Challenges and advances in measuring the burden of injury

Prof Belinda Gabbe
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Burden of Injury

- Key concepts of magnitude and cost

- Valid and reliable methods for quantifying the burden of disease and injury are essential to:
  - guide the public health response to conditions
  - identify priorities
  - policy setting and strategic health services planning and;
  - monitor the impact of interventions

- Many, many measures of burden....

- Impact of injury is multidimensional
LOAD Framework

Injury

Society

Death, including foetal I1
Pain and discomfort I2
Reduced short term physical activity I3
Long term physical disability I4
Psychological disability I5
Concomitant diseases I6
Development of secondary conditions I7
Behavioural change and secondary health loss I8
Fear of repeated injury I9
Tangible costs I10
Intangible costs I11
Diminished quality of life I12

Individual

Observer consequences F1
Carer consequences F2
Dependant consequences F3

Family

Types of burden measures

Ranking of burden of injury changes depending on the measure

- Mortality related
  - Absolute numbers of deaths
  - YLL
  - YPLL

- Morbidity related
  - Commonly relate to contact with health system
  - Length of stay, bed days, etc.

- Monetary costs
  - Medical costs +/- productivity costs
  - $$ are easy to understand

- Composite measures (M&M)
  - QALYs and DALYs

Need consistent measures across all disease groups to rank and compare
Table 2. Leading causes of the burden of injury using selected measures, US, 1997.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Deaths</th>
<th>Non-fatal Hospitalizations</th>
<th>Fatal and Non-fatal Injury</th>
<th>PYLL</th>
<th>QALYs</th>
<th>Medical Costs</th>
<th>Monetary Costs</th>
<th>Comprehensive Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Road injury</td>
<td>Fall</td>
<td>Fall</td>
<td>Road injury</td>
<td>Fall</td>
<td>Fall</td>
<td>Fall</td>
<td>Fall</td>
</tr>
<tr>
<td>2</td>
<td>Firearm suicide</td>
<td>Road injury</td>
<td>Struck by/against</td>
<td>Firearm suicide</td>
<td>Road injury</td>
<td>Road injury</td>
<td>Road injury</td>
<td>Firearm injury</td>
</tr>
<tr>
<td>3</td>
<td>Fall</td>
<td>Unintended poisoning</td>
<td>Road injury</td>
<td>Firearm assault</td>
<td>Struck by/against</td>
<td>Struck by/against</td>
<td>Struck by/against</td>
<td>Struck by/against</td>
</tr>
<tr>
<td>4</td>
<td>Unintended poisoning</td>
<td>Suicidal poisoning</td>
<td>Unintended cut/pierce</td>
<td>Unintended poisoning</td>
<td>Unintended poisoning</td>
<td>Pedestrian/ pedal cycle</td>
<td>Over-exertion</td>
<td>Over-exertion</td>
</tr>
<tr>
<td>5</td>
<td>Firearm assault</td>
<td>Pedestrian/ pedal cycle</td>
<td>Overexertion</td>
<td>Pedestrian/ pedal cycle</td>
<td>Burn</td>
<td>Overexertion</td>
<td>Pedestrian/ pedal cycle</td>
<td>Over-exertion</td>
</tr>
</tbody>
</table>

PYLL, potential years of life lost; QALYS, quality adjusted life years.
Quality Adjusted Life Year (QALY)

- Generally based on utility measure which provide an index of strength of a person’s preference for a health state compared with full health and death
  - 1 year perfect health = 1 QALY
  - Loss of year of life = 0 QALY
  - Year of less than full health weighted from 0 to 1
  - Based on Standard Gamble approach
    - Probability of full life is varied until the gamble is equally attractive as the certainty of life in the inferior health state
  - Favoured by health economists and often used in decision making about funding health interventions
DISABILITY ADJUSTED LIFE YEAR (DALY)
Years of Life Lost (YLL) component

