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RESIDENTS' WILLINGNESS TO ADOPT CYCLING AS INTRA-CITY TRANSPORT IN CALABAR, NIGERIA

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Abstract

This study investigated the willingness of residents to use bicycles for intra-city transportation in Calabar, South-South Nigeria. Administered questionnaires were successfully retrieved (82%) from residents of all income and employment groups in the 22 political wards of the study area. Stratified sampling technique was used to select survey participants. Initial socioeconomic characteristics of respondents in intercept only model was used to predict the willingness of respondents to ride in the city. Twelve problems of bicycle transportation were further presented to participants who rated them using a six-point scale (1-6), highly unwilling to highly willing to ride, respectively. Logistic Regression Analysis was employed to predict the probability that a respondent would be willing to ride. The predictor variables were respondents' gender, age, education, occupational status, 12 bicycle infrastructure characteristics and dummy variables coding each socioeconomic scenario. A test of the full model versus a model with intercept only was statistically significant, $\chi 2$ (24, N = 315) = 50.5, $p < .001$ and $\chi 2$ (19, N = 315) = 36.5, $p < .001$. The model was able to correctly classify 86% of those willing to ride and 29.1% of those unwilling to ride, for an overall success rate of 66.2%. The study revealed that there is no gender sensitivity in the willingness of residents to ride in the city. In model 2, the odd ratio of some bicycle infrastructure characteristics such as bicycle lanes (1.181), conflicts with motorist (1.338), lack of respect for cycling (1.078), culture/stigma (1.046), weather (1.013), potholes (1.222), safety issues (1.280), and illumination (1.241) are more significant in predicting the probability of respondents to ride bicycles. The study recommended designated bicycle paths/trails to motivate residents to ride bicycles in the city.

Keywords: bicycle transport, transport infrastructure, ordered probability, willingness

1. INTRODUCTION

The need for cycling and other non-motorized transport (NMT) in Calabar is due largely to the inability of the metropolitan authority to meet up with the

task of providing mobility to all commuters in a sustainable manner. This has been considered as one of the factors for the growing advocacy for cycling and other non-motorized modes. However, due to the conflicting modal choices of commuters, different income classes and preferences of cyclists, safety concerns and the lack of supporting infrastructure for some of the cycling mode, this advocacy has been complex. This is in addition to the inability of transport planners to account for non-automotive trips which Steiner (2007) observed as another fundamental transport problem and therefore noted that most transport studies are unable to recognize the diverse transport choices available to commuters such as walking, bicycling, carpooling, use of a transit system and so on. The overwhelming need for people to reduce spatial inequality and the psychological hold on the use of the automobile according to Stern (2007) makes it difficult to achieve reasonable reductions in transport-related pollutants. There is therefore the growing question of how to influence a change in current patterns of travel behavior without compromising spatial interaction and economic, social and recreational opportunities. Schafer and Victor (2000) estimated that the 'average world citizen in 2050 may travel as many kilometers as the average European in 1990, with the world citizen's travel distance increasing from an average 38,000 billion passenger km (2005) to between 104,000-150,000 billion passenger km in 2050'. In the same vein, Sperling and Gordon (2009) also predicted about two billion cars globally by the year 2030. Growing interest in sustainable transportation is evidenced from the many researches that have now been conducted to show how organizations, government, communities and individuals are involved in sustainable projects (Litman & Burwell, 2006; Mohan & Tiwari, 1999; Wei & Lovegrove, 2012).

Numerous advantages of cycling have been revealed in earlier studies. For example, cycling has been observed as a moderate-intensity physical activity and is independently associated with many health benefits (Haskell et al., 2007; Rissel et al., 2010). Furthermore, according to Rissel et al. (2010), cycling has a unique potential to support an active lifestyle through recreational cycling and through active transport, when it is integrated into daily travel routines. This is important that it remains the 4th most popular leisure time in Australia. Calabar city also holds enormous potentials for cycling. The cycling mode of transport is not entirely new to residents of this city which has undergone series of transformations, first as a colonial port city, then capital of Nigeria and now the administrative headquarters of Cross River State. The city further prides itself as Nigeria's tourist destination. The lack of scientific data on understanding that the willingness or otherwise of more residents to revisit cycling remains the

motivation for this study. Additionally, the need for the development of supporting bicycle infrastructure to set the stage for effective bicycle transportation in the city cannot be overemphasized.

