Vulnerable Road User

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### DALY: Disability-adjusted life year

<table>
<thead>
<tr>
<th>1990</th>
<th>2020</th>
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<tbody>
<tr>
<td>1 Lower respiratory infections</td>
<td>1 Ischaemic heart disease</td>
</tr>
<tr>
<td>2 Diarrhoeal diseases</td>
<td>2 Unipolar major depression</td>
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<tr>
<td>3 Perinatal conditions</td>
<td>3 Road traffic injuries</td>
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<tr>
<td>4 Unipolar major depression</td>
<td>4 Cerebrovascular disease</td>
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<tr>
<td>5 Ischaemic heart disease</td>
<td>5 Chronic obstructive pulmonary disease</td>
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<tr>
<td>6 Cerebrovascular disease</td>
<td>6 Lower respiratory infections</td>
</tr>
<tr>
<td>7 Tuberculosis</td>
<td>7 Tuberculosis</td>
</tr>
<tr>
<td>8 Measles</td>
<td>8 War</td>
</tr>
<tr>
<td><strong>9 Road traffic injuries</strong></td>
<td><strong>9 Diarrhoeal diseases</strong></td>
</tr>
<tr>
<td>10 Congenital abnormalities</td>
<td>10 HIV</td>
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</tbody>
</table>

- The global cost of traffic crashes is estimated to be US$ 518 billion per year.
- Low-income and middle-income countries account for US$ 65 billion
- No accident, completely man-made and largely an engineering problem
- Source: WHO report on Traffic Safety
Academic Base

• A problem is that work on road safety is still not recognised as a scientific occupation in our academic institutions and among decision makers.
  – A huge turnover in “experts” that work in this area.
  – Very few work on road safety as their dominant area of activity.
• Each batch of experts rediscover or reinvent the same wheel.
  – Known for over thirty years that driver education does not significantly reduce the incidence of RTIs.
  – Each new batch of “experts” ultimately agree and stop focussing on education as the main solution to RTIs.
RTI Statistics in India – Year 2000

• Official Numbers
  – 80,118 persons killed
  – 342,200 injured in road traffic crashes
• Not all injuries are reported. Actual numbers estimated
  – 1,200,000 persons with injuries requiring hospital treatment and
  – 600,000 persons sustaining minor injuries.
• RTI have been increasing over the past twenty years
  – Increase in the number of vehicles on the road
  – Absence of a coordinated official policy to control the problem.
• Number of fatalities have continued to increase at a steady rate of approximately 5% year on year, over the past two decades.
• The fatality rate per million vehicles has remained ~2% for the past few years
• The rate per million population continues to increase and is ~80 at present.

IIT Delhi
Attitudes: Govt. and the masses

• Government Approach – RTI and deaths are here to stay, and we can only attempt to reduce them.
• Road users are indifferent with respect to a range of risks around the average road traffic (Koornstra, 1990, 2007)
• HIC Government
  – Invested in road safety agencies, standards and some on research.
• LMIC Government:
  – Concerned but have not established effective agencies or spent any money on research.
• LMIC Citizens
  – show a greater intolerance of deaths caused by road traffic crashes.
  – In many Asian and African countries, angry crowd may lynch driver or burn a vehicle involved in a pedestrian crash.
  – Villagers on their own have also constructed “illegal” speed humps (speed-breakers) in thousands of villages to slow down vehicles speeding through their neighbourhoods.
Walking is not safe: world over

- Copenhagen
  - Bus commuters have fatal incidents as pedestrians on their access trips than that as bus passengers (Jorgensen, 1996).

- Mexico City
  - 57% of deaths from traffic crashes involve pedestrians (Hijar et al., 2001);

- Spain
  - Injury to pedestrians cause of multiple trauma (54%) among children (Sala et al., 2000)

- Seattle
  - 66% of the fatal injuries occurred on city or residential streets
  - 29% occurred on major thoroughfares
  - A single urban highway accounted for 12% of pedestrian fatalities and represented a particularly hazardous traffic environment (Harruff et al., 1998).
Children specially vulnerable

- **New South Wales, Australia**
  - The greatest risk to schoolchildren from bus related injuries was found to be as pedestrians after alighting from a bus in (Cass *et al.*, 1997)

- **Canada**
  - showed that children’s exposure to traffic (number of streets crossed) and injury rates were positively correlated (Macpherson *et al.*, 1998)

- **Kumasi, Ghana,**
  - the most common mechanisms of injury (40.0%) to children were pedestrian knock-downs (Abantanga and Mock, 1998);
Bicycling – How Safe

- In LMICs use of bicycles reducing with increasing income.
- In urban Europe, increase in bicycle use in the past two decades among adults.

Daily cycling trips in Europe:
- 1 in Holland to as low as 0.1 in the UK.
- 30 to 65% of the time trips by car is under 5km

Cyclists are in disproportionate number of fatal crashes, often more than pedestrians.
- Bicyclists are 5-6% of deaths and 7-8% of injuries in Europe
- In Copenhagen bicyclists had a fatality rate of 21 per million trips compared to 6 for car and 0.5 for bus occupants.
- In Delhi cyclists constitute 5% of the trips but 14% of the fatalities
Need a different solution

- The HMCs have never experienced road traffic with
  - High proportion of motorised two-wheelers (MTWs), buses and trucks sharing the same road space with pedestrians and bicyclists.
- Necessary to examine the issues at a more fundamental level.
- Simple transfer of knowledge and technologies from HMCs to LMCs will never be entirely feasible or that effective.
- The scientific basis generated in the HMCs can suggest framework to develop solutions for LMCs like India.
Small cars to stay in LMIC
Impact Kinematics

- Rider impacts bonnet, rolls up the windscreen towards the roof
- Rider rolling off the side of the car in some cases.
- For higher velocities, rider may clear the roof
- At lower velocities, rider may be “carried” on bonnet.
- Behavior qualitatively different for varying car / bicycle speeds & impact locations.
Bus – pedestrian kinematics
Redesign the bus front @ 20 km/h

- Studies on pedestrian and bicycle impacts in the last twenty years have concentrated on impacts with cars.
- Aimed at developing car fronts that are less aggressive.
- These kinematics are very different from bus and truck impacts with pedestrians
  - These vehicles present a vertical structure for the whole body, whether adult or child.
  - Pedestrians sustain fewer serious pelvic and leg injuries and more serious chest, arm and head injuries than when struck by cars.
- Need fronts of buses and trucks which are much more forgiving in impacts with pedestrians.
- We are working towards a formal analysis so that the relevant standards can be established.
The small list

- VRU Safety through finite element human body modelling.
- Safer common/share transit modes inclusive of region specific vehicles
- Small car safety standards
- Fundamental diagram for crashes?