EASR

Engineering and Applied Science Research

https://www.tci-thaijo.org/index.php/easr/index

Published by the Faculty of Engineering, Khon Kaen University, Thailand

Logistic model for adherence to ministry of health protocols and guidelines by public transport vehicles in Kenya during COVID-19 pandemic

Kiprotich Clement Kiptum*

Department of Civil and Structural Engineering, School of Engineering, University of Eldoret, P.O Box, 1125-30100, Eldoret, Kenya

Received 13 December 2020
Revised 13 May 2021
Accepted 19 May 2021

Abstract

To know whether a given public transport vehicle will observe COVID-19 Ministry of Health Protocols and Guidelines in Kenya, a logistic expression was developed based on gender, type of vehicle, distance covered and the possibility of contracting COVID-19 by passengers while on board a given vehicle. Data collection was done by use 112 questionnaires administered on line. The respondents were first year students attending online courses in Kenyan University. Results showed majority of the respondents (41%) used 8-seater vehicle to travel. As for the distance travelled, majority of the respondents (37.3%) covered less than 25 km to reach their home County Headquarters. Possibility of infection in 8-seater and 32-seater vehicle was concentrated in level 3 while that for 14-seater was concentrated in Level 4. For 45-seater and 63-seater vehicles the possibility of infection was in level 2. A model efficiency of 84.8% was found indicating that the model is good. The results of this study provided information on behaviour of public transport sector in Kenya.

Keywords: Logistic regression model, Public transport, Kenya, Pandemic, Passengers

1. Introduction

The Kenyan government gave measures to curb the spread of COVID-19 following the confirmation of first case of Corona Virus Disease COVID-19 in Kenya on 13th March 2020. The pandemic started in Wuhan City in China on 17th November, 2019 [1]. It took 116 days to reach Kenya. The measures are: regular washing of hands, use of face masks, social distancing of more than 1.0 m, avoidance of close contact among people, covering of mouth when sneezing or coughing using elbow or disposable tissue, prohibition of hand shaking, sanitizing hands regularly. Public transport providers known locally as *Matatu* were required to provide hand sanitizers and clean their vehicles regularly as per the Ministry of Health Protocols and Guidelines [2].

As at mid of December, 2020, more than 90 000 people in Kenya had contracted the disease. The pandemic has affected many sectors in the country. One such sector is education sector. All universities and tertiary institutions were closed on 18th March, 2020 through presidential directive on 15th March, 2020. Learning online resumed in some Universities in September particularly for first year students. The Universities started phase reopening on 12th October after seven months' suspension. This was welcome idea as the cabinet secretary for education had earlier declared 2020 year, as a lost academic year in Kenya. Although first year students doing online courses can stay at home and avoid contracting COVID-19, they need at some point to travel to their home county headquarters for various reasons. Distance to Home County was chosen because some counties during the month of April experienced lock down and were not supposed to travel to other counties [3].

Since 94 % of Kenyans do not own cars [4] means that Kenyans use public means to travel from home to their county headquarters. In fact, public transport in Kenya accounts for 88% of all motorized traffic [5]. The pandemic has affected public transport sector locally knows as '*Matatu* sector' in terms of reduced income due to travel restrictions, reduced capacity and curfew times. Bearing in mind that public transport is an important economic activity in Kenya and the need to allow them operate meant that they were supposed to comply with Ministry of Health protocols and guidelines to curb the spread of the COVID-19.

The protocols are to be followed by transport sector to curb the spread of the pandemic. The public transport in Kenya before the pandemic were14-seater, 8-seater, 63-seater bus. According to [3], the public transport vehicles were allowed to carry at most 50% of their licensed capacity and the penalty for contravening the law attracts a fine of shillings 20 000 approximately (200 USD), or imprisonment of six months. Adjusting to the new regulations, the 14-seater now carry 9 persons, and the 8-seater carry 5 people. 63-seater to be 32-seater. Reducing the number of passengers helps to reduce the number of infected persons in case a person suffering from COVID-19 boards a vehicle and infects other passengers unknowingly. Reduced carrying capacity of the vehicle means there are empty seats which can be used by other passengers with the permission of driver and thus compromising on the social distancing requirement. This causes overloading as was witnessed in City of Karachi in Pakistan [6]. Overloading has been seen to occur particularly in the morning when every person is rushing to work and in the evening when each person tries to reach home before curfew time. This was the case in Kenya when the curfew time used to start from 7 pm. Even after the extension of curfew time to 10 pm, overloading still occurs. This can be attributed to fewer vehicles and many commuters.

