

Evaluating the Variations in Discretionary Activity Episodes Before and During the Lockdown among Urban Indian University Students

Presented by:

Punyabeet Sarangi
Early Doc Fellow

Co Author:

Prof. (Dr.) Manoj M.
Associate Professor

Department of Civil Engineering
Indian Institute of Technology, Delhi



Tuesday, 06 February 2024

Outline

1. Introduction

2. Methodology

3. Data

1. Study Area and Data Collection

2. Descriptive Statistics

4. Results and Discussion

1. Introduction

Why is university students' travel behaviour important ??

Total students enrolled in higher education in 2019-20 stood at **38.5 million, 39% of the Indian population.**

University students' travel behavior can inform future urban transport planning and policies and trigger substantial changes in society.

Travel behavior of university students is not the same as general population. For instance, students are more dependent on active modes and show a higher concern for green lifestyle.

1. Introduction

Impact of COVID-19 pandemic on university students' activity-travel behavior ?

Number of trips to academic locations per week declined sharply due to closure of educational institutions and quarantine measures.

Arrival of pandemic, lockdown measures, and traffic restrictions led to a profound shift in travel mode choice and GHG emissions.

Negative perception about personal well-being, anxiety, and leisure has impacted student's active lifestyle and time use during the pandemic.

Lack of sustainable mobility options and destination hygiene has led to a higher tendency to switch to private modes and virtual working among students.

1. Introduction

Objectives of the study:

1

To explore the episode-level variations within and across physically active and physically passive recreational episodes of university students and its impact on their mode use behavior.

2

To examine the nature and degree of association between recreational episodes before and during the pandemic and the changes in the lifestyle of the university students.

3

To determine the impact of demographic variables, travel attributes, and psychometric indicators on the activity episodes of university populace during the 'new normal'.

2. Methodology

Model Formulation:

Multivariate Ordered Probit (MOP) Model

- $y_{qi}^* = \beta_i' x_{qi} + \varepsilon_{qi}$, $y_{qi} = m_{qi}$ if $\theta_i^{m_{qi}-1} < y_{qi}^* \leq \theta_i^{m_{qi}}$
- q represents no of samples, i.e., 203.
- i is the episode category index.
- y_{qi}^* is the latent propensity for each episode.
- β_i' list of coefficients.
- x_{qi} denotes the explanatory variables,
- y_{qi} is the observed ordinal outcome.
- m_{qi} is an index for discrete episode count.
- $\theta_i^{m_{qi}}$ denotes upper threshold limit for m_{qi}

- Error ε_{qi} allowed to correlate across episode categories.
- Enables to investigate whether episode categories are mutually 'complementary' or 'substitute' of each other.

- $\varepsilon_q \sim N \left[\begin{pmatrix} 0 \\ 0 \\ \vdots \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho_{12} & \rho_{13} & \cdots & \rho_{1I} \\ \rho_{21} & 1 & \rho_{23} & \cdots & \rho_{2I} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ \rho_{I1} & \rho_{I2} & \rho_{I3} & \cdots & 1 \end{pmatrix} \right]$ or $\varepsilon_q \sim N[\mathbf{0}, \Sigma]$

- Unlike classical MSL, the present study uses *composite marginal likelihood* (CML) technique for estimation.
- Produces *unbiased and consistent parameters* for error covariance matrix and *requires no simulations*.

3.Data

Data collection procedure:



Questionnaire Draft
(English Language)



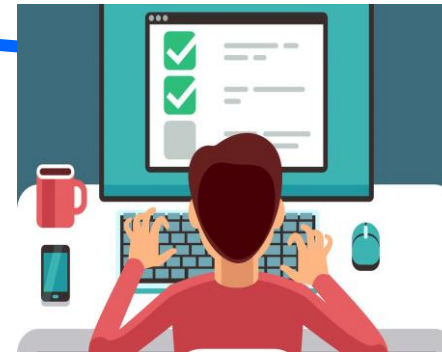
Web Page Design
<http://covid19iitdelhi.github.io/>



Mailing List compiled
from AICTE and
MHRD website



Data Cleaning
& Analysis



Pilot Testing & Final
Sample Collection
(May & June 2020)

3.Data

Study area and sample summary:

Sample Size

- 631 responses were collected.
- 249 were fully complete.
- Response rate of 39.46%.
- 46 survey forms screen out due to incorrect responses.
- 203 survey forms used for final analysis.

