



# Road safety is the key to low-carbon and active mobility transition in India

**Rahul Goel**

Assistant Professor

Transportation Research and Injury Prevention Centre

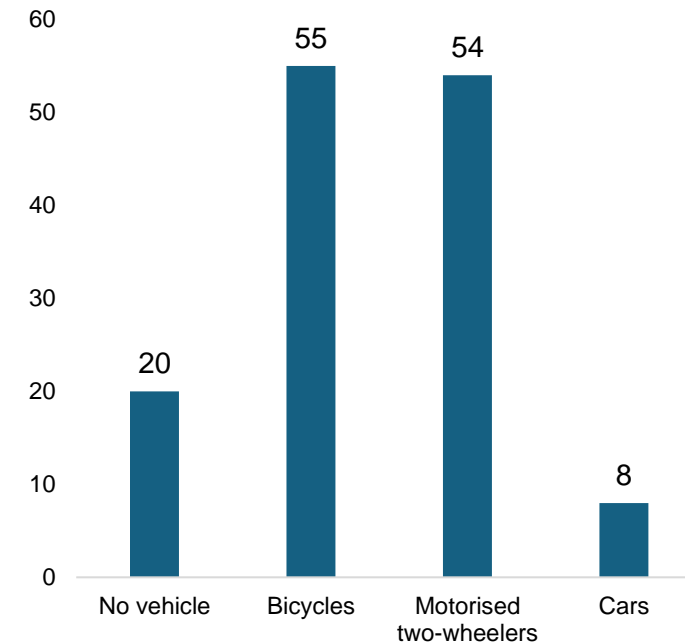
Indian Institute of Technology Delhi, India

28 March 2024

# Summary of the talk

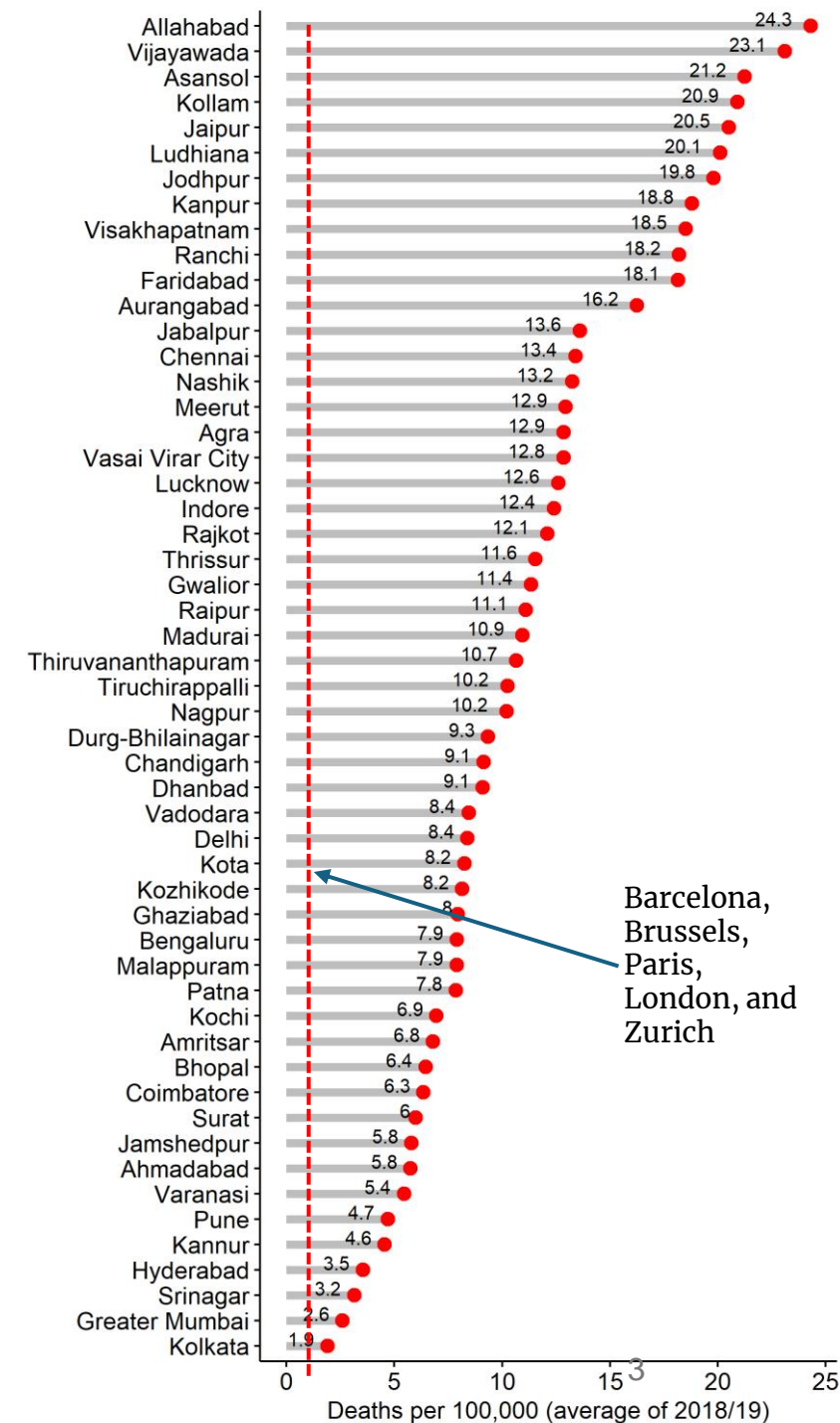
- I will not talk about cars; cars are evil, and we all agree [?]
- High levels of motorcycle and bicycle usage offer a great opportunity for low-carbon mobility in India
- However, both vehicles are highly sensitive to safety on the roads
- Motorcycles provide no physical activity and, with increasing engine power, likely more hazardous to other road users (e.g., pedestrians)
- Decarbonisation and electrification of transport should aim for:
  - ✓ Balancing public health benefits with carbon mitigation
  - ✓ Reduced vehicle power/smaller batteries for motorcycles
  - ✓ Putting e-bicycles at the centre of policy making, and not as an afterthought
  - ✓ Benefitting from the synergies between electric and conventional bicycles

Nationwide household vehicle ownership in India (2021)