*Corresponding author. Tel.: +2547 2504 4628
Email address: ckiptum@uoeld.ac.ke
doi: 10.14456/easr.2022.10

Other measures in *Matatu* industry included acquisition of clearance certificates from National Transport and Safety Authority (NTSA), Ministry of Health and Ministry of Interior. The public transport vehicles were required to record names of passengers as well as their temperatures before boarding the vehicle. Such records are good for contact tracing in case one of the passengers is found to have contracted the disease. Passengers with temperatures exceeding 38^0C are not supposed to board the vehicle as high fever is one of the symptoms of the disease. It is a fact of life that not all public transport vehicles' drivers and passengers will adhere to the measures to curb the spread of the highly contagious COVID-19. The critical person to ensure passengers are adhering to control measures is the driver of the vehicle. The driver is responsible for providing temperature gun, records of names, sanitizers, hand washing tanks and maintenance of social distance by carrying the recommended 50% of passengers. Passengers are responsible of only one item, wearing of a mask. The driver and passenger characteristics have a direct influence on whether a given public transport vehicle adheres to the Ministry of Health protocols and guidelines.

Studies have been conducted on use of public transport and spread of diseases. A study done in London showed that there was a correlation between the spread of Influenza-like illnesses and use of public transport. This was because of higher number of contacts while travelling in public transport [7]. This shows that public transport sector should not be ignored in the fight against the spread of a communicable disease like COVID-19.

On the type of public transport vehicles used in Kenya, some researchers have undertaken to study transport sector. Travel demand in large and small cities in Kenya was done by [5]. This study determined the main mode of travel for work and school in Kenya. It is worth noting that the study was done before the pandemic and therefore the protocols on controlling the disease had not been developed. Indeed, public transport in Kenya could jeopardize efforts to curb local spread of the pandemic [8].

Considering that factors affecting public transport are passenger's personal attributes, travel attributes, perception of COVID-19 [9] among others. Personal attributes for instance sex, affect choice of transportation system [10]. Another factor is gender [11]. Travel attributes include type of vehicle and distance travelled [12]. Many people in Kenya use public transport because they cannot afford a private car because of poverty. Indeed [13] studied transport poverty which affects the public transport. These factors affect the binary dependent variable that is adherence or non-adherence to the Ministry of Health protocols and guidelines. A logit regression analysis can be done for adherence and the factors mentioned. A logistic expression gives a relation between a dependent variable and a number of independent variable. The dependent variable has only two outcomes while the independent variable can have more than two outcomes. For the public transport, vehicles can choose to obey or not obey the measures taken to control the spread of the pandemic.

Logit regression analysis has been used by [9] to study choice of rail transport by commuters. Further, [14] used regression to study congestion factors in the city of Beijing while [15] used logistic expression to model and assess transport services. Interestingly, [16] used binary logit expression to study users' behaviors and influencing factors for Free-Floating Bike Sharing in Jiangsu. All these research show that logistic expressions are widely used in transport sector. Another study looked on barriers and drivers of transition to sustainable public transport in the Philippines and used political, economic, social, technological, legal and environmental (PESTLE) analysis to determine how different drivers embraced use of electric vehicles in transport system [17]. Logistic model is better than PESTLE because it is easy to use. There exist binary and multinomial logistic models. Multinomial logits are utilized in studies that have multiple choice problems [18]. In this study binary logistic model was used because of only two outcomes of adherence and non-adherence of Ministry of Health protocols and guidelines.

Despite a lot of work done on traffic management, there are few studies that have attempted to relate the adherence of health protocols by public transport vehicles in Kenya during this time of pandemic. The problem in Kenya is some public transport do not follow the rules and therefore become avenues for spreading the virus. The information from this study will inform policy at both county and national level.

Therefore, this paper investigated vehicle and passenger characteristics with a view of using these characteristics to find a logistic regression model for public transport in Kenya to ensure safe means of transport as country adjusts to the challenges of the pandemic.

2. Materials and methods

2.1 Data collection

Data was acquired through questionnaire sent to passengers purposively. Questionnaires were pre-tested by administering the questions to sample drivers and passengers. The questionnaires were then framed properly ready for actual data collection. Questionnaires were sent to first students joining a public university in Kenya (respondents). University students were chosen because they come from all over the country and hence a representative sample for the Kenyan population. First students were chosen purposively because they are the first group of students that are learning online. Questionnaires were sent to all the students using email.

The respondents' answers were checked for accuracy and where there was need for clarification, the respondent was told to resubmit the answer. This improved the quality of questionnaire data. The respondents were told to answer promptly as the data was to be used for scientific study of public transport in Kenya which needs more in-depth study. A total of 111 emails were sent. However, 9 of the respondents used private vehicles and were not considered. This meant that 102 samples were available for the logistic regression analysis.

