Why People use Private over Public Transportation? A Cross Sectional Study from Ernakulam District, Kerala

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ABSTRACT

Background: Development of sustainable cities and communities is one of the targets of sustainable development goals by the United Nations. Developed and developing countries are now focusing on physical activity through transportation by prioritizing sustainable modes of transportation such as active and public transportation. But in India data on different modes of transportation and its correlates among working population are limited. Therefore, we conducted this study with the following objectives (1) to identify the proportion of individuals using each mode of transportation and (2) to assess the factors associated with multiple modes of transportation.

Methods: We conducted a cross sectional survey among 350 working adults selected through multi-staged stratified random sampling. We used a pre-tested structured interview schedule to capture information on socio demographic details and modes of transportation. Anthropometric details were measured using standard protocol. Multivariate analysis was used to identify the correlates of public transportation.

Results: The prevalence of active, public, and private transportation was 6.6%, 29.4% and 64% respectively. Individuals who were male, married, with higher income status, more than one vehicle in the house, absence of convenient public transportation and presence of self-confidence to drive were more likely to use private transportation compared to their counterparts.

Conclusions: Efforts should be made to encourage people to use public transportation focussing on men, married workers, those belonging to the high-income group and having more vehicles

Key words: Non communicable disease, Physical activity, Public transportation, Active living, Sustainable living, Healthy behaviour,

INTRODUCTION

Non-communicable diseases (NCDs) accounted for 63 % of the global deaths and 80 % of these deaths occurred in low- and middle-income countries.[1,2] Physical inactivity is the fourth leading cause of NCD related mortality and in 2008, it was attributed to approximately 3.2 million deaths.[3] Inadequate physical activity increases the risk of NCDs by 20-30% and shortens the lifespan by three to five years.[5] A pooled analysis of 358 studies from 2001-'16 found that the highest levels of physical inactivity were among women in Latin America and the Caribbean (43·7%, 42·9-46·5), South Asia (43·0%, 29·6-74·9), and high-income Western countries (42·3%, 39·1-45·4).[4]

In India, a South East Asian country, the prevalence of physical inactivity among adults ranged from 41%- 59%.[5] Moderate to vigorous physical activity accrued per day was reported to be the lowest during transportation across six sites in India (14.3 min/day on average).[6] Adding to this, high reliance on private over public

transportation has been reported in India as well.[6]

The Indian State of Kerala has the highest burden of chronic diseases and its risk factors in the country.[7] A community-based study in Trivandrum identified the physical inactivity in each domain such as work, leisure and transportation as 31 percent, 74 percent and 39 percent respectively.[8]

Improving physical activity in the pretext of NCDs is a top priority among nations. Promotion of physical activity through active and public transportation has been found to be viable and sustainable with its benefits encompassing to the development of sustainable cities and improved planetary health.[9] Several factors at multiple levels play a role in individual's choice of mode of transportation and it is imperative to understand this in order to promote physical activity during transportation.[9] Previous studies done in developed countries had identified correlates of physical inactivity and found that women were more likely to use public transportation [10,11,12,13] while men actively commuted (walking/ cycling) to work and preferred private modes.[10] Higher income and ownership of vehicles were important correlates that encouraged the use of private transportation. [14,15,16] Improving public transport facility and imposition of higher parking fees had been found to shift the car commuters to public transport.[15] Planned urbanization with shorter distance to the amenities like schools, shops, bus stops etc. was identified to promote active commuting. [16, 17] Identifying these factors, several policies had been adopted by developed and developing countries to encourage active and public transportation. The Cycling policy of Europe, Ciclovia Recreativa in Brazil and Bus Rapid system in Brazil are some of the policies which were successful in the promotion of physical activity through transportation. [18, 19]

All over the world, ownership of cars shows status and power.[20] Thereby, people who have more income might prefer driving to work showing their higher status in the society.[21] Identifying this, in several countries, measures have been taken to attract all the sections of the society to utilize public transportation. In Brazil, the social fare system which subsidized the cost for longer journeys encourages more people to choose this mode.