Calabar is the capital city of Cross River State, South-South Nigeria. It lies between longitude 80 191 3011 and 80 251 3011 east of the Greenwich Meridian and latitude 40 571 5511 and 50 401 3011 north of the Equator. It is comprised of Calabar Municipality and Calabar South Local Government Area, which occupy an area of about 406 square kilometers (figure 1). Using a growth rate of 2.8 per cent and a 2006 baseline population of 328,826 (National Population Commission, 2006), the total population is estimated at about 414,112 in 2015. The National Population Commission in 2015 projections estimates the current population of Calabar at about 414,112, with a growth rate of 2.8 percent (NPC, 2015). The city is a lowland terrain with highest and lowest points at about 100m and 2m respectively (Okon, et al, 2015). This elevation could have implications to cycling when compared with some European countries such as Denmark, Netherlands, and many others that have relative flat urban landscape. On the other hand, topography remains a major advantage to cycling in Calabar when compared with cities in South America such as Bogota where bicycle use is increasing rapidly.

This paper is intended to offer a scientific methodology for estimating the level of willingness of residents to use bicycles in Calabar and therefore provide wide range of applicability in other cities of sub-Sahara Africa based on their peculiar transport and socioeconomic characteristics. It further reveals factors and alternative solutions which require encouragements and motivations for cycling as a mode of intra-city transport with less emphasis on motorization of our urban landscape. The result of this research is also expected to provide policy makers an evaluation tool for planning of non-motorized intra-city transport infrastructure options in the study area and many cities of the world.

2. LITERATURE REVIEW

A measure of commuters' willingness to adopt cycling as a mode of intra-city transport in terms of users' satisfaction differs from country to country and from city to city. This is due to different socio-economic, cultural and technological development, weather and topographic conditions, driving orientation and most importantly different satisfaction levels as perceived by residents across countries and cities. This is perhaps the reason why there has not been any generally acceptable statistically calibrated models for the

assessment of the willingness of residents to adopt cycling mode for non-motorized transit commuters. This is unlike the several attempts made to develop measures and standards for assessing non-motorized users' satisfaction. For instance, Dixon (1996) used the segment as a unit of analysis to develop a bicycle and pedestrian level of service performance measures in Gainesville, Florida as a congestion