Questionnaire covered personal attributes, travel attributes and the possibility of contracting COVID-19 in a public transport vehicle. Personal attributes included age and gender. Travel attributes included: distance of travel and whether COVID-19 protocols were being followed. Perception of COVID-19 was done by indicating the possibility of contracting the disease in public transport using 4-point Likert scale of Very high, high, low and very low. Very high was given high score of 4, high was given a score of 3, low was given a score of 2 and very low was given a score of 1.

Logistic regression analysis aims to best fit a model between a response variable and a set of independent variables.
Logistic expression takes the form in Eq.1 [19]:

$$Y_i = logit\ P_i = LN\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1 x_1 + \cdots + \beta_n x_n \tag{1}$$

Where Y is a dependable variable that has only two outcomes (binary). Y has a value of 1 for the occurrence of the event and 0 for event not occurring. β are coefficients for independent variables x_i for $i = 0,\ldots,k$. P_i is the probability and is calculated using Eq.2:

$$P_i = \frac{EXPONENTIAL(\beta_0 + \beta_1 x_1 + \cdots + \beta_n x_n)}{1 + EXPONENTIAL(\beta_0 + \beta_1 x_1 + \cdots + \beta_n x_n)} \quad (2)$$

Test sample size (*n*) for logistic expression is given by *n > 10(k+1)* where *k* is the number of independent variables [15] and in no case should the sample size be less than 100 [20].

The dependent variable was whether the vehicle one chooses observed the health protocols ($Y = 1$) equals choosing to observe the protocols and ($Y = 0$) means not to observe the protocols. It was hypothesized that the gender (X_1), type of vehicle (X_2), distance to be covered (X_3) and possibility of infection (X_4) affects a commuter in boarding a vehicle that is going to observe the protocols or not (Table 1). Categorical variables are variables that have two outcomes either yes or no. Continuous variable are those with more than two outcomes.

Table 1 Independent variables

Variable	Category	Detail
X_1 Gender	Categorical variable	X_1(0): Female X_1(1): Male
X_2 Type of Vehicle	Continuous variable	X_2(1): 8-Seater X_2(2): 14-Seater X_2(3): 32-Seater X_2(4): 45-Seater X_2(5): 63-Seater
X_3 Distance Travelled in Km	Continuous variable	X_3(1): < 25 X_3(2): 25-50 X_3(3): 51-75 X_3(4): 76-150 X_3(5): >150
X_4 Possibility of contracting COVID-19		X_4(1): Very low X_4(2): low X_4(3): High X_4(4): Very high

2.2 Logistic calculation procedures and model analysis

All Calculations were done in Microsoft Excel® following the formulae described by [21]. Since there were four parameters, five Betas (coefficients) were chosen. β_0 as a constant coefficient, β_1 coefficient for gender, β_2 coefficient for travel mode, β_3 coefficient for distance travelled, β_4 coefficient for possibility of contracting COVID-19. The coefficients were multiplied with each independent variable and added together to get Eq. (3):

$$\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 \quad (3)$$

The probability for each respondent (p_i) was calculated using Eq.4:

$$p_i = \frac{1}{1 + e^{-(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4)}} \quad (4)$$

The log-likelihood (LL) statistic was calculated using Eq. 5:

$$LL = \ln L = [y_i ln(p_i) + (1 - y_i)\ln(1 - p_i)] \quad (5)$$

The summation of log-likelihood was done to get LL_1. The cell with the sum was maximized using excel solver by changing the cell with the coefficients β_0, β_1, β_2, β_3 and β_4. The checkbox for Make Unconstrained Variables Non-negative was unchecked.
The Wald statistic was calculated using Eq. 6:

$$Wald\ statistic = \frac{\beta^2}{Standard\ error^2} \quad (6)$$

To test the model there was need to find first, n_0 as number of observations with values 0 and n_1 as number of observations with value 1. Adding n_0 and n_1 gave n the total sample size.