In India, the development of smart and sustainable urban transportation has received some attention with the introduction of metro in 1984, which is an eco- sustainable transportation modality. This was then followed by the introduction of metros in other major cities which were initiated in the ambit of reducing traffic congestion, efficient transportation and reducing carbon emission.[22] In 2007, after 5 years of Delhi metro inauguration, it was found that, the metro has not been able to achieve the targets and the pollution has increased in the following years and the number of vehicles and traffic crashes had increased by 20%. [23] Adding to this, increase in the number of motor vehicles played a major role in establishing it as one of the most polluted cities in the world. [24]

While, certain policy level actions has proved to improve the public transportation in India as well. The non-motorized transportation policy of Chennai, a south Indian state had further improved the active/ public transportation in the state. Chennai has now the largest share of public transport users in India. The adoption of this policy by Chennai Corporation led to the replacement of old, narrow and obstructed footpaths to good quality footpaths promoting more active commutation.[25] Recently, an initiative 'Pondy Bazaar Pedestrian Plaza' has transformed busiest and car centric shopping streets to a pedestrian promenade by prioritizing people over vehicles. The plaza was designed with safe pedestrian walkways on both sides, ample shaded seating, beautiful landscape and play elements accessible for all.[26]

The district of Ernakulam in Kerala reported the highest vehicular population compared to the other districts of Kerala [27]

with a reported increase of 29.35 % and 17.25 % of motor cars and two wheelers respectively from 2007-2010.[28] Strikingly the Ernakulam district is the diabetes capital of Kerala and is a place where the people travel longer distance to work compared to other states of India.[29] In 36 % of the rural households and 44 % of the urban households of Kerala atleast one earning member travel more than five kilometres to work. [29] With the increasing traffic congestion, the Government of Kerala has initiated various projects to improve the public transportation. Projects such as the Jawaharlal Nehru National Urban Rural Mission an initiative to connect the urban and rural Kerala introduced in the year 2005-'06 followed by the introduction of Kochi Metro in the year 2017 were aimed at more sustainable development of the state. [30] Inspite of these, in 2017-18, the highest vehicle population was recorded in Ernakulam District with 17,96,868 vehicles (14.9 per cent) followed by Thiruvananthapuram with 15,23,414 (12.7 per cent).[31] Further, a report by the Centre for Policy Research identified that only 10% of men and 10% of women preferred metro for travelling.[32] This translates to a threat of being a State with highest vehicular density or pollution as other metropolitan cities in the country and also it is imperative to recognise the role of transportation and the allied policies in transforming the State and its people to a state of "unsustainable living".

Addressing NCDs is vital for sustainable human development. Development of sustainable cities and communities is one of the targets of sustainable development goals by the United Nations. [1] Kerala needs a more efficient, sustainable and acceptable mode of transportation. The scope of identifying efficient transportation mechanisms should also consider improving health of the people by supplementing with policies that promote active and public transportation. Even after the provision of less costly, environmentally friendly modes of transportation, the vehicular population is increasing in Ernakulam district. Very limited effort has been taken to understand the "why", "how" and "when" people choose different transportation methods in India.

Objectives
(1) to find out the proportion of individuals using each mode of transportation (active transportation, public transportation and private transportation) and (2) to assess the factors (personal, inter-personal and environmental) associated with multiple modes of transportation