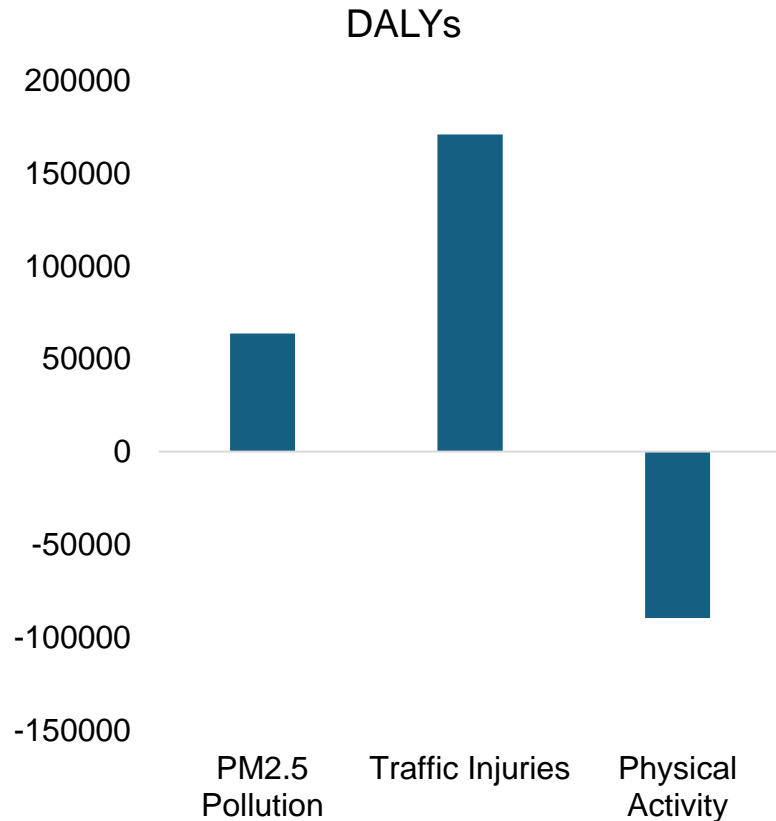


# Low carbon transition is not possible without safety on the road

- India's passenger transport is currently low carbon
  - low levels of motor vehicle ownership
  - intercity transport is dominated by buses and trains
  - personal motor vehicles are largely composed of motorcycles
- However, transport operates at high levels of road injury risk; active travel use is not a preferred choice
- Cities in Europe that witnessed a large-scale increase in bicycling (or electric bicycles) post-COVID are among the safest cities in the world
- In comparison, road death rates in Indian cities are an order of magnitude higher



# Health burden due to transport in Delhi

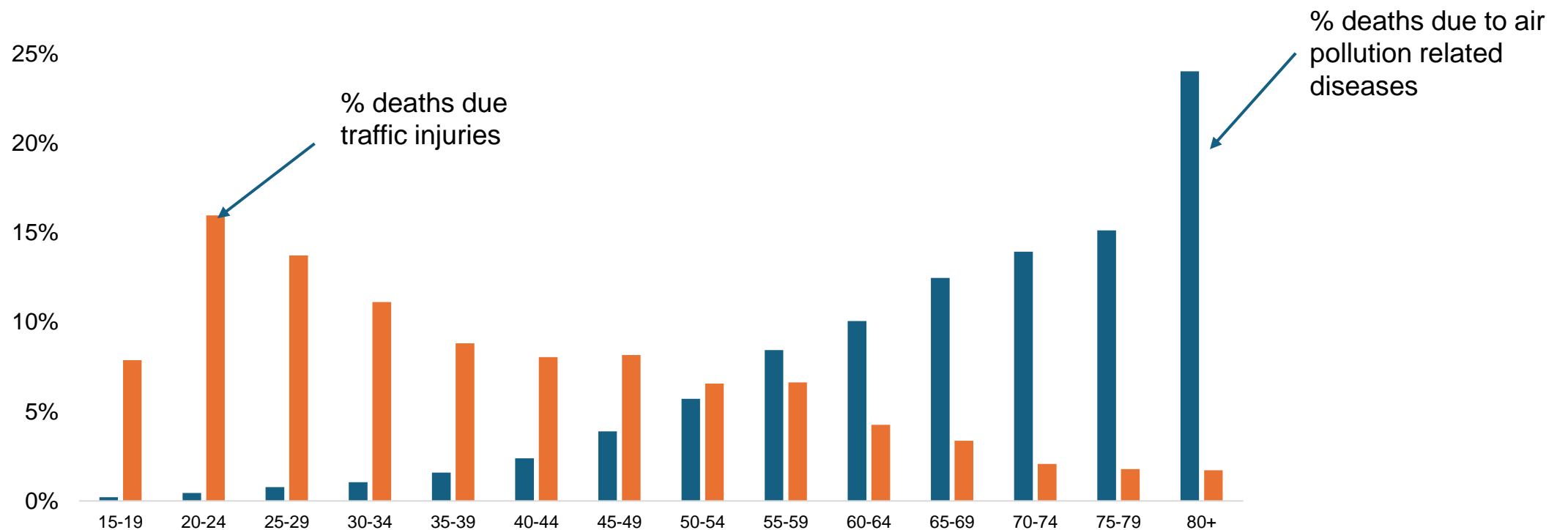


- Traffic injuries result in greater health burden than traffic-contributed PM<sub>2.5</sub>
- The preventive effect of the physical activity levels (walking and cycling) is far greater than the added burden due to PM<sub>2.5</sub>
- Scenario modelling shows that the small reduction in population-level travel physical activity results in far greater health burden than the *total contribution* of PM<sub>2.5</sub> from cars and motorcycles
- Physical activity levels remain least monitored risk factor of transport

DALY = YLL + YLD (includes years lost due to premature death and years lives in disability)

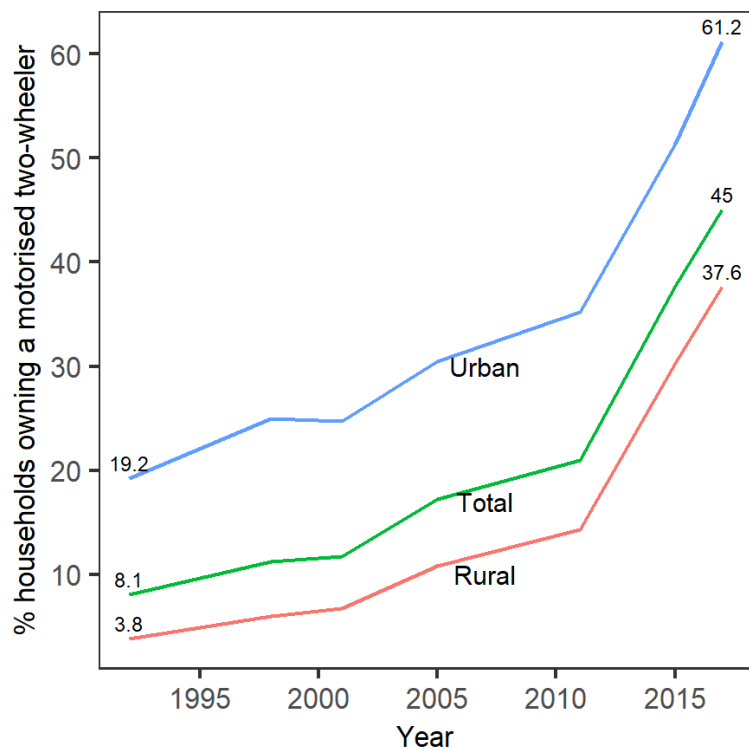
# Traffic injuries kill the young, while air pollution kills the old

This is why DALY burden from traffic injuries is greater than air pollution despite the high levels in Delhi