Secondly, LL_0 which refers to a model with only the intercept β_0 and was computed in Excel using the Eq.7:

$$LL_o = \ln L_0 = n_0 \ln\frac{n_0}{n} + n_1 ln\frac{n_1}{n} \quad (7)$$

After finding LL_0 and LL_1 the next stage was to compute the test statistics for the model. The formula for pseudo-R^2 statistics is Eq. 8:

$$R_L^2 = 1 - \frac{LL_1}{LL_0} \quad (8)$$

Cox and Snell's R^2 was computed using Eq. 9:

$$R_{CS}^2 = 1 - e^{-\frac{2}{n}(LL_1 - LL_0)} \quad (9)$$

Nagelkerke's R^2 was computed using Eq. 10:

$$R_N^2 = \frac{R_{CS}^2}{1 - e^{2LL_0/n}} \quad (10)$$

$$Chi - square = 2(LL_1 - LL_0) \quad (11)$$

Another statistical test is the probability value or p-value. This study took α = 0.05. Therefore, a p value of less than α means rejection of the null hypothesis and accepting the alternative hypothesis. The model development is summarized in the conceptual model in Figure 1. The factors affecting transport in Kenya were identified and were in Table 1 and were taken as independent variables. The independent variable was compliance or non-compliance of the measures to control spread of COVID-19.

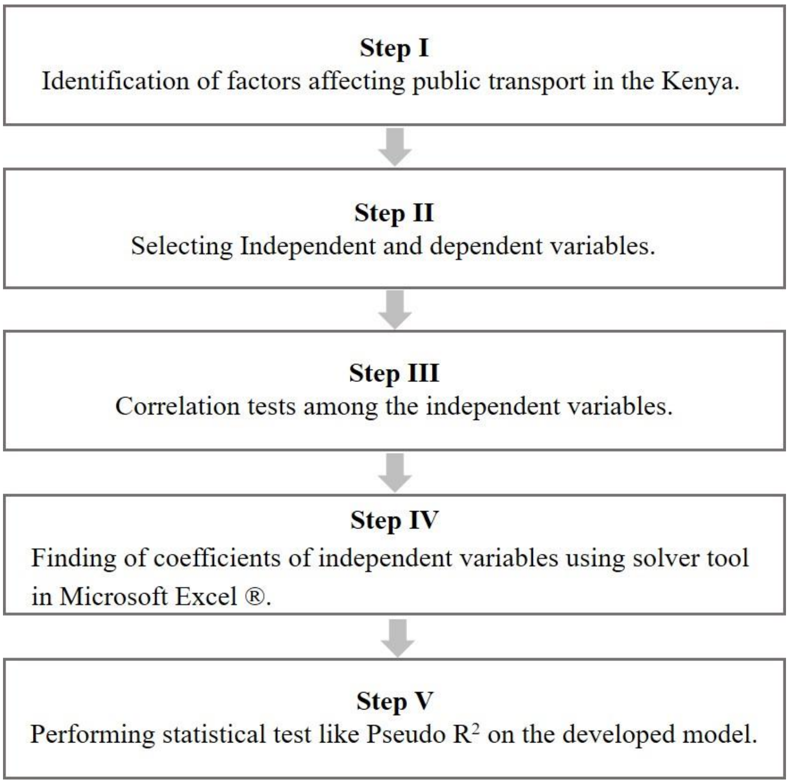

Figure 1 Logistic modelling process

3. Results and discussion

3.1 Personal characteristics

The respondents had different characteristics and so were their choice of vehicles they used when travelling from home to their County headquarters. These personal characteristics have an impact on whether one is going to board a vehicle that does not comply with the transport protocols during this time of pandemic. Table 2 gives the gender and age of the respondents. Men accounted to 73 % of the respondents while women were 27%. The high number of males is because there are more men enrolling to universities in Kenya than women.

This is consistent with the data that majority of persons contracting COVID-19 are male in Kenya as they are the ones who travel a lot. For instance, on 29.11.20, male percentage was 66% [22]. The mean age of the respondents was 19 and that is why majority of the respondents were under 20 years corresponding to 88%. Kenyan education 8-4-4 curriculum [23] consists of pre-primary, primary, secondary and university. A pupil takes around 15 years of basic education. Considering that most children start school when they are three years old, so by the time they join university they are aged around 19 years.

Table 2 Respondents' characteristics

Variable	Type	Number of respondents	Percentage
Gender	Male	74	73
	Female	28	27
Age (Years)	18-20	90	88
	21-25	8	8

Majority of the respondents (41%) used 8-seater vehicle to travel Figure 2. As for the distance travelled, majority of the respondents (37.3%) covered less than 25 km to reach their home County Headquarters Figure 3.