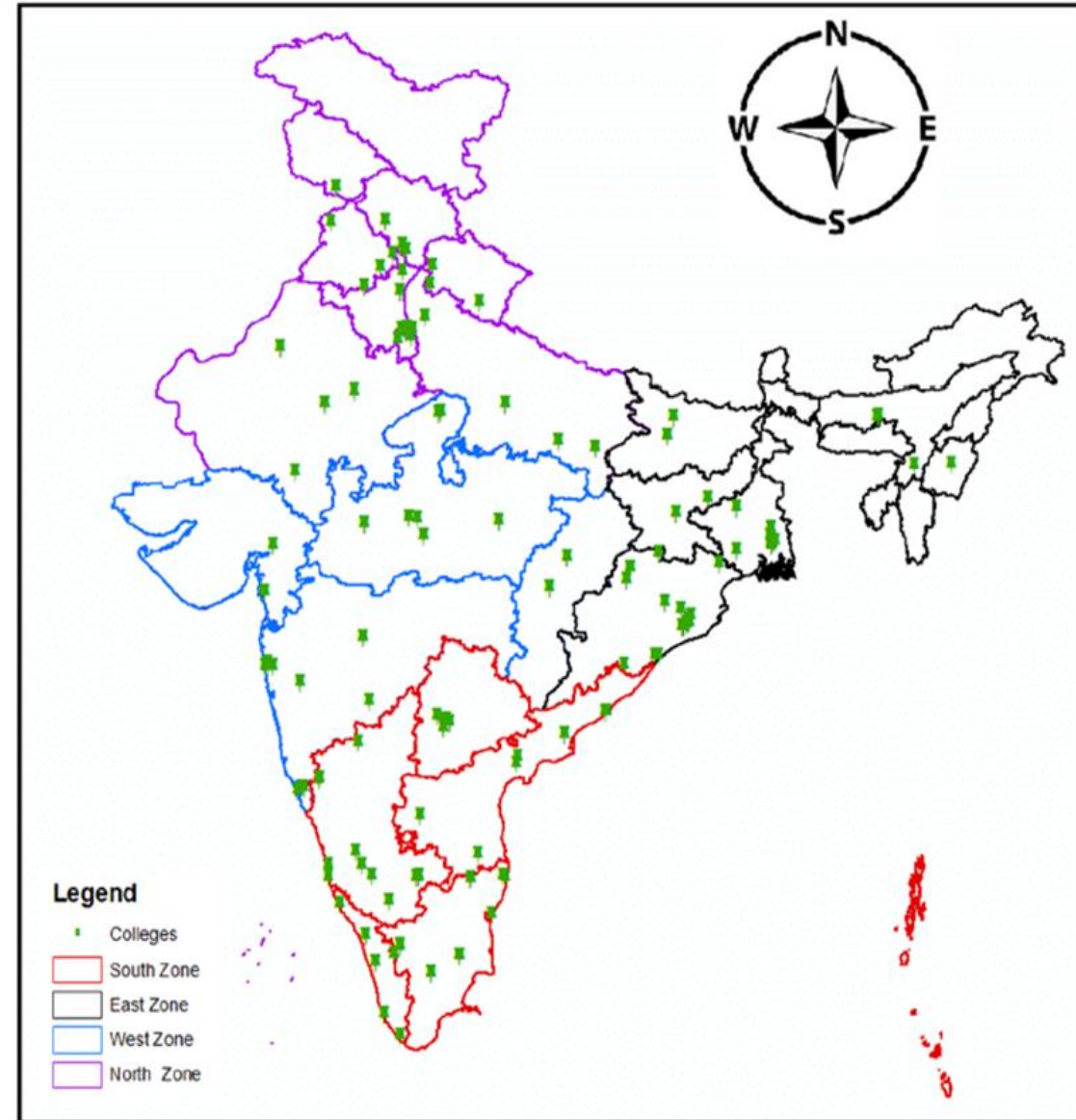


Fig. 1. Spatial distribution of respondents' university locations.

