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A silent revolution: Rapid rise of cycling to school in rural India

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Abstract

Cycling to school improves access to education for children, provides them physical activity benefits, and gives them independence in mobility. There is a poor understanding of the levels of cycling to school, who cycles, and how these behaviours have changed over time in India. We address this major research gap using data from the three rounds, covering a decade (2007, 2014, and 2017), of a population-representative nationwide survey of India for household consumption on education. The dataset reported the mode of transport to school. We conducted national and sub-national (35 states of India) exploratory analyses of longitudinal changes in cycling to school by trip distance, age and gender, and urban and rural residence, for school-going children aged 5-17 years. We developed logistic regression models to understand the associations of these characteristics on cycling use and how they vary over time. We also gathered information on bicycle distribution schemes (BDS) implemented in multiple Indian states, under which school-going children are provided free bicycles by the government, and tested the impact of such schemes on cycling levels. Nationally, cycling to school levels increased from 6.6% to 11.2% over the decade (2007 to 2017). These levels nearly doubled in rural India (6.3% to 12.3%) while remaining stable (7.8% to 8.3%) in urban areas. Among the four population sub-groups (rural/urban x female/male), the largest increase in cycling was among girls in rural areas. Nationally, the gender gap in cycling reduced in rural areas through an increase in cycling among girls and, in urban areas, through a reduction of cycling among boys. In rural areas, cycling increased across all distance ranges, except for >5 km where it reduced, and in urban areas, cycling reduced the most for >3 km. We found strong evidence that BDS helped increase cycling levels in states where it was implemented and their greatest impact was for cycling among rural girls. Gender norms, affordability of bicycles, distance to school, and safety on roads are likely the major determinants of cycling to school in India.

Keywords: cycling; school; rural; urban; gender; bicycle distribution scheme

1 Introduction

Cycling is gaining policy attention worldwide at city, national and supranational levels. The European Commission adopted the European Declaration on Cycling in 2024, thus recognising cycling as a standalone mode of travel in the European Union [1]. The Intergovernmental Panel on Climate Change in 2018 identified cycling as a key pathway to achieve a targeted reduction in carbon emissions and ensuring the habitability of our planet [2]. Besides saving the planet, cycling contributes to improving the health of its inhabitants by reducing the risk of mortality in populations [3] and helping individuals attain physical activity in their daily lives [4]. The National Institution for Transforming India (NITI), a think-tank of Indian government, actively works towards 'transforming India's mobility' as one of the key elements of the government's vision and acknowledges the need to promote bicycles to achieve this goal. A report published by NITI in 2020 recommended policies for turnaround of the Indian bicycle industry, promoting the use of bicycles for diverse needs and enabling its resurgence in urban spaces [5].

In India, the nationwide cycling behaviour was reported for the first time by the Census in 2011 [6]. It reported the mode of travel and distance to work aggregated at the district level. Nationally, 20% of those travelling to work outside the home reported cycling as their main commute mode [7]. These percentages were 21% in rural areas and 17% in urban areas. Among the states, cycling levels varied widely, from <1% to as high as 33% [7]. Though the levels of cycling to work in some states of India were higher than in high-cycling contexts such as Germany, Japan and the Netherlands, cycling is

not evenly distributed among age and gender groups in India. Representation of children, women and the elderly in cycling, compared to their share in the population, is far lower in India than in many other countries [8].

Cycling in Indian cities is highly gender-unequal [8]. As per Census 2011, among the working population, 21.7% of men used bicycles for commuting, compared to only 4.7% women [6]. An international analysis of cycling by Goel et al. [8] found that females were on average one-tenth as likely to cycle compared to males in Indian cities. The study also highlighted that the representation of females in cycling, defined as the percentage of cyclists who were females, was strongly associated with levels of cycling. To ensure equity in cycling growth and its ubiquitous adoption, cycling policies should not only aim at overall use but also be specific to usage by gender [8].

In India, gender inequality in cycling should be seen within the broader context of patriarchal norms that restrict mobility of women outside home. A study using nationwide time-use survey of India reported that only 53% of the females went out of home during the day for which they reported their diary, compared to 87% males. Compared to international settings, this level of "immobility" among females is among the highest in the world [9]. Among girls, it is the intersection of young age and gender that impacts their mobility [10, 11]. In this study, our focus is on cycling behaviour among children.

There are multiple reasons why societies should aim for greater use of cycling among children. Cycling helps develop physical and cognitive abilities among children [12], gives them independence in mobility [13, 14] and helps them achieve physical activity [15–17]. Children who cycle to school are more likely to meet the recommended levels of physical activity compared to children who are driven by motor vehicles [18]. Cycling to school improves cardiorespiratory fitness [16, 19, 20], reduces the likelihood of obesity [21–23] and translates into improved muscular fitness in adulthood [17, 24].

Cycling to school significantly contributes to social equality and empowerment and has been used in public policies to achieve these goals. This is particularly true in the resource-poor context of low- and middle-income countries (LMICs). In India, for example, education departments of multiple states provide free bicycles to school-going children aged 14–17 years to improve enrollment rates in secondary and higher secondary education [5]. These schemes are commonly referred to as bicycle distribution schemes (BDS) and often focus on girls [25, 26] as their dropout rates from schools are often higher than boys. This gender gap in education is a result of the stringent patriarchal social norms in India that are hostile and indifferent to the education of girls [27]. Girls are often responsible for household chores, especially in rural areas, and walking long distances to school (in the absence of a bicycle or public transport) leads to exhaustion [28], thus forcing them to drop out of school [5].

The provision of free bicycles is an effective strategy to ensure inclusive and quality education for all, thus fulfilling the Sustainable Development Goal target 4 [29, 30]. Evaluation of BDS in India has reported benefits in terms of increase in enrolment rates and gender equity in education [31]. Similar outcomes have been reported by Fiala et al. [32] in Zambia. Evidence from other LMICs such as Colombia, Kenya, Malawi and Zimbabwe also suggested that bicycles are an effective way to help girls enroll in schools and improve their retention [28]. Besides short-term benefits, BDS has also demonstrated long-term benefits in terms of completion of higher education, engagement in jobs outside agriculture, and delay of early marriage and childbearing [33]. However, we find no study that examines how BDS influences cycling use.

Despite the transformative impacts of cycling to school, its levels vary widely across settings, from $<3\%$ in Australia, the United Kingdom and the United States to $>25\%$ in Germany and the Netherlands [34]. Research has shown a greater likelihood of cycling among boys compared to girls [35–37], children in older age groups than their younger counterparts [38, 39], and students enrolled in schools located closer to their residence [39–41]. However, the scientific literature on cycling-to-school behaviour is mostly limited to developed countries, with a lack of evidence from developing countries, including India. As a consequence, we do not know who cycles to school and how far in India.

Studies exploring cycling-to-school behaviour have used both cross-sectional [35, 36, 41–43] and longitudinal data [44–49]. Compared to cross-sectional studies that analyse cycling behaviour at a single time point, longitudinal analysis uses data from multiple time points to show trends and patterns in cycling. These trends help in understanding the reasons for the increase or decline in cycling levels [44], informing policies aimed at increasing its usage [38] and further assessing their effectiveness [50]. However, longitudinal studies have mostly been conducted in the cities of Australia, Europe and

North America. Among low- and middle-income countries, literature that evaluated temporal trends in active commuting to school did not study cycling exclusively (instead analysed the combined effect of walking and cycling) nor included India in their analysis [51, 52]. For transport, the only longitudinal data available in India is the annual number of registered motor vehicles [53]. However, this data limits any understanding of how the population and different sub-groups use these vehicles and how much they cycle. Overall, we did not find any study that investigated cycling-to-school behaviour in India longitudinally.

With a focus on levels of cycling, and how it varies longitudinally among the four sub-groups (rural/urban × gender), we will address the following research questions:
1. What are the changes in cycling levels across the states and how does representation of girls in cycling vary with this change?
2. How do cycling levels vary with the age of the individual and distance to school?
3. What is the impact of bicycle distribution schemes on cycling levels in states?
We will answer these questions using three rounds of a population-representative sample survey reporting data on travel to school.

2 Method

2.1 Data

We use data from the population-representative social Consumption on education surveys of a sample of households in India [54–56] conducted by the National Sample Survey Office (NSSO). We utilise information from three rounds of the survey conducted in 2007-08 (July 2007-June 2008), 2014 (January 2014-June 2014) and 2017-18 (July 2017-June 2018). Henceforth, the three survey rounds will be referred to as 2007, 2014, and 2017, respectively. All the members of the household were administered questionnaires using face-to-face interviews.

The primary objective of the survey was to provide information on the participation of individuals in education (e.g. education level attained, whether received free education, current enrollment), expenditure incurred on education (e.g. expenditure incurred on books and stationery) and indicators of individuals currently not attending education (e.g. reason for being never enrolled, age when discontinued). It covers details on the educational attainment of the household members and the educational services used by them.

The survey provides information at the household and individual levels. The household-level data includes information on the household location, size, expenditure and type and the individual-level dataset includes information on demographics, socio-economics and education attainment of all the household members.

Data on education was reported at the individual level. In 2007 and 2014, the education questionnaire was administered to individuals who were aged between 5-29 years and reported attending education. In 2017, the age range was broadened to 3-35 years. The education questionnaire recorded the mode of transport for going to the educational institution, which was classified into five categories: i) on foot, ii) bicycle iii) school/institution bus, iv) public transport and v) others. Others include transport provided by public sector undertakings for children of their employees etc. Among the five options for travel modes, only one could be selected. If the respondent reported using more than one mode of transport, the one covering the longest distance was recorded. The questionnaire also recorded the distance to the school, current enrollment status and type of institution (government, private).

2.2 Defining variables

For our analysis, we selected individuals who were going to school (up till grade XII) and were in the age group of 5-17 years. We excluded 3.6% of individuals older than 17 years who were attending school, and were eligible to obtain a motor vehicle license. The percentage of children in the age group 5-17 years who reported going to school was 76% in 2007, 85% in 2014, and 86% in 2017. The number of school-going children aged 5-17 years covered by the education survey was 83,927 in 2007 (55,474: rural, 28,453: urban), 68,276 in 2014 (40,527: rural, 27,749: urban) and 100,348 in 2017 (63,909: rural, 36,439: urban).

India has 29 states and 7 Union Territories (UTs). States have their own elected governments, while UTs are governed by the central (federal) government. The state of Telangana was officially formed in the year 2014, however, we considered the undivided state of Andhra Pradesh (out of which Telangana was formed) for consistency across the three years. We present analysis of 28 states and 7 UTs, which we refer to as 35 states, henceforth. For state-specific sample sizes, refer to Table S1 in Supplementary Information.

We classified the sample into following age groups based on levels of school education: 5-10 years, including those in the primary level of education from grades I-V; 11-13 years (upper primary/middle level of education from grades VI-VIII); 14-15 years (secondary level of education from grades IX-X) and 16-17 years (higher secondary level of education from grades XI-XII) [57]. We express monthly household expenditure in terms of monthly per capita expenditure and classify it into five quintiles specific to the year. We use it as a proxy for income. While conducting our analysis, we corrected an error in the gender coding of 2007 where we detected that the proportion of girls cycling was higher than the proportion of boys cycling across age, thus contrasting with 2014 and 2017.

2.3 Bicycle distribution schemes

We also use data on BDS prevalent in many Indian states. In these schemes, the government arranges funds to be given to beneficiaries for purchasing a cycle or they provide cycles to beneficiaries. The information that we use from these schemes includes the year in which the scheme started and the eligibility criteria (rural/urban, grades enrolled, caste, gender, type of school, distance to school, income, and specific regions of the state).

As the details of these schemes were either unavailable or incompletely reported in the public domain, we filed the Right to Information (RTI) applications (online or through post) to the respective departments of each state. We requested information on the name of the scheme, the year in which the scheme started, the department that administers this scheme, eligibility criteria, and the number of bicycles distributed. For states from which we did not receive the RTI response, we used information on bicycle distribution schemes reported online on their official state websites or through news articles. We present the details on state-specific bicycle distribution schemes and the source of information in Tables S19 and S20.

2.4 Analysis

2.4.1 Using survey design

Our unit of analysis is individuals aged 5-17 years who reported going to school. To conduct exploratory analyses and develop regression models, we used the sampling design and survey weights in our analysis to compute weighted proportions and their confidence intervals. We used the independent samples t-test to test the statistical significance of the change in cycling levels over the decade. We operationalised this using the 'survey' library in R [58]. The education survey used a stratified multi-stage sampling design, with strata at the rural/urban and district levels, and reported survey weights at the household level. We validated our analysis by comparing the estimates with those published by NSSO [57].

2.4.2 Metrics of cycling to school behaviour

We present a descriptive summary of the sample classified into four sub-groups (rural/urban $\times$ gender) across three years. We present multiple metrics to assess longitudinal variation in cycling-to-school behavior, with individuals as the unit of analysis. The mode share of cycling (or cycling levels) refers to the proportion of individuals who reported cycling to go to school of all the individuals who reported going to school.

Gender representation in cycling

We present the state-specific gender representation in cycling relative to the mode share of cycling classified by rural/urban across two years (2007 and 2017). The gender representation is measured as the proportion of all cycling trips made by girls following the approach by Goel et al.[8].

Age-specific mode share of cycling

To study the relationship between cycling levels and age, and longitudinal changes in this relationship, we fit gender-specific generalised additive models (GAM) at the individual level stratified by rural/urban across two years, 2007 and 2017. GAM are regression models that model the non-linear relationship between variables using a smooth function of the predictor variable. We used the 'mgcv' library [59] in R statistical software to model the relationship and represented the results of these models in a graphical format.

Distance-specific mode share of cycling

We present the gender-specific cycling levels by distance to school stratified by rural/urban across two years, 2007 and 2017. We used distance bins reported in the education survey dataset (<1 km, 1-2 km, 2-3 km, 3-5 km and >5 km) and calculated the percentage of respondents cycling for each distance range.

Bicycle distribution schemes and cycling levels

To understand the impact of BDS on variation in cycling use over time, we conduct a BDS-based comparison for the four sub-groups (rural/urban $\times$ gender). Using the state-level mode share of cycling across the years, we compare the percentage point (pp) change in cycling levels over the decade relative to the presence of BDS among the respective sub-groups.

Logistic regression models

To quantify the association between cycling levels and user demographics (age and gender) and distance to school, we developed multivariate logistic regression models at the individual level. We used a binary outcome with individuals reporting cycle to go to school being assigned as one and zero, otherwise. We developed two sets of models classified as rural and urban. To study how the association varies over the decade, we developed models specific to the two years, 2007 and 2017, for each set of models. We controlled for the caste of individuals, the type of school (government/private) and the monthly per-capita expenditure.

3 Results

3.1 Descriptive summary

Table 1 presents the national-level weighted descriptive statistics of the survey respondents (5-17 years and going to school) stratified into four sub-groups (rural/urban $\times$ boys/girls), across three years (2007, 2014, and 2017). The percentage of children enrolled in higher secondary grades (age $\sim$ 16-17 years) doubled over the decade in rural areas and increased by $\sim$ 1.5 times in urban areas. Similarly, the proportion of respondents enrolled in secondary grades (age $\sim$ 14-15 years) increased in both rural and urban areas. As expected from an increase in the proportion of those attending higher grades, the percentage of respondents with distance to school >5 km almost doubled across the four sub-groups. The mode share of walking to school declined among all the sub-groups, though this mode still retained the majority share (rural girls: 87% to 72%, rural boys: 83% to 69%, urban girls: 72% to 58% and urban boys: 69% to 56%). In rural areas, half the compensation for the decline in walking was through an increase in bicycling (girls: 5% to 11%, boys: 8% to 13%) and the other half through an increase in the use of public transport (girls: 7% to 14%, boys: 8% to 15%). In urban areas, almost all the reduction in walking seems to be compensated by an increase in the use of public transport (girls: 13% to 25%, boys: 14% to 25%).

Variable	Category	Rural girls			Rural boys			Urban girls			Urban boys		
	Year	**2007**	**2014**	**2017**	**2007**	**2014**	**2017**	**2007**	**2014**	**2017**	**2007**	**2014**	**2017**
Age (years)	5-10	54.4	47.0	46.3	52.1	46.8	46.3	47.5	44.1	42.9	48.1	43.2	43.7
	11-13	25.4	26.6	25.9	25.3	25.7	25.7	25.6	26.0	26.5	25.0	26.1	25.2
	14-15	13.2	16.1	16.8	14.2	16.1	16.7	15.6	17.3	17.5	14.6	17.2	17.0
	16-17	7.1	10.3	10.9	8.5	11.3	11.3	11.3	12.7	13.1	12.3	13.5	14.2
Grade enrolled	Primary	57.9	51.1	48.5	56.0	51.0	48.8	46.9	46.7	44.6	48.2	46.3	45.5
	Middle	26.8	25.7	26.3	27.0	25.4	25.8	28.5	24.4	25.8	27.7	25.6	24.6
	Secondary	11.5	16.1	16.5	12.6	16.1	16.8	15.5	18.1	17.6	15.6	17.7	17.3
	Higher Secondary	3.7	7.2	8.7	4.4	7.4	8.7	9.1	10.8	12.0	8.6	10.5	12.5
Mode of transport	Walk	87.1	77.2	72.4	83.2	72.8	68.8	72.4	60.8	57.6	69.1	57.8	55.7
	Public Transport^{*a}	7.0	11.7	13.6	7.5	12.9	14.8	13.2	21.5	24.5	14.0	21.8	25.4
	Bicycle	4.5	8.4	11.0	7.7	11.6	13.3	5.9	6.3	6.8	9.4	10.1	9.4
	Others^{*b}	1.5	2.7	3.0	1.5	2.7	3.1	8.5	11.4	11.1	7.5	10.3	9.6
Distance to school	d<1km	69.2	59.7	60.6	65.3	56.5	58.0	63.8	52.7	52.1	62.5	50.9	51.1
	1km<=d <2kms	12.8	15.7	15.0	13.3	15.8	14.8	19.2	22.3	20.8	18.9	21.3	21.0
	2km<=d <3kms	7.5	8.7	8.3	8.3	8.9	8.2	7.6	9.5	11.3	8.4	10.8	10.6
	3km<=d <5kms	4.8	6.0	5.4	5.3	6.3	5.4	4.8	6.3	7.3	4.9	6.8	7.3
	d>=5km	5.8	9.8	10.7	7.8	12.5	13.7	4.7	9.2	8.5	5.3	10.1	10.0
Type of school	Government	80.5	74.0	74.9	76.6	68.9	71.5	44.8	36.8	36.9	40.3	32.4	33.3
	Private	19.5	26.0	25.1	23.4	31.1	28.5	55.2	63.2	63.1	59.7	67.6	66.7
Monthly expenditure per person (quintiles)	Q1	35.2	36.2	34.7	33.0	33.3	33.9	8.4	11.2	7.5	6.7	10.3	6.8
	Q2	26.4	27.4	28.3	26.1	27.7	28.3	11.6	17.4	11.2	10.4	16.0	11.0
	Q3	21.0	19.2	22.2	21.7	19.4	21.8	18.5	17.7	18.2	17.8	17.0	17.2
	Q4	12.9	13.9	12.4	13.9	15.3	13.3	27.4	28.7	29.2	27.6	29.5	29.0
	Q5	4.4	3.4	2.4	5.2	4.2	2.8	34.1	24.9	34.0	37.5	27.2	36.0
Caste	Scheduled tribe^{*c}	10.1	12.4	11.7	10.2	12.1	11.6	2.9	3.8	4.2	3.3	3.8	4.3
	Scheduled caste^{*d}	20.7	21.2	22.9	21.4	21.0	21.1	15.9	14.9	15.1	15.1	15.2	13.6
	Other backward classes^{*e}	45.6	44.6	46.1	45.2	44.8	47.6	39.0	46.3	45.4	38.7	43.9	45.9
	Others	23.6	21.8	19.3	23.2	22.1	19.7	42.2	35.0	35.4	42.9	37.1	36.3

Table 1. Sample distribution of persons of age 5-17 years and reported going to school for the four sub-groups across three years ^{*a} We include school bus in the category of public transport which includes both rail and road transport. ^{*b} Others include transport provided by public sector undertakings for children of their employees etc. [54]. ^{*c} refer to indigenous tribal groups. ^{*d} comprise of formerly untouchable caste groups. ^{*e} refers to economic and socially backward groups besides the Scheduled Castes and Scheduled Tribes. These castes have been officially classified and defined by the Constitution of India. Also, note that group-specific percentages corresponding to each variable for each year sum up to 100 percent.

3.2 Mode share of cycling by state

Table 2 presents the overall mode share of cycling of all 35 states among school-going children across the three years. It also presents the percentage point change in cycling levels between 2007 and 2017 and its statistical significance. Nationally, the percentage of children cycling to school increased steadily from 6.6% (95% confidence interval: 6.4, 6.8) in 2007 to 9.6% (9.3, 10.0) in 2014 and to 11.2% (10.9, 11.6) in 2017. Figure 1 presents a map of India, with cycling levels across states, overall, and by rural and urban residence.