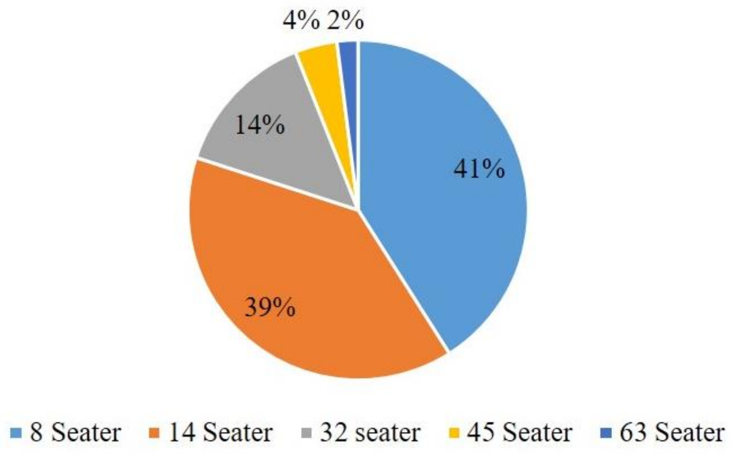

Figure 2 Vehicle type used

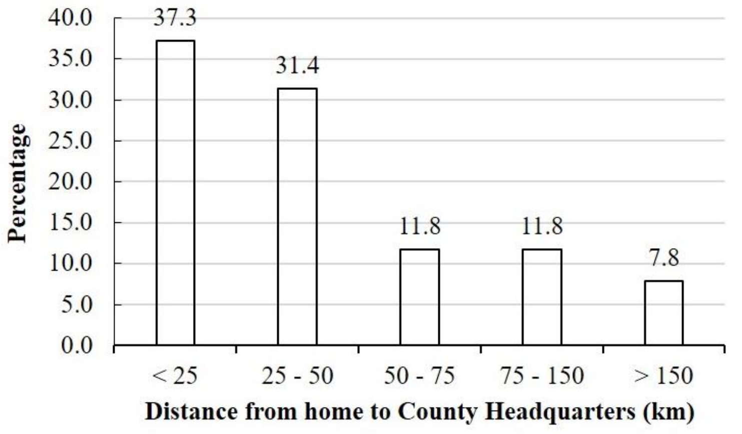

Figure 3 Distances covered

The possibility of being infected in the vehicle was categorized in four levels as shown in Figure 4. Level 1 was when the possibility is very low, level 2 was for low possibility, level 3 for high possibility and level 4 for very high possibility. Possibility of infection in 8-seater and 32-seater vehicle was concentrated in level 3 while that for 14-seater was concentrated in Level 4. For 45-seater and 63-seater vehicles the possibility was in level 2. The high possibility of contracting COVID-19 in 8-seater and 32-seater is in agreement with [9] who found high possibility of contracting COVID-19 when using public transport. The low possibility of contracting COVID-19 while using the 45-seater or 63-seater could be attributed to smaller number of respondents who used this type of transport mode. Level 2 is found in 8-seater, 14-seater, 45-seater, and 63-seater and absent in 32-seater. Level 3 is found in 8-seater, 14-seater to 32-seater vehicles.

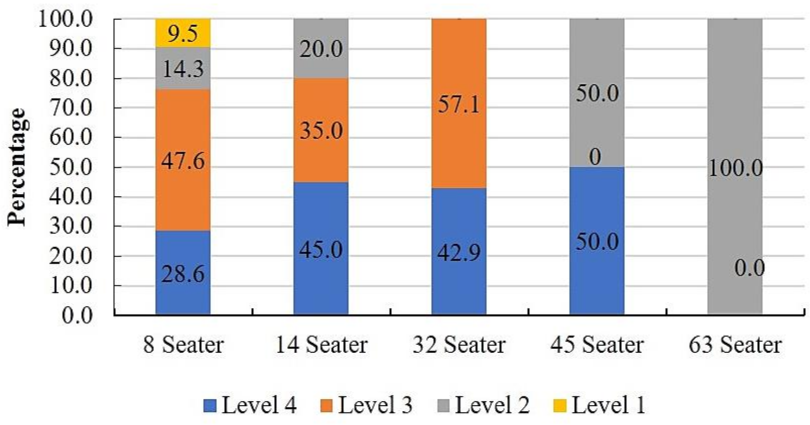

Figure 4 Possibility of being infected in a given type of vehicle

3.2 Logistic expression

Before performing logistic regression Spearman's correlation between various independent variables was done using Microsoft Excel® correlation function CORREL (array 1, array 2) and tabulated in Table 3. The results showed that the independent variables had correlation coefficients of less than 0.5 and hence there was no possibility of multicollinearity.

There was a negative correlation between distance travelled and gender, type of vehicle and possibility of contracting COVID-19. Positive correlation existed between gender and type of vehicle, distance and type of vehicle and between distance and the possibility of contracting COVID-19.