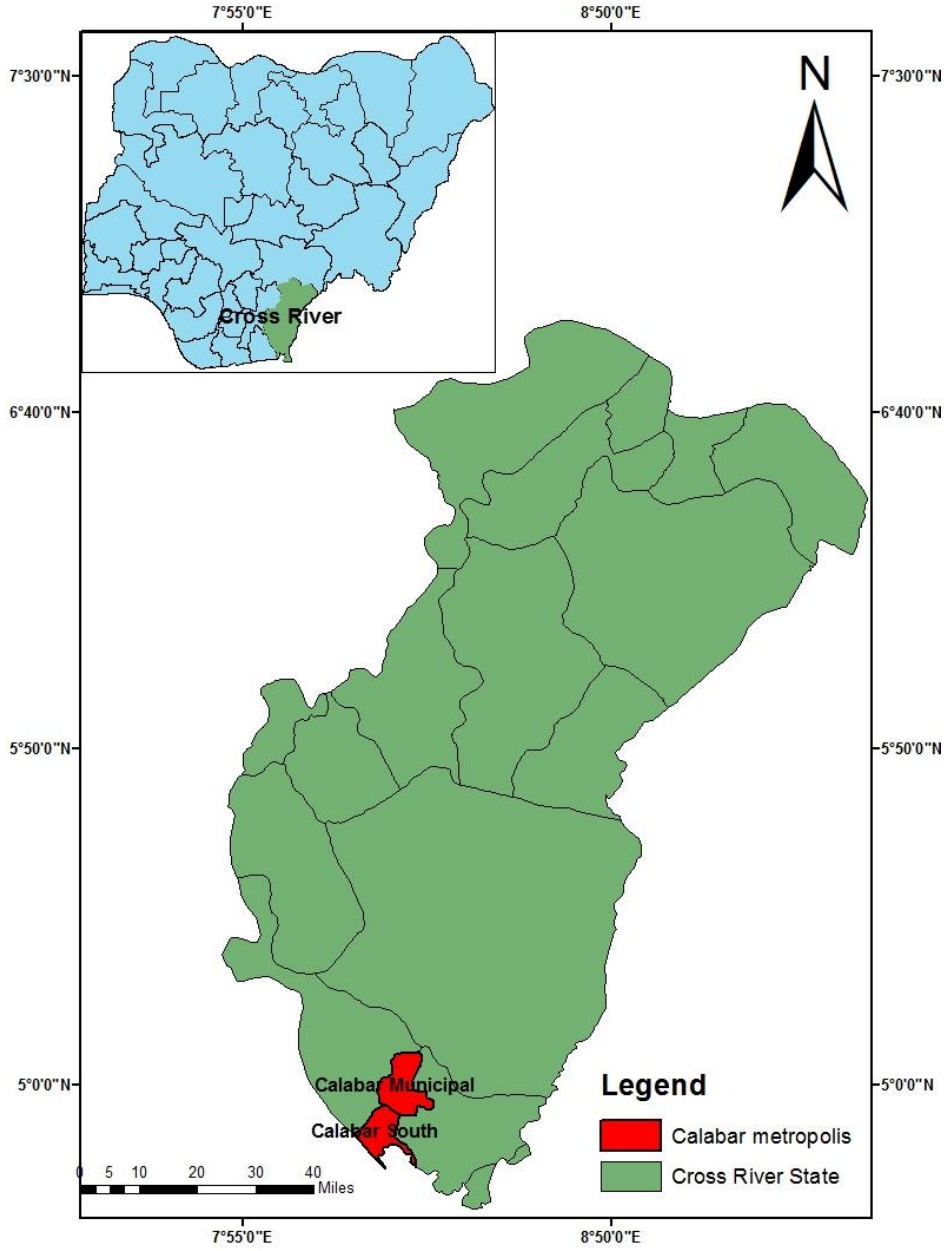

Figure 1. Cross River State showing Calabar metropolis (Calabar Municipal and Calabar South) Insert: Nigeria showing Cross River State

management plan. Similarly, from the user's perspective, Kang, Xiong, and Mannering (2013) also developed a bicycle level of satisfaction for South Korea using facility, operation, intersection and safety characteristics. Several other studies focused on factors that influence bicycle use. For example, Baltes and Smith, 1999; Dill and Voros, 2007; Pucher and Buehler, 2008, have identified socio-demographic characteristics of individuals including age, income level and so on as determinants for bicycle use. Others such as family size, access to car or bicycle have also been observed to have direct relation with bicycle use (de Dios Ortuzar, Iacobelli, & Valeze, 2000; Taylor & Mahmassani, 1996). Additional factors such as gender have been investigated and found to be related more to cycling culture than bicycle use (Heesch, Sahlqvist, & Garrard, 2012). Similarly, Okon, et al., (2017) produced videos of 16 segments and 8 intersections and showed to participants who rated their level of satisfaction using a 6-point scale (A–F – 'highly satisfied' to 'highly dissatisfied'), equivalent to 1360 segments and 680 intersections (2040 total ratings). Ordered probability models were used to estimate random parameters of cyclists LOS perception which was strongly influenced by side path separation (β=0.605, $p<0.05$); vehicle speed (β=0.717, $p<0.05$); motorised traffic volume (β=-0.381, $p<0.05$); and conflicts with pedestrians (β=1.173, $p<0.05$). They further identified other factors having high probabilities to influence LOS to include bicycle lane width, wide outside lane, pavement conditions, trees and benches, daylight, gender and the experience of the cyclist.

Structural factors have also been highlighted as relating to any city's adaptation to bicycle use. Hunt & Abraham, 2007 have reported the influence of structural factors such as presence of a bicycle network as encouraging bicycle use. With respect to off-street paths, there is conflicting evidence regarding the level of influence on cyclists (Aultman-Hall, Hall, & Baetz, 1997; Dill & Voros, 2007). For instance, a disaggregate cross-sectional study that uses 608 randomly selected respondents, 'objective parcel-level GIS measures of land use and infrastructure conditions' as primary data in urbanized King County, Washington found both perceived and environmental conditions as likely contributors to bicycle commuting (Moudon et al., 2005). They further observed access to trails, land use mix, location of hospitals, restaurants as environmental variables that correlate strongly with bicycle commuting. Conversely, the study of Krizek and Johnson (2006) in Minneapolis which used multivariate modeling techniques upheld the statistical significance of distances to retail and bicycle facilities as predictors for active mode choice at close distances but not necessarily any linear relationship between them. Another stated preference