State	2007	2014	2017	Percentage point change (2017-2007)
INDIA	6.6 (6.4,6.8)	9.6 (9.3,10)	11.2 (10.9,11.6)	*4.6
Andaman & Nicobar Islands	0.4 (-0.4,1.1)	1 (-0.5,2.4)	1.5 (0.1,3)	1.1
Andhra Pradesh	6 (5.3,6.7)	7.4 (6.3,8.5)	7.2 (6.2,8.3)	1.2
Arunachal Pradesh	0.9 (0.2,1.5)	4.6 (2.4,6.7)	6.1 (5,7.2)	*5.2
Assam	8.3 (6.9,9.7)	16.6 (14.6,18.7)	19 (17.2,20.7)	*10.7
Bihar	3.6 (3.1,4.1)	10.2 (8.8,11.6)	14.2 (12.6,15.8)	*10.6
Chandigarh	13.5 (8.3,18.6)	14.2 (6.3,22)	6.9 (2.6,11.1)	-6.6
Chhattisgarh	9.2 (7.6,10.8)	17.2 (14,20.3)	18.9 (17.2,20.6)	*9.7
Dadra & Nagar Haveli	6.7 (1.9,11.6)	0.9 (-0.1,1.9)	0.3 (-0.2,0.7)	*-6.4
Daman & Diu	6.3 (2.9,9.8)	1.6 (0.1,3.1)	8.6 (-1.4,18.5)	2.3
Delhi	0.9 (0.2,1.5)	0.3 (-0.2,0.7)	3.7 (1.7,5.6)	*2.8
Goa	1.3 (0.1,2.4)	0.2 (-0.2,0.5)	3.3 (0.1,6.5)	2.0
Gujarat	6.7 (5.7,7.6)	5.6 (4.6,6.5)	7.7 (6.2,9.1)	1.0
Haryana	4.6 (3.5,5.7)	2.1 (1.3,2.9)	3.6 (2.5,4.7)	-1.0
Himachal Pradesh	0.2 (-0.1,0.5)	0 (0,0)	0.1 (-0.1,0.4)	-0.1
Jammu & Kashmir	0.1 (-0.1,0.3)	0.2 (-0.2,0.6)	0.2 (0,0.4)	0.1
Jharkhand	7.3 (5.9,8.6)	13.8 (11.5,16.1)	10.1 (8.8,11.4)	*2.8
Karnataka	3.2 (2.5,3.9)	9.4 (8,10.8)	4.9 (3.9,6)	*1.7
Kerala	3 (2.2,3.8)	4.6 (3.6,5.7)	4.8 (3.7,6)	*1.8
Lakshadweep	29.2 (22.1,36.4)	49 (39.3,58.7)	46.8 (36.7,56.8)	*17.6
Madhya Pradesh	6.2 (5.5,6.9)	10.3 (9.1,11.5)	9.7 (8.6,10.8)	*3.5
Maharashtra	6.7 (5.9,7.4)	6.4 (5.6,7.2)	5.2 (4.4,6)	*-1.5
Manipur	14.9 (13.1,16.8)	6.5 (4.9,8)	6 (4.8,7.1)	*-8.9
Meghalaya	2.6 (1.6,3.6)	2.7 (1.4,4.1)	0.8 (0.2,1.4)	*-1.8
Mizoram	0 (0,0)	0.2 (-0.2,0.5)	0.3 (0,0.5)	*0.3
Nagaland	0.3 (-0.1,0.6)	0 (0,0.1)	0.8 (-0.1,1.7)	0.5
Odisha	10 (8.8,11.2)	20 (18.1,21.9)	19.3 (17.5,21.2)	*9.3
Puducherry	12 (8,16.1)	11.3 (6.8,15.9)	8.3 (4.7,11.9)	-3.7
Punjab	12.2 (10.6,13.8)	7.7 (5.9,9.4)	7.9 (6.3,9.6)	*-4.3
Rajasthan	3.1 (2.5,3.7)	3.1 (2.4,3.8)	3 (2.3,3.7)	-0.1
Sikkim	0 (0,0)	0 (0,0)	0.1 (-0.1,0.3)	0.1
Tamil Nadu	7.5 (6.6,8.4)	10.8 (9.6,12.1)	13.6 (11.9,15.4)	*6.1
Tripura	5.2 (4,6.3)	7.8 (5.8,9.8)	13.3 (11,15.5)	*8.1
Uttar Pradesh	8.1 (7.5,8.7)	10.9 (10,11.7)	13.8 (12.9,14.8)	*5.7
Uttarakhand	4.5 (2.9,6.1)	2.4 (0.9,3.9)	4.2 (2.9,5.6)	-0.3
West Bengal	11.4 (10.5,12.3)	16.1 (14.7,17.5)	26.2 (24.5,28)	*14.8

Table 2. State-specific mode share of cycling (%) across three years
$*p<0.05$
95% confidence intervals are mentioned in parentheses

Cycling increased in half of the states and remained almost the same in a quarter of those (n=9), while it declined in the rest (n=8). The most impressive increase in cycling occurred in the state of Bihar, where the levels quadrupled over the decade (3.6% in 2007 to 14.2% in 2017). The levels more than doubled in the following states: Assam (8.3% in 2007 to 19.0% in 2017), Chhattisgarh (9.2% to 18.9%), Tripura (5.2% to 13.3%) and West Bengal (11.4% to 26.2%). States in which cycling levels declined two-fold over the decade include Manipur (14.9% to 6.0%) and Punjab (12.2% to 7.9%). Of

the 35 states, 11 had a mode share of cycling greater than 10% in 2017 compared to only six in 2007 (median mode share of cycling remained the same: 6.0% in 2007 and 6.1% in 2017).

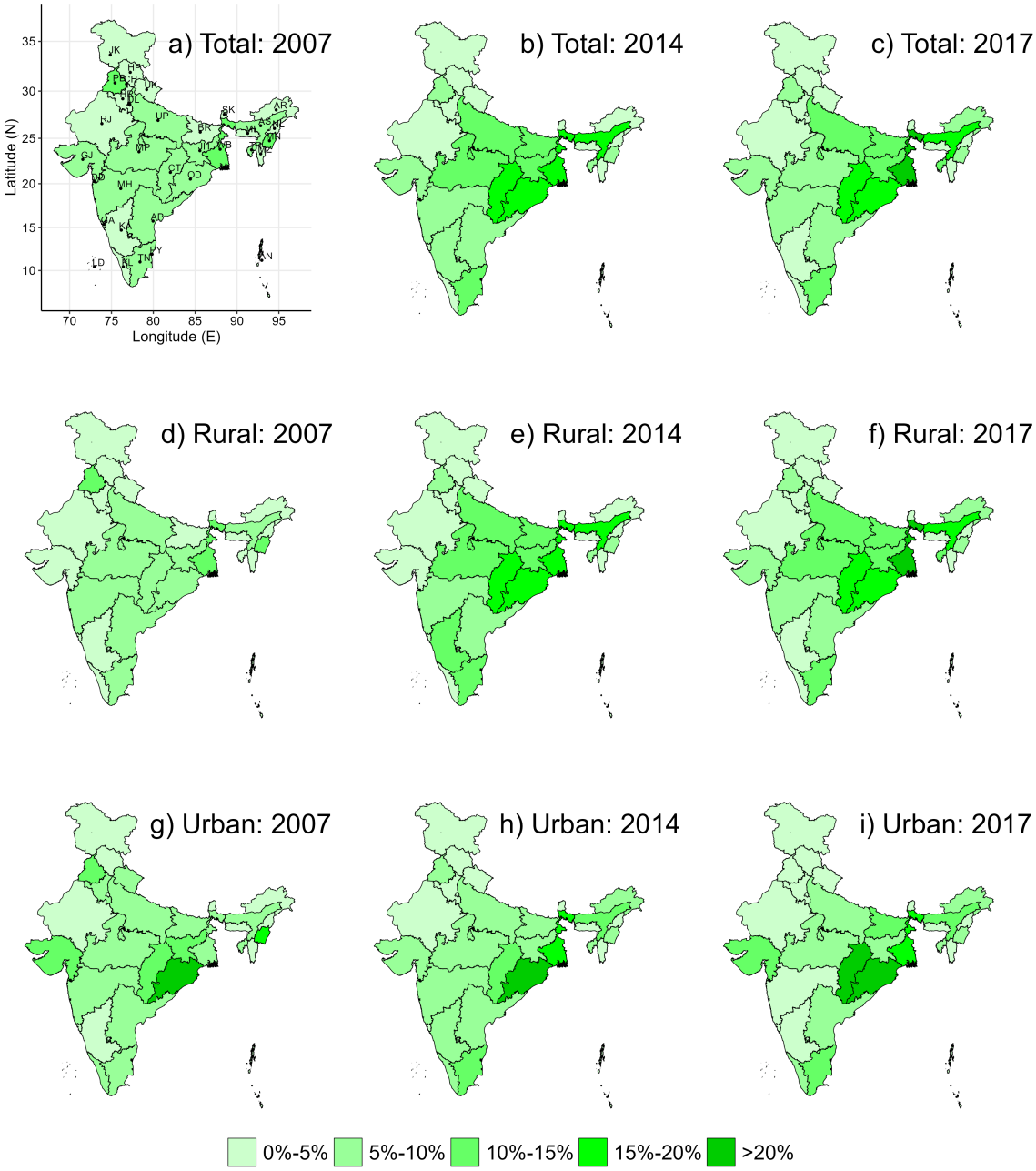

Fig 1. Mode share of cycling (%) across three years: Total, Rural and Urban
AN: Andaman & Nicobar Islands, AP: Andhra Pradesh, AR: Arunachal Pradesh, AS: Assam, BR: Bihar, CH: Chandigarh, CT: Chhattisgarh, DL: Delhi, DD: Daman & Diu and Dadar & Nagar Haveli, GA: Goa, GJ: Gujarat, HR: Haryana, HP: Himachal Pradesh, JK: Jammu & Kashmir, JH: Jharkhand, KA: Karnataka, KL: Kerala, LD: Lakshadweep, MP: Madhya Pradesh, MH: Maharashtra, MN: Manipur, ML: Meghalaya, MZ: Mizoram, NL: Nagaland, OD: Odisha, PY: Puducherry, PB: Punjab, RJ: Rajasthan, SK: Sikkim, TN: Tamil Nadu, TR: Tripura, UP: Uttar Pradesh, UK: Uttarakhand, WB: West Bengal; the map shows the undivided state of Andhra Pradesh.

There was a large variation in the mode share of cycling across the states. In 2017, the highest levels of cycling were in West Bengal (26.2%) followed by Odisha (19.3%), Assam (19.0%) and Chhattisgarh (18.9%). There was almost no cycling to schools in Dadra & Nagar Haveli (DNH), Himachal Pradesh and Jammu & Kashmir and the northeastern states such as Mizoram, Nagaland, and Sikkim. All of

these, except DNH, are hilly states.

Rural and urban level

Cycling levels in rural areas increased two-fold from 6.3% (6.0, 6.5) in 2007 to 12.3% (11.8, 12.7) in 2017. The levels in urban areas did not show a statistically significant change over the decade (7.8% (7.3, 8.3) to 8.3% (7.8, 8.8)). Figures 1d- 1i present the variation in cycling levels across the decade in rural and urban areas in India's geographical map. The state-specific cycling levels stratified by rural/urban across the three survey rounds are presented in Tables S2 and S3.

Gender-specific in rural areas of states

Figure 2 presents gender-stratified longitudinal variation in cycling levels over the decade in rural areas of each state (Figures 2a and 2b). In the following, we discuss changes in cycling levels for the states where decadal change is statistically significant. In a large majority of states, cycling share increased for both genders, with a greater increase among girls. The greatest increase in cycling among girls occurred in rural Bihar where levels increased eight-fold (1.7% in 2007 to 13.5% in 2017). In West Bengal, cycling among girls increased three-fold (9.1% to 27.6%), making it the state with the highest cycling level among rural girls across the country. The cycling levels among girls almost doubled in the rural regions of the following states: Assam (8.4% to 17.9%), Chhattisgarh (8.3% to 18.4%), Jharkhand (4.0% to 8.6%), Madhya Pradesh (5.2% to 10.2%), Odisha (7.7% to 16.1%), Tamil Nadu (6.4% to 14.0%) and Uttar Pradesh (4.8% to 12.4%).

The cycling levels among boys increased three-fold in rural areas of Bihar (4.5% to 14.8%) and Tripura (6.5% to 17.5%) while it doubled in rural areas of Assam (8.3% to 21.2%), Chhattisgarh (8.9% to 18.9%), Odisha (9.0% to 21.1%), Tamil Nadu (7.2 to 14.7%) and West Bengal (15.0% to 29.9%). The cycling levels declined significantly in rural areas of Manipur for both genders.

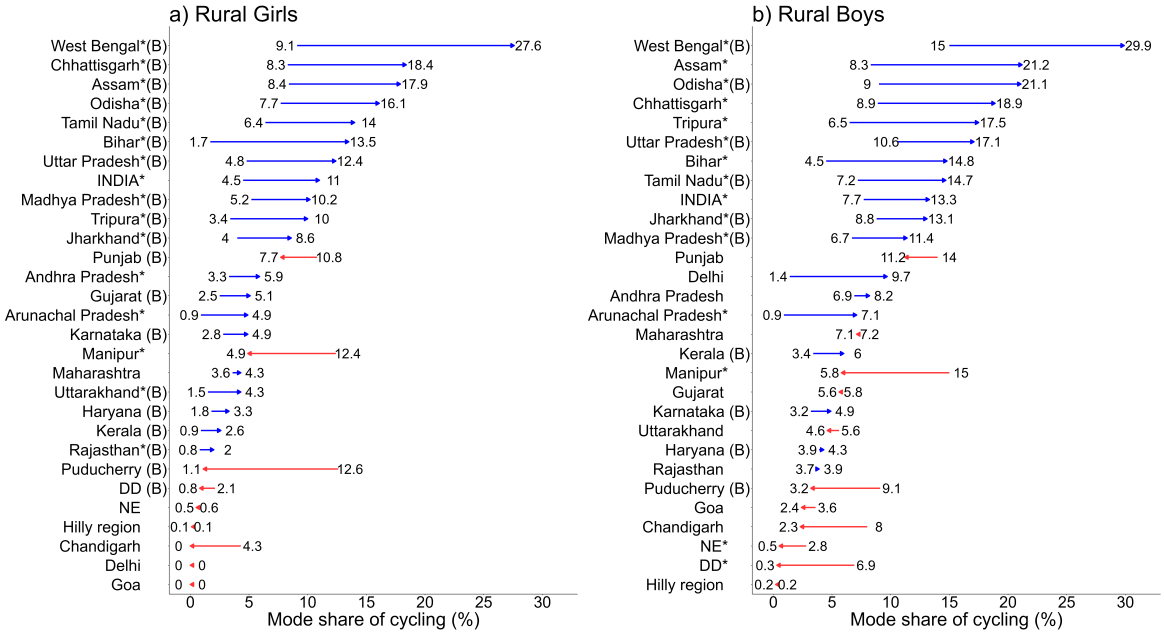

Fig 2. Longitudinal variation in cycling levels in the rural areas of states between 2007 and 2017. Panel a presents the variation in cycling levels for girls and panel b presents the variation in cycling levels for boys. The states are presented in a descending order of their cycling levels in 2017. States of Meghalaya, Mizoram, Nagaland and Sikkim are combined and abbreviated as NE, states of Himachal Pradesh and Jammu & Kashmir are combined as Hilly region and the states of Daman & Diu and Dadra & Nagar Haveli are combined and abbreviated as DD. The blue-coloured arrow represents an increase in cycling levels from 2007 to 2017 while the red arrow represents reduction in cycling levels from 2007 to 2017. "(B)" indicates that BDS is implemented in those states specific to gender in rural areas. * $p<0.05$

Gender-specific in urban areas of states

Figure 3 presents gender-stratified longitudinal variation in cycling levels over the decade in urban

areas of each state. In urban areas, cycling levels either declined or remained constant in more than half of the states among both genders. In a few states, where cycling levels increased, there has been significant jumps. For girls, cycling levels increased 10 times in Tripura (0.7% to 7.8%), quadrupled in the states of Arunachal Pradesh (1.5% to 6.3%) and Bihar (2.7% to 11.8%), and tripled in West Bengal (5.5% to 14.6%). For boys, cycling levels increased from no cycling to 5.8% in Arunanchal Pradesh, more than tripled in Delhi (1.5% to 5.0%) and doubled in the states of Chhattisgarh (11.2% to 22.9%) and West Bengal (10.2% to 22.2%). In urban areas of the states (Haryana, Maharashtra and Punjab) where cycling share declined for both genders, the decline was greater for boys compared to girls. See Tables S6 and S7 for 95% confidence intervals.

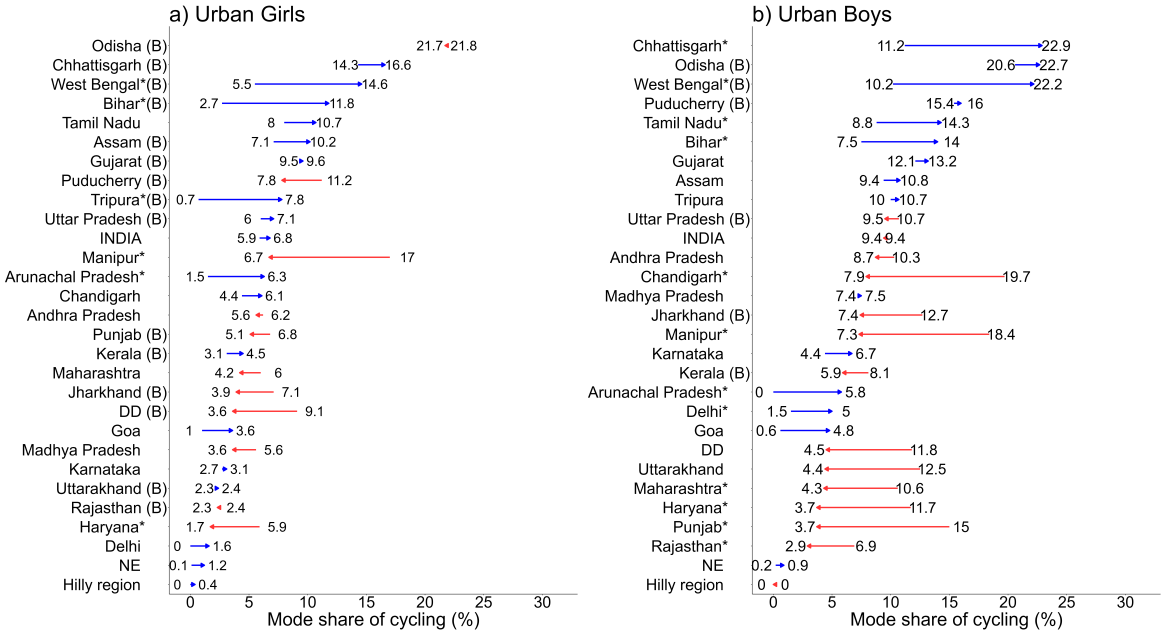

Fig 3. Longitudinal variation in cycling levels in the urban areas of states between 2007 and 2017. Panel a presents the variation in cycling levels for girls and panel b presents the variation in cycling levels for boys. The states are presented in a descending order of their cycling levels in 2017. States of Meghalaya, Mizoram, Nagaland and Sikkim are combined and abbreviated as NE, states of Himachal Pradesh and Jammu & Kashmir are combined as Hilly region and the states of Daman & Diu and Dadra & Nagar Haveli are combined and abbreviated as DD. The blue-coloured arrow represents an increase in cycling levels from 2007 to 2017 while the red arrow represents reduction in cycling levels from 2007 to 2017. "(B)" indicates that BDS is implemented in those states specific to gender in urban areas. * $p<0.05$

3.3 Gender representation in cycling

Across the decade, girls were less likely to cycle to school compared to boys. The mode share of cycling among girls was less compared to boys in both rural and urban areas of the majority of the states. Another index to measure the gender gap in cycling is in terms of the representation of girls in cycling, i.e. the percentage of girls among all cyclists.

Figure 4 presents representation of girls in cycling relative to the mode share of cycling for 2007 and 2017. In rural areas, across both years, we observe a positive correlation between the representation of girls in cycling and levels of cycling, with a steep relationship up to 10% mode share of cycling (see Figure 4a). Compared to 2007, the relationship in 2017 shifts upwards to the right, showing improvement in the representation of girls in cycling with the increase in cycling levels across states. With a more than two-fold increase in cycling levels in the rural areas of Bihar, Uttar Pradesh and West Bengal, the proportion of girls in cycling increased by about 1.5 times (For exact percentages and 95% confidence intervals, refer to Table S8).