Table 3 Spearman's correlation for variables

	Gender (X_1)	Type of vehicle (X_2)	Distance (X_3)	Possibility of contracting COVID-19 (X_4)
Gender (X_1)	1.00			
Type of vehicle(X_2)	0.18	1.00		
Distance (X_3)	-0.20	0.15	1.00	
Possibility of contracting COVID-19(X_4)	0.11	-0.05	0.05	1.0

The logistic regression Eq. (12) has the parameters shown in Table 4.

$$Logit\ for\ probability = 3.772 + 3.275(X_1) + 0.443X_2 + 0.137X_3 - 3.243X_4 \quad (12)$$

Table 4 Logistic expression parameters

Variable	β	Standard error	Wald Statistic	EXP(β)
Constant	3.772	0.468	64.914	
Gender	3.275	0.395	68.724	26.440
Type of vehicle	0.443	0.460	0.931	1.558
Distance	0.137	0.469	0.085	1.146
Possibility of infection	-3.243	0.221	214.455	0.039

Gender is positively related to adherence of Ministry of Health protocols and guidelines and the odds for this are 26.44. That is, keeping all the other influencing factors constant, the probability of a vehicle adhering to Ministry of Health protocols and guidelines will be 26.44 for vehicles with male passengers. Maybe because the drivers fear male passengers than female passengers. The type of vehicle is positive with the adherence of Ministry of Health measures, and the odds for this are 1.558. This shows that each time a person boards a vehicle with fewer seats, the possibility of that vehicle maintaining the Ministry of Health measures will increase by 1.558 times. This is mainly because the vehicle with less seats has less empty seats than a vehicle that has many seats. The distance travelled is estimated at 0.137 and the odds ratio is 1.146. This suggests that with the increase of distance, the possibility of adherence to Ministry of Health protocols and guidelines will increase 1.146 times. This is mainly because vehicles operating long distances have fixed bus stops than vehicles operating short distance. It could also be because long distance vehicles do not start their journeys' before all the seats are occupied. The parameter estimation for the possibility of infection is -3.243, and the odds are 0.039. This shows that as the possibility level of infection increases, the possibility of adherence to Ministry of Health measures will increase 0.039 times. In other words, the higher the possibility of COVID-19 infection, the lower the adherence of health protocols. This is because as the level infection increases the fewer people will likely board that vehicle and thus forcing the drivers of the vehicles to obey the measures.

To ensure that the vehicles comply with the Ministry of Health protocols and guidelines there is need for using more police, installing of CCTV cameras and having public transport installed with panic buttons as recommended by [24]. Some police officers in Kenya have been corrupt and if they are given some money, they would not arrest the law breakers. Addition of cameras and use of panic buttons are technologies that can be adopted but in Kenya where many people are poor, their affordability is therefore out of reach of most people. Therefore, this leaves Kenyans to take care of themselves against the pandemic.

From Table 5, the pseudo-R^2 was higher than 0.2 and meant that the model results were acceptable. It also means that the independent factors could explain 0.565 for the adherence of health protocols by public transport vehicles. Since p-value is less than 0.05 showed that at least one of the independent variables contributed to the prediction of the adherence of the Ministry of Health protocols and guidelines. In reference to theory of statistics, a value of significance less than 0.05, indicates that the variable has a significant effect on the selection result and should be retained based on a confidence level of 95%. In addition, the Chi-square is 32.7 and the significance is less than 0.05, which shows that the variables used in the model have significant impact on the adherence of Ministry of Health protocols and guidelines.

Table 5 Logistic model test results

Index	Value
p statistic	< 0.05
Model efficiency	84.8%
LL_0	-57.901
LL_1	-25.203
-2log likehood	50.407
Cox and Snell's R^2	0.480
Nagelkerke's R^2	0.707
pseudo-R^2	0.565
Chi-Square	32.7

Interestingly, the model efficiency of 84.8% indicating that the model is good. Therefore, the model predicted values close to those ones observed. Model efficiency observed was interestingly equal to 84.8% observed by [9] but higher than 78.4 % observed by [25].

The Microsoft Excel sheet is attached for one to review as Table 6. The LL column in the table shows that the log likelihood was between 0 and -∞.