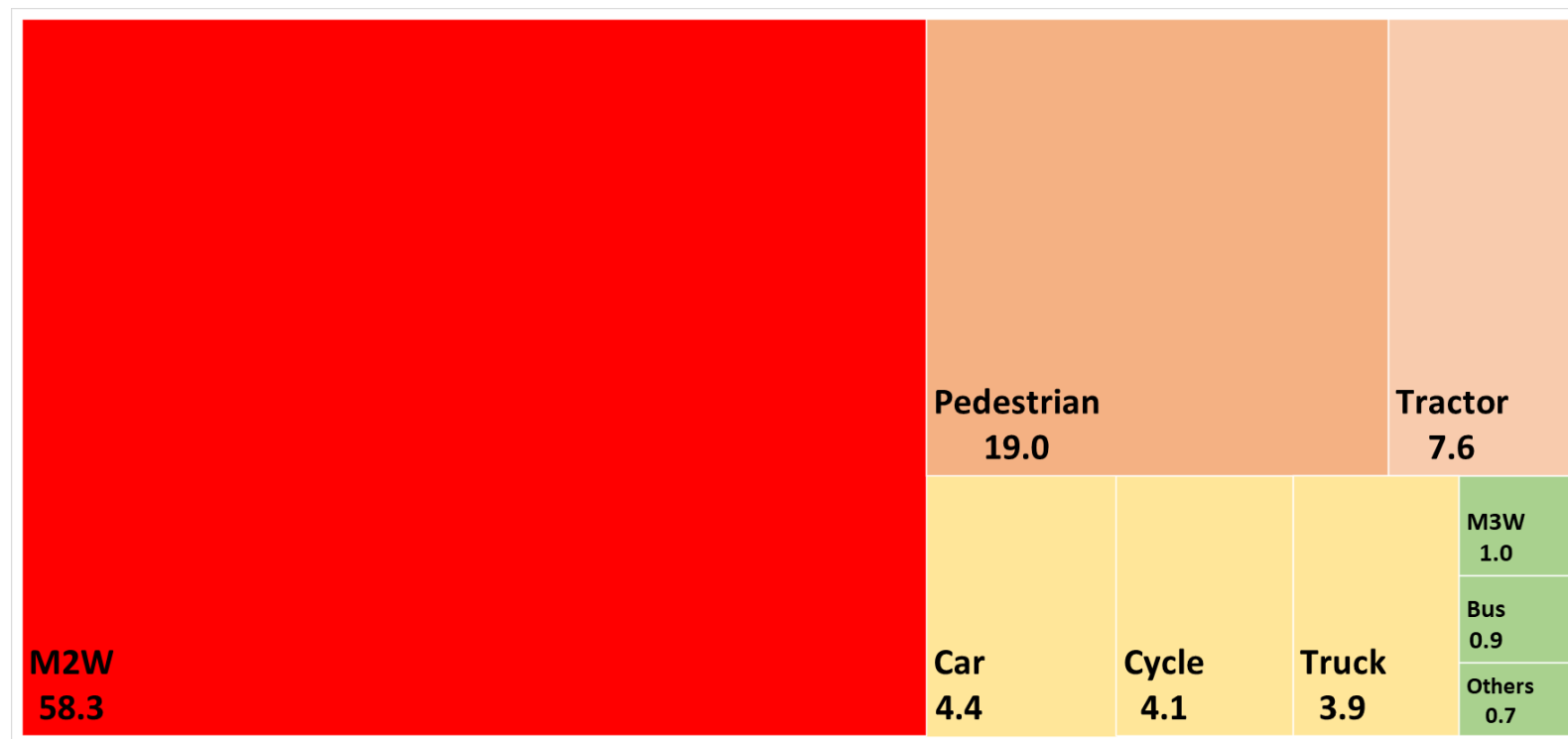


# Rise and rise of motorcycles in India

National household ownership



Distribution of road deaths (2016-2018)



Chhattisgarh 2017-2019: 12000 road deaths

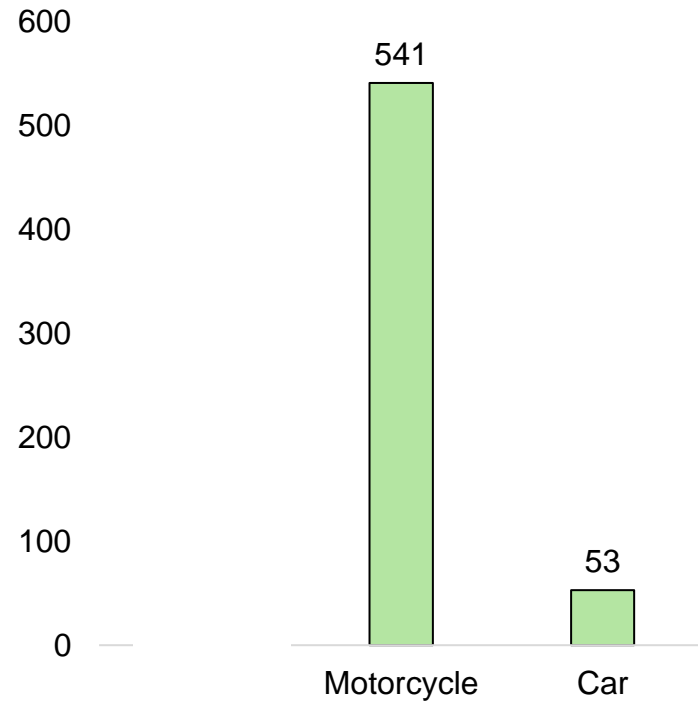
Motorcyclists are the largest contributor to road deaths in India

Source: National Family Health Surveys, Census and Longitudinal Ageing Survey of India

Banerjee et al. (2022) State-wide crash pattern of road traffic fatalities in India. Submitted to Accident analysis and prevention.

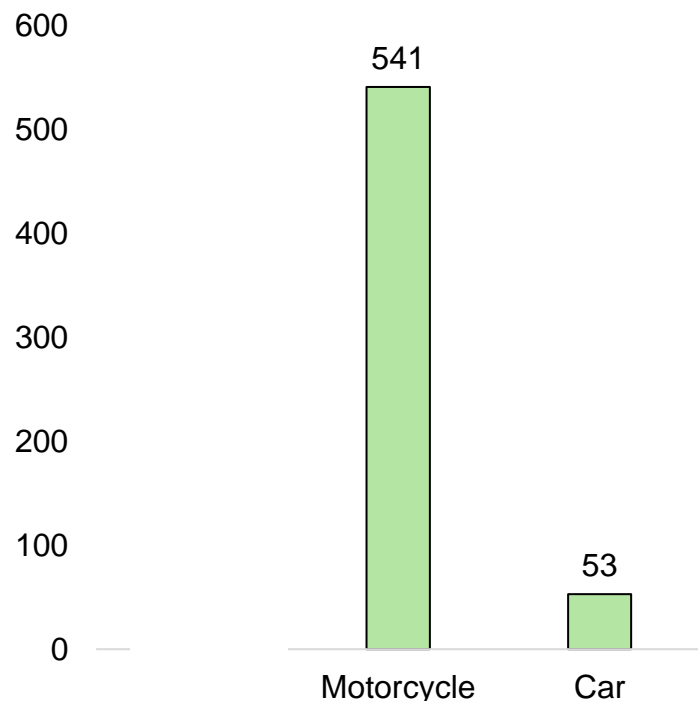
# Risk of fatality of a motorcyclist in Delhi