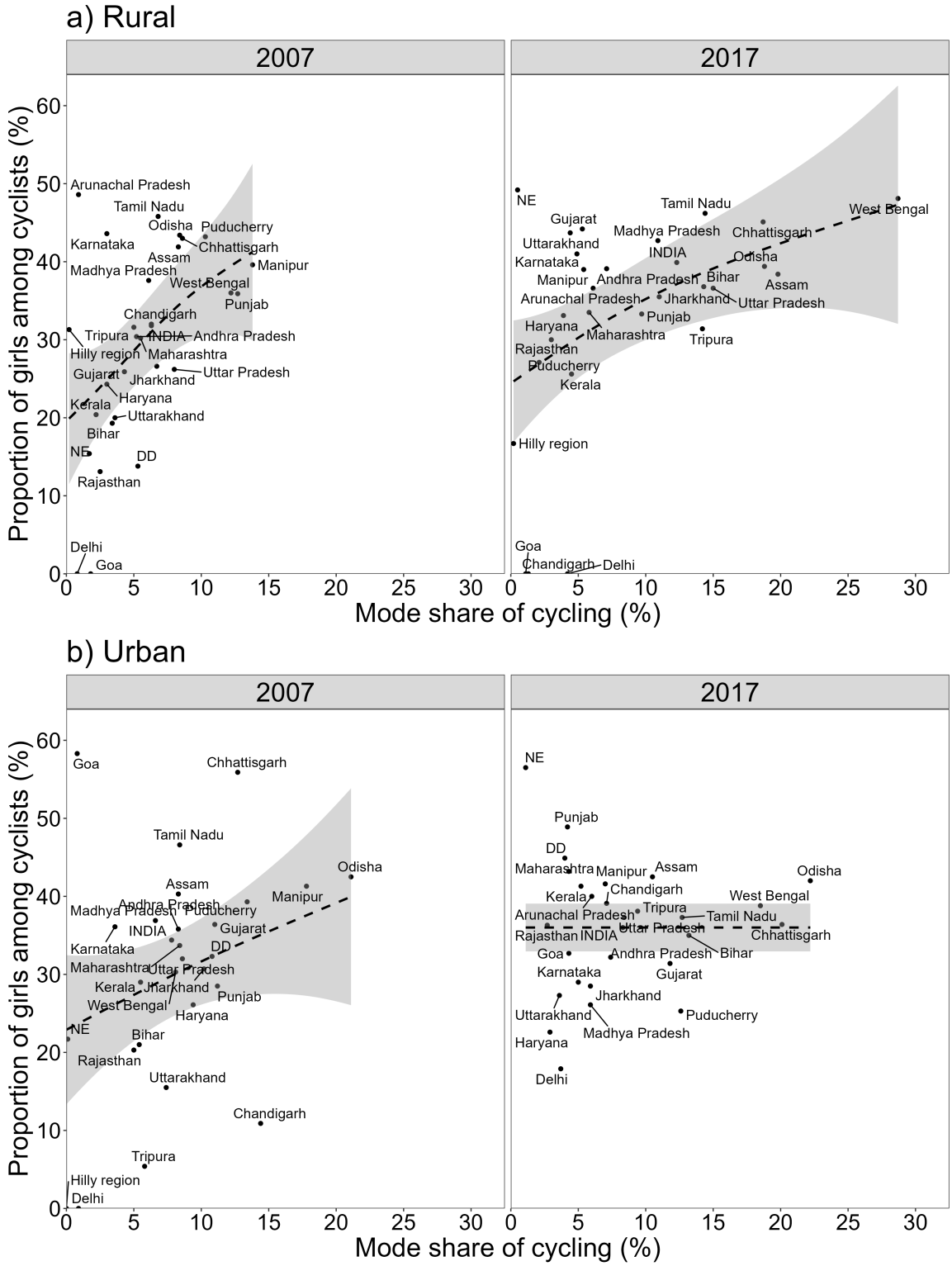

Fig 4. State-specific girl representation in cycling and cycling levels across two years, 2007 and 2017. Panel a presents the percentage of girls in cycling and cycling levels in rural areas of states. Panel b presents the percentage of girls in cycling and cycling levels in urban areas of states. The relationship is fit using GAM and is represented by a black dashed line. The gray shaded area represents the 95% confidence interval of the fit. States of Meghalaya, Mizoram, Nagaland and Sikkim are combined and abbreviated as NE, states of Himachal Pradesh and Jammu & Kashmir are combined as Hilly region, Daman & Diu and Dadra & Nagar Haveli are combined and abbreviated as DD.

In urban areas, there is an absence of a clear relationship between the gender representation in cycling

and the mode share of cycling across both years (see Figure 4b). Among the states, there are almost no differences in the representation of girls in cycling between the two years except for Tripura, where the proportion of girls in cycling increased seven-fold (For exact percentages and 95% confidence intervals, refer to Table S9).

3.4 Mode share of cycling by age

Figure 5 presents gender-specific relationships between mode share of cycling and age, stratified by rural and urban residence and year. The mode share of cycling increases monotonically with age for both genders in both rural and urban areas across the two years. This relationship was steeper among boys than girls in 2007 while it rises at a similar rate for both genders in 2017. The increase in cycling levels with age also relates to the increasing distance to school. With increasing age and thus, enrollment in higher grades, distance to school increases and thus levels of cycling to school increased (see Tables S14 and S15).

The gender gap in cycling across age declined in both rural and urban areas over the decade. In rural areas, the reduction occurred because cycling use among girls increased at a greater rate compared to boys. In urban areas, the reduction occurred because cycling use among boys declined at a greater rate compared to girls. Please see Tables S10 and S11 for gender-specific cycling levels across age groups in rural and urban areas and their 95% confidence intervals.

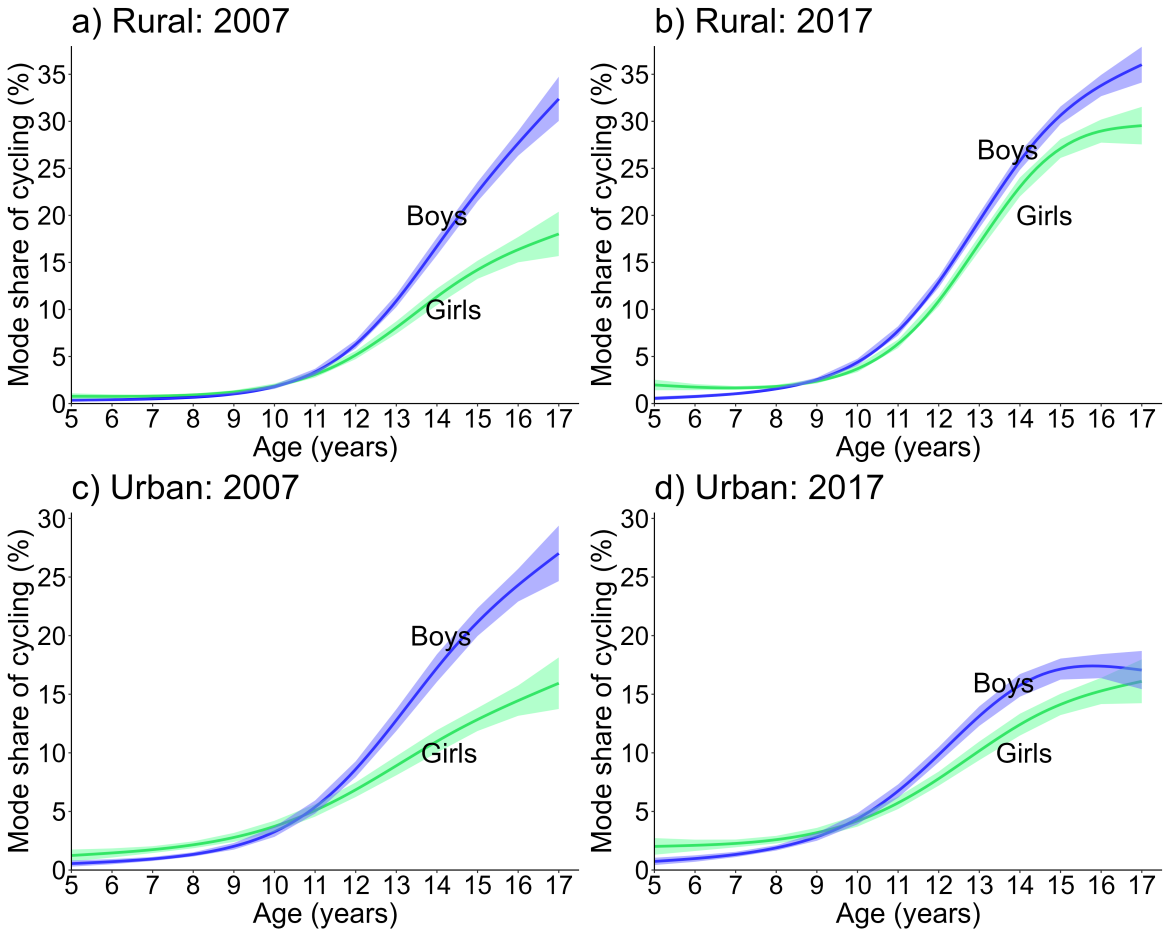

Fig 5. Mode share of cycling by age. Panel a and b present the relationship between mode share of cycling and age in 2007 and 2017, respectively, for rural India. Panel c and d present the relationship between mode share of cycling and age in 2007 and 2017, respectively, for urban India. The relationship between mode share of cycling and age is fit using GAM. The shaded area represents the 95% confidence interval of the fit.

3.5 Mode share of cycling by distance to school

Figure 6 presents the gender-stratified longitudinal variation in cycling levels by distance to the school. The first set (Fig 5a and 5b) and the second set (Figures 6c and 6d) present year-specific variations in rural and urban areas, respectively. In rural areas, cycling use increased for both gender groups across all distances, except in >5̄ km range, where cycling among boys reduced. The greatest increase in cycling occurred in rural areas for distances shorter than 3 km. The level of cycling in the 1-2 km range increased four-fold among girls (5.4% to 20.5%) and three-fold among boys (8.4% to 22.3%). In urban areas, cycling use declined for both gender groups across all distance ranges, except for shorter distances (<2 km). The greatest reduction in cycling occurred in urban areas for distances longer than 3 km. The likelihood of cycling in the 3-5 km declined two-fold among girls (16.2% to 7.1%) and more than three-fold among boys (26.5% to 7.3%).

The gender gap in cycling across distances reduced in both rural and urban areas. In rural areas, cycling levels increased for <5 km among both genders, with a greater increase among girls. In urban areas, cycling levels declined for >2 km among both genders, with a greater reduction among boys (For these values and 95% confidence intervals, see Tables S12 and S13). In 2017, the highest levels of cycling are in 2-5 km distance range for both boys and girls in rural areas, with more than 40% of children cycling to school cycling that far. In contrast, the highest level in urban areas is in 1-2 km range, with 15-20% children cycling.

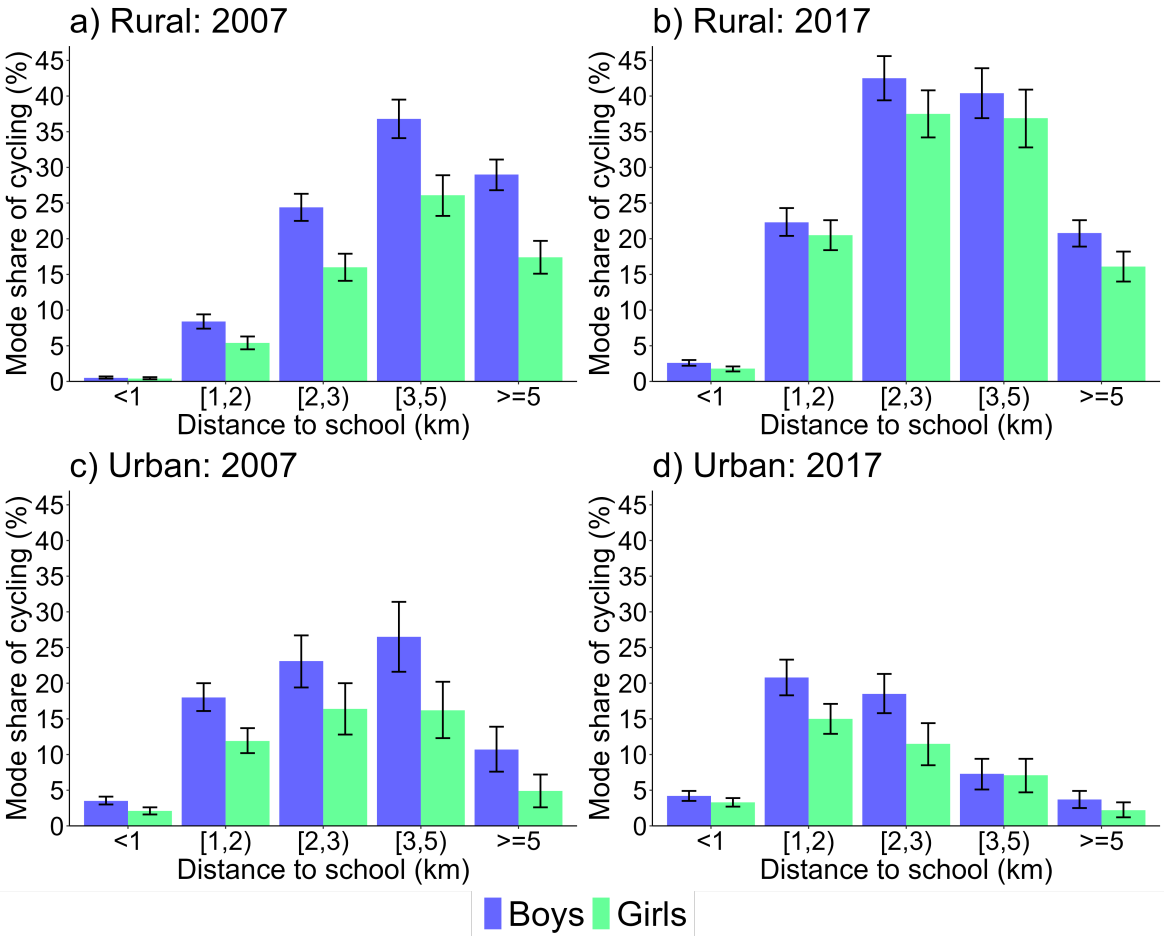

Fig 6. Mode share of cycling by distance to school. Panel a and b present the mode share of cycling by distance to school in 2007 and 2017, respectively, for rural India. Panel c and d present the mode share of cycling by distance to the school in 2007 and 2017, respectively, for urban India. The error bars represent the 95% confidence interval.

3.6 Bicycle distribution schemes

We present the state-specific information on BDS in Tables S19 and S20. We report the year when the scheme started, the department that administers the scheme, the number of bicycles distributed,

the type of transfer (cash or in-kind) and the eligibility criteria of the scheme. A brief summary is as follows. A total of 20 states had BDS implemented before 2017. The years in which the scheme started varied widely across states, from as early as 1995 in Gujarat to as late as 2016 in Uttar Pradesh. BDS has been active across states for an average of eight years till 2017. The schemes were mostly administered by the education departments of the states, and were applicable to those studying in government-run schools. In the majority of the states, bicycles were given to the children who passed the eighth standard (approx age: 13 years) and enrolled themselves in the secondary schools (ninth and tenth standards), with the underlying aim to improve access to secondary education [25, 26, 60–62]. In half (n=10) of the states with BDS (n=20), only girls were eligible for the scheme, while in the rest, both boys and girls were eligible. In one-fifth (n=4) of the states with BDS, the scheme was implemented only in rural areas. The scheme was applicable to both boys and girls only in rural areas in four states, to both boys and girls in rural as well as urban areas in six states and only to females in both rural and urban areas in ten states. We represent the presence of BDS in states across the four subgroups (rural/urban × boys/girls) by the letter "(B)" next to state names in 2 and 3.

Relationship between BDS and cycling levels across states

Overall, among the states where cycling levels increased (n=16) over the decade, 75% (n=12) of those had an operational BDS. In comparison, among the states where cycling levels either remained constant or declined (n=19), 42% (n=8) of those had BDS. It is noteworthy that the ten states with the highest levels of cycling among girls in rural areas in 2017 (West Bengal to Jharkhand in Figure 2a) were those with the largest statistically significant increases in cycling levels since 2007 and, in each of those, BDS had been implemented. The impact of BDS is most visible in the state of West Bengal, where the scheme started in 2015, and the mode share of cycling increased from 15.4% (2014) to 27.6% (2017)— a 12 pp increase over just a 3-year period (see Table S4). Even among boys in rural areas, the ten states with the highest levels of cycling in 2017 (West Bengal to Madhya Pradesh in Figure 2b) were those that experienced the largest statistically significant increases in cycling levels since 2007 and, in the majority of those (6 of 10 states), BDS had been implemented. Unlike in the case of rural girls, there are four states (Assam, Bihar, Chhattisgarh, and Tripura) that had a significant increase in cycling among boys even though BDS was not applicable to males. Thus, BDS is strongly associated with an increase in rural levels of cycling, and the association is stronger for girls than for boys.

Crude estimate of the impact of BDS on cycling levels

Figure 7 presents the percentage point (pp) change in cycling levels between 2007 and 2017 relative to the presence of BDS for each of the four subgroups (rural/urban × boys/girls). The average pp increase in cycling was greater in states with BDS than those without, except for girls in urban areas. The greatest impact of BDS was for girls in rural areas, among whom, cycling levels ***increased*** by 4.5 pp in states with BDS (n=20) and ***decreased*** by 1.2 pp for states without BDS (n=15). This resulted in an effective increase of 5.7 pp (4.5-(-1.2)) in cycling levels among states with BDS compared to states without. Using the same approach, among the other three sub-groups, cycling levels effectively increased by 3.3 pp for boys in rural areas and 1.3 pp for boys in urban areas, while they effectively reduced by 0.8 pp for girls in urban areas.

3.7 Regression models

Table 3 presents the results of the four logistic regression models– rural/urban for 2007 and 2017, with cycling to school as a binary outcome. The results are presented as odds ratios with their 95% confidence intervals. The graphical format of the outputs of regression models is presented in Figures S2 and S3.

In rural areas, distance-to-school categories have the largest effect size among the variables considered and remain so for both 2007 and 2017. The odds for all distance categories are higher than the reference of <1km. In urban areas, too, the effect sizes for distance are large, but much smaller than in rural areas. Also, the odds for all distance categories are greater than the reference, except >5km which has an odds ratio of 0.67. In both, rural and urban areas, it is the relative likelihood of cycling for distance >5km that has reduced significantly. In rural areas, the odds ratio reduced from 30.6 in 2007 to 7.7 in 2017, and in urban areas from 1.6 to 0.7.

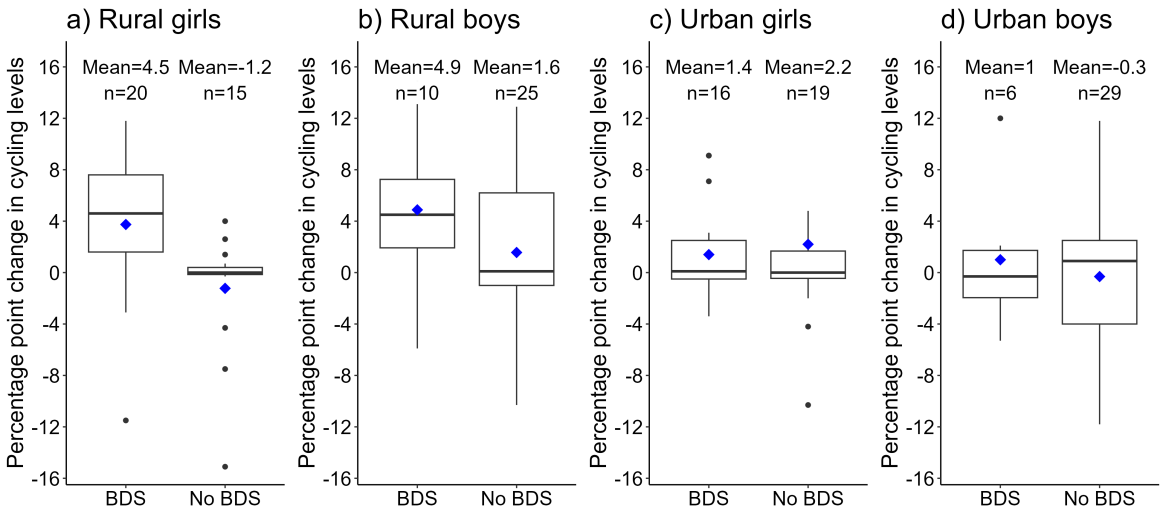

Fig 7. Percentage point change in cycling levels by presence of BDS. The graphs are specific to the four sub-groups: rural girls, rural boys, urban girls and urban boys. The y-axis presents the percentage point change in cycling levels between 2007 and 2017 corresponding to the particular subgroup. The x-axis indicates the presence of BDS for the particular sub-group. The blue point represents the mean. 'n' represents the number of states in which BDS was present or absent corresponding to the subgroup.

Interestingly, the effects for age bands remain the same over the years and are also comparable for rural and urban residents. In rural areas, the income gradient was flat in 2007 and became sharper in 2017, with cycling use *reducing* among those from higher-income households. In contrast, in urban areas, the income gradient was sharper in 2007, with cycling use *increasing* with household income, and flattened in 2017, implying no differences across income levels.

Students enrolled in government schools were more likely to cycle compared to those in private schools (reference), and the likelihood increased over the years. For instance, in rural areas, students enrolled in government schools were 12% more likely to cycle in 2007 and 78% more likely to cycle in 2017, compared to those enrolled in private schools. In urban areas, in 2007, the type of school was not a predictor of cycling to school, however, in 2017, students enrolled in government schools were 49% more likely to cycle compared to those enrolled in private schools.