- Need quality and complete deaths data which includes the age and gender of the person
- Need a relevant life table to establish life expectancy in the population
- For injury, external cause required to enable comparisons of injury subgroups
  - ICD-10 commonly used to code deaths
  - X59 and unspecified case of injury codes create some problems
    - Often proportional redistribution based on age and gender
- Paucity of quality deaths registration data in low and middle income countries
Challenges for measuring YLDs in injury

- Data sources
- ICD basis
- Health state definitions
- Multiple injuries

- Panel/vignette based generation
- Empirical basis for weights not related to patient experiences
- Limited use of WHO ICF domains in descriptors

- When does recovery plateau?
- Delayed mortality
- Not based on empirical data

\[ \text{Incidence} \times \text{Disability weight} \times \text{Duration} = \text{YLD} \]
Data sources

- Predominantly hospital discharge registers
- Limited emergency department presentation data
  - Recent UK study shows that using ED and HDR data result in equivalent YLD to YLL
- Paucity of data for cases not presenting to hospital
  - Mostly WHO and other surveys
  - Population-based or large cohort studies rare
ICD basis for injury health states

- More than 1200 ICD-10 diagnosis codes for injury
- Multiple published classifications
  - 33 injury health states (ICD-9 based) for GBD 1990
  - 44 injury health states for GBD 2010 recommended by GBD-IEG
  - 23 injury health states in GBD 2010 final estimates
  - Meerding 13
  - EUROCAST and JAMIE
  - “injury bundling”
    - e.g. fracture scapula, humerus, clavicle
    - e.g. fracture patella, fibula, tibia or ankle
- None based on homogeneity of disability outcomes
- None address multiple injuries
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>ICD-10 Codes</th>
<th>Reference Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 N1</td>
<td>Open wound, superficial injuries and dislocations</td>
<td>S00-S01, S03-S03.5, S05, S08-S10, S11.1-S11.9, S13, S15, S19-S21, S23, S29, S30-S31, S32.2, S33, S39.0, S40-S41, S45-S46, S50-S51, S53.0-S53.4, S55-S58, S60-S61, S63, S65-S66, S70-S71, S73.1, S75-S76, S80-S81, S83-S86, S90-S91, S93.0-S93.6, S95-S96, S99 (except S99.7), T00-T01, T03, T06.3-T06.4, T09.0-T09.2, T09.5, T11.0-T11.2, T11.4-T11.5, T13.0-T13.2, T13.5, T14.0-T14.1, T14.3, T14.5-T14.6, T15-T17, T19.0, T35, T90.1, T90.4, T92.0, T92.3, T92.5, T93.0, T93.3, T93.5.</td>
<td>830-830.1, 832-834, 837-839, 840, 840.3, 840.5, 841-848, 864.01, 864.11, 870-873, 874.2, 875-884, 889-894, 900, 903-904, 905.6-905.8, 906.0-906.3, 910.4-910.9, 911-924, 930-934, 950, 991.0-991.3.</td>
</tr>
<tr>
<td>2 N2</td>
<td>Injury Requiring Urgent Care</td>
<td>S07, S16-S17, S38.0-S38.3, S47, S57, S67, S77, S87, S97, T04, T14.7, T18-T19, T36-T65, T67-T70, T73-T74, T75.0-T75.2-T75.8, T78-T85, T88, T91.5, T92.6, T93.6, T96-T97.</td>
<td>906.4, 925-929, 935.0-935.2, 936-939.9, 940-990, 991.4-994.0, 994.2-994.6, 994.8-999.9.</td>
</tr>
<tr>
<td>3 N3</td>
<td>Injury Requiring Emergency Care</td>
<td>S35-S37, S39.6-S39.9, T27.0-T27.7, T71, T75.1.</td>
<td>863-869, 902, 947.1, 991.1, 994.7.</td>