Average number of annual road deaths in Delhi (2017-2019)

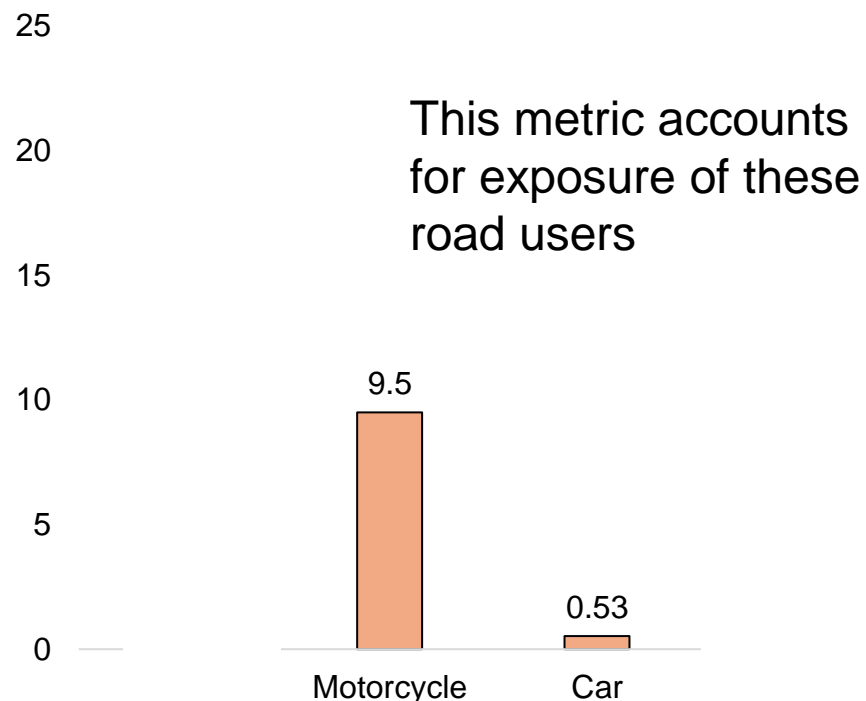


# Risk of fatality of a motorcyclist in Delhi

Average number of annual road deaths in Delhi (2017-2019)



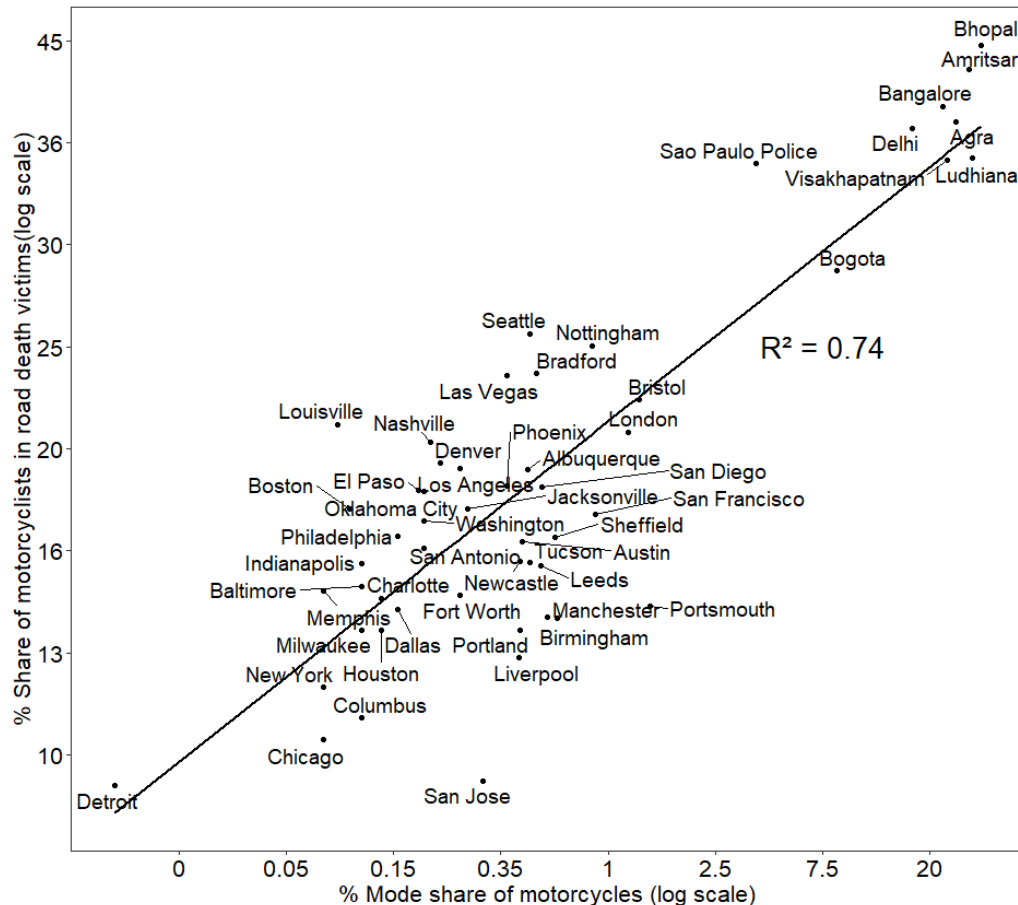
Risk (Deaths per billion kilometre)