Variable	Rural 2007	2017	Urban 2007	2017
(Intercept)	0.00 (0.00, 0.00)***	0.01 (0.01, 0.01)***	0.01 (0.00, 0.01)***	0.01 (0.01, 0.02)***
Gender Boy	1	1	1	1
Gender Girl	0.58 (0.53, 0.64)***	0.75 (0.68, 0.82)***	0.58 (0.51, 0.67)***	0.65 (0.56, 0.75)***
Age 5-10 years	1	1	1	1
Age 11-13 years	3.34 (2.83, 3.94)***	3.97 (3.41, 4.63)***	4.11 (3.31, 5.10)***	3.44 (2.70, 4.37)***
Age 14-15 years	6.55 (5.56, 7.72)***	7.90 (6.77, 9.21)***	7.54 (6.08, 9.37)***	6.07 (4.77, 7.72)***
Age 16-17 years	7.40 (6.23, 8.79)***	8.82 (7.49, 10.38)***	9.46 (7.60, 11.77)***	7.18 (5.60, 9.21)***
Distance to school <1 km	1	1	1	1
Distance to school 1-2 km	10.51 (8.65, 12.77)***	9.29 (7.97, 10.82)***	4.65 (3.92, 5.51)***	5.36 (4.49, 6.39)***
Distance to school 2-3 km	30.13 (24.91, 36.44)***	21.73 (18.44, 25.61)***	5.89 (4.73, 7.34)***	4.52 (3.65, 5.60)***
Distance to school 3-5 km	49.76 (40.84, 60.64)***	21.29 (17.80, 25.46)***	5.80 (4.52, 7.45)***	1.79 (1.34, 2.39)***
Distance to school 5+ km	30.58 (25.00, 37.41)***	7.72 (6.51, 9.15)***	1.55 (1.13, 2.14)**	0.67 (0.48, 0.93)*
Type of school Private	1	1	1	1
Type of school Government	1.12 (1.01, 1.24)*	1.78 (1.60, 1.99)***	0.92 (0.79, 1.07)	1.49 (1.28, 1.74)***
Monthly expenditure per person Q1	1	1	1	1
Monthly expenditure per person Q2	0.99 (0.87, 1.12)	0.85 (0.76, 0.96)**	1.14 (0.72, 1.80)	0.93 (0.69, 1.24)
Monthly expenditure per person Q3	1.14 (1.01, 1.30)*	0.75 (0.65, 0.85)***	1.70 (1.14, 2.53)**	1.10 (0.83, 1.46)
Monthly expenditure per person Q4	1.02 (0.88, 1.18)	0.42 (0.36, 0.50)***	2.28 (1.57, 3.31)***	1.00 (0.77, 1.30)
Monthly expenditure per person Q5	0.82 (0.67, 1.01)	0.47 (0.35, 0.61)***	2.71 (1.86, 3.95)***	0.88 (0.66, 1.17)
Caste Others	1	1	1	1
Caste Other Backward Classes*a	0.93 (0.83, 1.04)	0.88 (0.78, 1.00)	1.08 (0.93, 1.26)	1.35 (1.14, 1.59)***
Caste Scheduled Caste*b	0.75 (0.65, 0.86)***	1.01 (0.87, 1.17)	0.97 (0.79, 1.20)	1.18 (0.94, 1.48)
Caste Scheduled Tribe*c	0.74 (0.62, 0.89)***	0.63 (0.54, 0.74)***	0.91 (0.62, 1.33)	1.10 (0.78, 1.55)

Table 3. Logistic regression models with individual reporting cycling to school as the binary outcome in rural and urban India across two years, 2007 and 2017
p <0.05, **p <0.01, ***p <0.001
Results are reported as odds ratios with their 95% confidence intervals.
*a refer to economic and socially backward groups besides the Scheduled Castes and Scheduled Tribes.
*b comprise of formerly untouchable caste groups. *c refer to indigenous tribal groups. These castes have been officially classified and defined by the Constitution of India.

4 Discussion

4.1 Principal findings

We used three rounds, spanning a decade (2007-2017), of population-representative nationwide sample surveys on education in India and analysed this data for school-going children in the age group of

5-17 years. We conducted descriptive analyses to study longitudinal changes in cycling levels at the national and sub-national levels (35 states), and to study how those changes vary by distance to school, demographic and socioeconomic characteristics of children, and urban and rural areas. Next, we examined the impact of bicycle distribution schemes (BDS) on cycling levels in states.

Nationally, cycling to school increased from 6.6% in 2007 to 11.2% in 2017 (see Table 2). In rural areas, the levels nearly doubled (6.3% to 12.3%) while, in urban areas, there was almost no change (7.8% to 8.3%) (see Tables S2 and S3). In rural areas, cycling levels ***increased*** across a large majority of states for both genders, with a greater increase among girls (see Figures 2a and 2b). In urban areas, cycling levels ***declined*** in almost all the states for both genders, with a greater reduction among boys (see Figures 3a and 3b). Most prominently, cycling levels increased more than two-fold in rural as well as in urban areas of the two states, Bihar and West Bengal.

We found strong evidence of the positive impact of bicycle distribution schemes on cycling levels. Overall, cycling levels increased by an average of 3.6 percentage points (pp) in states with BDS (n=20) and by 0.8 pp without BDS (n=15). States with the largest growth in cycling levels were often the ones where BDS was implemented, particularly in rural areas (see Figures 2a and 2b). Also, the effects of BDS were more prominent in rural areas, because a large proportion of students (>70%) are enrolled in government schools (see Table 1), which are type of schools that are eligible for BDS. In comparison, in urban areas, majority of the students are enrolled in private schools where BDS is not applicable and hence its impact is small.

For 2007, in rural as well as in urban areas, we found a positive association between the representation of girls in cycling and overall levels of cycling across the states (see Figure 4). In other words, more girls cycled in places where cycling was more common. This association persisted longitudinally in rural areas, indicating that states where cycling increased in 2017, girl participation in cycling improved, as well. However, in urban areas, girl participation nearly flattened in 2017, across the range of cycling levels.

There were rural-urban differences in how cycling levels changed for different age groups and distance ranges. In rural areas, cycling levels increased for both genders across the age groups while, in urban areas, the levels declined for boys (see Figure 5). In rural areas, the largest increase in cycling levels was for distance <3 km and, in urban areas, the largest reduction was for >3 km (see Figure 6). Compared to urban areas, distance to school was a stronger predictor of cycling to school in rural areas (see Table 3). There was a reduction in the gender gap in cycling across age groups and distance ranges over the decade in rural as well as urban areas (see Figures 5 and 6). However, this narrowing of the gender gap occurred differently in rural areas than in urban areas. In rural India, the gap narrowed because the levels of girl cycling increased and came at par with that of boys, while in urban areas, it narrowed because cycling levels reduced among boys and came closer to that of girls.

4.1.1 A silent revolution

We call the phenomenal rise in cycling levels across a large part of the country, a "silent revolution". To highlight the scale of this phenomenon, consider that the states that saw the greatest growth in cycling— Bihar (2017 population: 116 million), West Bengal (96 million), Assam (34 million), and Chhattisgarh (28 million) [63]—have populations as large as some of the largest European countries. We use the term 'silent' to not only indicate the absence of traffic noise, cycling is associated with, but also to highlight a complete lack of attention on this trend and its underlying reasons within the community of transport researchers, policymakers, or practitioners. For instance, we did not find a single research paper published in a transportation journal that studied the travel behavior impact of bicycle distribution schemes, which we found are the drivers for the growth and widespread use of cycling in many states. We call it a 'revolution' because cycling levels increased among girls in a country which has high levels of gender inequality in terms of female mobility outside the home, in general [9], and for cycling, in particular [8, 64]. Nationwide, cycling among girls living in rural areas increased more than two times from 4.5% in 2007 to 11% in 2017 (see Figure 2a).

4.2 Strengths and weaknesses

Our study is the first nationwide investigation of cycling-to-school behaviour in India. A major strength of our study is that we reported a decade-long change in cycling behaviour. The sample size of the study enabled state-specific analysis further stratified by various characteristics. There is

a limitation in our evaluation of BDS implementation. We could only map the BDS to gender and urban/rural residence. However, in some states, BDS was applicable to a smaller subset of these four sub-groups, such as those below a certain income, or those belonging to some social classes. Thus, our estimate of the impact of BDS is likely an underestimate as we assumed a much larger population to benefit from the scheme, while the actual beneficiaries of the scheme were only a part of that population.

4.3 Meaning of our study

4.3.1 Bicycle ownership and its affordability

A major concern in rural areas is the lack of transport options to go to school [31, 65, 66], as the schools of secondary and senior-secondary grades are often located as far as 5 km or more [67]. Lack of public transport and low levels of personal vehicle ownership results in dependence on walking and cycling. Evaluations of BDS have shown that these schemes resulted in increased enrolment and completion rates in secondary schools [31, 68, 69]. An increase in enrollment implies that there was a population of children who did not buy a bicycle despite missing their education. It is, therefore, possible that for a vast majority of the rural population, bicycles are unaffordable. Previously, using a survey across five villages in India, a study had reported price of bicycles as a major deterrent to its use among low-income households [70].

There is another indicator that shows how cycling growth in Indian states may be related to poverty and the lack of affordability of bicycles. The states that have witnessed the greatest increase in cycling levels (see Table 2) are among the poorest in the country, with some exceptions. The average per-capita income of states where cycling levels increased was US$ 1946 [1] and that of states where it remained stable or reduced was US$ 4942 [71]– a difference of more than 2.5 times. It is possible, though, that poor access to bicycles may also be because of inadequate supply chains of bicycles in villages [72], a gap that is likely addressed by bicycle distribution schemes.

4.3.2 Traffic safety concerns

Our analysis does not explicitly account for exposure to injury risk, however, some findings point to the role that danger from traffic may be playing in reducing urban cycling. In urban areas, the largest reduction in cycling occurred for trips longer than >3 km, while the levels of cycling remained the same (or reduced only slightly) for shorter distances (see Figures 6c and 6d). Longer distances to schools may have greater likelihood of exposing children to major roads, or crossings, and therefore, may discourage them from cycling. From a global perspective, roads in Indian cities are highly unsafe. Road death rates in Indian cities are many times higher than those in Western European countries [73]. Lack of traffic safety has been reported as a major reason for the decline in urban cycling by multiple studies [44, 48, 74–77]. Since, increase in motorisation increases the risk posed on cyclists, we looked at the population-level household vehicle ownership over the period 2005-2019 reported by nationwide sample surveys [78, 79]. In states where urban cycling levels increased (see Table S3), there was a 4.6 pp increase in household car ownership from 2005 to 2019, while this increase was more than two times higher (12.2 pp) in states where cycling levels did not increase (see Table S23). The data indicates that an increasing presence of cars on the road and resulting car-centric infrastructure may be responsible for the decline in urban cycling to school [80]. Interestingly, the changes in the levels of motorcycle ownership did not show much difference among states where cycling levels increased compared to where they did not (28.2 pp vs 25.2 pp).

4.3.3 Removing gendered barriers to cycling

We found that girls in India were less likely to cycle to school compared to boys in both rural and urban areas (see Table 3), which is in line with findings reported in multiple other studies [41, 64, 74, 81]. One of the common barriers to cycling is the lack of knowledge on how to cycle [82, 83] and therefore, interventions that focus on building cycling skills have the potential to change the mobility patterns of the population [84]. Often, cultural and societal norms contribute to the individual's decision to begin cycling [85]. This social influence on exposure to cycling differs by gender, affecting girls more than boys [86], and is more pronounced in low-cycling countries [87]. In many parts of India, patriarchal

[1] 1US$ = 0.012 Indian Rupees; year: 2020-21

societal norms result in prioritising the allocation of the girl's share of resources towards savings for marriage instead of directing investments that could potentially improve her socioeconomic status [27]. Such households probably would not have opted to purchase a bicycle for girls by themselves [31]. It is this gendering process that BDS may have successfully hindered. The provision of free bicycles introduced cycling to adolescent girls. In rural Bihar, for example, almost no girl cycled to schools in 2007 (1.7%), while this level increased to 13.5% in just a decade (see Figure 2a). In addition, the ten states with the largest significant increases in cycling levels among rural girls had the support of BDS (see Figure 2a). However, cycling levels among rural boys increased despite the lack of support of BDS in four of ten states (see Figure 2b). This indicates that girls have a greater need for government support than boys, which BDS is able to provide. The social image attached to cycling in childhood influences the decision of an individual to continue or discontinue cycling after childhood [88]. Interventions focused on encouraging cycling at a younger age often translate into higher rates of cycling at an older age [89]. We also found that in states where cycling levels improved, so did the representation of girls (see Figure 4). This is in line with previous studies [8, 34, 90] which highlight that higher cycling is associated with gender equity, though all this work, unlike ours, is based on cross-sectional analysis.

4.4 Unanswered questions and future research

Our study highlights various determinants of cycling that future research could study to identify specific policy levers and role of stakeholders to improve cycling use among school children. Firstly, there is a strong indication that bicycles may be unaffordable to a large section of low-income population in India. The range of interventions may include widening the geographical scope and eligibility of beneficiaries of BDS, changes in taxation on bicycles to reduce market price, or provision of subsidies to bicycle manufacturers. Secondly, and related to affordability, is the role that gender norms play in households that restrict access to bicycles among girls. Besides providing free or subsidised bicycles, could there be added benefits of providing school-based training to girls for riding bicycles? Thirdly, we hypothesised that the reduction in cycling to school in urban areas may be because of increased motorisation, especially because of cars, in cities. While danger from traffic is a well-known barrier to cycling, studies are needed to identify risk factors that are specific to journey of children to school.

Declarations of interest

None.

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Data availability

The data is in the public domain. The code and supporting files are available in the following GitHub repository: `https://github.com/agrawal-srishti/cycling_to_school_India`

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A silent revolution: Rapid rise of cycling to school in rural India

Supplementary Information

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Table S1. State-specific sample sizes

State	2007					2014					2017				
	Rural		Urban		Total	Rural		Urban		Total	Rural		Urban		Total
	Girls	Boys	Girls	Boys		Girls	Boys	Girls	Boys		Girls	Boys	Girls	Boys	
INDIA	24837	30647	13078	15365	83927	18409	22118	12876	14873	68276	28257	35382	16118	20321	100078
Andaman & Nicobar Islands	95	104	71	73	343	81	83	54	55	273	140	135	86	106	467
Andhra Pradesh	1526	1694	811	847	4878	791	971	794	959	3515	1473	1934	942	1201	5550
Arunachal Pradesh	276	328	202	200	1006	234	251	117	139	741	638	783	206	274	1901
Assam	560	806	288	333	1987	800	1049	205	245	2299	1223	1578	346	451	3598
Bihar	2120	3290	546	678	6634	1252	1549	665	707	4173	1833	2714	744	1066	6357
Chandigarh	25	27	59	104	215	36	35	48	55	174	20	24	78	93	215
Chhattisgarh	538	656	264	278	1736	356	408	235	284	1283	1003	1241	439	556	3239
Dadra & Nagar Haveli	39	72	30	72	213	41	41	35	30	147	60	71	47	51	229
Daman & Diu	36	75	48	59	218	44	41	27	37	149	24	35	23	25	107
Delhi	48	62	363	469	942	19	37	401	537	994	27	24	408	555	1014
Goa	40	51	55	60	206	55	39	51	49	194	51	47	76	121	295
Gujarat	823	1052	631	829	3335	733	990	593	786	3102	803	1084	643	1017	3547
Haryana	424	587	261	346	1618	334	430	319	410	1493	525	806	386	580	2297
Himachal Pradesh	529	631	135	177	1472	342	372	69	88	871	713	795	137	115	1760
Jammu & Kashmir	406	456	250	338	1450	406	464	237	266	1373	806	1104	430	561	2901
Jharkhand	615	747	241	320	1923	474	597	302	309	1682	1106	1329	463	620	3518
Karnataka	916	1025	639	725	3305	681	829	646	731	2887	877	1239	697	843	3656
Kerala	605	671	358	339	1973	530	543	581	533	2187	753	908	675	729	3065
Lakshadweep	34	35	59	72	200	39	46	40	36	161	40	46	56	76	218
Madhya Pradesh	1488	1901	771	947	5107	1128	1248	799	916	4091	1555	1914	835	1127	5431
Maharashtra	1605	1836	1422	1560	6423	1175	1469	1052	1298	4994	1547	1964	1491	1829	6831
Manipur	528	655	218	317	1718	339	463	258	365	1425	606	797	506	631	2540
Meghalaya	482	488	172	137	1279	343	344	145	139	971	526	539	186	178	1429
Mizoram	218	273	313	391	1195	207	217	185	208	817	383	475	366	354	1578
Nagaland	357	394	132	172	1055	179	178	108	95	560	430	499	129	165	1223
Odisha	1137	1294	329	457	3217	846	981	340	316	2483	1400	1638	398	462	3898
Puducherry	38	64	98	113	313	26	32	73	94	225	38	39	117	146	340
Punjab	518	675	412	486	2091	340	405	292	382	1419	520	768	456	641	2385
Rajasthan	1177	1746	563	706	4192	875	1166	583	712	3336	1527	1887	650	906	4970
Sikkim	407	449	63	79	998	143	174	85	63	465	328	319	66	71	784
Tamil Nadu	1106	1147	996	998	4247	872	1034	842	883	3631	1227	1431	957	1090	4705
Tripura	630	706	157	186	1679	302	484	166	232	1184	558	701	187	213	1659
Uttar Pradesh	3420	4389	1211	1383	10403	2909	3572	1520	1789	9790	3243	4106	1768	2208	11325
Uttarakhand	400	434	213	231	1278	179	263	114	147	703	472	557	237	301	1567
West Bengal	1671	1827	697	883	5078	1298	1313	895	978	4484	1782	1851	887	959	5479

Table S2. State-specific cycling levels (%) in rural areas

State	2007	2014	2017
INDIA	6.3 (6.0,6.5)	10.1 (9.7,10.5)	12.3 (11.8,12.7)
Andaman & Nicobar Islands	0.6 (-0.6,1.7)	1.6 (-1.1,4.2)	1.6 (0.0,3.1)
Andhra Pradesh	5.2 (4.4,6.0)	6.2 (4.8,7.6)	7.1 (5.7,8.5)
Arunachal Pradesh	0.9 (0.0,1.8)	4.2 (1.7,6.7)	6.1 (4.8,7.3)
Assam	8.3 (6.8,9.9)	17.0 (14.8,19.2)	19.8 (17.9,21.7)
Bihar	3.4 (2.8,3.9)	10.3 (8.7,11.8)	14.3 (12.5,16.1)
Chandigarh	6.3 (0.6,11.9)	1.0 (0.0,2.0)	1.3 (-0.3,2.9)
Chhattisgarh	8.6 (6.8,10.4)	17.8 (14.1,21.5)	18.7 (16.8,20.6)
Dadra & Nagar Haveli	7.8 (2.2,13.3)	1.0 (-0.4,2.3)	0.0 (0.0,0.0)
Daman & Diu	0.0 (0.0,0.0)	5.8 (0.4,11.2)	4.3 (-0.8,9.4)
Delhi	0.8 (-0.8,2.4)	0.0 (0.0,0.0)	4.2 (-2.8,11.1)
Goa	1.8 (-0.2,3.8)	0.5 (-0.4,1.4)	1.1 (-0.8,3.0)
Gujarat	4.3 (3.3,5.3)	3.5 (2.4,4.6)	5.3 (3.8,6.9)
Haryana	3.0 (1.9,4.1)	1.9 (0.9,2.9)	3.9 (2.4,5.4)
Himachal Pradesh	0.2 (-0.1,0.6)	0.0 (0.0,0.0)	0.1 (-0.1,0.4)
Jammu & Kashmir	0.1 (-0.1,0.3)	0.2 (-0.2,0.7)	0.2 (0.0,0.4)
Jharkhand	6.7 (5.3,8.1)	14.9 (12.2,17.6)	11.0 (9.5,12.5)
Karnataka	3.0 (2.3,3.8)	10.3 (8.2,12.4)	4.9 (3.4,6.4)
Kerala	2.2 (1.4,3.0)	3.9 (2.6,5.3)	4.5 (3.0,6.1)
Lakshadweep	21.2 (11.2,31.2)	26.1 (14.5,37.8)	15.9 (2.4,29.4)
Madhya Pradesh	6.1 (5.3,6.9)	11.2 (9.7,12.7)	10.9 (9.5,12.2)
Maharashtra	5.5 (4.7,6.3)	6.2 (5.2,7.3)	5.8 (4.7,7.0)
Manipur	13.8 (11.7,16.0)	6.7 (4.7,8.7)	5.4 (4.0,6.9)
Meghalaya	3.0 (1.8,4.2)	3.0 (1.5,4.6)	0.9 (0.3,1.6)
Mizoram	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.1 (-0.1,0.4)
Nagaland	0.3 (-0.1,0.8)	0.1 (-0.1,0.2)	0.0 (0.0,0.0)
Odisha	8.4 (7.2,9.5)	19.7 (17.6,21.8)	18.8 (16.8,20.8)
Puducherry	10.3 (4.2,16.4)	6.5 (-0.9,13.8)	2.1 (-0.1,4.3)
Punjab	12.7 (10.6,14.7)	7.0 (4.8,9.1)	9.7 (7.4,12.0)
Rajasthan	2.5 (1.9,3.1)	2.8 (2,3.6)	3.0 (2.3,3.8)
Sikkim	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)
Tamil Nadu	6.8 (5.7,7.8)	11.0 (9.2,12.8)	14.4 (12.1,16.6)
Tripura	5.0 (3.8,6.3)	8.2 (5.8,10.6)	14.2 (11.5,16.8)
Uttar Pradesh	8.0 (7.4,8.6)	11.9 (10.8,12.9)	15.0 (13.9,16.1)
Uttarakhand	3.6 (2.2,5.1)	2.4 (0.6,4.2)	4.4 (2.9,6.0)
West Bengal	12.2 (11.1,13.3)	15.9 (14.2,17.7)	28.7 (26.6,30.9)