MATERIALS AND METHODS
Study design, Settings and Participants

This cross-sectional study was conducted in rural Ernakulam district with a total population of 32,82,388 (rural population 31.93%).[28] The study population included working individuals in the age group of 18- 60 years who met the inclusion criteria (18-60 years, currently employed in a workplace at a distance of at least one kilometre from home, individuals who worked five or more days a week) and exclusion criteria (Pregnant women/ women on maternity leave, taxi drivers, autorickshaw drivers, lorry drivers). Individuals were selected using multi-staged stratified random sampling method (Figure 1). The sample size was estimated using the prevalence estimates of private, public and active transport users in Chennai which were 40 %, 28 % and 32 % respectively.[33] We used the lowest prevalence of public transport users, a precision factor of five percent and a non-responsive rate of ten percent. A sample size of 340.5 was obtained which was rounded off to a final sample size of 350. The individuals from each ward were selected using population proportional to the size of the total ward population. A household randomly selected from the voters list was surveyed first. Subsequently, every second household was included based on the inclusion/exclusion criteria of the study. In case of absence of working individuals or a locked house, the house adjacent to the previous house was

selected. Men and women were surveyed alternatively so as to ensure equal representation. Lottery method was used to select one individual if more than one working individual was present in the house.

Ethics approval was obtained from the Institutional Human Ethics Committee of Central University of Kerala (IHEC number: CUK/IHEC2017-003 date: 7th July 2017). Informed consent was obtained prior to the study after explaining to the participants about the research. Participation in the study was voluntary and each individual had the freedom to not to participate in the study or to discontinue at any stage in the study.

Data collection

Structured interview schedule was used for data collection. The interview schedule was prepared in English and translated to local language and back translated to English. The anthropometric measurements were captured at the place of interview using Automatic personal digital weighing scale (OMRON HN 289), stadiometer (Seca 213) and a non-elastic waist circumference tape (Seca 201). The modes of transportation of individuals were classified according to the operational definitions (See supplementary file). In brief, an individual was referred to as "private transport user" if he/ she relied on private transportation such as autorickshaw, motor cycles, scooter, mopeds/ other motorized vehicles for four or more days a week for transportation to work place for both onward and return journey. An individual was referred to as "public transport user" if he/ she relied on public transportation such as buses, trains on four or more days a week for transport to work place, for both onward and return journey. Active transportation refers to exclusively walking/ using bicycle for transportation to work place. The correlates assessed were socio-demographic factors, personal factors, psychosocial factors and health outcome. Modified International physical activity questionnaire (IPAQ) was used to capture the modes of transportation which was validated in India [32] and the anthropometric measures were assessed using standard equipment and protocols. Revised Kuppuswamy scale was used to assess the socio-economic status of the household. [25]

Statistical Analysis

Data analysis was done using IBM SPSS Statistics for windows version 23.0 (Armonk, NY: IBM Corp.Chicago,IL). Data cleaning was done to identify any missing variables. Descriptive statistics was done to describe the sample, followed by bivariate analysis to explore the association between the independent and dependent variable. Since, active transportation was reported only by 23 individuals (6.6%) of our sample, bivariate and multivariate analyses were restricted to individuals using public and private transportation. Variables found to be significant at 5% level were included in the multivariate analysis to find out the correlates of public transportation.

RESULTS

The study included equal number of males and females (175 each) for equal representation of each gender. Majority of the participants were between 31-50 years (59.1% of the total). Among the participants, 32% were semi-professionals (based on revised Kuppuswamy scale). The total family monthly income of 50.5% of the participants was more than INR 21438/ month.

Prevalence of Modes of transportation

The prevalence of each mode of transportation was captured. The prevalence of active transportation, public transportation and private transportation was 6.6%, 29.4% and 64% respectively.

3.2.2 Public transportation
The characteristics of public transport users are given in table 1.

Table 1: Characteristics of Public transport users		N= 103	(%)
Variables		**N= 103**	**(%)**
Duration of travel in bus (minutes)	<=30	81	78.6
	>30	22	21.4
Duration of waiting in bus stop (minutes)	<=5	84	81.6
	>5	19	18.4
Presence of comfortable bus in terms of seat availability	Yes	45	43.7
	No	58	56.3
At least ten minutes of walk to bus stop	Yes	39	37.9
	No	64	62.1

The reasons for choosing this mode of transportation was captured and 7.6% chose this due to high price of petrol/diesel. Safety from traffic was the reason for 5.3 % of the bus users. Presence of only one vehicle in the house, lack of confidence to drive and presence of no other alternatives were the reason for choosing public transportation among 21.2 %, 12.9 % and 4.5 % respectively. Among the bus travellers, 11.4 % felt that transportation by bus was cheap. About 35.6 % felt travel by public transportation was less stressful.