3.Data

Socio-demographic variables:

VARIABLES	SHARE IN %	VARIABLES	SHARE IN %
Individual Attributes		Vehicle Ownership	
<i>Gender</i>		<i>MTW</i>	
Male	54.19	Yes	75.86
*Female	45.81	*No	24.14
<i>Age (in years)</i>		<i>Bicycle</i>	
18 – 25	48.77	Yes	59.61
25 – 30	26.60	*No	40.39
*30 – 35	24.63	College Information	
<i>Highest Completed Degree</i>		<i>Spatial Location</i>	
Intermediate	38.92	North Zone	23.64
Graduation	24.63	East Zone	33.01
*Above Graduation	36.45	West Zone	24.63
<i>Marital Status</i>		*South Zone	18.72
Single	75.37	<i>Place of Stay</i>	
*Married	24.63	Inside Campus	36.45
<i>BMI Proportion</i>		Outside Campus	28.57
Obese/Overweight	40.89	*With parents	34.98
*Underweight/Healthy	59.11	<i>College Duration[#]</i>	504.44 (84.22)
Household Characteristics		<i>Mode to access campus</i>	
<i>Family Size[#]</i>	4.47 (1.75)	Private	23.15
<i>Household Income</i>		Public	33.50
Low	41.87	*Active	43.35
High	34.98	<i>Travel Time to Campus</i>	
*Middle	23.15	*< 20 min	52.71
		20 – 45 min	24.14
		> 45 min	23.15

Indicates those variables were taken as continuous and expressed in mean (std. dev)

* Indicates that the respective categories were kept as the base in the model estimation.

3.Data

Psychometric Indicators:

ITEM NO	LEISURE	ITEM SCORE
LE1	<i>Engaging in Leisure activities is a wise use of time.</i>	3.27 (1.17)
LE2	<i>Leisure activities contribute to my health and happiness</i>	3.77 (1.20)
LE3	<i>Leisure activities are good opportunities for social contact.</i>	3.49 (1.20)
LE4	<i>Leisure activities help to renew one's energy and work productivity.</i>	3.74 (1.18)
PERSONAL WELL-BEING ITEMS (How satisfied are you with -)		
PW1	<i>Your health condition</i>	3.65 (1.20)
PW2	<i>Your ability to tackle daily problems and much-needed break</i>	3.53 (1.10)
PW3	<i>Your safety consciousness and of your family members</i>	3.79 (1.08)
PW4	<i>Your community connectedness during COVID Pandemic</i>	3.05 (1.18)
ANXIETY ITEMS		
AN1	<i>I feel nervous and anxious</i>	2.82 (1.27)
AN2	<i>I am afraid for no reason</i>	2.56 (1.19)
AN3	<i>I am upset and feel panicked about the current situation</i>	2.76 (1.28)
AN4	<i>I stay calm and think clearly.</i>	3.48 (1.17)

3.Data

Activity episodes:

RECREATION/DISCRETIONARY

<i>Physically Passive</i>	<i>Physically Active</i>
<ul style="list-style-type: none"> • Watching television; Surfing internet, playing games in mobile/computer at home/outside • Self-studying after college hours/ attending online courses. • Chatting on WhatsApp, Facebook, or other social networking sites • Sitting around; Hanging out with friends or listening to music • Reading Newspaper, Novels, or other articles/books in your leisure • Playing Board games such as Chess, Carrom, Ludo, etc. • Engaged in painting, origami or playing a musical instrument. • Eating food like breakfast; lunch/dinner; drinking tea, juice etc. 	<ul style="list-style-type: none"> • Morning/evening walk • Taking short bicycle rides, Jogging; Light Frisbee; Bowling games, Casual swimming etc. • Yoga, aerobics, Pranayama, or other light exercises like Stretching, taking dance classes. • Doing exercise with weights and equipment either at the Gym or at-home • Playing outdoor games such as badminton, squash, tennis, football, cricket etc. • Playing indoor games, i.e., badminton, squash or Doing boxing, martial arts, etc. in free time • Running, swimming competitively, or other vigorous exercises to stay healthy

RECREATION	NO OF EPISODES	BEFORE LOCKDOWN (BL)	DURING LOCKDOWN (DL)	CHI-SQUARE TEST STATISTICS
Physically passive (PP)	<4 (LT4)	49.75	55.17	8.54 (df = 4, p-value = 0.07)
	4 (ET4)	28.57	27.09	
	>4 (MT4)	21.67	17.73	
Physically active (PA)	<4 (LT4)	52.22	66.01	11.05 (df = 4, p-value = 0.03)
	4 (ET4)	27.09	19.70	
	>4 (MT4)	20.69	14.29	