Table S3. State-specific cycling levels (%) in urban areas

State	2007	2014	2017
INDIA	7.8 (7.3,8.3)	8.4 (7.9,8.8)	8.3 (7.8,8.8)
Andaman & Nicobar Islands	0.0 (0.0,0.0)	0.3 (-0.3,0.8)	1.5 (-1.3,4.3)
Andhra Pradesh	8.3 (6.8,9.8)	9.7 (8.1,11.2)	7.4 (5.8,8.9)
Arunachal Pradesh	0.7 (-0.3,1.7)	6.6 (3.7,9.4)	6.0 (3.8,8.2)
Assam	8.3 (5.7,11)	13.4 (8.3,18.6)	10.5 (7.7,13.4)
Bihar	5.4 (3.1,7.8)	9.5 (7.3,11.6)	13.2 (10.4,15.9)
Chandigarh	14.4 (8.6,20.1)	14.7 (6.6,22.9)	7.1 (2.7,11.5)
Chhattisgarh	12.7 (8.6,16.9)	14.4 (10.1,18.7)	20.1 (16.0,24.2)
Dadra & Nagar Haveli	0.0 (0.0,0.0)	0.8 (-0.8,2.4)	0.6 (-0.4,1.7)
Daman & Diu	15.9 (7.7,24.1)	0.0 (0.0,0.0)	10.2 (-3.3,23.8)
Delhi	0.9 (0.2,1.6)	0.3 (-0.2,0.7)	3.7 (1.7,5.7)
Goa	0.8 (-0.3,1.9)	0.0 (0.0,0.0)	4.3 (-0.2,8.9)
Gujarat	11.0 (9,13)	9.2 (7.3,11)	11.8 (9.1,14.6)
Haryana	9.4 (6.5,12.2)	2.5 (1.2,3.8)	2.9 (1.5,4.4)
Himachal Pradesh	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)
Jammu & Kashmir	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.2 (-0.2,0.7)
Jharkhand	10.2 (6.3,14.1)	9 (5.5,12.5)	5.9 (3.5,8.3)
Karnataka	3.6 (2.2,4.9)	7.8 (6.3,9.3)	5.0 (3.6,6.5)
Kerala	5.5 (3.3,7.8)	5.6 (4.1,7.2)	5.2 (3.5,7.0)
Lakshadweep	38.1 (28.2,48.0)	55.8 (44.1,67.6)	63.0 (53.1,72.8)
Madhya Pradesh	6.6 (5.1,8.1)	7.5 (6.0,9.0)	5.9 (4.3,7.4)
Maharashtra	8.4 (7.1,9.8)	6.6 (5.5,7.8)	4.3 (3.1,5.4)
Manipur	17.8 (14.2,21.4)	6.0 (3.5,8.5)	7.0 (5.2,8.8)
Meghalaya	0.3 (-0.3,0.8)	1.3 (0.1,2.4)	0.0 (0.0,0.0)
Mizoram	0.0 (0.0,0.0)	0.4 (-0.4,1.1)	0.4 (-0.1,0.9)
Nagaland	0.1 (-0.1,0.4)	0.0 (0.0,0.0)	3.1 (-0.3,6.4)
Odisha	21.1 (16.8,25.3)	21.6 (17.5,25.6)	22.2 (17.1,27.4)
Puducherry	13.4 (8,18.9)	14.2 (8.5,19.9)	12.6 (7,18.2)
Punjab	11.2 (8.9,13.5)	9.0 (6.1,12)	4.2 (2.6,5.9)
Rajasthan	5.0 (3.4,6.5)	4.1 (2.8,5.4)	2.7 (1.1,4.2)
Sikkim	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.5 (-0.5,1.5)
Tamil Nadu	8.4 (6.8,10.0)	10.6 (8.8,12.4)	12.7 (9.9,15.5)
Tripura	5.8 (2.6,8.9)	6.0 (3.0,9.0)	9.4 (6.2,12.6)
Uttar Pradesh	8.6 (7,10.2)	6.7 (5.6,7.9)	8.4 (6.9,10.0)
Uttarakhand	7.4 (2.3,12.4)	2.5 (0.1,4.9)	3.6 (1.4,5.7)
West Bengal	8.1 (6.7,9.5)	16.7 (14.5,18.9)	18.5 (16.2,20.8)

Table S4. State-specific cycling levels in rural girls

State	2007	2014	2017
INDIA	4.5 (4.2,4.8)	8.4 (7.8,8.9)	11.0 (10.4,11.6)
Andaman & Nicobar Islands	0.0 (0.0,0.0)	0.2 (0.0,0.3)	1.4 (-0.5,3.3)
Andhra Pradesh	3.3 (2.4,4.3)	4.0 (2.4,5.5)	5.9 (3.9,7.9)
Arunachal Pradesh	0.9 (-0.4,2.2)	4.5 (1.0,8.0)	4.9 (3.2,6.6)
Assam	8.4 (6,10.8)	16.2 (13,19.5)	17.9 (15.2,20.6)
Bihar	1.7 (1.1,2.2)	7.7 (5.6,9.7)	13.5 (10.7,16.3)
Chandigarh	4.3 (-1.7,10.3)	0.0 (0.0,0.0)	0.0 (0.0,0.0)
Chhattisgarh	8.3 (5.7,10.8)	16.3 (10.8,21.7)	18.4 (15.6,21.2)
Dadra & Nagar Haveli	3.1 (-2.9,9)	0.9 (-0.9,2.8)	0.0 (0.0,0.0)
Daman & Diu	0.0 (0.0,0.0)	2.7 (-2.6,8)	5.7 (0.0,14.4)
Delhi	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)
Goa	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)
Gujarat	2.5 (1.4,3.7)	3.2 (1.7,4.6)	5.1 (2.6,7.5)
Haryana	1.8 (0.5,3)	1.5 (0.0,3.1)	3.3 (0.9,5.7)
Himachal Pradesh	0.3 (-0.2,0.7)	0.0 (0.0,0.0)	0.0 (0.0,0.0)
Jammu & Kashmir	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.1 (-0.1,0.3)
Jharkhand	4.0 (2.4,5.7)	10.6 (7.5,13.7)	8.6 (6.7,10.5)
Karnataka	2.8 (1.7,4.0)	7.8 (5.2,10.3)	4.9 (2.6,7.2)
Kerala	0.9 (0.2,1.6)	3.6 (1.7,5.5)	2.6 (0.9,4.4)
Lakshadweep	28.3 (12.6,44)	26.1 (9.1,43.1)	13.2 (-3.7,30.0)
Madhya Pradesh	5.2 (4.1,6.4)	9.6 (7.6,11.6)	10.2 (8.3,12.1)
Maharashtra	3.6 (2.5,4.6)	4.8 (3.4,6.3)	4.3 (2.9,5.8)
Manipur	12.4 (9.3,15.5)	5.6 (2.8,8.4)	4.9 (2.8,7.0)
Meghalaya	1.0 (0.0,1.9)	2.9 (0.8,5.0)	1.0 (0.1,1.8)
Mizoram	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)
Nagaland	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)
Odisha	7.7 (6.0,9.4)	19.0 (15.9,22)	16.1 (13.4,18.7)
Puducherry	12.6 (1.1,24)	1.3 (-1.3,3.8)	1.1 (-0.2,2.4)
Punjab	10.8 (7.9,13.7)	7.2 (4.0,10.5)	7.7 (4.7,10.7)
Rajasthan	0.8 (0.3,1.4)	2.2 (1.2,3.3)	2.0 (1.0,3.0)
Sikkim	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)
Tamil Nadu	6.4 (4.9,7.9)	8.7 (6.3,11.1)	14.0 (10.8,17.1)
Tripura	3.4 (1.9,4.9)	6.3 (3.1,9.4)	10.0 (6.7,13.3)
Uttar Pradesh	4.8 (4,5.5)	8.7 (7.4,10.0)	12.4 (10.8,14.0)
Uttarakhand	1.5 (0.2,2.9)	2.2 (-0.8,5.2)	4.3 (2.2,6.4)
West Bengal	9.1 (7.7,10.6)	15.4 (12.9,17.8)	27.6 (24.6,30.6)

Table S5. State-specific cycling levels in rural boys

State	2007	2014	2017
INDIA	7.7 (7.4,8.1)	11.6 (11.0,12.2)	13.3 (12.7,13.9)
Andaman & Nicobar Islands	1.1 (-1.1,3.4)	3.4 (-2.6,9.4)	1.7 (-0.7,4.1)
Andhra Pradesh	6.9 (5.7,8.1)	8.0 (5.8,10.2)	8.2 (6.3,10.2)
Arunachal Pradesh	0.9 (-0.3,2.1)	3.9 (0.2,7.6)	7.1 (5.1,9.0)
Assam	8.3 (6.3,10.3)	17.5 (14.5,20.5)	21.2 (18.6,23.8)
Bihar	4.5 (3.7,5.2)	12.4 (10.1,14.6)	14.8 (12.5,17.1)
Chandigarh	8 (-1.1,17.2)	1.9 (-0.1,3.9)	2.3 (-0.8,5.3)
Chhattisgarh	8.9 (6.5,11.3)	19.2 (14.1,24.3)	18.9 (16.3,21.5)
Dadra & Nagar Haveli	10.3 (2.4,18.1)	1.0 (-1.0,3.0)	0.0 (0.0,0.0)
Daman & Diu	0.0 (0.0,0.0)	9.4 (-0.6,19.4)	2.8 (-2.5,8.0)
Delhi	1.4 (-1.3,4.1)	0.0 (0.0,0.0)	9.7 (-6.5,25.9)
Goa	3.6 (-0.5,7.6)	1.7 (-1.7,5.1)	2.4 (-1.8,6.6)
Gujarat	5.8 (4.2,7.3)	3.8 (2.2,5.4)	5.6 (3.5,7.6)
Haryana	3.9 (2.3,5.6)	2.1 (0.8,3.5)	4.3 (2.3,6.2)
Himachal Pradesh	0.2 (-0.2,0.7)	0.0 (0.0,0.0)	0.3 (-0.2,0.7)
Jammu & Kashmir	0.2 (-0.2,0.6)	0.4 (-0.3,1.2)	0.2 (-0.1,0.6)
Jharkhand	8.8 (6.6,11.0)	18.3 (14.2,22.4)	13.1 (10.9,15.3)
Karnataka	3.2 (2.1,4.3)	12.7 (9.5,15.9)	4.9 (3.0,6.8)
Kerala	3.4 (2.0,4.8)	4.3 (2.3,6.2)	6.0 (3.6,8.3)
Lakshadweep	14.1 (2.2,25.9)	26.2 (10.2,42.1)	24.5 (6.7,42.3)
Madhya Pradesh	6.7 (5.6,7.9)	12.7 (10.5,14.9)	11.4 (9.5,13.3)
Maharashtra	7.2 (6.0,8.5)	7.4 (5.8,9.0)	7.1 (5.3,8.8)
Manipur	15.0 (11.9,18)	7.4 (4.6,10.3)	5.8 (3.9,7.8)
Meghalaya	5.0 (2.8,7.1)	3.2 (0.8,5.5)	0.9 (-0.1,1.9)
Mizoram	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.2 (-0.2,0.7)
Nagaland	0.6 (-0.2,1.4)	0.1 (-0.1,0.3)	0.0 (0.0,0.0)
Odisha	9.0 (7.3,10.6)	20.4 (17.5,23.3)	21.1 (18.3,24.0)
Puducherry	9.1 (2.0,16.1)	10.5 (-2.1,23.2)	3.2 (-1.1,7.4)
Punjab	14.0 (11.2,16.9)	6.7 (3.8,9.6)	11.2 (7.9,14.5)
Rajasthan	3.7 (2.8,4.6)	3.2 (2.1,4.3)	3.9 (2.8,5.0)
Sikkim	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)
Tamil Nadu	7.2 (5.7,8.7)	13.0 (10.4,15.7)	14.7 (11.6,17.9)
Tripura	6.5 (4.5,8.5)	9.4 (6.1,12.8)	17.5 (13.6,21.4)
Uttar Pradesh	10.6 (9.6,11.5)	14.4 (12.8,16.0)	17.1 (15.6,18.7)
Uttarakhand	5.6 (3.1,8.0)	2.5 (0.4,4.7)	4.6 (2.3,6.9)
West Bengal	15.0 (13.3,16.7)	16.5 (14.0,19.0)	29.9 (26.8,32.9)

Table S6. State-specific cycling levels in urban girls

State	2007	2014	2017
INDIA	5.9 (5.3,6.5)	6.3 (5.8,6.9)	6.8 (6.2,7.5)
Andaman & Nicobar Islands	0.0 (0.0,0.0)	0.6 (-0.6,1.7)	0.0 (0.0,0.0)
Andhra Pradesh	6.2 (4.4,7.9)	7.8 (5.6,9.9)	5.6 (3.6,7.5)
Arunachal Pradesh	1.5 (-0.6,3.5)	6.8 (2.5,11.1)	6.3 (2.5,10.2)
Assam	7.1 (3.4,10.8)	14.6 (6.2,22.9)	10.2 (5.5,14.9)
Bihar	2.7 (1.0,4.3)	5.6 (3.3,7.8)	11.8 (8.3,15.2)
Chandigarh	4.4 (-0.5,9.3)	15.4 (2.8,27.9)	6.1 (-0.1,12.2)
Chhattisgarh	14.3 (7.2,21.5)	13.6 (7.3,19.9)	16.6 (11.3,21.9)
Dadra & Nagar Haveli	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)
Daman & Diu	12.3 (1.1,23.5)	0.0 (0.0,0.0)	10.1 (-9.2,29.4)
Delhi	0.0 (0.0,0.0)	0.0 (0.0,0.0)	1.6 (-0.2,3.5)
Goa	1.0 (-1.0,3.0)	0.0 (0.0,0.0)	3.6 (-3.2,10.5)
Gujarat	9.5 (6.7,12.3)	5.6 (3.4,7.8)	9.6 (5.4,13.8)
Haryana	5.9 (2.5,9.3)	3.4 (1.0,5.8)	1.7 (0.2,3.2)
Himachal Pradesh	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)
Jammu & Kashmir	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.6 (-0.6,1.7)
Jharkhand	7.1 (1.0,13.2)	4.9 (1.5,8.2)	3.9 (1.7,6.2)
Karnataka	2.7 (0.9,4.5)	6.2 (4.3,8.1)	3.1 (1.4,4.8)
Kerala	3.1 (0.7,5.6)	4.0 (2.3,5.7)	4.5 (2.1,6.8)
Lakshadweep	26.9 (14.1,39.6)	36.4 (20.3,52.5)	69.2 (54.7,83.8)
Madhya Pradesh	5.6 (3.4,7.7)	7.0 (4.9,9.2)	3.6 (1.9,5.3)
Maharashtra	6.0 (4.2,7.8)	4.0 (2.8,5.2)	4.2 (2.4,5.9)
Manipur	17.0 (11.5,22.6)	2.4 (0.5,4.2)	6.7 (4.0,9.4)
Meghalaya	0.0 (0.0,0.0)	1.1 (-0.4,2.5)	0.0 (0.0,0.0)
Mizoram	0.0 (0.0,0.0)	0.8 (-0.8,2.4)	0.0 (0.0,0.0)
Nagaland	0.3 (-0.3,0.9)	0.0 (0.0,0.0)	4.3 (-1.5,10.1)
Odisha	21.8 (14.7,28.8)	23.5 (17.8,29.3)	21.7 (14.2,29.2)
Puducherry	11.2 (4.1,18.3)	8.8 (3.1,14.4)	7.8 (0.1,15.4)
Punjab	6.8 (4.3,9.4)	6.2 (2.6,9.9)	5.1 (1.8,8.3)
Rajasthan	2.4 (0.9,3.9)	3.4 (1.7,5.2)	2.3 (-0.2,4.8)
Sikkim	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)
Tamil Nadu	8.0 (5.7,10.3)	7.3 (5.2,9.3)	10.7 (7.9,13.6)
Tripura	0.7 (-0.3,1.7)	4.7 (-0.2,9.7)	7.8 (3.2,12.5)
Uttar Pradesh	6.0 (4.2,7.8)	4.2 (2.9,5.5)	7.1 (4.8,9.4)
Uttarakhand	2.3 (0.0,4.5)	2.6 (-0.7,5.9)	2.4 (-0.1,4.8)
West Bengal	5.5 (3.8,7.1)	13.3 (10.5,16.1)	14.6 (11.6,17.7)

Table S7. State-specific cycling levels in urban boys

State	2007	2014	2017
INDIA	9.4 (8.8,10.1)	10.1 (9.5,10.8)	9.4 (8.6,10.1)
Andaman & Nicobar Islands	0.0 (0.0,0.0)	0.0 (0.0,0.0)	2.5 (-2.1,7.1)
Andhra Pradesh	10.3 (7.9,12.7)	11.3 (9.1,13.5)	8.7 (6.4,11.0)
Arunachal Pradesh	0.0 (0.0,0.0)	6.4 (2.3,10.5)	5.8 (3.1,8.5)
Assam	9.4 (5.6,13.2)	12.3 (6.6,17.9)	10.8 (7.2,14.3)
Bihar	7.5 (3.7,11.3)	12.9 (9.3,16.4)	14.0 (10.1,18.0)
Chandigarh	19.7 (11.6,27.9)	14.1 (3.6,24.6)	7.9 (1.6,14.1)
Chhattisgarh	11.2 (7.2,15.1)	15.0 (9,21.1)	22.9 (16.9,28.8)
Dadra & Nagar Haveli	0.0 (0.0,0.0)	1.8 (-1.7,5.3)	1.3 (-0.8,3.4)
Daman & Diu	18.5 (7.0,30.0)	0.0 (0.0,0.0)	10.3 (-8.7,29.3)
Delhi	1.5 (0.3,2.7)	0.5 (-0.3,1.3)	5.0 (1.9,8.1)
Goa	0.6 (-0.6,1.8)	0.0 (0.0,0.0)	4.8 (-1.2,10.8)
Gujarat	12.1 (9.3,14.9)	12.1 (9.3,14.9)	13.2 (9.6,16.9)
Haryana	11.7 (7.6,15.9)	1.8 (0.3,3.3)	3.7 (1.5,5.9)
Himachal Pradesh	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)
Jammu & Kashmir	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)
Jharkhand	12.7 (7.6,17.8)	13.6 (7.3,19.8)	7.4 (3.6,11.1)
Karnataka	4.4 (2.5,6.3)	9.3 (7.1,11.6)	6.7 (4.4,9.0)
Kerala	8.1 (4.2,12.0)	7.4 (4.7,10.0)	5.9 (3.4,8.4)
Lakshadweep	46.5 (32.6,60.3)	74.8 (60.3,89.4)	58.3 (45.3,71.4)
Madhya Pradesh	7.4 (5.3,9.5)	7.9 (5.9,10.0)	7.5 (5.2,9.8)
Maharashtra	10.6 (8.7,12.6)	8.6 (6.8,10.4)	4.3 (2.8,5.8)
Manipur	18.4 (13.6,23.2)	8.9 (4.8,13.1)	7.3 (4.7,9.8)
Meghalaya	0.7 (-0.7,2.1)	1.5 (-0.4,3.3)	0.0 (0.0,0.0)
Mizoram	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.9 (-0.1,1.9)
Nagaland	0.0 (0.0,0.0)	0.0 (0.0,0.0)	1.9 (-1.8,5.7)
Odisha	20.6 (15.4,25.7)	19.5 (13.7,25.2)	22.7 (15.6,29.7)
Puducherry	15.4 (7.4,23.5)	17.9 (9.2,26.7)	16.0 (8.2,23.7)
Punjab	15.0 (11.3,18.6)	11.2 (6.9,15.5)	3.7 (1.9,5.4)
Rajasthan	6.9 (4.5,9.3)	4.7 (2.8,6.6)	2.9 (0.9,5.0)
Sikkim	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.9 (-0.9,2.8)
Tamil Nadu	8.8 (6.6,11.0)	14.1 (11.1,17.1)	14.3 (9.8,18.7)
Tripura	10 (4.4,15.6)	7.0 (3.3,10.8)	10.7 (6.2,15.2)
Uttar Pradesh	10.7 (8.2,13.2)	8.9 (7.1,10.7)	9.5 (7.4,11.6)
Uttarakhand	12.5 (3.1,21.9)	2.4 (-1.0,5.8)	4.4 (1.2,7.5)
West Bengal	10.2 (8.1,12.3)	19.7 (16.5,23.0)	22.2 (18.7,25.7)

Table S8. Girls representation in cycling and cycling levels in rural India across states and years