3.2.3 Private transportation

Characteristics of private transport users are given in table 2

Table 2: Characteristics of Private transport users		N= 224	(%)
Variables		**N= 224**	**(%)**
Type of private transportation used	Car	072	32.1
	Two-wheeler	148	66.1
	Auto/private vehicle of the work place	004	01.8
Time spent on private transportation	<=30 minutes	180	80.4
	>30 minutes	044	19.6
At least 10 minutes of walk to reach the private transportation	Yes	002	00.9
	No	222	99.1
Time to reach the private transportation area	No walk	222	99.1
	10 minutes	002	00.9

Among the private transport users,70.8% chose this mode to reach the workplace on time. Privacy was the reason for 13.1 %. Short distance to workplace and prolonged and unsure working hours made 1.3%, 1.7% respectively to opt for private transportation. Amongst the private commuters, 3.2 % used this mode to get a sense of self-esteem. While, 1.7 % reported that they can alter the routes if blocks are present. Absence of direct buses to the workplace and lack of nearby bus stops compelled 5.2% and 2% of the participants respectively to choose this mode. In order to travel with colleagues 0.3% of the respondents chose private mode. The private transport users were asked whether the provision of more buses, reliable bus services, parking fees will encourage them to opt for public transportation. Reliable bus services would encourage 11.8% of the respondents to choose public transportation and 8.2% will alter the mode if more number of public transportation facilities are provided. Imposing parking fee at working place will encourage 41.1% of the respondents to alter the mode of transportation to public. Inspite of all these provisions one third of the participants reported that they will not choose public transportation.

Factors associated with private transportation

Bivariate analysis was done and the factors such as gender, occupation, monthly household income, marital status, number of family members, possession of driving license, number of vehicles in the household, presence of convenient public transportation, distance to the nearest bus stop, incentives for public transportation, self-confidence for driving and BMI were found to be significant. Further multivariate analysis was done using these variables. The factors associated with private and public transportation are given in table 3.

Table 3: Factors associated with private transportation		Private Transportation n (%) N= 224	Adjusted OR (95% CI)
Sex	Men	150 (89.3)	11.91 (4.92-28.80)**
	Women	74 (46.5)	1
Occupation	Semi-professionals/professionals	119 (77.3)	1.74 (0.63-4.82)
	Unskilled/skilled/clerical	105 (60.7)	1
Marital status	Married	196 (71.5)	7.44 (2.74-20.20) **
	Single (Unmarried/divorced/widower	28 (52.8)	1
Monthly Household Income (INR)	More than 21437	140 (80.5)	4.21 (1.50-11.77)**
	Up to 21437	84 (54.9)	1
Number of Household members	>4	63 (79.7)	0.79 (0.31-2.01)
	<=4	161 (64.9)	1
Possession of driving licence	Yes	215 (74.7)	1.20 (0.29-4.93)
	No	9 (23.1)	1
Number of private vehicles in the house	<=1 vehicle	158 (81.4)	5.30 (2.41-11.64)**
	>1 vehicle	66 (49.6)	1
Presence of convenient public transportation to the workplace	No	108 (78.8)	3.76 (1.62-8.69)*
	Yes	116 (61.1)	1
Distance to the nearest public transportation area (kilometre)	<1	186 (71.5)	1.59 (0.64-3.94)
	>=1	38 (56.7)	1
Incentives for public transportation	No	222 (70.0)	8.93 (0.89-89.71)
	Yes	2 (20.0)	1
Self-confidence to drive	Yes	215 (81.7)	19.69 (7.17-54.07)*
	No	9 (14.1)	1
BMI category	Pre-obesity/ above	106 (74.6)	1.93 (0.89-4.17)
	Normal weight	118 (63.8)	1
* Significant at 0.05 **Significant at 0.01. BMI= Body Mass Index			

DISCUSSION

Main findings of the study

This study sought to identify the prevalence of active, public and private transportation in Ernakulam district which was 6.6%, 29.4% and 64% respectively. Since the proportion of people engaging in active transportation was low (6.6%) we restricted our analysis of correlates to private transportation only. The major correlates of private transportation were, gender, income, marital status, number of vehicles in the house, feeling of self-confidence and convenient public transportation.