survey by Shafizadeh and Niemeier (1997) observed that longer routes using a path was preferred to a shorter route using a motor vehicle lane by 40 per cent of bicyclists. An observational study in Australia where 6,589 cyclists through bicycle census were interviewed and clearly showed that women preferred off-road paths to lanes and lanes with facilities to those without (Heesch et al., 2012). Okon and Moreno (2019) also estimated bicycle level of service model for the cycloruta, Bogota, Colombia, where it was observed that BLOS was strongly influenced by side path separation, vehicle speed, motorised traffic volume and conflicts with pedestrians. However, many other factors were found to have high probabilities to influence level of service with unit change. They include bicycle lane width, wide outside lane, pavement conditions, trees and benches, daylight, gender and experience of cyclist. Similarly, a model for intersection LOS was estimated in Bogota and the results thus revealed that the volume of cyclists (β=1.116, $p<0.05$), conflicts with pedestrians/other cyclists (β=1.048, $p<0.05$) and total intersection legs (β=-0.365, $p<0.05$) are factors with a high influence on cyclist's LOS (Okon & Brussel, 2019).

Using a self-completion mail-back questionnaire technique, an intercept survey in Melbourne, Australia, Rose and Marfurt (2007) observed that 50 per cent of sampled bicyclists spent their riding time on off-road facilities and an approximate 20 per cent agreed that they would change mode if off-road facilities were not available. Furthermore, about 60 per cent of those who would turn to public transport if off-road facilities are not available are opposed to the use of car as an alternative. This underscores the role of bicycle commuting in Australia's intra-urban transit. There is also a corresponding preference for separate bicycle paths by inexperienced cyclists. Separate bike lanes breed a feeling of safety and thus build confidence on new-comer cyclists. In order to determine level of bicycle use in San Diego, 3,800 surveys were conducted by telephone where majority of those who bicycle to work indicated they do so on separated bicycle lanes (Jackson & Ruehr, 1998).

The ability to predict the probability of individual willingness to ride remains fundamental for the planning of bicycle infrastructure in many cities. This is evident as socioeconomic characteristics, individual tastes and behavior continue to change rather quickly. It is this behavior change that is being predicted holding certain variables constant. Some of these changes are cultural while others are products of external influence. The focus of this study is on the willingness of residents to cycle in the city as an age long mode of transportation until the discovery of oil which now remains the mainstay of the Nigerian economy. At various stages in the development of pre-colonial and post-colonial

Nigeria, evidence from Calabar Museum and Monuments suggest an early use of bicycles in the city. Particularly, following the early 1970s oil boom, transport policies were strongly influenced by the divergence in economic fortunes which occurred in Nigeria. The country's oil resources brought a spectacular - if short-lived - development in transport infrastructure and services following the hike in oil prices in 1973. The year 1975 had particular significance in terms of accessibility, because of massive back-dated pay awards ('udoji') in both public and private sectors - a direct result of the boom - brought motorbike and vehicle purchases, for the first time, within the reach of many ordinary working-class Nigerians. Furthermore, many more Nigerians could afford transport fares for the first time. The benefits of vehicle ownership extended to the rapidly growing entrepreneurial group of owner-drivers who started taxi and mammy-wagon services, thus providing an expanded transport service to (accessible) rural populations. Guyer et al (1997) vividly described the oil-boom impact as both rapid and dramatic. According to him, the Western region recorded 'even relatively poor farmers at the end of the capillaries of distribution as been able to afford a motorcycle… '. This was the era when the Datsun pick-up arrived, aptly named, in Yoruba, the jalukere ('let's go into the potholes'). By 1977, annual imports of this kind of vehicle reached nearly 31,000 (Guyer et al, 1997). Elsewhere in Nigeria, where large areas that remained remote from paved roads, a massive all-season road building programme commenced and focused on inter-urban connections. There was a corresponding estimated doubling of vehicle numbers between 1976 and 1982. The two mutually reinforcing elements of road construction and rapidly increasing vehicle ownership contributed both to major urban expansion and to rural reorganisation, with significant repercussions for people across the country.

