Road Traffic Injury: From Epidemiology to Global Translation

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Prof. Mark Stevenson (MUARC) presentation
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Overview

- Background
- Cycle of Research
- Significance of the Problem
- Global Translation
Background
Australia’s Progress...

Source: Australian Transport Safety Bureau
Global Burden of Road Traffic Injury

Regional distribution of global RTI mortality, 2000
Total no. of deaths = 1,260,000

AFR 13%
WPR 24%
AMR 11%
EMR 7%
EUR 10%
SEAR 35%

Regional distribution of the global RTI burden (DALYs lost), 2000
Total no. of DALYs lost = 41,234,000

AFR 14%
WPR 24%
AMR 11%
EMR 8%
EUR 9%
SEAR 34%

Source: WHO World Report on Road Traffic Injury, 2004
Cycle of Road Traffic Injury Research
Injury Prevention Model

**Stage 1:** Extending beyond linked data sources, enumerating RTI in Low and middle-income countries

**Stage 2:** Identify the key determinants and understand the systems in which the injuries occur

**Stage 3:** To increase the evidence-base on interventions to reduce the incidence of road injury

**Stage 4:** To increase the uptake of evidence-based policies to reduce the burden of road injury

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**STAGE 1**

The Burden of Road Injury

**STAGE 2**

Risk Factors for Road Injury

**STAGE 3**

Efficacy & Effectiveness of Interventions

**STAGE 4**

Translation of the Evidence
Stage 2: Risk Factors for Road Injury

- To examine the effects of phone use on the risk of serious crashes
- To determine whether the risk differs for hands-free versus hand-held phones
## Stage 2: Risk Factors for Road Injury

**Design:** Case-Crossover  
**Sample:** 971 Drivers  
**Site:** Perth ED’s

<table>
<thead>
<tr>
<th>Factor</th>
<th>OR (95% CI)</th>
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<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>5.21 (1.89 to 14.37)</td>
</tr>
<tr>
<td>Female</td>
<td>3.49 (1.57 to 7.74)</td>
</tr>
<tr>
<td><strong>Age group</strong></td>
<td></td>
</tr>
<tr>
<td>&lt;30 years</td>
<td>3.87 (1.60 to 9.38)</td>
</tr>
<tr>
<td>≥30 years</td>
<td>4.33 (1.79 to 10.47)</td>
</tr>
<tr>
<td><strong>Type of mobile phone</strong></td>
<td></td>
</tr>
<tr>
<td>Hand-held</td>
<td>4.91 (1.55 to 15.50)</td>
</tr>
<tr>
<td>Hands-free</td>
<td>3.78 (1.80 to 7.97)</td>
</tr>
</tbody>
</table>
Stage 2: Risk Factors for Road Injury
Stage 2: Risk Factors for Road Injury

Why Are The Crash Rates So High?

- **Carriage of Peer Passengers**
  - Increases risk of injury up to 15 fold
  - Increases risk of death 2 fold

- **Driving at Night**
  - Young drivers are at an increased risk
    - 31% of young driver fatalities occur between midnight and 6.00am
Stage 2: Risk Factors for Road Injury

Restricting Carriage of Peer Passengers

Injury-related Crash Reductions

- NZ no passengers 35%

Injury-related Reductions for 15-19 year old passengers

- U.S. (California) no passengers 3-23%

Night Driving Restrictions

Reduction in Nighttime Crashes

- U.S. (California) midnight - 05.00am 20%
- U.S. (North Carolina) 10.00pm - 05.00am 47%
- NZ 10.00pm - 05.00am 32%
Stage 2: Risk Factors for Road Injury

- 330 deaths and over 1000 serious injuries each year in Australia involve heavy vehicles
- Approximately 18% of fatal crashes in Australia involve a heavy vehicle
- Heavy vehicle crashes cost approximately $2 billion, annually
Stage 2: Risk Factors for Road Injury

To determine the role risk factors namely

i) Driver characteristics such as sleepiness, sleep disorders, health status and drug and alcohol use

ii) Employer/company-related factors (scheduling, payment of drivers)

iii) Vehicle characteristics (truck configuration and modifications)

play, in heavy vehicle crashes
Stage 2: Risk Factors for Road Injury

Research Design: Case-control
Sample: 517 Cases
517 Controls
Sites: WA and NSW

Instrument: Driver demographics, work schedules and payment, vehicle characteristics, work/rest schedule, general health, sleep-related questions
Stage 3: Effectiveness of Interventions for Road Injury

1. **Child Pedestrian Injury Prevention Project**
   - Design: Pre-Post-test Controlled Trial
   - Outcome: Children in high intervention group had significantly improved road crossing behaviours compared with controls