Table 6 Part of the calculations

x1	x2, b1	x3, b2	Follow rule	b3	Logit	e^{logit}	Probability	yiln (pi)	(1-yi)ln(1-pi)	LL
gender	**Means of transport**	**distance (km)**		**x4**						
1	2	3	0	4	-4.631	102.61521	0.00965	0	-0.009698	-0.0097
1	1	1	1	2	1.13967	0.3199244	0.75762	-0.2776	0	-0.2776
1	1	2	0	3	-1.9674	7.1518978	0.12267	0	-0.130873	-0.1309
1	1	2	0	4	-5.211	183.27551	0.00543	0	-0.005441	-0.0054
1	1	5	0	3	-1.5577	4.7478143	0.17398	0	-0.191135	-0.1911
0	1	1	0	4	-8.6224	5554.9711	0.00018	0	-0.00018	-0.0002
1	4	5	1	2	3.01625	0.0489847	0.9533	-0.0478	0	-0.0478
0	1	5	0	4	-8.0762	3216.9554	0.00031	0	-0.000311	-0.0003
1	1	2	0	3	-1.9674	7.1518978	0.12267	0	-0.130873	-0.1309
0	2	4	0	4	-7.7693	2366.8501	0.00042	0	-0.000422	-0.0004
1	2	4	0	3	-1.2508	3.4931677	0.22256	0	-0.251749	-0.2517
0	2	1	0	4	-8.179	3565.3184	0.00028	0	-0.00028	-0.0003
1	3	3	0	3	-0.9439	2.5700711	0.28011	0	-0.328652	-0.3287
1	3	2	0	4	-4.3241	75.498351	0.01307	0	-0.0.13158	-0.0132
1	3	3	0	4	-4.1875	65.860993	0.01496	0	-0.015069	-0.0151
1	2	1	0	4	-4.9041	134.90341	0.00736	0	-0.007389	-0.0074
1	5	4	1	2	3.32312	0.0360401	0.96521	-0.0354	0	-0.0354
0	1	4	0	3	-4.9691	143.90341	0.0069	0	-0.006925	-0.0069
1	1	1	0	4	-5.3476	210.09399	0.00474	0	-0.004748	-0.0047
1	2	1	0	3	-1.6605	5.2619535	0.15969	0	-0.17399	-0.174
0	2	5	0	4	-7.6328	2064.7219	0.00048	0	-0.000484	-0.0005
1	2	1	1	2	1.58311	0.2053354	0.82964	-0.1868	0	-0.1868
1	1	2	0	4	-5.211	183.27551	0.00543	0	-0.005441	-0.0054
0	1	2	0	3	-5.2423	189.09911	0.00526	0	-0.005274	-0.0053
1	3	1	0	4	-4.4607	86.545931	0.01142	0	-0.011488	-0.0115
1	2	2	0	3	-1.5239	4.5902656	0.17888	0	-0.197089	-0.1971
0	1	2	0	3	-5.2423	189.09911	0.00526	0	-0.005274	-0.0053

Column 1, has gender variable X_1 which were coded as 1 for male and 0 for female. Means of transport (X_2) is provided in column 2. For example, a value of 2, means a 14-seater. Column 3 contains distance where 1 is when the distance was less than 25 km. Column 4 shows whether the COVID-19 Ministry of health protocols and guidelines with 1 for adherence and 0 for non-conformity. Column 5 contained the possibility of COVID-19. Column 6 were calculated using Eq. (3). Column 7 were calculated by getting negative exponentials of column 6. Column 11 were calculated using Eq. (5).

4. Conclusions and recommendations

This paper has provided a binary logistic regression equation that relates the adherence of COVID-19 protocols by public transport in Kenya. Based on the coefficient of the model established that sex, type of vehicle and distance were positively correlated with the adherence of the health protocols. The results have shown that public transport vehicles adherence to Ministry of Health protocols and guidelines was negatively correlated with the possibility of infection. On the other hand, health protocols and guidelines were positively correlated with the gender, type of vehicle and distances covered. This meant that vehicles with males with less seats and covering short distances were likely to observe the health protocols.

The model is useful in predicting proportion of public transport vehicles who adhere to the Ministry of Health protocols and guidelines in future as the world awaits the vaccine for the pandemic. Kenyan government, and in particular the department of National Transport and Safety Authority may further investigate on the information this study has exposed in order to prevent spread of COVID-19 which has affected lives of Kenyans. The government should continue educating and sensitizing the citizens on the need on the need of following measures while travelling in a public transport system. The model was developed from a small sample size and can be improved in future when more information is available. Future study needs to be done to evaluate other factors like children having seats, whether some passengers are from the same household, gender of the driver and number of hours to curfew time. Also, there is need to study the gender of drivers and whether the drivers are the vehicles owners. There is also need to study the impact of police owning public transport and its effects on the adherence to Ministry of Health protocols and guidelines. This fitted model is recommended for use by police department to curb vehicle flouting the protocols which will go a long way in controlling the spread of the pandemic in Kenya.

5. Acknowledgements

The author is grateful to all those students who responded to the survey questionnaire.