Willingness to cycle is predicted holding certain socioeconomic factors, including gender, age and income status constant. The subjective definition of willingness by individual survey participants is observed to have some influence on our result and remains one of the limitations of the study. Furthermore, the sample size of respondents is low comparative to the overall population of study which the scope of this research can accommodate. Further studies may validate willingness to ride bicycles in the city using a larger sample size since it is the opinion of the authors that generalizations of research participants may not reliably represent the views of over 400,000 inhabitants. However, averages obtained in the results are a fair reflection of the likely behavior of the population of the city. A different perception level across age groups is also one

of the limitations of this study. For instance, the study of Moudon et al. (2005) on 'cycling and built environment, a US perspective', revealed that middle-aged and young adults tend to cycle more than older adults and by extension have more experience thus tolerating difficult cycling environments than older people. Kang and Lee (2012) also revealed a high tolerance level for congestion by people younger than 25 years and therefore increases their likelihood to perceive pedestrian facilities as being A, B, or C than older people. For as much as it was desired that participants be drawn to reflect all socioeconomic background, it might not be feasible in real life, and also considering the limited scope for this research.

3. METHODOLOGY

This study adopts a descriptive research design which involves observation, measurement and description of the behavior of residents to cycle without influencing this in any way. A descriptive approach in measuring the willingness to cycle implies prediction of average responses of residents. Both discrete and continuous data was used for this study. Discrete data with definite value include all socio-economic characteristics of the sampled commuters while on the other hand, continuous data is the willingness to use cycling in Calabar. Instruments were developed based on extensive review of literature on willingness to cycle and related research. This led to the development of a household survey questionnaire. These tools with pre coded responses explore the perception of residents towards cycling in Calabar. This is in addition to basic demographic and socioeconomic information from the surveyed households.

Household heads of all selected localities in the 22 wards of the city comprised the study population. In order to have good representation for the study population, the multi-stage sampling design was adopted. Existing political council wards in the city formed initial strata for the collection of data where a total of 440 questionnaires were administered across the wards with a response rate of 82 percent.

20 questionnaires were purposively administered to each ward using the stratified sampling technique. This involves division of the study population into smaller strata wherein initial listing of every 5th house of the chosen streets was carried out. Where the 5th house is not a residential house, it is skipped to the next residential house and counting continued. The choice of this sampling

technique is to achieve a wider spread since the study is more concerned with predicting individual behavior towards cycling rather than group behavior.

The tools were then administered by the authors to all head of households of every fifth house initially listed. Questions were asked to respondents ranging from socio-economic characteristics, experience in cycling and the willingness to cycle in the city. Other bicycle infrastructure and traffic characteristics which formed the independent variables (Table 1) were rated by research participants using the likert scale. This ranking ranges from highly satisfied (1) to highly dissatisfied (6). Data was coded and analysis was carried out in Statistical Package for Social Sciences (SPSS) environment. Logistic Regression was used in this study to predict the categorical variable (willingness to ride in the city)

Table 1. Variables description

Variable	**Variable description**
Dependent variable	Willingness to cycle in the city
Participant's personal characteristics	Gender, Age, Education, Occupation
Independent variables	Motorized traffic Lack of designated lanes Conflicts with motorized traffic Conflicts with pedestrian Lack of respect for cyclists Bicycle lane Lack of shoulder lane Bad road surfaces/potholes Poor cycling culture & stigma Poor traffic signals Safety issues Weather conditions Illumination All independent variables are coded as highly satisfied (1) to highly dissatisfied (6)

from many predictor variables including road infrastructure and traffic characteristics.

There was an initial consideration of simple (bivariate) logistic regression using willingness to ride as the dichotomous criterion variable and their gender

as a dichotomous predictor variable. Our regression model will be predicting the logit, that is, the natural log of the odds of any of the decision. That is,

$$\ln(\text{ODDS}) = \ln\left[\frac{(\hat{Y})}{1-\hat{Y}}\right] = a + bX, \quad (1)$$

Where $\hat{Y}$ is the predicted probability of willingness to ride coded with 1 rather than 0, unwillingness to ride. $1-\hat{Y}$ is the predicted probability of the other decision and X is our predictor variable.