2. **School-based peer bicycle helmet intervention**
   - Design: Cluster Randomised Controlled Trial
   - Outcome: Arrested the rate of decline in helmet-use in 10-11yo children

3. **Buckle-up Safely: a pre-school program to increase appropriate use of child restraints**
   - Design: Cluster Randomised Controlled Trial
   - Outcome: TBC
Significance of the Problem
A Decade of Action for Road Safety 2011-2020

- 3500 people die, globally, each day from road trauma
- May 11, 2011 UN General Assembly declared a Decade of Action for Road Safety 2011-2020
- Purpose: to highlight that road injury is a public health issue that merits concern and attention as a global development priority.
Why should RTI be a Global Development Priority?

- From 2000-2030 more cars will be produced than in the first 100 years of motorisation.
- Most of these cars will be introduced into LMIC (where vulnerable road user predominates).
- More than 50 million deaths and 500 million serious RTI’s are projected over the first 50 years of this century.
Why should RTI be a Global Development Priority?

- Global road safety has become linked with
  - sustainable development
  - priorities addressing poverty reduction
  - achievement of the Millennium Development Goals
Global Translation
Two Examples of Translation

Focus on China

- RTI’s 6th leading cause of burden of disease
  - Urban population in China to increase from 30% to 49%
  - Car ownership projected to increase 10-fold
  - Declining pedestrian and cyclist mobility
Aims
- To increase seat belt use by 20%
- To estimate the cost effectiveness of the intervention
- To implement an intervention targeting seat belt restraint use

Findings
- Seat belt restraint use increased by 20%
- Restraint use increased by 26% among taxi drivers
- Highly cost effective
Evaluation of the Intervention

- Guangzhou Intervention Site
  - Enhanced Enforcement
  - Police Training
  - Health Promotion

- Nanning Comparison Site

<table>
<thead>
<tr>
<th>Apr</th>
<th>May</th>
<th>Aug</th>
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<tbody>
<tr>
<td>05</td>
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<td>06</td>
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<td>06</td>
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## Comparison of DALYs across a Range of Road Safety and Health Interventions

### Road Safety Interventions in LMICs

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Cost (US$)</th>
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<tbody>
<tr>
<td>Traffic Calming – Speed Bumps</td>
<td>5</td>
</tr>
<tr>
<td>Bicycle Helmet Legislation (China)</td>
<td>107</td>
</tr>
<tr>
<td><strong>China Seat Belt Intervention</strong></td>
<td><strong>418</strong></td>
</tr>
<tr>
<td>Motorcycle Helmet Legislation (Thailand)</td>
<td>467</td>
</tr>
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### Other Health Interventions

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Cost (US$)</th>
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<tbody>
<tr>
<td>Coronary Heart Disease – Reducing salt via legislation &amp; education campaign</td>
<td>1,325</td>
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<tr>
<td>Stroke – Acute management with heparin within 48 hours of onset</td>
<td>1,630</td>
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</table>
Two Examples of Translation

Focus on India

- 110% increase in deaths from RTI’s by 2020
  - Car ownership projected to increase 60-fold by 2050
  - 267 million vehicles by 2050
Child Restraint Systems: Highly efficacious

- Effectiveness/Efficacy of child restraints
  - 28% reduction in risk of death for children aged 2-6 years using a CRS
  - CRS (FFR) reduced the likelihood of injury to a child (toddler) by 82% compared with standard seat belt
  - CRS (booster seat) reduced the risk of injury to 4-7 year olds in a crash by 59% compared with standard seat belt
  - Australian study found no serious/fatal injuries among children optimally restrained; 30% of sub-optimally restrained children were seriously injured.
Child Restraint Systems: Effectiveness?

Misuse of CRS

Figure 13  Example of child seated out of position while travelling in the vehicle in a booster with high back.
Child Restraint Systems: Effectiveness?

Misuse of CRS

Figure 14

Example of child seated out of position while travelling in the vehicle in an H-harness.

Child has moved her body to the left to rest against the rear centre armrest in order to be more comfortable whilst viewing a DVD.
Child Restraint Systems: Effectiveness?

A: Inappropriate use of seatbelt (child should be in booster seat)
B: Misuse of seatbelt.
C: Improved fit using a booster seat
Child Restraint Systems: Challenges

- Recent study showed (with exception of FFR) serious misuse of CRS was observed in 50% or more of children
- Barriers to implementation and correct use
  - Socioeconomic status/cost
  - NESB
  - Access to CRS and correct fitting
  - Maintenance of CRS
Conclusion
Journey from epidemiology to translational research/development

Iterative approach
  - Data Systems 2012-2014

Lots to be done!!
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