State	2007		2014		2017	
	Mode share of cycling (%)	Proportion of girls among cyclists (%)	Mode share of cycling (%)	Proportion of girls among cyclists (%)	Mode share of cycling (%)	Proportion of girls among cyclists (%)
INDIA	6.3 (6.0,6.5)	31.8 (29.9,33.6)	10.1 (9.7,10.5)	37.6 (35.6,39.7)	12.3 (11.8,12.7)	39.9 (38,41.7)
Andaman & Nicobar Islands	0.6 (-0.6,1.7)	0.0 (0.0,0.0)	1.6 (-1.1,4.2)	5.6 (-5.7,16.9)	1.6 (0.0,3.1)	45.3 (-3.1,93.8)
Andhra Pradesh	5.2 (4.4,6.0)	30.4 (23.3,37.6)	6.2 (4.8,7.6)	28.3 (18.3,38.4)	7.1 (5.7,8.5)	39.1 (29.0,49.2)
Arunachal Pradesh	0.9 (0.0,1.8)	48.6 (0.0,97.3)	4.2 (1.7,6.7)	53.6 (22.1,85.1)	6.1 (4.8,7.3)	36.6 (26.1,47.1)
Assam	8.3 (6.8,9.9)	41.9 (32.5,51.3)	17.0 (14.8,19.2)	39.6 (32.7,46.6)	19.8 (17.9,21.7)	38.4 (33.3,43.4)
Bihar	3.4 (2.8,3.9)	19.3 (13.1,25.5)	10.3 (8.7,11.8)	33.1 (25.7,40.6)	14.3 (12.5,16.1)	36.8 (30.2,43.5)
Chandigarh	6.3 (0.6,11.9)	32.0 (-7.3,71.4)	1.0 (0.0,2.0)	0.0 (0.0,0.0)	1.3 (-0.3,2.9)	0.0 (0.0,0.0)
Chhattisgarh	8.6 (6.8,10.4)	43.0 (32.4,53.6)	17.8 (14.1,21.5)	43.2 (31.3,55.1)	18.7 (16.8,20.6)	45.1 (39.7,50.5)
Dadra & Nagar Haveli	7.8 (2.2,13.3)	13.8 (-11.5,39.1)	1.0 (-0.4,2.3)	50.0 (-19.4,119.4)	0.0 (0.0,0.0)	0.0 (0.0,0.0)
Daman & Diu	0.0 (0.0,0.0)	0.0 (0.0,0.0)	5.8 (0.4,11.2)	24.9 (-16.9,66.7)	4.3 (-0.8,9.4)	69.3 (20.3,118.3)
Delhi	0.8 (-0.8,2.4)	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)	4.2 (-2.8,11.1)	0.0 (0.0,0.0)
Goa	1.8 (-0.2,3.8)	0.0 (0.0,0.0)	0.5 (-0.4,1.4)	0.0 (0.0,0.0)	1.1 (-0.8,3)	0.0 (0.0,0.0)
Gujarat	4.3 (3.3,5.3)	25.9 (15.5,36.3)	3.5 (2.4,4.6)	39.7 (24.5,54.9)	5.3 (3.8,6.9)	44.2 (28.9,59.6)
Haryana	3.0 (1.9,4.1)	24.3 (9.3,39.4)	1.9 (0.9,2.9)	37.4 (10.5,64.3)	3.9 (2.4,5.4)	33.1 (14.0,52.1)
Himachal Pradesh	0.2 (-0.1,0.6)	47.3 (-21.8,116.4)	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.1 (-0.1,0.4)	0.0 (0.0,0.0)
Jammu & Kashmir	0.1 (-0.1,0.3)	0.0 (0.0,0.0)	0.2 (-0.2,0.7)	0.0 (0.0,0.0)	0.2 (0.0,0.4)	26.6 (-20.9,74.0)
Jharkhand	6.7 (5.3,8.1)	26.6 (17.0,36.3)	14.9 (12.2,17.6)	31.0 (22.6,39.4)	11.0 (9.5,12.5)	35.5 (28.8,42.2)
Karnataka	3.0 (2.3,3.8)	43.6 (30.6,56.7)	10.3 (8.2,12.4)	36.2 (26,46.3)	4.9 (3.4,6.4)	41.0 (26,56.1)
Kerala	2.2 (1.4,3.0)	20.4 (6.5,34.3)	3.9 (2.6,5.3)	46.0 (28.2,63.7)	4.5 (3.0,6.1)	25.6 (10.9,40.4)
Lakshadweep	21.2 (11.2,31.2)	67.0 (42.2,91.8)	26.1 (14.5,37.8)	49.3 (23.6,74.9)	15.9 (2.4,29.4)	62.3 (26.3,98.2)
Madhya Pradesh	6.1 (5.3,6.9)	37.6 (30.8,44.4)	11.2 (9.7,12.7)	40.7 (33.7,47.7)	10.9 (9.5,12.2)	42.7 (36.3,49.1)
Maharashtra	5.5 (4.7,6.3)	30.2 (22.9,37.5)	6.2 (5.2,7.3)	34.1 (25.5,42.6)	5.8 (4.7,7.0)	33.5 (24.1,42.9)
Manipur	13.8 (11.7,16.0)	39.6 (31.4,47.9)	6.7 (4.7,8.7)	34.6 (20.0,49.2)	5.4 (4.0,6.9)	39.0 (26.0,52.0)
Meghalaya	3.0 (1.8,4.2)	15.9 (1.7,30.0)	3.0 (1.5,4.6)	46.3 (20.0,72.6)	0.9 (0.3,1.6)	50.6 (14.9,86.3)
Mizoram	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.1 (-0.1,0.4)	0.0 (0.0,0.0)
Nagaland	0.3 (-0.1,0.8)	0.0 (0.0,0.0)	0.1 (-0.1,0.2)	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)
Odisha	8.4 (7.2,9.5)	43.4 (36.2,50.7)	19.7 (17.6,21.8)	45.7 (39.8,51.6)	18.8 (16.8,20.8)	39.4 (33.8,44.9)
Puducherry	10.3 (4.2,16.4)	43.2 (11.9,74.5)	6.5 (-0.9,13.8)	8.6 (-9.7,26.9)	2.1 (-0.1,4.3)	27.1 (-7.0,61.2)
Punjab	12.7 (10.6,14.7)	35.9 (27.5,44.2)	7.0 (4.8,9.1)	47.9 (32,63.9)	9.7 (7.4,12.0)	33.3 (22.1,44.5)
Rajasthan	2.5 (1.9,3.1)	13.1 (5.0,21.2)	2.8 (2.0,3.6)	33.9 (20.8,47.0)	3.0 (2.3,3.8)	30.0 (17.8,42.1)
Sikkim	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)
Tamil Nadu	6.8 (5.7,7.8)	45.8 (37.7,53.9)	11.0 (9.2,12.8)	36.4 (28.1,44.7)	14.4 (12.1,16.6)	46.2 (37.9,54.6)
Tripura	5.0 (3.8,6.3)	31.6 (19.7,43.5)	8.2 (5.8,10.6)	30.5 (17.1,44.0)	14.2 (11.5,16.8)	31.4 (22.2,40.6)
Uttar Pradesh	8.0 (7.4,8.6)	26.2 (22.5,29.8)	11.9 (10.8,12.9)	32.9 (28.6,37.2)	15.0 (13.9,16.1)	36.6 (32.7,40.6)
Uttarakhand	3.6 (2.2,5.1)	20.0 (4.0,35.9)	2.4 (0.6,4.2)	37.8 (-0.4,76.0)	4.4 (2.9,6.0)	43.7 (25.9,61.6)
West Bengal	12.2 (11.1,13.3)	36.0 (31.3,40.7)	15.9 (14.2,17.7)	48.8 (42.8,54.8)	28.7 (26.6,30.9)	48.1 (43.7,52.5)

Table S9. Girls representation in cycling and cycling levels in urban India across states and years

State	2007		2014		2017	
	Mode share of cycling (%)	Proportion of girls among cyclists (%)	Mode share of cycling (%)	Proportion of girls among cyclists (%)	Mode share of cycling (%)	Proportion of girls among cyclists (%)
INDIA	7.8 (7.3,8.3)	34.4 (31.5,37.3)	8.4 (7.9,8.8)	35.3 (32.8,37.8)	8.3 (7.8,8.8)	36 (32.9,39)
Andaman & Nicobar Islands	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.3 (-0.3,0.8)	100.0 (100.0,100.0)	1.5 (-1.3,4.3)	0.0 (0.0,0.0)
Andhra Pradesh	8.3 (6.8,9.8)	35.8 (27.1,44.6)	9.7 (8.1,11.2)	36.6 (28.4,44.9)	7.4 (5.8,8.9)	32.2 (22.9,41.6)
Arunachal Pradesh	0.7 (-0.3,1.7)	100.0 (100.0,100.0)	6.6 (3.7,9.4)	45.9 (21.9,69.9)	6.0 (3.8,8.2)	40.0 (21.2,58.7)
Assam	8.3 (5.7,11.0)	40.3 (23.9,56.7)	13.4 (8.3,18.6)	55.8 (36.6,75.1)	10.5 (7.7,13.4)	42.5 (28.2,56.8)
Bihar	5.4 (3.1,7.8)	21.0 (7.4,34.6)	9.5 (7.3,11.6)	27.4 (17.3,37.6)	13.2 (10.4,15.9)	35.0 (25.1,44.8)
Chandigarh	14.4 (8.6,20.1)	10.9 (-0.8,22.6)	14.7 (6.6,22.9)	51.5 (21.4,81.7)	7.1 (2.7,11.5)	39.1 (7.7,70.4)
Chhattisgarh	12.7 (8.6,16.9)	55.9 (40,71.9)	14.4 (10.1,18.7)	42.8 (26.6,59)	20.1 (16,24.2)	36.4 (26.1,46.7)
Dadra & Nagar Haveli	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.8 (-0.8,2.4)	0.0 (0.0,0.0)	0.6 (-0.4,1.7)	0.0 (0.0,0.0)
Daman & Diu	15.9 (7.7,24.1)	32.3 (6.0,58.5)	0.0 (0.0,0.0)	0.0 (0.0,0.0)	10.2 (-3.3,23.8)	50.0 (-19.4,119.4)
Delhi	0.9 (0.2,1.6)	0.0 (0.0,0.0)	0.3 (-0.2,0.7)	0.0 (0.0,0.0)	3.7 (1.7,5.7)	17.9 (-1.4,37.2)
Goa	0.8 (-0.3,1.9)	58.3 (-9.1,125.7)	0.0 (0.0,0.0)	0.0 (0.0,0.0)	4.3 (-0.2,8.9)	32.7 (-18.4,83.7)
Gujarat	11.0 (9.0,13.0)	36.4 (27.6,45.3)	9.2 (7.3,11.0)	27.6 (18.1,37.0)	11.8 (9.1,14.6)	31.4 (19.6,43.1)
Haryana	9.4 (6.5,12.2)	26.1 (12.7,39.4)	2.5 (1.2,3.8)	59.4 (32.9,85.9)	2.9 (1.5,4.4)	22.6 (3.6,41.5)
Himachal Pradesh	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)
Jammu & Kashmir	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.2 (-0.2,0.7)	100.0 (100.0,100.0)
Jharkhand	10.2 (6.3,14.1)	30.7 (9.4,52.1)	9.0 (5.5,12.5)	28.6 (11.1,46.0)	5.9 (3.5,8.3)	28.5 (12.4,44.5)
Karnataka	3.6 (2.2,4.9)	36.1 (17.2,54.9)	7.8 (6.3,9.3)	37.5 (28.0,46.9)	5.0 (3.6,6.5)	29.0 (15.6,42.3)
Kerala	5.5 (3.3,7.8)	29.0 (9.5,48.5)	5.6 (4.1,7.2)	37.7 (24.4,51.0)	5.2 (3.5,7.0)	41.3 (24.5,58.1)
Lakshadweep	38.1 (28.2,48.0)	30.1 (15.9,44.3)	55.8 (44.1,67.6)	32.2 (17.1,47.2)	63.0 (53.1,72.8)	46.8 (32.8,60.7)
Madhya Pradesh	6.6 (5.1,8.1)	36.9 (25.4,48.4)	7.5 (6.0,9.0)	43.4 (33.2,53.6)	5.9 (4.3,7.4)	26.1 (14.9,37.3)
Maharashtra	8.4 (7.1,9.8)	33.7 (25.5,42.0)	6.6 (5.5,7.8)	25.6 (18.4,32.8)	4.3 (3.1,5.4)	43.2 (29.8,56.7)
Manipur	17.8 (14.2,21.4)	41.3 (30.2,52.4)	6.0 (3.5,8.5)	17.2 (4.1,30.4)	7.0 (5.2,8.8)	41.6 (28.3,55.0)
Meghalaya	0.3 (-0.3,0.8)	0.0 (0.0,0.0)	1.3 (0.1,2.4)	42.3 (-3,87.6)	0.0 (0.0,0.0)	0.0 (0.0,0.0)
Mizoram	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.4 (-0.4,1.1)	100.0 (100.0,100.0)	0.4 (-0.1,0.9)	0.0 (0.0,0.0)
Nagaland	0.1 (-0.1,0.4)	100.0 (100.0,100.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)	3.1 (-0.3,6.4)	66.7 (13.3,120.1)
Odisha	21.1 (16.8,25.3)	42.5 (30.9,54.1)	21.6 (17.5,25.6)	56.0 (46.1,66.0)	22.2 (17.1,27.4)	42.0 (28.8,55.1)
Puducherry	13.4 (8.0,18.9)	39.3 (18.5,60.0)	14.2 (8.5,19.9)	25.4 (9.5,41.3)	12.6 (7.0,18.2)	25.3 (3.3,47.3)
Punjab	11.2 (8.9,13.5)	28.5 (19,37.9)	9.0 (6.1,12.0)	30.2 (14.8,45.6)	4.2 (2.6,5.9)	48.9 (28.5,69.3)
Rajasthan	5.0 (3.4,6.5)	20.3 (8.3,32.3)	4.1 (2.8,5.4)	38.5 (22.8,54.2)	2.7 (1.1,4.2)	36.3 (6.0,66.6)
Sikkim	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.5 (-0.5,1.5)	0.0 (0.0,0.0)
Tamil Nadu	8.4 (6.8,10.0)	46.6 (36.7,56.5)	10.6 (8.8,12.4)	34.6 (26.3,42.9)	12.7 (9.9,15.5)	37.3 (26.9,47.8)
Tripura	5.8 (2.6,8.9)	5.4 (-2.6,13.3)	6.0 (3.0,9.0)	34.6 (7.1,62.1)	9.4 (6.2,12.6)	38.1 (20.4,55.8)
Uttar Pradesh	8.6 (7.0,10.2)	32.0 (23.2,40.8)	6.7 (5.6,7.9)	28.5 (20.6,36.4)	8.4 (6.9,10.0)	37.3 (27.7,47.0)
Uttarakhand	7.4 (2.3,12.4)	15.5 (-1.7,32.6)	2.5 (0.1,4.9)	49.6 (1.8,97.3)	3.6 (1.4,5.7)	27.3 (2.2,52.4)
West Bengal	8.1 (6.7,9.5)	30.3 (22.2,38.3)	16.7 (14.5,18.9)	37.9 (30.9,44.8)	18.5 (16.2,20.8)	38.8 (32.0,45.6)

Table S10. Gender-specific cycling levels in rural areas by age

Age (years)	Girls			Boys		
	2007	**2014**	**2017**	**2007**	**2014**	**2017**
5-10	0.7 (0.6,0.9)	1.4 (1.1,1.8)	2.0 (1.6,2.3)	1.1 (0.9,1.3)	2.4 (1.9,2.9)	2.5 (2.1,2.9)
11-13	5.0 (4.4,5.6)	8.1 (7.1,9.2)	10.5 (9.3,11.7)	7.2 (6.5,7.8)	10.9 (9.8,12.0)	13.2 (12.1,14.3)
14-15	12.7 (11.3,14.0)	19.2 (17.3,21.2)	25.3 (23.1,27.4)	19.7 (18.3,21.1)	25.8 (23.8,27.8)	28.6 (26.6,30.6)
16-17	16.0 (14.1,18.0)	23.7 (21,26.3)	28.6 (25.9,31.2)	29.7 (27.7,31.7)	30.7 (28.2,33.3)	35.3 (32.8,37.9)

Table S11. Gender-specific cycling levels in urban areas by age

Age (years)	Girls			Boys		
	2007	**2014**	**2017**	**2007**	**2014**	**2017**
5-10	1.7 (1.2,2.2)	1.9 (1.4,2.4)	2.1 (1.6,2.7)	2.2 (1.8,2.6)	2.5 (1.9,3.0)	2.9 (2.2,3.7)
11-13	6.8 (5.5,8.1)	5.8 (4.8,6.8)	7.0 (5.6,8.4)	9.1 (7.8,10.4)	11.6 (10.2,13.0)	10.2 (8.8,11.7)
14-15	10.4 (8.4,12.4)	12.7 (10.9,14.5)	12.4 (10.4,14.4)	19.8 (17.4,22.3)	19.2 (17.1,21.3)	17.1 (14.8,19.5)
16-17	15.1 (12.6,17.6)	14.2 (12.0,16.4)	14.6 (11.9,17.2)	26.0 (23.0,29.0)	20.2 (17.8,22.6)	18.4 (15.6,21.2)

Table S12. Gender-specific cycling levels in rural areas by distance to school

Distance to school (km)	Girls			Boys		
	2007	**2014**	**2017**	**2007**	**2014**	**2017**
d<1km	0.4 (0.3,0.6)	1.5 (1.2,1.8)	1.8 (1.4,2.1)	0.5 (0.4,0.7)	2.0 (1.7,2.4)	2.6 (2.2,3.0)
1km<=d <2kms	5.4 (4.5,6.3)	12.0 (10.4,13.5)	20.5 (18.4,22.6)	8.4 (7.4,9.4)	16.0 (14.1,17.9)	22.3 (20.4,24.3)
2km<=d <3kms	16.0 (14.1,17.9)	28.2 (25.2,31.3)	37.5 (34.2,40.8)	24.4 (22.5,26.3)	32.6 (29.8,35.4)	42.5 (39.4,45.6)
3km<=d <5kms	26.1 (23.2,28.9)	29.8 (26.2,33.4)	36.9 (32.8,40.9)	36.8 (34.1,39.5)	35.4 (31.9,38.9)	40.4 (36.9,43.9)
d>=5km	17.4 (15.1,19.7)	13.8 (11.7,16.0)	16.1 (14,18.2)	29.0 (26.8,31.1)	22.0 (19.7,24.2)	20.8 (18.9,22.6)

Table S13. Gender-specific cycling levels in urban areas by distance to school

Distance to school (km)	Girls			Boys		
	2007	**2014**	**2017**	**2007**	**2014**	**2017**
d<1km	2.1 (1.6,2.6)	3.0 (2.5,3.6)	3.3 (2.7,3.9)	3.5 (3,4.1)	5 (4.3,5.6)	4.2 (3.5,4.9)
1km<=d <2kms	11.9 (10.2,13.7)	12.4 (10.9,13.9)	15.0 (12.9,17.1)	18.0 (16.1,20.0)	17.9 (16.2,19.7)	20.8 (18.3,23.3)
2km<=d <3kms	16.4 (12.8,20.0)	13.2 (10.7,15.7)	11.5 (8.5,14.4)	23.1 (19.4,26.7)	20.5 (17.6,23.5)	18.5 (15.8,21.3)
3km<=d <5kms	16.2 (12.3,20.2)	7.4 (5.2,9.6)	7.1 (4.7,9.4)	26.5 (21.6,31.4)	12.9 (9.9,15.8)	7.3 (5.1,9.4)
d>=5km	4.9 (2.6,7.2)	2.9 (1.7,4.1)	2.2 (1.2,3.3)	10.7 (7.6,13.9)	6.5 (4.8,8.2)	3.7 (2.5,4.9)

Table S14. Grade-specific distance distribution in rural areas

Grade enrolled	2007					2017				
	d<1 km	[1,2)	[2,3)	[3,5)	d>=5 km	d<1 km	[1,2)	[2,3)	[3,5)	d>=5 km
Primary	83.3	9.5	3.5	1.5	2.2	75.4	10.9	4.1	2.5	7.1
Upper primary/middle	55.0	18.8	12.4	7.0	6.7	58.3	18.3	8.7	5.4	9.2
Secondary	33.7	17.5	17.0	14.6	17.3	33.5	20.8	15.9	10.6	19.1
Higher Secondary	17.0	12.6	14.1	13.6	42.8	19.5	15.5	14.9	11.9	38.2

Table S15. Grade-specific distance distribution in urban areas

Grade enrolled	2007					2017				
	d<1 km	[1,2)	[2,3)	[3,5)	d>=5 km	d<1 km	[1,2)	[2,3)	[3,5)	d>=5 km
Primary	72.9	15.0	6.4	2.7	3.0	59.1	18.7	9.7	5.8	6.7
Upper primary/middle	61.6	20.9	7.6	5.2	4.7	53.1	21.2	10.8	7.2	7.7
Secondary	51.2	24.4	10.2	7.4	6.8	44.2	25.3	11.7	8.4	10.4
Higher Secondary	35.7	25.6	14.6	10.2	13.9	30.8	22.6	14.3	11.7	20.6

Table S16. Gender-specific cycling levels in rural areas by income quintile

Monthly expenditure per person (quintile)	Girls			Boys		
	2007	2014	2017	2007	2014	2017
Q1	3.3 (2.9,3.8)	7.2 (6.4,8.0)	12.1 (10.9,13.2)	5.6 (5.1,6.1)	9.8 (8.9,10.8)	14.0 (12.9,15.1)
Q2	3.7 (3.1,4.2)	9.1 (8.0,10.2)	11.1 (9.9,12.2)	7.2 (6.5,7.8)	12.3 (11.2,13.5)	14.0 (12.9,15.2)
Q3	5.7 (5.0,6.4)	9.1 (7.8,10.4)	10.2 (9.0,11.4)	8.9 (8.1,9.7)	14.6 (12.9,16.2)	13.5 (12.2,14.8)
Q4	6.5 (5.6,7.5)	8.7 (7.2,10.3)	9.3 (7.6,11.0)	10.3 (9.3,11.4)	10.6 (9.2,11.9)	10.0 (8.7,11.3)
Q5	6.5 (4.9,8.0)	8.9 (5.9,11.8)	10.7 (6.5,14.9)	11.9 (10.1,13.8)	10.1 (7.3,12.8)	11.1 (8.2,14.1)