</tr>
<tr>
<td>4 N4</td>
<td>Fracture of clavicle, scapula, humerus, or skull</td>
<td>S02.0-S02.1, S02.7, S02.9, S42, S49.7, T02.0, T90.2.</td>
<td>800-801, 803.0, 803.5, 804.0, 804.5, 810-812.</td>
</tr>
<tr>
<td>5 N5</td>
<td>Fracture of sternum, rib, or face bone</td>
<td>S02, S02.2-S02.6, S02.8, S32, S22.2-S22.3, S22.8-S22.9.</td>
<td>802, 807.0, 807.2.</td>
</tr>
<tr>
<td>6 N6</td>
<td>Fracture of wrist and other distal part of hand, fracture of foot except ankle</td>
<td>S62, S69, S69.7-S69.9, S92, S99.7, T92.2.</td>
<td>814-819, 825-827.</td>
</tr>
<tr>
<td>7 N7</td>
<td>Fracture of radius or ulna</td>
<td>S52, S59.7-S59.9, T02.1, T02.4, T10, T92.1.</td>
<td>813, 905.2.</td>
</tr>
<tr>
<td>8 N8</td>
<td>Fracture of femur</td>
<td>S72, S72.3-S72.9.</td>
<td>821.</td>
</tr>
<tr>
<td>9 N9</td>
<td>Fracture of Hip</td>
<td>S72.0-S72.2, T93.1.</td>
<td>820, 905.3.</td>
</tr>
<tr>
<td>10 N10</td>
<td>Fracture of patella, tibia, fibula, or ankle</td>
<td>S82, S89.7, T02.3, T02.5-T02.6, T12.0-T12.1.</td>
<td>822-824, 905.4.</td>
</tr>
<tr>
<td>11 N11</td>
<td>Fracture of pelvis</td>
<td>S32.1, S32.3-S32.8.</td>
<td>805.6-805.7, 808-809.1.</td>
</tr>
<tr>
<td>13 N14</td>
<td>Burns, &lt;20% total burned surface area without lower airway burns</td>
<td>T20-T27, T28-T30, T31.0-T31.1, T32.0-T32.1.</td>
<td>910.0-910.3, 940-947 (except 947.1), 948.0-948.1, 949.</td>
</tr>
<tr>
<td>14 N16</td>
<td>Burns, &gt;20% total burned surface area or &gt;10% total burned surface area if head/neck or hands/wrist involved</td>
<td>T31.2-T31.9, T32.2-T32.9, T66, T95.</td>
<td>906.5-906.9, 948.2-948.9.</td>
</tr>
<tr>
<td>15 N17</td>
<td>Amputation of both lower limbs or both upper limbs</td>
<td>T05.0-T05.5.</td>
<td>887.6-887.7, 896.2-896.3, 897.6-897.7.</td>
</tr>
<tr>
<td>16 N19</td>
<td>Amputation of one lower limb or one upper limb</td>
<td>S48.0, S48.1, S48.9, S58-S58.9, S68, S68.3-S68.9, S78, S88, S98-S98.0, S99.3-S99.4, T05.6, T11.6, T13.6.</td>
<td>887.0-887.5, 896.0-896.1, 897.0-897.5.</td>
</tr>
<tr>
<td>17 N20</td>
<td>Amputation of finger(s) (with or without thumb or toe)</td>
<td>S68.0-S68.2, S98.1-S98.2.</td>
<td>885-886, 895.0, 895.1.</td>
</tr>
<tr>
<td>18 N21</td>
<td>Injured nerve</td>
<td>S04, S44, S54, S64, S74, S84, S94, T06.2, T11.3, T13.3, T14.4, T90.3, T92.4, T93.4.</td>
<td>907.3-907.9, 951, 953-957.</td>
</tr>
<tr>
<td>19 N22</td>
<td>Spinal cord lesion at neck level</td>
<td>S14, T04.0.</td>
<td>806.0-806.1, 952.0.</td>
</tr>
<tr>
<td>20 N23</td>
<td>Fracture of vertebral column</td>
<td>S12, S22.0-S22.1, S32.0, T91.1.</td>
<td>805.0-805.5, 805.8-805.9, 905.1.</td>
</tr>
<tr>
<td>21 N24</td>
<td>Spinal cord lesion below neck level</td>
<td>S24, S34, T06.1, T08, T91.3.</td>
<td>8062-8069, 9072-9531-9539.</td>
</tr>
<tr>
<td>22 N27</td>
<td>Severe of traumatic brain injury</td>
<td>S06, T90.5.</td>
<td>907.</td>
</tr>
<tr>
<td>23 N28</td>
<td>Severe chest injury</td>
<td>S11.0, S22.4-S22.5, S25-S28, S29.7, T91.4.</td>
<td>807.1, 807.3-807.6, 880-862, 874-874.1, 901.008.</td>
</tr>
</tbody>
</table>
• Prediction performance was best for lower levels of function such as independent living, mobility and self-care.