**For the same distance travelled, a motorcyclist has 20 times greater risk than a car occupant**

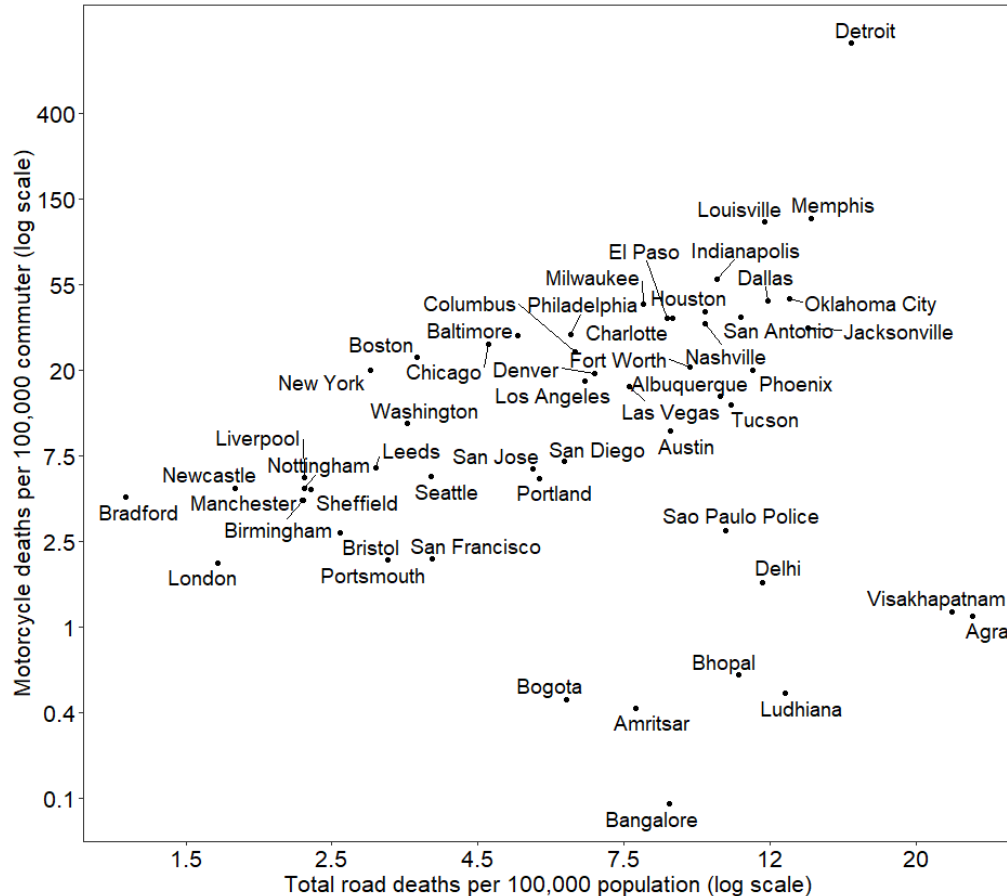


# Motorcycle risk is among the lowest in Indian cities



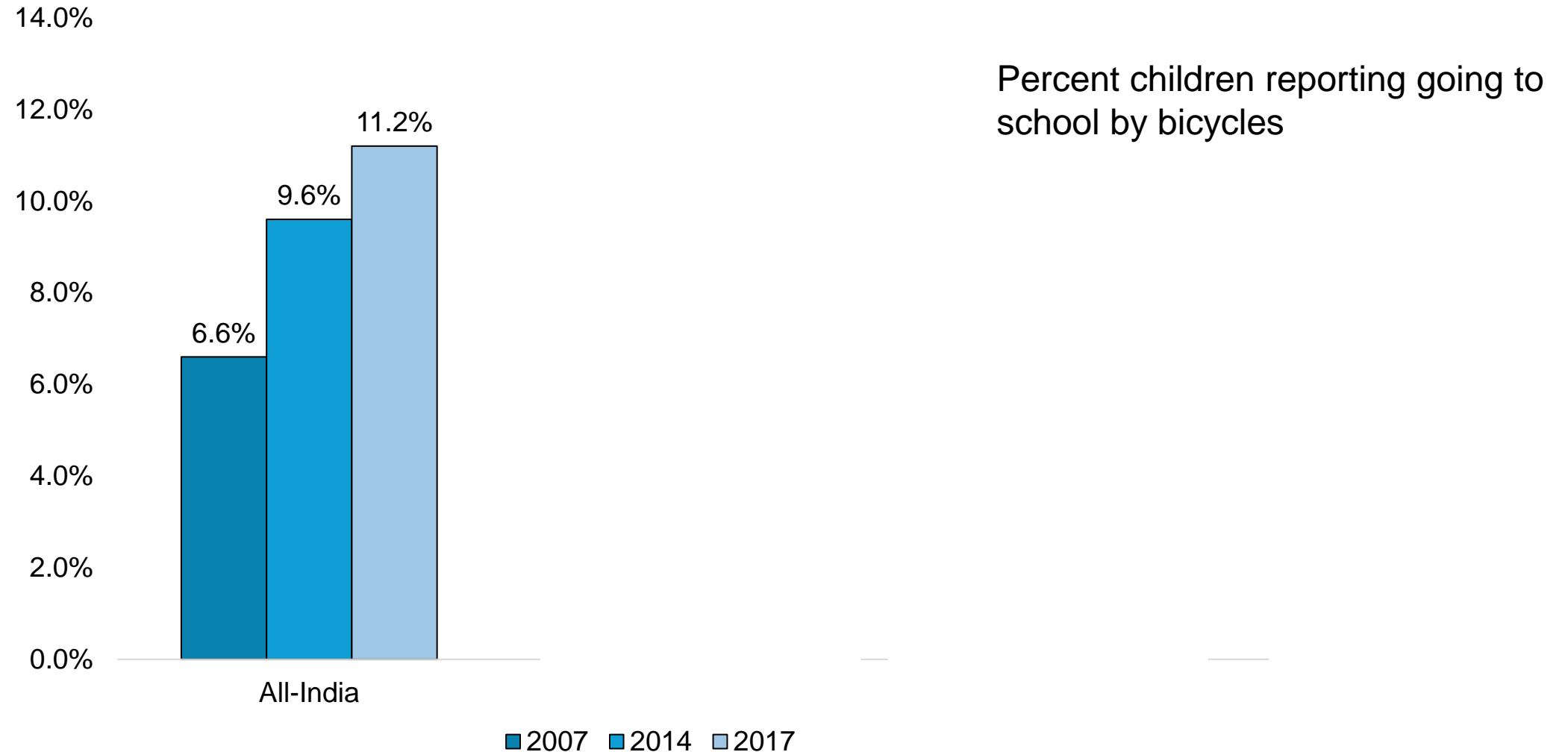
- Even with extremely low mode share of motorcycles, cities in the US and UK have share of 10 to 25% of motorcyclists among all road deaths
- In comparison, mode share of motorcycles is orders of magnitude higher in Indian cities
- Much of the differences between the traffic death rates of high-income countries and India can be attributed to high levels of motorcycle usage