Table S17. Gender-specific cycling levels in urban areas by income quintile

Monthly expenditure per person (quintile)	Girls			Boys		
	2007	2014	2017	2007	2014	2017
Q1	2.8 (1.5,4.2)	5.0 (3.6,6.4)	6.8 (4.8,8.8)	2.8 (1.5,4.1)	6.7 (5.0,8.4)	9.0 (6.8,11.2)
Q2	3.0 (1.5,4.4)	5.3 (4.1,6.4)	6.6 (5.0,8.3)	3.4 (2.2,4.5)	7.8 (6.4,9.2)	9.5 (7.5,11.4)
Q3	4.1 (2.9,5.3)	6.9 (5.7,8.2)	8.3 (6.2,10.3)	5.8 (4.7,7.0)	9.3 (7.9,10.8)	9.1 (7.5,10.7)
Q4	5.6 (4.6,6.7)	6.6 (5.5,7.7)	7.7 (6.4,8.9)	9.0 (7.8,10.2)	11.3 (10.0,12.6)	9.3 (8.1,10.6)
Q5	8.8 (7.6,9.9)	7.0 (5.8,8.1)	5.4 (4.5,6.4)	14.4 (13.0,15.8)	12.0 (10.6,13.4)	9.6 (8.1,11.1)

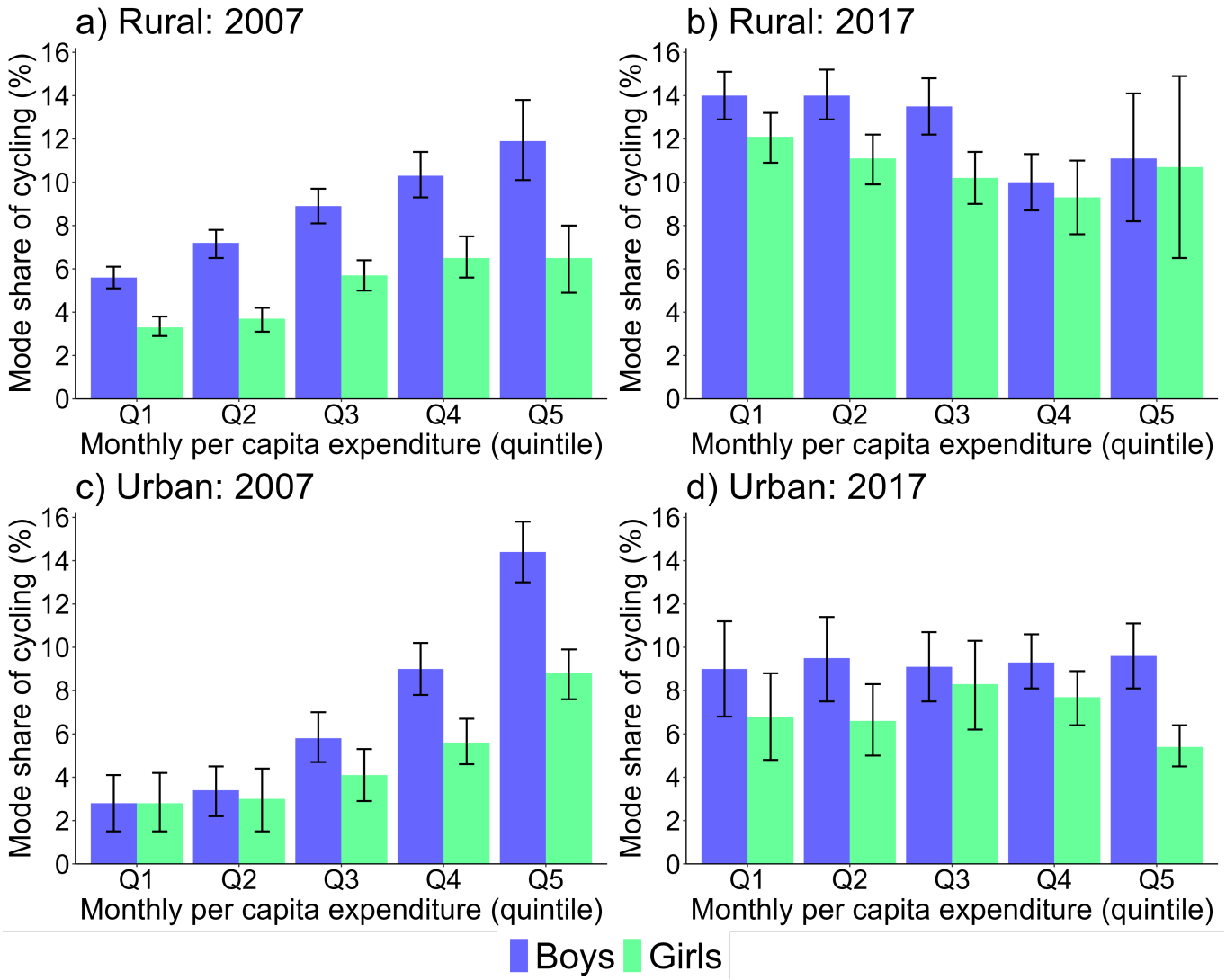

Fig S1. Cycling levels by monthly expenditure per person (quintile)

Table S18. Percentage point change in cycling levels over the decade and BDS implementation across states

State	BDS starting year (a)	R/U	G/B	Years of BDS 2017-(a)	Change in cycling levels			
					RG	RB	UG	UB
Gujarat	1995	R+U	F	22	2.6	-0.2	0.1	1.1
Tamil Nadu	2001	R	F+M	16	7.6	7.5	2.7	5.5
Chhattisgarh	2004	R+U	F	13	10.1	10.0	2.3	11.7
Madhya Pradesh	2004	R	F+M	13	5.0	4.7	-2.0	0.1
Jharkhand	2005	R+U	F+M	12	4.6	4.3	-3.2	-5.3
Bihar	2006	R+U	F	11	11.8	10.3	9.1	6.5
Karnataka	2006	R	F+M	11	2.1	1.7	0.4	2.3
Kerala	2006	R+U	F+M	11	1.7	2.6	1.4	-2.2
Rajasthan	2007	R+U	F	10	1.2	0.2	-0.1	-4.0
Haryana	2008	R	F+M	9	1.5	0.4	-4.2	-8.0
Odisha	2011	R+U	F+M	6	8.4	12.1	-0.1	2.1
Punjab	2011	R+U	F	6	-3.1	-2.8	-1.7	-11.3
Assam	2012	R+U	F	5	9.5	12.9	3.1	1.4
Tripura	2013	R+U	F	4	6.6	11.0	7.1	0.7
Uttarakhand	2013	R+U	F	4	2.8	-1.0	0.1	-8.1
Dadra & Nagar Haveli	2014	R+U	F	3	-3.1	-10.3	0.0	1.3
Daman & Diu	2014	R+U	F	3	5.7	2.8	-2.2	-8.2
Puducherry	2015	R+U	F+M	2	-11.5	-5.9	-3.4	0.6
West Bengal	2015	R+U	F+M	2	18.5	14.9	9.1	12.0
Uttar Pradesh	2016	R+U	F+M	1	7.6	6.5	1.1	-1.2
Andaman & Nicobar Islands	Absent			0	1.4	0.6	0.0	2.5
Andhra Pradesh	Absent			0	2.6	1.3	-0.6	-1.6
Arunachal Pradesh	Absent			0	4.0	6.2	4.8	5.8
Chandigarh	Absent			0	-4.3	-5.7	1.7	-11.8
Delhi	Absent			0	0.0	8.3	1.6	3.5
Goa	Absent			0	0.0	-1.2	2.6	4.2
Himachal Pradesh	Absent			0	-0.3	0.1	0.0	0.0
Jammu & Kashmir	Absent			0	0.1	0.0	0.6	0.0
Lakshadweep	Absent			0	-15.1	10.4	42.3	11.8
Maharashtra	Absent			0	0.7	-0.1	-1.8	-6.3
Manipur	Absent			0	-7.5	-9.2	-10.3	-11.1
Meghalaya	Absent			0	0.0	-4.1	0.0	-0.7
Mizoram	Absent			0	0.0	0.2	0.0	0.9
Nagaland	Absent			0	0.0	-0.6	4.0	1.9
Sikkim	Absent			0	0.0	0.0	0.0	0.9

Table S19. State-specific bicycle distribution schemes

State	Scheme name	Starting year	Department	Type of transfer	Number of bicycles distributed	Source
Andaman and Nicobar Islands	No BDS					Online search
Andhra Pradesh	No BDS					RTI
Arunachal Pradesh	No BDS					Online search
Assam	Distribution of Ladies Bicycle	2012	Department of Secondary Education		Till 2016: 456,379	https://education.assam.gov.in/portlets/distribution-of-ladies-bicycle; https://education.assam.gov.in/schemes/significant-schemes
Bihar	Mukhyamantri Cycle Yojana	2006		Cash		https://pradhanmantriyojana.co.in/mukhyamantri-balika-cycle-bihar/
Chandigarh	No BDS					Online search
Chhattisgarh	Saraswati Cycle Yojana	2004	Department of School Education	In-kind	Till 2011: 437,799	https://eduportal.cg.nic.in/schemes/Cycle_Yojna.aspx; https://scert.cg.gov.in/pdf/researchpapers/Evaluation%20Study%20of%20Saraswati%20Bicycle%20Supply%20Scheme%20(Free)%20in%20Chhattisgarh%202012-13.pdf
Dadra and Nagar Haveli	Saraswati Vidya Yojana	2014	Department of Education	In-kind		https://www.simadnh.org/images/userFiles/Notification%20Saraswati%20Vidya%20Yojna.pdf
Daman and Diu	Saraswati Vidya Yojana	2014	Department of Education	In-kind		https://www.simadnh.org/images/userFiles/Notification%20Saraswati%20Vidya%20Yojna.pdf
Delhi	No BDS					RTI
Goa	No BDS					RTI
Gujarat	Saraswati Sadhna Yojana	1995	Social Justice and Empowerment Department	In-kind	Till 2019: 1,155,000	RTI
Haryana	Providing free bicycles to SC students (Boys & Girls) studying in 6th Grade.	2008	Maulik Education Department		Till date: 74,018	RTI

Table 19 continued ...

... **Table 19 continued**

State	Scheme name	Starting year	Department	Type of transfer	Number of bicycles distributed	Source
Himachal Pradesh	No BDS					Online search
Jammu and Kashmir	No BDS					Online search
Jharkhand	Cycle Distribution Scheme	2005	Department of Welfare	In-kind and later Cash		https://cag.gov.in/uploads/download_audit_report/2014/Chapter%203%20-%20Compliance%20Audit-060d04a72697661.40757006.pdf2)https://avenuemail.in/jharkhand-governments-generous-move-general-category#:~:text=The%20allocated%20amount%20of%20Rs,students%20in%20this%20initial%20phase.
Karnataka	Free Bicycle Scheme	2006	Department of Primary and Secondary Education	Cash	Till 2018: 6,282,109	https://kmea.karnataka.gov.in/storage/pdf-files/Reports%20and%20other%20docs/Bicycle%20English%20Final%20Report.pdf
Kerala		2006		In-kind		https://www.deccanherald.com/india/karnataka/bjp-govt-puts-brakes-on-free-bicycle-scheme-for-scho html
Lakshadweep	No BDS					Online search
Madhya Pradesh	Nishulk Cycle Praday Yojana	2004	School Education Department	Cash	Till 2023: 7,310,702	RTI; https://www.educationportal.mp.gov.in/Cycle/Default.aspx
Maharashtra	No BDS					RTI
Manipur	No BDS					Online search
Meghalaya	No BDS					RTI
Mizoram	No BDS					RTI
Nagaland	No BDS					Online search
Odisha	Free bicycle scheme for students	2011		Cash		https://sme.odisha.gov.in/schemes/schemes-gov-orissa?field_schemes_gov_orissa_categor_target_id=562
Puducherry	Karamveerar Kamaraj Scheme	2015	Welfare of Backward Classes and Minorities	In-kind		RTI; https://bcmwel.py.gov.in/welfare-schemes

Table 19 continued ...

... **Table 19 continued**

State	Scheme name	Starting year	Department	Type of transfer	Number of bicycles distributed	Source
Punjab	Mai Bhago Vidya	2011	Social Security and Women and Child Development Department	In-kind	Till 2019: 618,888	RTI; https://sswcd.punjab.gov.in/en/mai-bhago-vidya-scheme
Rajasthan	Free Cycle Distribution Scheme	2007	Secondary Education Department	Cash	Till 2019: 2,658,908	https://evaluation.rajasthan.gov.in/scheme/detail/336
Sikkim	No BDS					RTI
Tamil Nadu	Amma Free Bicycle	2001				https://pradhanmantriyojana.co.in/free-bicycle-scheme-tamilnadu-school-students/; https://www.researchgate.net/publication/305778305_AMMA_Free_Bicycle_Scheme_For_The_StudentCommunity_Its_Reach_And_Its_Impact_On_Rural_Development_A_Study_Specially_Focused_On_Katpadi_Taluk_In_Vellore_District_Of_Tamil_Nadu
Tripura	Supply of bicycle to girl students belonging to low-income group families	2013	Education (School) Department	In-kind	Till 2022: 213,448	RTI
Uttar Pradesh	Sant Ravidas Shiksha Protsahan Yojana	2016	Labour Department (Building and other construction workers Welfare Board)	Cash		RTI; https://upbocw.in/English/StaticPages/schemes.aspx#tab2
Uttarakhand	Balika Shiksha Protsahan (Muft Cycle) Yojana	2013	Secondary Education Department	Cash		RTI
West Bengal	Sabooj Saathi	2015	Backward Classes Welfare Department	In-kind	Till 2022: 10,731,174	https://wbsaboojsathi.gov.in/v2/

Table S20. State-specific eligibility criteria in bicycle distribution schemes

State	Starting year	R/U	Gender	Grades enrolled	Type of school	Caste	Distance to school	Income	Other
Assam	2012	R+U	G	School-going upto Grade X	Government and provincialized High/Higher Secondary Schools			Below Poverty Line	
Bihar	2006	R+U	G	IX	Government				
Chhattisgarh	2004	R+U	G	IX	Government and Government-Aided		Scheduled caste and Scheduled Tribe	Below Poverty Line	
Dadra and Nagar Haveli	2014	R+U	G	VIII	Government and Government-Aided				
Daman and Diu	2014	R+U	G	VIII	Government and Government-Aided				
Gujarat	1995	R+U	G	VIII to X	Government	Scheduled caste and Scheduled tribe		Annual income: INR 120,000 for rural and INR 150,000 for urban	In 1995, the scheme was applicable only for Scheduled tribe students. In 1998, the scheme started including both Scheduled tribe and Scheduled Caste students. Not more than two girls are eligible for this scheme from a single household. In 2016, annual household income criteria were added: Rural—less than INR 47,000, Urban—less than INR 68,000.
Haryana	2008	R	G+B	VI	Government	Scheduled caste	>2km from their resident village		There must not be a middle school in their resident village.

Table 20 continued ...

... **Table 20 continued**

State	Starting year	R/U	Gender	Grades enrolled	Type of school	Caste	Distance to school	Income	Other
Jharkhand	2005	R	G+B	VIII		Scheduled Caste, Scheduled Tribe, Backward Classes, Minority earlier. General students added as of 2023	>2km		Not residing in school hostels, Scheme started off as only girls and was further extended to boy students of the same categories with effect from 2009-10.
Karnataka	2006	R	G+B	VIII	Government and Government-Aided			Below poverty line	The students studying in schools in city corporation limits, bus pass holders, and students staying in hostels have been excluded. However, students staying in hilly regions who walk from house to bus stop (though possessing bus pass) are included (as per latest revisions in 2016-17). Initially, only girl students enrolled in 8th standard in Government schools in rural and hilly regions were included. In 2007-08, the scheme was extended to all 8th standard students belonging to all categories in 2008-09.
Kerala	2006	R+U	G+B	VIII	Government and Government-Aided				Extended from just girls to both girls and boys in the second year. Stopped after and during COVID.
Madhya Pradesh	2004	R	G+B	VI and IX	Government		>2 km from their resident village		The village in which the student lives does not have a secondary/high school and the student goes to a government school in a different village/city. Students who are residing in a poor hamlet in the village– the secondary should be at a distance of more than 2km from their residence. Girl students in girls hostel located in rural areas whose secondary school is at a distance of 2km or more from the hostel.

Table 20 continued ...

... **Table 20 continued**

State	Starting year	R/U	Gender	Grades enrolled	Type of school	Caste	Distance to school	Income	Other
Odisha	2011	R+U	G+B	X	Government, Government-aided and block-grant high schools in state and all schools in tribal study areas			Below poverty line	In 2011: 10th grade students studying in government and government-aided high schools and all scheduled caste and scheduled tribe students studying in 10th grade in government schools in 118 tribal-sponsored blocks. In 2012: all students studying in 10th standard in government, government-aided Sanskrit tolls and madrasas and 10th standard students studying in all tolls and madrasas of 118 tribally-taught blocks and families belonging to below poverty line in the state along with the students concerned in the above schools.
Puducherry	2015	R+U	G+B		Government/ Govt. aided schools / Partly aided schools				
Punjab	2011	R+U	G	IX to XII	Government				
Rajasthan	2007	R+U	G	IX	Government				
Tamil Nadu	2001	R	G+B	XI and XII	Government and Government-aided				
Tripura	2013	R+U	G	IX to XII	Government and Government-aided				The family income of the student shall not exceed INR 125,000 per annum. In 2018, the family income criteria were removed. The student should not have received a similar benefit, either in cash or in kind, under any other government scheme during the last three years.

Table 20 continued ...

... **Table 20 continued**

State	Starting year	R/U	Gender	Grades enrolled	Type of school	Caste	Distance to school	Income	Other
Uttar Pradesh	2016	R+U	G+B	IX to XII	Government				Sons/daughters of registered construction workers have passed Grade-9, Grade-10, Grade-11 or Grade-12 and have taken admission in the next grade. The construction worker should have an active labour board membership. After the registration by the construction worker, the membership period of the board should have been completed for at least 365 days. The age of such a boy and girl should be 25 years or less on July 01 of every year. Benefit will be given to maximum two children of registered construction workers i.e. only maximum 2 people from a family will be able to apply for this scheme.
Uttarakhand	2013	R+U	G	IX	Government and Government-aided				Girls studying in plain regions and students in hilly regions with adverse geographical conditions.
West Bengal	2015	R+U	G+B	IX to XII	Government-run, Government Aided Schools and Madrasahs		>= 2 km	Family income of the student should not exceed INR 200,000 per annum	Age Limit: The student must be between 13 to 18 years of age. Residency: The student must be a permanent resident of West Bengal. Attendance: The student must have at least 60% attendance in the last academic year. Ownership: The student should not already own a bicycle.