Our model was constructed by an iterative maximum likelihood procedure where the program starts with arbitrary values of the regression coefficients and then constructed an initial model for predicting the observed data. It then evaluated errors in such prediction and changed the regression coefficients so as to make the likelihood of the observed data greater under the new model, repeating this procedure until the model converges (that is, until the differences between the newest model and the previous model are trivial).

4. RESULTS AND DISCUSSIONS

A total of 361 questionnaires were successfully retrieved which represent a response rate of 82 percent. A cross tabulation of some demographics did not reveal a significant difference in the willingness to cycle across gender as only 7 and 8 of those unwilling are male and female respectively. Furthermore, the observed chi-square is 0.028 which is associated with an 86.6 percent risk of being wrong in rejecting our null hypothesis. This is however too great a risk (far exceeding our standard of 5 percent risk). In terms of ridership across age of respondents, a chi-square value of 11.866 associated with a 0.18 percent is low enough to reject the null, that there is no significant relationship between age of respondents and ridership in the city. Crosstab results revealed 18-35 years of age as the age group that is most willing to cycle (57.1 percent). Furthermore, of the 79 respondents that are willing to cycle, 57.0 percent are also within the same age group. The result also shows that in terms of marital status, more single people either do not ride (60.8 percent) or actually ride (73.8 percent). Therefore, a chi-square value of 3.428 which is associated with 18.0 percent risk of being wrong in rejecting the null hypothesis thus enables a rejection of the null hypothesis that there is no significant relationship in marital status and the level of ridership. In terms of willingness to ride, though the chi-square value of

1.116 is associated with 57.2 percent risk of being wrong in rejecting the null, cross tabulation revealed 66.7 percent and 58.2 percent unwillingness and willingness to ride respectively. This result is corroborated by earlier findings that that willingness to ride in Calabar has close relationship with the active age group.

When gender of cyclists was used as a predictor, a Chi-Square of .000 on 1 df, significant beyond .001 was obtained from Omnibus Tests of Model Coefficients. This imply that addition of gender variable does not necessarily improve the predictability of the model on willingness to cycle. The -2 Log Likelihood statistic of 500.117 is high and thus a measure of how poorly the model predicts the decisions.

Logistic regression analysis was employed to predict the probability that a respondent would be willing to cycle in Calabar. The predictor variables were respondent's gender, age, educational, occupational status, 12 bicycle infrastructure characteristics and dummy variables coding each socioeconomic scenario. A test of the full model versus a model with intercept only was statistically significant, $\chi 2$ (24, N = 315) = 50.5, $p < .001$ and $\chi 2$ (19, N = 315) = 36.5, $p < .001$. The model was able to correctly classify 86 percent of those unwilling to ride and 29.1 percent of those unwilling to ride, for an overall success rate of 66.2 percent.

In Table 2, the logistic regression coefficient, Wald test, and odds ratio for each of the predictors are represented. Employing a 0.05 criterion of statistical significance, gender, educational status, age, and eleven of the scenario dummy variables had significant partial effects.

The odds ratio for gender indicates that when holding all other variables constant, a man is 0.918 or 91.8 percent times more willing to ride than a woman. This corroborates earlier findings of Gerrard, Crawford and Hakman, 2006; Gerrard, Rose and Lo, 2008; Byrnes, Miller and Schafer, 1999. Looking first at the result for age, there is highly significant overall effect (Wald=11.499, df=4, p<.000). The coefficients for all ages (1-4) are significant and positive, indicating that increasing age is associated with increased odds of willingness to ride. The odds ratio tells us that respondents from 50-65 years are .723 times (or 72 percent) more willing to ride than all other age groups holding 18-35 (our reference age) constant. In terms of occupation, traders are 1.094 times (or 109 percent) more likely to ride in the city than all other occupations holding students as our control. Similarly, for education (Ordinary National Diploma/National Certificate of Education) is 1.73 times (173 percent) more likely to cycle in the city than all other educational groups holding

SSCE/WAEC as constant (Table 2). All independent variables (motorised traffic, bicycle lanes, conflicts with motorized traffic, conflicts with pedestrian, lack of respect for cyclists, culture/stigma, weather, shoulder lane, potholes, safety issues, illumination, lack of signals) are significant as they are all greater than 0.05.