# Motorcycle risk is among the lowest in Indian cities

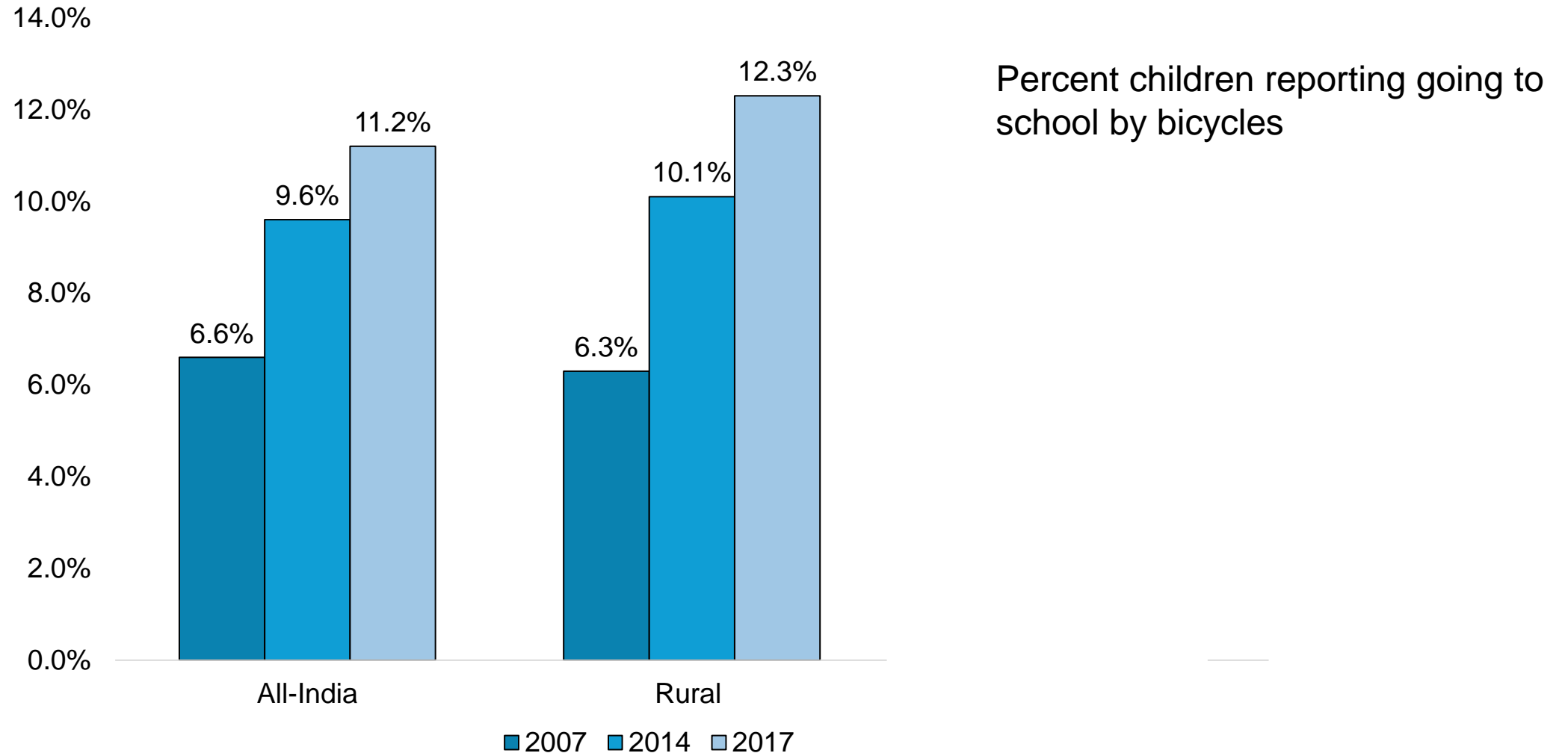


- The y-axis shows the number of motorcycle deaths per 100,000 commuters
- Among those shown here, Indian cities have the lowest motorcycle death rates
- Motorcycles in India are much smaller in engine size than those in high-income countries
- Even with low levels of risk, high levels of motorcycle use results in large number of road deaths