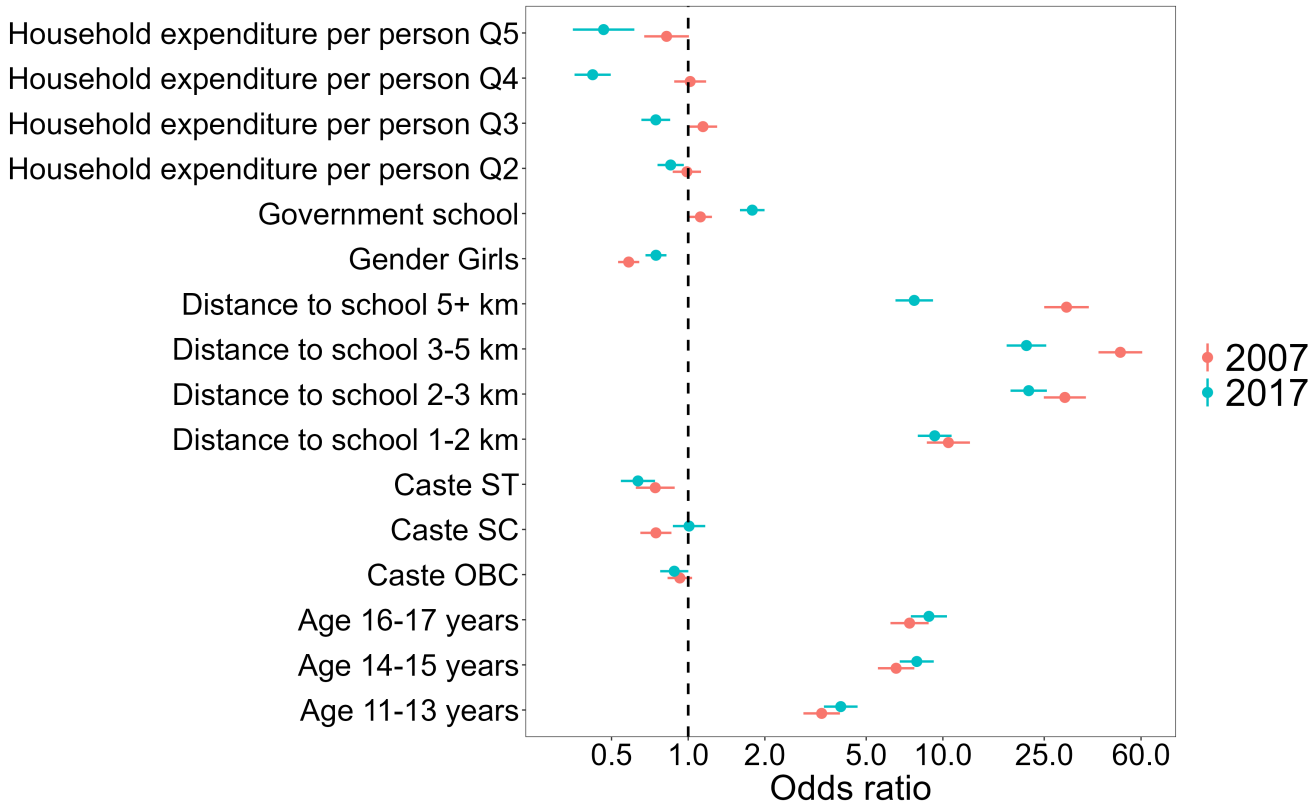

Fig S2. Year-specific regression model for rural India with individual reporting cycle to go to school as the binary outcome (Reference categories: Household expenditure per person Q1, Private school, Gender Boys, Distance to school <1 km, Caste Others, Age 5-10 years)

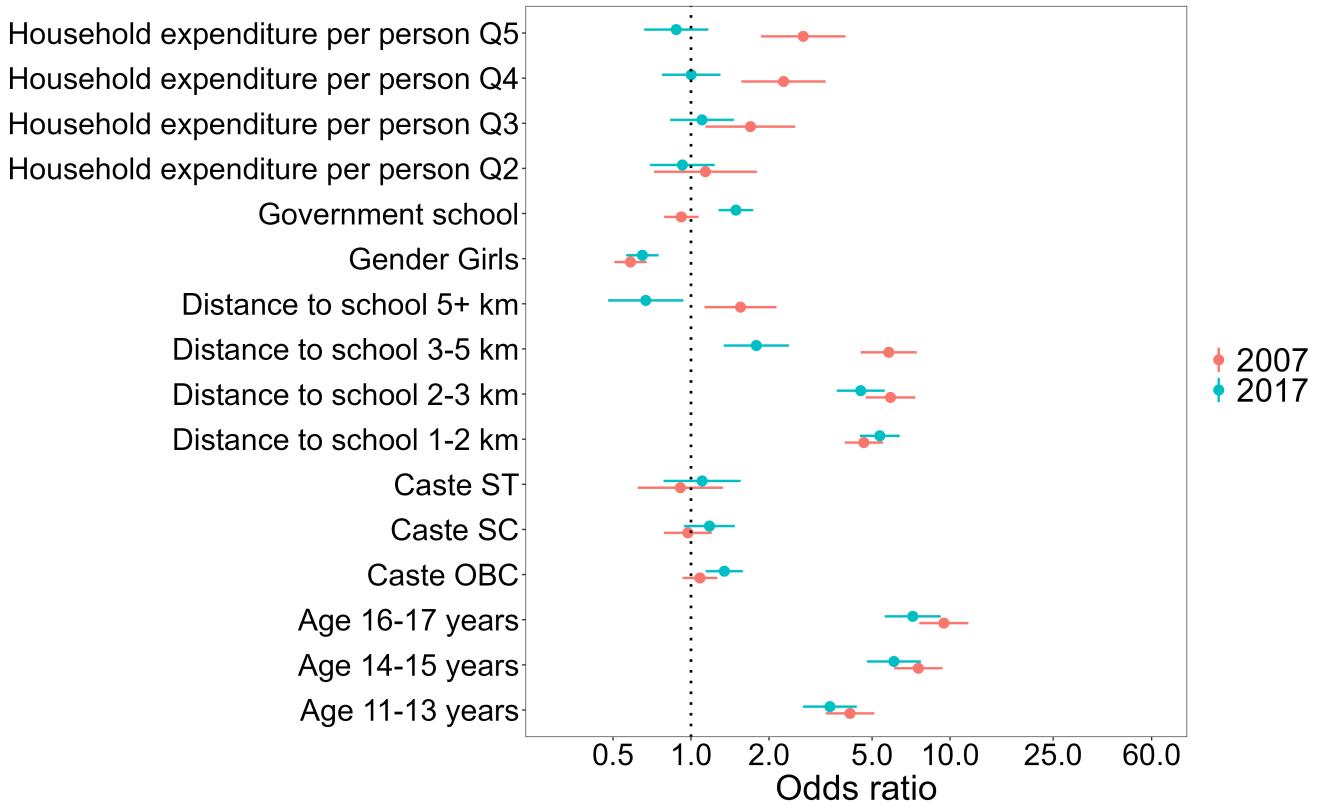

Fig S3. Year-specific regression model for urban India with individual reporting cycle to go to school as the binary outcome (Reference categories: Household expenditure per person Q1, Private school, Gender Boys, Distance to school <1 km, Caste Others, Age 5-10 years)

Table S21. Total vehicle ownership by states (%)

Total	Bicycle		Motorcycle		Car	
State	**2005**	**2019**	**2005**	**2019**	**2005**	**2019**
INDIA	51.1	50.4	17.2	49.7	2.7	7.5
Andhra Pradesh	41.7	28.0	14.0	50.5	1.2	3.8
Arunachal Pradesh	22.2	25.6	12.1	43.6	4.7	19.3
Assam	61.2	70.3	10.5	29.0	2.9	8.1
Bihar	55.5	65.2	9.5	30.5	1.0	2.5
Chhattisgarh	68.1	70.8	15.2	54.8	1.9	4.3
Delhi	35.6	27.2	34.9	53.1	14.6	19.4
Goa	31.3	35.7	49.6	86.7	16.8	45.2
Gujarat	47.8	29.9	28.8	61.1	2.9	10.9
Haryana	57.3	44.3	25.0	63.3	4.0	15.3
Himachal Pradesh	13.2	12.7	12.6	32.3	4.9	22.1
Jammu & Kashmir	19.0	18.3	15.6	30.3	6.5	23.7
Jharkhand	62.8	66.3	14.2	41.1	1.8	4.1
Karnataka	33.6	32.2	19.5	61.1	3.1	9.1
Kerala	26.4	24.5	21.8	58.2	7.6	24.2
Madhya Pradesh	48.8	45.1	16.6	51.5	2.6	5.3
Maharashtra	37.7	29.3	20.7	53.9	3.2	8.7
Manipur	55.2	45.3	21.2	40.8	4.5	17.0
Meghalaya	13.6	18.4	4.6	20.2	5.5	12.9
Mizoram	6.5	9.3	12.4	41.5	7.6	15.5
Nagaland	11.8	5.5	5.3	16.7	5.2	21.3
Odisha	64.5	72.5	13.2	43.5	0.9	2.7
Punjab	73.3	67.8	38.9	75.6	8.2	21.9
Rajasthan	39.5	32.2	20.9	66.4	3.6	8.2
Sikkim	1.9	5.9	3.8	11.4	6.0	20.9
Tamil Nadu	46.4	43.3	22.3	63.9	2.2	6.5
Tripura	48.1	50.9	8.9	27.4	1.7	4.6
Uttar Pradesh	72.4	75.6	14.9	51.1	1.6	5.5
Uttarakhand	35.4	30.2	20.9	46.1	3.7	12.7
West Bengal	62.8	78.9	7.9	28.5	1.1	2.8

Table S22. Rural vehicle ownership by states (%)

Rural	Bicycle		Motorcycle		Car	
State	2005	2019	2005	2019	2005	2019
INDIA	51.6	54.2	10.8	44.3	1.0	4.4
Andhra Pradesh	41.4	29.0	7.8	45.7	0.5	1.7
Arunachal Pradesh	22.9	25.3	9.4	42.3	3.0	17.1
Assam	64.1	74.6	8.0	26.2	1.6	5.9
Bihar	54.7	66.7	5.8	26.8	0.5	1.3
Chhattisgarh	66.8	73.3	8.1	50.6	0.7	2.3
Delhi	47.7	39.4	21.0	68.7	4.7	27.9
Goa	30.7	36.6	41.8	84.5	11.4	39.6
Gujarat	41.5	28.6	21.1	54.5	1.3	6.2
Haryana	54.9	44.0	19.3	62.4	2.3	11.6
Himachal Pradesh	12.6	12.4	10.9	31.6	3.2	19.4
Jammu & Kashmir	14.6	15.9	8.9	25.8	1.8	17.9
Jharkhand	62.3	69.4	6.6	35.0	0.3	1.5
Karnataka	33.7	32.6	11.0	56.9	1.0	5.6
Kerala	23.4	21.4	18.5	55.4	5.6	22.1
Madhya Pradesh	45.0	45.4	8.7	46.0	0.4	3.0
Maharashtra	37.8	30.4	13.1	48.2	1.1	3.9
Manipur	49.5	43.1	15.7	33.8	2.7	12.8
Meghalaya	14.7	19.4	2.5	17.5	3.2	8.4
Mizoram	4.0	5.9	7.5	26.8	2.0	7.4
Nagaland	10.9	4.6	4.3	14.3	2.8	16.1
Odisha	62.3	73.6	8.5	39.5	0.3	1.3
Punjab	77.8	72.4	35.6	76.6	5.9	18.6
Rajasthan	34.7	30.7	12.5	62.9	0.9	5.6
Sikkim	2.0	6.7	3.3	12.8	4.4	17.2
Tamil Nadu	45.3	44.0	15.7	60.5	0.6	3.3
Tripura	48.1	51.3	6.9	23.2	1.2	3.7
Uttar Pradesh	74.3	80.0	9.7	47.6	0.6	3.3
Uttarakhand	33.4	27.5	14.2	38.4	1.4	8.3
West Bengal	64.4	82.3	5.0	23.2	0.1	1.0

Table S23. Urban vehicle ownership by states (%)

Urban State	Bicycle		Motorcycle		Car	
	2005	2019	2005	2019	2005	2019
INDIA	50.1	43.0	30.5	60.6	6.1	13.8
Andhra Pradesh	42.2	26.1	27.2	60.3	2.5	7.9
Arunachal Pradesh	20.3	27.4	19.3	50.5	9.2	30.8
Assam	50.0	48.4	20.8	43.6	8.4	19.3
Bihar	60.0	58.8	24.0	47.6	3.6	7.8
Chhattisgarh	72.7	62.2	40.6	69.5	6.1	11.2
Delhi	34.7	26.9	36.0	52.8	15.4	19.2
Goa	31.7	35.0	55.7	88.1	20.9	49.1
Gujarat	56.5	31.6	39.3	69.8	5.0	17.2
Haryana	62.4	44.7	37.3	64.9	7.5	22.0
Himachal Pradesh	17.1	14.9	23.9	37.0	15.9	38.1
Jammu & Kashmir	28.6	24.4	30.5	41.8	16.8	38.9
Jharkhand	64.0	56.4	36.3	60.3	6.3	12.4
Karnataka	33.6	31.7	32.0	67.2	6.1	14.0
Kerala	32.5	27.9	28.5	61.3	11.4	26.4
Madhya Pradesh	58.4	44.3	36.6	66.2	8.1	11.4
Maharashtra	37.6	28.1	28.9	60.1	5.4	14.0
Manipur	67.3	48.9	33.0	52.3	8.3	23.9
Meghalaya	10.2	14.6	10.5	30.2	11.8	29.0
Mizoram	8.7	12.1	16.5	53.5	12.4	22.0
Nagaland	14.4	7.6	7.9	21.7	11.7	32.1
Odisha	75.1	67.3	36.4	63.1	4.0	9.3
Punjab	66.4	60.6	44.1	74.0	11.8	27.0
Rajasthan	51.2	36.5	41.5	77.2	10.2	16.3
Sikkim	1.4	4.7	6.1	9.4	12.7	25.8
Tamil Nadu	47.8	42.6	29.9	67.6	4.1	9.9
Tripura	47.9	50.2	18.3	37.2	3.9	6.7
Uttar Pradesh	66.8	63.0	30.3	61.3	4.6	11.9
Uttarakhand	40.7	35.9	37.8	62.1	9.7	21.8
West Bengal	59.4	71.9	14.2	39.3	3.2	6.4

Table S24. State-specific mode shares in rural areas. Each row in a specific year sums to 100 percent.

State	2007				2014				2017			
	Walk	Bicycle	PT*	Others	Walk	Bicycle	PT*	Others	Walk	Bicycle	PT*	Others
Andaman & Nicobar Islands	68.8	0.6	28.0	2.6	49.2	1.6	38.7	10.5	52.1	1.6	29.5	16.8
Andhra Pradesh	76.0	5.2	16.0	2.8	64.9	6.2	23.6	5.4	56.9	7.1	29.9	6.1
Arunachal Pradesh	93.8	0.9	3.5	1.8	85.9	4.2	4.7	5.2	89.1	6.1	3.1	1.8
Assam	88.6	8.3	1.2	1.9	73.3	17.0	5.8	4.0	69.3	19.8	6.3	4.5
Bihar	94.4	3.4	1.8	0.4	82.7	10.3	6.0	1.1	78.4	14.3	5.7	1.6
Chandigarh	78.5	6.3	0.0	15.2	64.5	1.0	19.9	14.6	77.6	1.3	13.0	8.1
Chhattisgarh	89.4	8.6	0.5	1.5	78.6	17.8	2.9	0.7	75.5	18.7	3.8	2.0
Dadra & Nagar Haveli	78.1	7.8	11.8	2.4	87.7	1.0	0.0	11.3	68.1	0.0	0.0	31.9
Daman & Diu	80.1	0.0	14.1	5.8	48.0	5.8	16.7	29.5	39.0	4.3	25.0	31.7
Delhi	88.7	0.8	6.5	4.0	69.2	0.0	24.3	6.5	83.3	4.2	12.3	0.3
Goa	74.4	1.8	19.8	4.1	20.8	0.5	65.7	13.1	36.5	1.1	48.3	14.1
Gujarat	85.9	4.3	7.0	2.8	83.1	3.5	8.7	4.6	75.0	5.3	12.3	7.3
Haryana	78.9	3.0	17.2	0.8	67.5	1.9	28.6	2.1	61.3	3.9	32.9	1.9
Himachal Pradesh	86.1	0.2	11.5	2.1	69.8	0.0	24.1	6.1	67.3	0.1	29.8	2.7
Jammu & Kashmir	83.7	0.1	15.1	1.1	80.7	0.2	18.7	0.4	74.1	0.2	25.2	0.5
Jharkhand	91.3	6.7	1.5	0.5	75.8	14.9	6.4	2.9	82.6	11.0	4.3	2.1
Karnataka	82.6	3.0	12.9	1.4	65.6	10.3	20.4	3.7	65.9	4.9	26.5	2.7
Kerala	47.8	2.2	42.6	7.4	35.3	3.9	48.0	12.8	27.2	4.5	51.7	16.6
Lakshadweep	78.8	21.2	0.0	0.0	73.9	26.1	0.0	0.0	72.8	15.9	0.0	11.3
Madhya Pradesh	90.3	6.1	3.0	0.6	75.7	11.2	11.1	1.9	74.5	10.9	12.8	1.8
Maharashtra	84.5	5.5	7.5	2.5	74.6	6.2	15.6	3.6	69.6	5.8	19.4	5.1
Manipur	72.2	13.8	9.6	4.4	67.5	6.7	22.2	3.6	70.0	5.4	19.5	5.0
Meghalaya	90.3	3.0	5.2	1.5	85.2	3.0	10.0	1.7	87.9	0.9	7.0	4.2
Mizoram	96.4	0.0	3.6	0.0	97.5	0.0	1.3	1.2	98.0	0.1	1.0	0.8
Nagaland	95.4	0.3	2.1	2.2	92.7	0.1	4.0	3.3	94.4	0.0	3.7	1.8
Odisha	89.6	8.4	1.0	1.1	74.2	19.7	4.6	1.4	71.5	18.8	6.9	2.7
Puducherry	70.1	10.3	18.5	1.0	61.6	6.5	29.0	2.9	63.3	2.1	25.2	9.4
Punjab	66.8	12.7	17.4	3.1	57.5	7.0	30.4	5.1	54.2	9.7	29.9	6.1
Rajasthan	90.1	2.5	7.0	0.5	81.3	2.8	13.7	2.3	76.4	3.0	18.9	1.6
Sikkim	95.9	0.0	1.2	2.9	95.6	0.0	3.0	1.5	89.5	0.0	3.4	7.1
Tamil Nadu	70.1	6.8	21.5	1.6	50.7	11.0	34.6	3.6	46.8	14.4	35.7	3.1
Tripura	93.2	5.0	1.3	0.5	87.0	8.2	3.6	1.2	80.6	14.2	4.3	1.0
Uttar Pradesh	88.0	8.0	3.0	1.0	79.6	11.9	6.6	1.9	75.6	15.0	7.6	1.8
Uttarakhand	89.8	3.6	6.1	0.4	87.7	2.4	8.6	1.3	78.6	4.4	11.9	5.1
West Bengal	83.4	12.2	3.3	1.1	76.0	15.9	6.5	1.6	62.8	28.7	6.4	2.0

*PT refers to public transport

Table S25. State-specific mode shares in urban areas. Each row in a specific year sums to 100 percent.

State	2007				2014				2017			
	Walk	Bicycle	PT*	Others	Walk	Bicycle	PT*	Others	Walk	Bicycle	PT*	Others
Andaman & Nicobar Islands	51.9	0.0	24.9	23.2	28.1	0.3	55.8	15.8	20.3	1.5	49.1	29.1
Andhra Pradesh	69.5	8.3	11.9	10.3	55.2	9.7	22.5	12.6	55.6	7.4	24.9	12.2
Arunachal Pradesh	87.9	0.7	5.0	6.4	77.2	6.6	11.2	5.0	76.8	6.0	14.1	3.1
Assam	69.8	8.3	12.4	9.5	53.0	13.4	20.6	13.0	59.2	10.5	20.9	9.3
Bihar	80.7	5.4	8.2	5.6	76.5	9.5	11.6	2.4	66.6	13.2	16.1	4.1
Chandigarh	48.6	14.4	14.7	22.3	49.0	14.7	15.5	20.8	48.7	7.1	30.0	14.3
Chhattisgarh	67.3	12.7	10.0	9.9	58.9	14.4	18.0	8.7	55.2	20.1	13.7	10.9
Dadra & Nagar Haveli	75.4	0.0	14.7	10.0	48.2	0.8	14.4	36.6	65.4	0.6	25.2	8.8
Daman & Diu	62.4	15.9	11.7	10.0	57.6	0.0	24.4	17.9	8.7	10.2	28.3	52.8
Delhi	72.7	0.9	15.9	10.6	70.6	0.3	17.9	11.2	62.9	3.7	21.4	12.1
Goa	53.2	0.8	38.4	7.7	38.5	0.0	54.1	7.4	40.2	4.3	43.3	12.1
Gujarat	67.0	11.0	8.0	13.9	49.9	9.2	16.3	24.6	46.0	11.8	21.3	20.9
Haryana	67.9	9.4	14.3	8.4	59.7	2.5	24.6	13.2	58.0	2.9	31.4	7.7
Himachal Pradesh	85.7	0.0	11.4	2.9	60.6	0.0	35.9	3.4	47.9	0.0	45.9	6.2
Jammu & Kashmir	75.2	0.0	21.8	3.0	65.9	0.0	29.7	4.4	59.9	0.2	36.9	3.0
Jharkhand	67.0	10.2	17.8	5.0	70.3	9.0	16.0	4.8	61.0	5.9	23.1	10.0
Karnataka	74.6	3.6	14.1	7.8	62.1	7.8	21.5	8.6	58.8	5.0	23.7	12.4
Kerala	39.3	5.5	42.4	12.7	28.6	5.6	49.2	16.6	26.5	5.2	53.6	14.8
Lakshadweep	55.1	38.1	1.6	5.2	31.3	55.8	1.5	11.4	26.0	63.0	0.6	10.4
Madhya Pradesh	76.2	6.6	13.5	3.7	69.8	7.5	15.1	7.6	68.1	5.9	18.6	7.4
Maharashtra	67.8	8.4	14.9	8.9	57.7	6.6	27.4	8.3	59.1	4.4	27.1	9.5
Manipur	59.2	17.8	11.0	12.0	53.8	6.0	32.4	7.8	50.2	7.0	30.4	12.5
Meghalaya	84.0	0.3	6.8	8.9	58.5	1.3	28.0	12.2	66.2	0.0	25.2	8.6
Mizoram	91.4	0.0	7.2	1.4	73.1	0.4	15.5	11.0	72.2	0.4	21.0	6.3
Nagaland	88.4	0.1	6.9	4.6	75.4	0.0	14.3	10.3	74.5	3.1	12.7	9.8
Odisha	60.8	21.1	5.8	12.3	50.7	21.6	18.6	9.2	48.2	22.2	16.3	13.3
Puducherry	55.7	13.4	14.9	16.0	47.7	14.2	19.8	18.3	24.8	12.6	38.2	24.4
Punjab	63.1	11.2	13.0	12.7	46.8	9.0	32.1	12.1	43.7	4.2	37.2	14.9
Rajasthan	75.6	5.0	12.7	6.7	69.4	4.1	18.7	7.7	63.8	2.7	26.8	6.7
Sikkim	92.4	0.0	4.8	2.8	80.1	0.0	16.7	3.2	93.7	0.5	5.8	0.0
Tamil Nadu	67.9	8.4	17.1	6.6	42.3	10.6	29.5	17.5	40.7	12.7	36.3	10.4
Tripura	74.2	5.8	15.4	4.6	74.8	6.0	11.0	8.2	62.3	9.4	20.6	7.7
Uttar Pradesh	77.7	8.6	8.5	5.3	70.2	6.7	14.6	8.4	70.1	8.4	14.3	7.1
Uttarakhand	70.2	7.4	13.3	9.2	77.4	2.5	13.7	6.4	60.3	3.6	21.7	14.4
West Bengal	70.3	8.1	17.2	4.4	60.0	16.7	15.6	7.6	54.8	18.5	20.8	5.8

*PT refers to public transport