• The classifications were poorer predictors of anxiety/depression and pain/discomfort.

• Discrimination was marginally higher when using individual ICD-10 diagnosis codes rather than grouped injury classifications.

• There was no clearly superior classification for injury burden studies.
Multiple injuries

Not considered previously

- Past methods allow only one disability weight and therefore only one injury
- Need to understand the impact of multiple injuries
<table>
<thead>
<tr>
<th>Outcome at 12-months</th>
<th>Adjusted RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GOS-E &lt;8</td>
<td>1.08 (1.07, 1.09)</td>
</tr>
<tr>
<td>EQ-5D limitations Mobility</td>
<td>1.10 (1.09, 1.12)</td>
</tr>
<tr>
<td>EQ-5D limitations Self-care</td>
<td>1.08 (1.06, 1.10)</td>
</tr>
<tr>
<td>EQ-5D limitations Usual activities</td>
<td>1.09 (1.08, 1.10)</td>
</tr>
<tr>
<td>EQ-5D limitations Pain or discomfort</td>
<td>1.09 (1.07, 1.10)</td>
</tr>
<tr>
<td>EQ-5D limitations Anxiety or depression</td>
<td>1.08 (1.07, 1.10)</td>
</tr>
</tbody>
</table>
Multiple injuries were common in hospitalised injury cases

Strong association between the number of injuries and disability outcomes at 12-months

Difference between cases with 8+ injuries and cases with 1 injury averaged >20% for the GOS-E (27-32%), EQ-5D mobility (18-23%), usual activities (22-24%), and pain/discomfort (19-27%)

Existing composite measures of anatomical injury severity such as the NISS or ISS may be insufficient to characterise and account for multiple injuries in disability studies

Future studies should consider the impact of multiple injuries to avoid under-estimation of injury burden

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Disability weights

Panel

- Disability weights generally higher (i.e. less disability)
- Resource intensive to get weights for large numbers of health states
- Highly dependent on quality of descriptor/vignette
- “patient-derived weights result in “over-estimation” of the disability resulting from more minor injuries due to the potential for reporting bias and differences between self-reported health status and “actual” health status”

Empirical data

- Deriving values from people who have had the condition of interest
- Limitations in administering a MAUI to some injury patients
- MAUI approach still relies on population tariffs to generate weights
- Cohort studies also expensive
Alternative approaches to derive disability weights in injuries: do they make a difference?

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Abstract

Background In burden of disease studies, several approaches are used to assess disability weights, a scaling factor necessary to compute years lived with disability (YLD). The aim of this study was to quantify disability weights for injury consequences with two competing approaches, (a) standard QALY/DALY model (SQM) which derives disability weights from patient survey data and (b) the annual profile model (APM) which derives weights for the same patient data valued by a panel.

Methods Disability weights were assessed using (a) EQ-5D data from a postal survey among 8,564 injury patients 2½, 5, and 9 months after attending the Emergency Department, and (b) preferences of 143 laymen elicited with the time trade-off method.

Results Compared with APM, SQM disability weights were consistently higher. YLD calculated with SQM disability weights was more than three times higher compared with YLD calculated with APM disability weights, for mild injuries with short duration, this increase was six fold.

Conclusions The APM seems the preferred method in burden of injury studies that includes mild conditions with a rapid course, since the SQM approach might overestimate the impact of the latter. The APM, however, might underestimate the impact of injury consequences, especially in case of severe injuries.