4. Results

Exploratory Factor Analysis:

Measurement items	Latent factors & Item loadings			Average Variance Explained (AVE)	Composite Reliability (CR)
	<i>Leisure (LE)</i>	<i>Personal well-being (PW)</i>	<i>Anxiety (AN)</i>		
LE1	0.485				
LE2	0.651			68.25%	0.629
LE3	0.768				
LE4	0.826				
PW1		0.650			
PW2		0.616		65.33%	0.516
PW3		0.694			
PW4		—			
AN1			0.761		
AN2			0.701	70.06%	0.584
AN3			0.640		
AN4			—		

4. Results

MOP Model Fit Parameters:

Thresholds

LT4 | ET4

ET4 | MT4

Correlation Matrix

PP_BL

PA_BL

PP_DL

PA_DL

Log-Likelihood

Null Model

Final Model

Parameters

Pseudo R Square

**Before
Lockdown (BL)**

Physically
Passive (PP)

Physically
Active (PA)

**During
Lockdown (DL)**

Physically
Passive (PP)

Physically
Active (PA)

-1.670

-0.952

-0.818

-0.686

-0.909

0.186

0.083

0.068

1

-0.251

0.135

0.439

1

-0.548

-0.296

1

-0.146

1

-5729.668

-4574.018

71

0.256

4. Results

MOP Model Results:

Explanatory Variables	PP_BL	PP_DL	PA_BL	PA_DL
Gender (Male)	-	-0.181	-0.144	-0.207
Age (18-25 years)	-0.350	-	0.576	-0.667
Age (25-30 years)	-	-	0.374	-0.461
Education (Intermediate)	-	0.306	-0.620	-
Education (Graduation)	-	-	-0.254	-
Marital status (Single)	-	0.484	-	0.398
BMI proportion (Obese/ Overweight)	-0.184	0.170	-0.214	0.184
Family size	0.051	-0.156	-	0.070
Family Income (Low-income)	0.179	-	0.227	0.108
Family Income (High-income)	0.407	-	-	-
MTW (Yes)	-0.423	-	-	-0.287
Bicycle (Yes)	-	-	0.152	-
Spatial location (North)	-	-	-0.350	-0.305
Spatial location (East)	0.332	-0.284	-0.335	-
Spatial location (West)	-	-0.125	-0.185	-
Place of stay (Inside)	-0.271	-	-	0.211
Place of stay (Outside)	-	-0.133	0.123	-0.117
College Duration	-0.074	-	-0.118	-0.098
Mode to access campus (Private)	-0.966	-0.284	-	0.441
Mode to access campus (Public)	-0.369	-	-	-
Travel Time to Campus (20 - 45 min)	-	0.192	-0.494	0.391
Travel Time to Campus (> 45 min)	-0.608	-	-0.291	-
Leisure (LE)	-0.086	-	-	-0.152
Personal Well-Being (PW)	-	-	0.152	0.086
Anxiety (AN)	-0.093	-0.089	-	-

4. Results

Summary, Policy Discussions, & Scope

1

PP recreational episodes between BL and DL period were positively correlated whereas PA episodes negatively correlated. Creating awareness among university students regarding the benefits of active lifestyle.

2

Individuals who are graduates or above in age group of 25-35 years show a higher preference for PP episodes for BL period. Perhaps, burden of research work confines them to spend longer duration in labs.

3

Students from low-income households show a higher inclination towards PP activities as they may have limited access to high-end gyms and recreational parks due to financial constraints.

4

Use of private modes to access university campus indicates a more comfort-oriented and sedentary lifestyle. This correlation is relevant as the desire to own a car is gradually increasing among Indian adults.

5

Bicycle owners are more likely to spend time in physical activities. So, policymakers and planners can temporarily allocate less-used motorized streets (due to pandemic) to students who prefer walking and cycling.

6

'Anxiety' factor had an adverse effect on PP episodes for DL period partly due to uncertainty, boredom, and feeling of getting stuck in one place.



Thank You for your attention