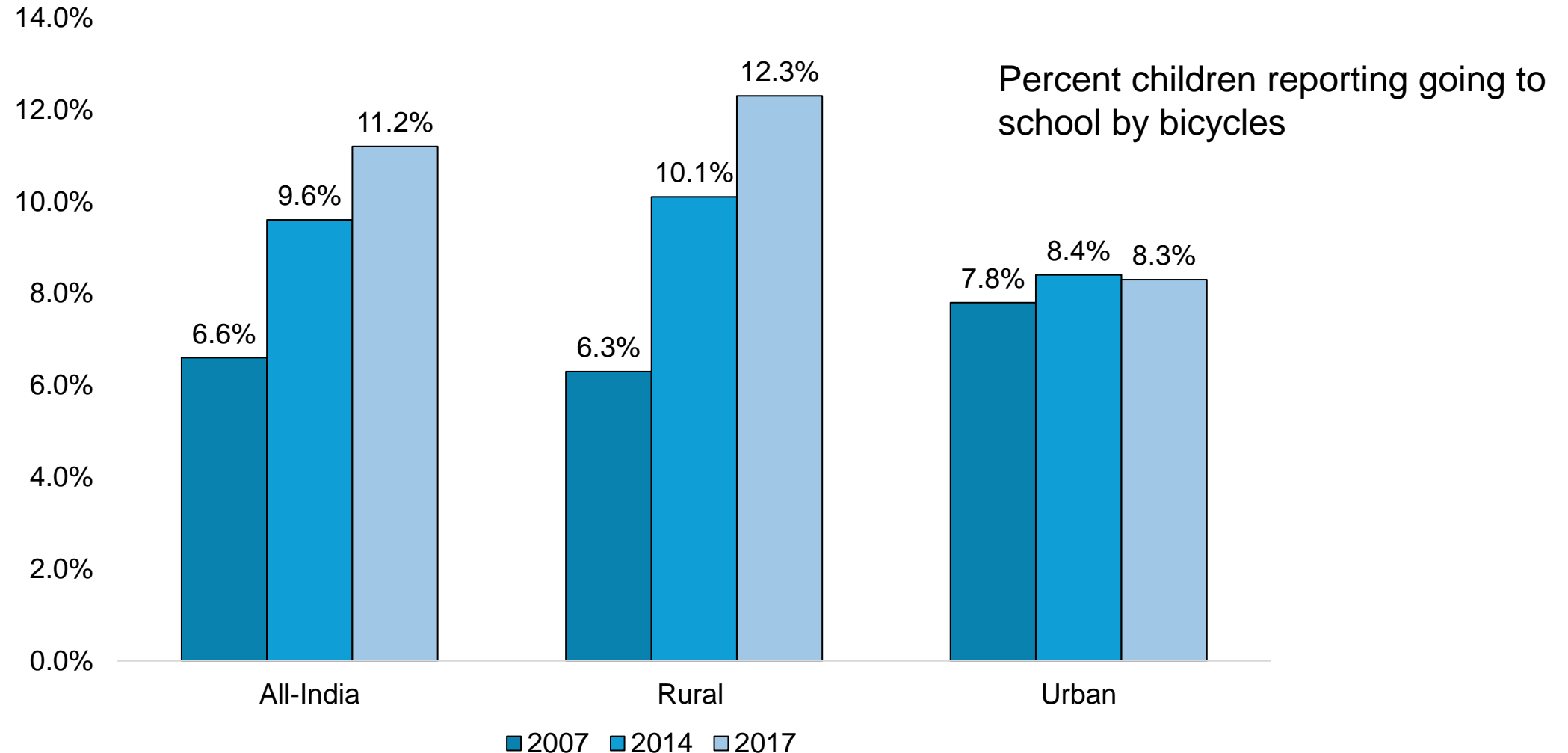
# Rise of cycling to school in India



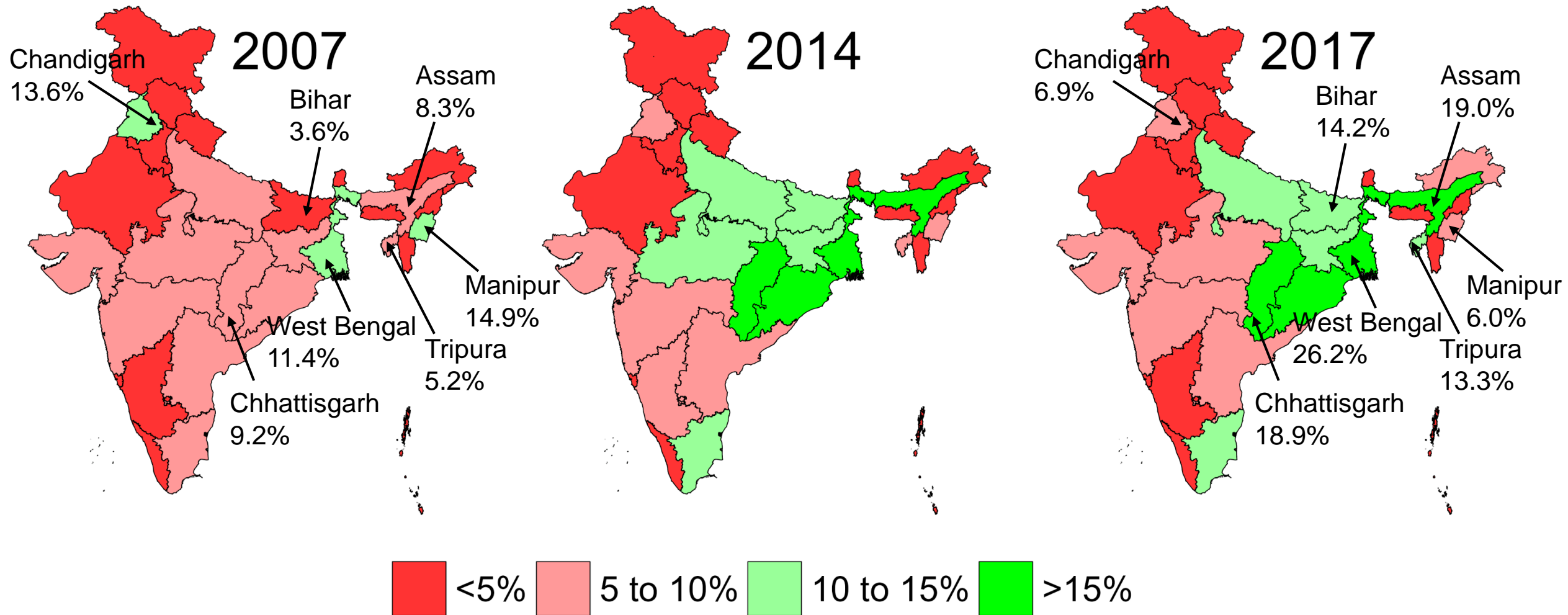
# Rise of cycling to school in India



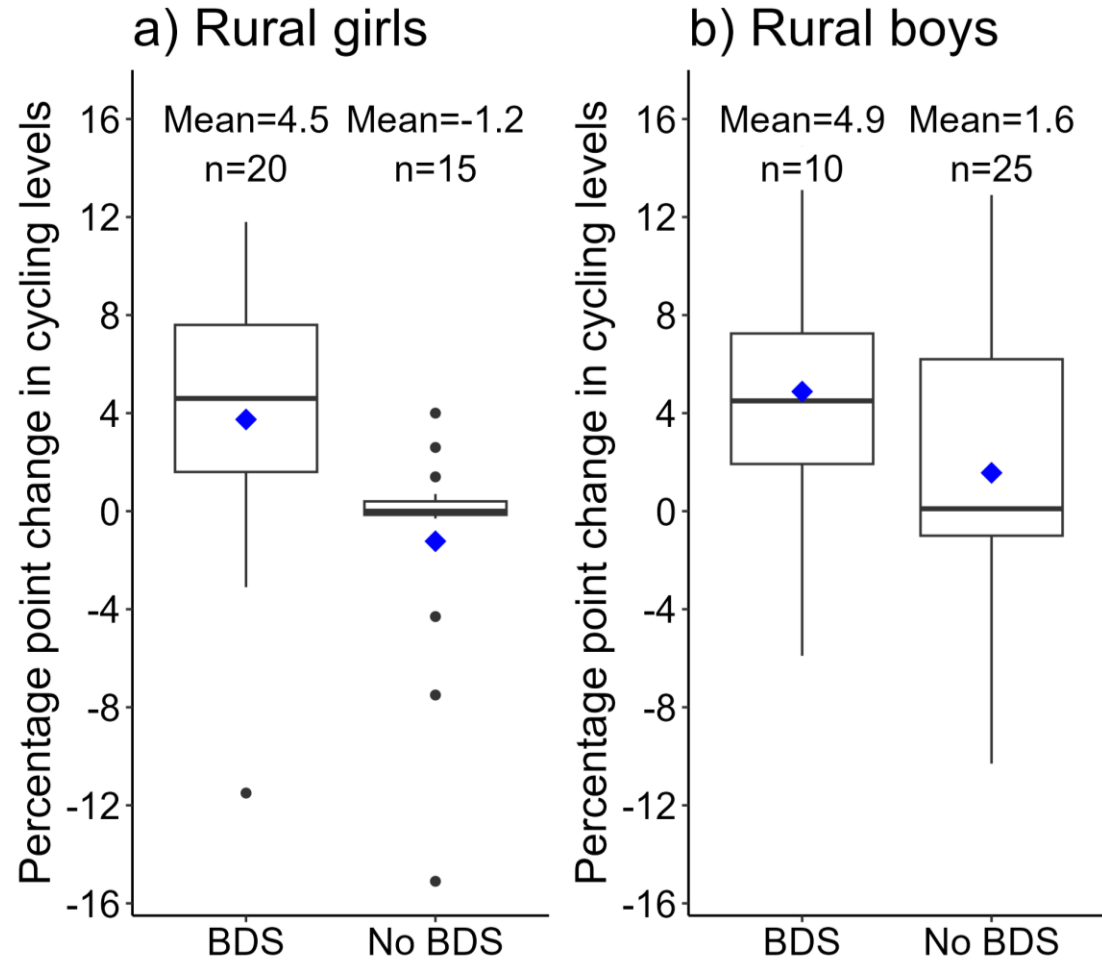
# Rise of cycling to school in India



# Geographical spread of cycling growth



# Bicycle distribution schemes in states: a major contributor to growth in cycling use

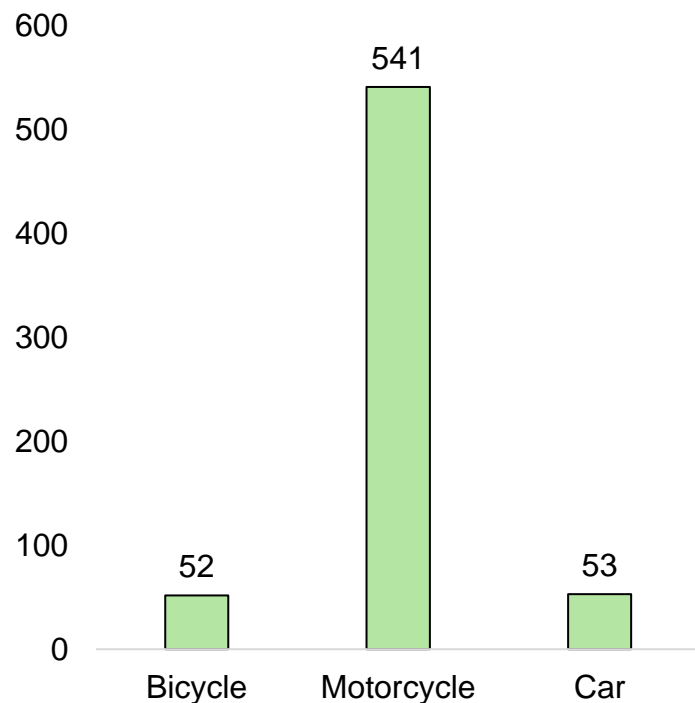


**Decadal change in cycling use**

- This scheme is 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
- Bicycles given to the children enrolled in secondary schools (ninth and tenth standards), with the underlying aim to improve access to secondary education
- States with the highest growth in cycling were those where BDS had been implemented

# Risk of fatality of a cyclist in Delhi

Average number of annual road deaths in Delhi (2017-2019)

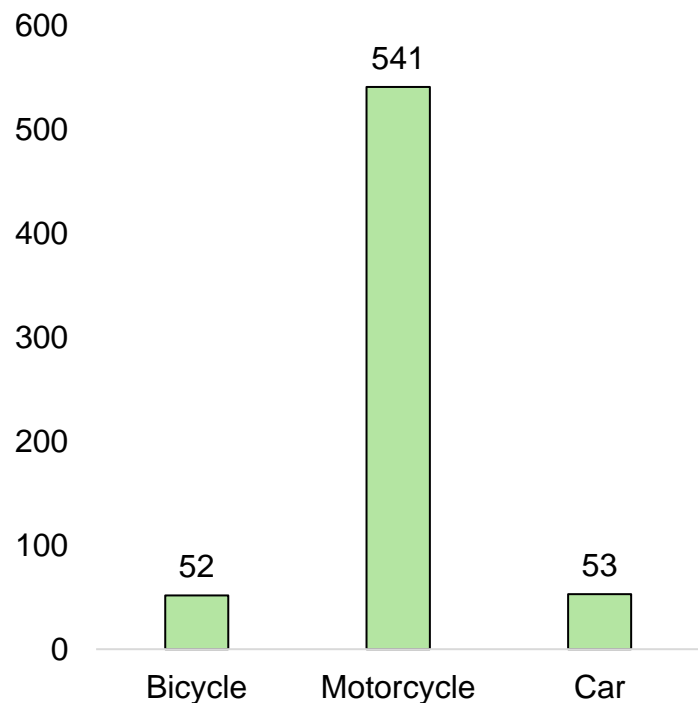


Bicyclist and car occupant deaths are almost one-tenth of motorcyclists

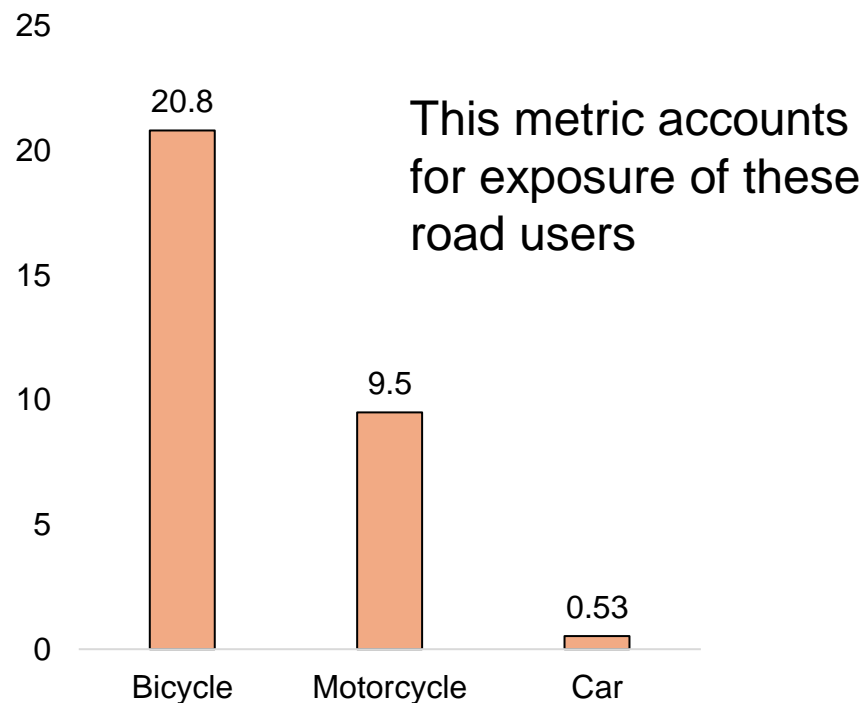


# Risk of fatality of a cyclist in Delhi

Average number of annual road deaths in Delhi (2017-2019)



Risk (Deaths per billion kilometre)



For the same distance travelled, a has 40 times greater risk of dying than a car occupant

# E-bikes combine the best of motorcycles and bicycles

- Electric bicycles can be broadly grouped into two categories:
  1. Pedal-assist
  2. Throttle powered
- Pedal-assist: uses both human and motor power to drive the wheels of the cycle
  - Provides 75% as much physical activity as a conventional bicycle
- E-bikes combine the ability of a motor with human power
  - Lower speeds compatible with cycling infrastructure