In model 2, the odd ratio of some bicycle infrastructure characteristics such as bicycle lanes (1.181), conflicts with motorist (1.338), lack of respect for cycling (1.078), culture/stigma (1.046), weather (1.013), potholes (1.222), safety issues (1.280), and illumination (1.241) are greater than one (relative to others). So, while the model identifies that age, occupation and gender and education are significantly associated with the willingness to ride outcome, and indeed can explain 17.4 percent of the variance in outcome (quoting the Nagelkerke pseudo-R2), they do not predict the outcome for individual respondents very well. This is important because it indicates all socioeconomic characteristics in our model are not significant, except age, in determining the willingness to ride

Table 2. Logistic regression analysis of bicycle infrastructure characteristics respondents' demography

	Model 1			**Model 2**		
Variable	**B**	**SE**	**OR**	**B**	**SE**	**OR**
Constant				-1.194	1.532	.303
Motorized traffic	-.432	.181	.649	-.435	.187	.648
Bicycle lanes	.405	.210	1.499	.166	.241	1.181
Conflicts_motorised	.299	.202	1.348	.291	.217	1.338
Conflicts_pedestrian	-.299	.152	.741	-.348	.156	.706
Lack_respect	.110	.172	1.116	.075	.182	1.078
Culture_stigma	.069	.163	1.072	.045	.175	1.046
Weather	-.009	.141	.991	.013	.156	1.013
Shoulder_lane	-.109	.200	.897	-.167	.225	.846
Potholes	.121	.185	1.129	.201	.208	1.222
Safety issues	.122	.241	1.130	.247	.256	1.280
Illumination	.143	.142	1.153	.216	.154	1.241
Lack_signals	-.026	.111	.974	-.143	.125	.867
Gender	.009	.246	1.009			
Female (base=male)	-.086	.256	.918			
Age	.392	.213	1.480			
Age (1)	-.290	.431	.748			
Age (2)	.723	.575	2.061			
Age (3)	1.979	.975	7.234			
Age (4)	-21.03	1.641	.000			
Education	-.077	.157	.926			
Education (1)	-.156	.959	.885			
Education (2)	.379	.661	1.461			
Education (3)	.556	.582	1.745			

Education (4)	-.028	.525	.972			
Occupation	-.279	.160	.757			
Occupation (1)	.090	.358	1.094			
Occupation (2)	-.124	.408	.883			
Occupation (3)	-1.419	.852	.242			
Age(1)*Edu(1)*Gen(1)*Occu(2)				21.346	2.101	1.864
Age(1)*Edu(2)*Gen(1)*Occu(1)				.044-	1.086	1.045
Age(1)*Edu(2)*Gen(1)*Occu(2)				.412	.655	.662
Age(1)*Edu(3)*Gen(1)*Occu(1)				-.337	.596	.714
Age(1)*Edu(4)*Gen(1)*Occu(1)				.135	.748	1.144
Age(2)*Edu(2)*Gen(1)*Occu(2)				.232	1.354	1.261
Age(2)*Edu(3)*Gen(1)*Occu(1)				.397	.789	1.487
Age(2)*Edu(4)*Gen(1)*Occu(2)				-.692	1.080	.501
Age(3)*Edu(4)*Gen(1)*Occu(1)				-.134	2.842	.875
-2LL Nagelkerke R2 Hosmer & Lemeshow test Classification accuracy	450 X2=50.5,df=24,p<.001 10.9% p=1.03 51.5%			464 X2=36.5,df=19,p<.001 17.4% p=0.969 66.2%		

Notes: the coefficients for gender are contrast with majority male, age with 18-35 majority age group, education with SSCE/WAEC and occupation by student group of respondents.

'outcomes (although they are significantly associated with it). There is substantial individual variability that cannot be explained by socio-economy, bicycle infrastructure and traffic characteristics in the city, and this is expected to reflect on individual factors like prior attainment, ownership of car, administrative duties, etc. The overall Wald for the Age*Education*Gender*Occupation interaction is not significant (Wald=1.472, df=9, p>0.005) (Table 2). Individual regression coefficients of each interaction also reveal no significance but however indicate positive odds ratio.