According to WHO, the prevalence of T2DM will double in the following years creating a burden to the developing countries. Kerala being the epicentre of T2DM in India needs much attention on the control and prevention of T2DM. Chennai, a south Indian state has introduced policy level actions and has proved to be successful in the years. But in Kerala, despite the introduction of numerous policy level actions to encourage people to use more active and sustainable modes of transportation, people choose private transportation more. The reason for people choosing private mode over public transportation remains unexplored. This study highlights the correlates of private transportation in Kerala and the modal share of working population. The transportation policy of Kerala is yet to address non-motorised transportation.[33] The lack of such a policy had resulted in poor road conditions for the commuters. In this study, compared to women, men preferred private transportation for commutation. The reasons for choosing private mode over public transportation were reduction in travel time, comfort, cost effectiveness, convenience and safety, lack of bus stops near the office and unsure working hours. This study identified that people with higher income preferred to travel in cars than in public transportation. In this study, almost 60% of the households in Ernakulam district had more than one vehicle in their houses. Owning more than one vehicle was significantly associated with the use of private transportation. If more than one vehicle is present in the house, the members will have an option to take their own vehicle rather than depending on the public

transport. Also, driving to work increased individual's self-confidence as this gives them a feel of power and dignity. Even in this study people who have more self-confidence to drive preferred private vehicles for commutation. This can be due to a notion that driving and going for work makes them more independent. Improving the public transportation facility and giving it a 'high class' standard can promote and attract the higher sections of the society to utilize public transportation more. Being married was positively associated with the use of private transportation. This might be because most of the unmarried individuals are in their early career years and are not able to afford the purchase of a new vehicle. Most of the women who do not have the driving license travel with their husbands to work if they have a vehicle in their home. The married individuals may have multiple destinations during single travel like dropping children at school, purchasing the groceries etc. which might make it difficult for them to access if they use public transportation.

Presence of convenient public transportation to work was positively associated with the use of public transportation. In this study, the private transport users were asked whether the provision of more buses, reliable bus services, parking fees will encourage them to opt for public transportation. Reliable bus services would encourage 11.8 % of the respondents to choose public transportation and 8.2 % will alter the mode if more number of public transportation facilities are provided. Imposing parking fee at working place will encourage 41.1 % of the respondents to alter the mode of transportation to public. Inspite of all these provisions one third of the participants reported that they will not choose public transportation.

Thus this study enlightens the fact that the status of public transportation in India is considered to be poor. There should be policy level actions that can improve the public transportation in India by making it more attractive to all the sections of the society. The policy makers and the Government can strengthen the existing public transportation by increasing the number of bus services, convenient, user friendly, comfortable, more economic, creating lanes for buses so that the traffic related issues can be avoided. Restricting the private vehicles in certain areas can make people use more public transportation. Increasing the parking fee for the private vehicles is yet another way to increase the use of public transportation.

CONCLUSION

In our study among 350 working adults in rural Ernakulam district of Kerala we found that the prevalence of active, public, and private transportation was 6.6%, 29.4% and 64% respectively. Active and public transportation in this population were low**.** This study highlights the fact that more efforts at policy level should be taken to encourage the utilization of active and public transportation. Efforts should be made to increase availability of convenient public transportation and encourage employees to use public transportation focussing on men, married employees, those who belong to the high income group and having more vehicles in their home

Limitation
Because it was a cross sectional study the direction and the temporality of the association cannot be established

Funding source

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