  - Retains physical activity while electric motor supports longer distance, hilliness, hot weather, and frailty
  - Most efficient use of batteries: electrification that minimises ecological impacts because of metal extraction
  - International experience shows potential of mode shift from motorised vehicles



# We conducted a qualitative study to understand the potential of e-bikes in Delhi

- Types of interviewees:
  - Users
  - Retailers
  - Manufacturers
  - Retrofitters
  - Policymakers
  - Advocacy groups/industry organizations
- Goal was to understand what is the current landscape of electric cycle use, as well as why it is happening
- Length ranges from approx. 10 minutes to an hour or more

# Challenges and enablers for the growth of e-bicycles

- **Affordability:** Who will buy an e-bike? A potential cyclist or a potential motorcyclist
- **Taxation & subsidy:** FAME subsidy, GST, bank loans
- **Traffic safety:** e-bikes, just like bicycles need safe infrastructure—also adds to synergy
- **Accessibility:** those with injuries and older adults find e-bikes convenient
- **Physical activity benefits:** customers are interested in e-bikes for convenience and physical activity

# Way forward

- Use electrification and decarbonisation as a pivot for transformative changes in transport
- Focus on micromobility and vehicles that use small batteries
- Cycling infrastructure is a major policy push in many countries: for decarbonising and public health
- Micromobility has strong synergy with cycling policies
- E-bikes should be treated as motor vehicles and should find a prominent place in the electrification policy of India