5. CONCLUSIONS AND POLICY IMPLICATIONS

Willingness to cycle is predicted holding certain socioeconomic factors, including gender, age and income status constant. The subjective definition of willingness by individual survey participants is observed to have some influence on the result and remains one of the limitations of the study. Furthermore, the sample size of respondents is low compared to the overall population of the geographical area. Further studies may validate willingness to ride a bicycle in the city using a larger sample size since it is the opinion of the authors that generalizations of research participants may not reliably represent the views of over 400,000 inhabitants. However, averages obtained in the results are a fair reflection of the likely behavior of the population of the city towards cycling. A different perception level across age groups is also one of the limitations of this

study. For instance, the study of Moudon et al. (2005) on 'cycling and built environment, a US perspective' revealed that middle-aged and young adults tend to cycle more than older adults' and by extension have more experience thus tolerating difficult cycling environments than older people. Kang and Lee (2012) also revealed a high tolerance level for congestion by people younger than 25 years and therefore increases their likelihood to perceive pedestrian facilities as being A, B, or C than older people. For as much as it was desired that participants be drawn to reflect all socioeconomic background, it was not feasible in real life, and also considering the limited scope for this research

Despite increasing interest and focus on cycling planning and infrastructure in many developed countries, many research and policy frameworks in developing countries are focused on motorized transportation. Elsewhere in developed countries also, interest is now on two important aspects of cycling: motivations and trip satisfaction, while the willingness of urban residents to cycle has remain highly unpredictable. The study has found that socioeconomic characteristics (age, occupation, age and gender) of residents are not a good parameter for predicting the probability of residents of Calabar to cycle. Rather quality of bicycle transport infrastructure and other transport characteristics are more significant variables for predicting willingness to cycle in the study area. This study has also quantified a wide range of items with relative influence on possible cycling behavior. Specifically, lanes (1.181), conflicts with motorist (1.338), lack of respect for cycling (1.078), culture/stigma (1.046), weather (1.013), potholes (1.222), safety issues (1.280), and illumination (1.241) which have odd ratios that reveal significant contribution to the willingness of respondents to use the bicycle for urban transportation. The need for separate bicycle lanes as an ideal motivation for cycling especially for inexperienced cyclists also has additional advantages of protecting cyclists from motorized traffic, noise and conflicts with pedestrian.

It is recommended that the municipal authorities implement the following: traffic calming in residential neighborhoods; smart urban design oriented to people rather than cars; and car policy with some measure of restrictions. Others are: bicycle transport education especially directed at young people in schools (possible inclusion in school curriculum); and strict enforcement of traffic regulations that protect cyclists. The findings of this research also provide sources of evidence relating to specific infrastructures and environment that planners can look out as motivators to cycling. Whereas a comprehensive and holistic approach to promoting cycling in Calabar is likely to prove most effective, this research has provided ample evidence on a specific area to focus

efforts in order to enhance the willingness to ride in the city. The study revealed factors relating to the built environment such as separate cycling lanes devoid of potholes, paths' illumination, and so on influencing willingness to cycle rather than socio-economic variables. It is also important to note that stigma is positively related with unwillingness to cycling and therefore recommended for further investigation. Transportation planners and public health officials can use results of this research to direct resources at specific transport infrastructure that promotes cycling. An enabling legislature and state government policy on cycling may not necessarily depend on physical cycling activities to develop associated infrastructure, rather, results of this survey can be used as a baseline to commission studies of larger scope to ascertain the level of willingness of residents to cycle. Therefore, as valid as the idea that cycling activity must be a condition for investment in cycling infrastructure, the changing level of taste and safety consciousness rather makes it untenable. Deliberate attempt must therefore be made to include in urban infrastructure design designated bicycle paths to motivate residents to ride bicycles in the city. The advantages of cycling justify for any such investment. In view of the significance of weather in predicting willingness to cycle in the city, the planting of trees in major roads where they do not exist may become another motivation for cycling. Other policies designed to discourage motorist as well as protect cyclists should be encouraged.

Further studies that seek to include other parameters and thus examine the satisfaction level of a few cyclists that exist in the city are further recommended. There is a high possibility for overwhelming conversion from motorized transport to bicycling in Calabar if the enabling environment is enhanced. The findings of this research further support policy shift in intra city transport infrastructure planning in Calabar and many other cities where cycling is not given a place in urban transit. Therefore, a comprehensive bicycle route planning study should be undertaken in Calabar to provide infrastructure that supports cycling. Since this study did not exclude residents without access to bicycles or those with physical constraints against cycling, it is therefore recommended that other research that focuses on motivation for cycling for residents with access to bicycles should be undertaken.

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