6. References

[1] Ouhsine O, Ouigmane A, Layati E, Aba B, Isaifan RL, Berkani M. Impact of COVID-19 on the qualitative and quantitative aspect of household solid waste. Global J Environ Sci Manag.2020;6:41-52.
[2] Ministry of Health Kenya. First case of coronavirus disease confirmed in Kenya [Internet] Nairobi: Briefs on Corona virus; 2020 [Updated 2020 May 31; cited 2020 Jun 1]. Available from: https://www.health.go.ke/first-case-of-coronavirus-disease-confirmed-in-kenya/.
[3] The Public Health Act. Kenya Gazette Supplement No. 41. Kenya: Kenya Gazette; 2020.
[4] Kenya National Bureau of Statistics (KNBS). 2019 Kenya population and housing census volume 4: distribution of population by socio-economic characteristics. Nairobi: Republic of Kenya; 2019.
[5] Gulyani S, Salon D. Commuting in urban Kenya: unpacking travel demand in large and small Kenyan cities. Sustain. 2019;11(14):3823.
[6] Rao ZI, Khan K, Jafri SF, Sheeraz K. Public transportation improvement validation for Metropolitan City Karachi. Eng J. 2013;18(1):55-64.
[7] Gosce L, Johansson A. Analysing the link between public transport use and airborne transmission: mobility and contagion in the London underground. Environ Health. 2018;17(1):1-11.
[8] Nakweya G. Public transport could stifle Africa’s COVID-19 control [Internet]. Nairobi: Public transport could stifle Africa’s COVID-19 control; 2020 [updated 2020 Dec 11; cited 2020 Dec 12]. Available from: https://www.scidev.net/sub-saharan-africa/news/public-transport-could-stifle-africa-s-covid-19-control/.
[9] Tan L, Ma C. Choice behavior of commuters’ rail transit mode during the COVID-19 pandemic based on a logistic model. J Traffic Transp Eng. 2020;8(2):186-95.
[10] Ratanavaraha V, Champahom T, Jomnokwao S, Nambulee W, Klungboonkrong P, Karoonsoontawong A. Analyzing transport mode choice for aging society in Thailand. Eng Appl Sci Res. 2020;47(4):383-92.
[11] Choocharukul K, Eung N. Modeling frequency of using informal public transport and public bus: a case study in Phnom Penh, Cambodia. Eng J. 2018;22(3):109-22.
[12] Osman S, Omari-Sasu AY, Boadi RK. Logit model for the determinants of drug driving in Ghana. Int J Stat Appl. 2016;6: 339-46.
[13] Perez-Pena M, Jimenez-Garcia M, Ruiz-Chico J, Pena-Sanchez AR. Transport poverty with special reference to sustainability: a systematic review of the literature. Sustain. 2021;13(3):1451.
[14] Liu SY, Wu TS, Chen YQ. Analysis of influencing factors of traffic jam in Beijing. Sci Tech Informat. 2017;15:177-9.
[15] Borucka A. Logistic regression in modelling and assessment of transport services. Open Eng. 2020;10(1):26-34.
[16] Li X, Zhang Y, Sun L, Qiyang L. Free-floating bike sharing in Jiangsu: users’ behaviors and influencing factors. Energ. 2018;11(17):1664.
[17] Guno CS, Collera AA, Agaton C. Barriers and drivers of transition to sustainable public transport in the Philippines. World Elec Vehicle J. 2021:12(1):46.
[18] Du M, Cheng L. Better understanding the characteristics and influential factors of different travel patterns in free-floating bike sharing: evidence from Nanjing, China. Sustain. 2018;10(4):1244.
[19] Washington SP, Karlaftis MG, Mannering F. Statistical and econometric methods for transportation data analysis. 2nd ed. Florida: Chapman and Hall/CRC; 2010.
[20] Ae Park H. An introduction to logistic regression: from basic concepts to interpretation with particular attention to nursing domain. J Kor Acad Nurs. 2013;43(2):154-64.
[21] Real statistics.com [Internet]. New York: Real Statistics; 2020 [updated 2020 May 16; cited 2020 Dec 12]. Available from: http://www.real-statistics.com.
[22] National emergency response committee on coronavirus. Update on COVID-19 in the country and response measures, as at November 29, 2020. Day 258, Brief No. 250. Nairobi: Republic of Kenyan; 2020.
[23] Miligan LO. Education quality and the Kenyan 8-4-4 curriculum: Secondary school learners’ experiences. Res Comp Int Educ. 2017;12(2):198-212.
[24] Aloul S, Naffa R, Mansour M. Gender in public transportation a perspective of women users of public transportation. Jordan: Friedrich-Ebert-Stiftung; 2019.
[25] Phiophuead T, Kunsuwan N. Logistic regression analysis of factors affecting travel mode choice for disaster evacuation. Eng J. 2019;23(6):309-417.