2011) found gender differences for gaze target when pedestrians crossed the road. The study found that whereas females focused their gaze on other pedestrians, males focused their gaze on traffic.

In terms of relationship, the study showed that there is a relationship between pedestrian demographic factors and implementation of road safety rules which can be molded into a linear system. The relationship is statistically significant hence improvement in pedestrian demographic factors enhances implementation of pedestrian safety rules. The findings are in contrast with Walker (2004) who found limited information on pedestrian demographic factors aimed at improving their road safety.

5. CONCLUSION

Based on the findings, the study concludes that pedestrian demographic factors significantly influence implementation of road safety rules. More effort should be directed towards identifying and improving critical pedestrian demographic factors to influence implementation of road safety rules. Age as an indicator of pedestrian demographic factors should be considered in the design and planning of road infrastructure interventions to enhance the implementation of pedestrian safety rules. Moreover, pedestrian education level on safety awareness should be both designed and emphasized to meet the specific needs of pedestrian road users.

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Tables

Table 1

Statements	**SA**	**A**	**N**	**D**	**SD**	**Mean**	**Std.Dev**
You just need your feet to walk not education	35 (17.5%)	27(13.5%)	18(9.0%)	63(31.5%)	57(28.5%)	3.40	1.463
Level of education determines decisions made while using the roads	57(28.5%)	66(33.0%)	25(12.5%)	27(13.5%)	25(12.5%)	3.52	1.360
Female pedestrians are keen when using pedestrian crossing	54(27.0%)	51(25.5%)	32(16.0%)	39(19.5%)	24(12.0%)	3.36	1.375
My age makes it easy to use pedestrian crossing	42(21.0%)	87(43.5%)	25(12.5%)	27(13.5%)	19(9.5%)	3.53	1.232

Pedestrian Demographic Factors (N = 200)

Table 2

No. Statement	SA	A	N	D	SD	Mean	Std.Dev
The level of road safety awareness improves implementation of pedestrian safety rules	123(61.5%)	66(33.0%)	6(3.0%)	4(2.0%)	1(0.5%)	4.53	0.701
Age is critical in implementing pedestrian safety rules	61(30.5%)	81(40.5%)	16(8.0%)	21(10.5%)	21(10.5%)	3.70	1.292
Female pedestrians follow regulations relating to implementation of pedestrian safety rules always	40(14.5%)	52(18.5%)	42(21.0%)	37(26.0%)	29(20.0%)	3.19	1.342

Implementation of Pedestrian Safety Rules (N = 200)

Table 3

Model Summary	R	R Square	Adjusted R Square		Std. Error of the Estimate	
	416[a]	0.173	0.169		0.52967	
Model ANOVA		Sum of Squares	Df	Mean Square	F	Sig.
	Regression	11.646	1	11.646	41.510	.000[b]
	Residual	55.549	198	.281		
	Total	67.195	199			
Model s coefficient	Model	Unstandardized Coefficients			Standardized Coefficients	Sig
		B	Std. Error	Beta	T	
	(Constant)	2.988	0.164		18.254	.000
	Pedestrian demographic factors	0.297	0.046	0.416	6.443	.000

R^2 =0.173, R^2 adjusted=0.169, Se= 0.52967, F-stat: 41.510 on 1 and 198 df, p = 0.000

Pedestrian demographic factors and implementation of safety rules