Keywords Burden of illness · Injuries · Quality-adjusted life years · Utility

Abbreviations

APM Annual profile model
DALY Disability adjusted life years
ED Emergency department
EQ-5D EuroQol-5D
ICD International statistical classification of disease, injuries and causes of death
QALY Quality adjusted life years
SQM Standard QALY/DALY model
TTO Time trade-off technique
YLD Years lived with disability
YLL Years of life lost
VAS Visual analogue scale
Measuring the Population Burden of Injuries—Implications for Global and National Estimates: A Multicentre Prospective UK Longitudinal Study

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Abstract

Background: Current methods of measuring the population burden of injuries rely on many assumptions and limited data available to the global burden of diseases (GBD) studies. The aim of this study was to compare the population burden of injuries using different approaches from the UK Burden of Injury (UKBOI) and GBD studies.

Methods and Findings: The UKBOI was a prospective cohort of 1,517 injured individuals that collected patient-reported outcomes. Extrapolated outcome data were combined with multiple sources of morbidity and mortality data to derive population metrics of the burden of injury in the UK. Participants were injured patients recruited from hospitals in four UK cities and towns: Swansea, Nottingham, Bristol, and Guildford, between September 2005 and April 2007. Patient-reported changes in quality of life using the EQ-5D at baseline, 1, 4, and 12 months after injury provided disability weights used to calculate the years lived with disability (YLDs) component of disability adjusted life years (DALYs). DALYs were calculated for the UK and extrapolated to global estimates using both UKBOI and GBD disability weights. Estimated numbers (and rates per 100,000) for UK population extrapolations were 750,999 (1,240) for hospital admissions, 7,982,947 (13,339) for emergency department (ED) attendances, and 22,185 (36.8) for injury-related deaths in 2005. Nonadmitted ED-treated injuries accounted for 67% of YLDs. Estimates for UK DALYs amounted to 1,771,486 (82% due to YLDs), compared with 669,822 (52% due to YLDs) using the GBD approach. Extrapolating patient-derived disability weights to GBD estimates would increase injury-related DALYs 2.6-fold.

Conclusions: The use of disability weights derived from patient experiences combined with additional morbidity data on ED-treated patients and inpatients suggests that the absolute burden of injury is higher than previously estimated. These findings have substantial implications for improving measurement of the national and global burden of injury.

Please see later in the article for the Editors’ Summary.
<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amputation of one leg: long term, with treatment</td>
<td>has lost part of one leg, leaving pain and tingling in the stump. The person has a comfortable artificial leg and only slight difficulties moving around.</td>
</tr>
<tr>
<td>Amputation of one leg: long term, without treatment</td>
<td>has lost part of one leg, leaving pain and tingling in the stump. The person does not have an artificial leg, has frequent sores, and uses crutches.</td>
</tr>
<tr>
<td>Fracture of face bone: short or long term, with or without treatment</td>
<td>has a broken cheek bone, broken nose, and chipped teeth, with swelling and severe pain.</td>
</tr>
<tr>
<td>Spinal cord lesion below neck: treated</td>
<td>is paralyzed from the waist down and cannot feel or move the legs. The person uses a lightweight and comfortable wheelchair to move around.</td>
</tr>
<tr>
<td>Fracture of pelvis: long term</td>
<td>had a broken pelvis in the past and now walks with a limp. There is often pain in the back and groin, and when urinating and sitting for a long time.</td>
</tr>
<tr>
<td>Fracture of neck of femur: long term, without treatment</td>
<td>had a broken hip bone in the past, which was never treated and did not heal properly. The person cannot get out of bed and needs help washing and going to the toilet.</td>
</tr>
</tbody>
</table>
# 2013 GBD Study weights

<table>
<thead>
<tr>
<th>2013 GBD injury health state</th>
<th>Long term disability weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fracture of patella, tibia, fibula or ankle</td>
<td>0.055</td>
</tr>
<tr>
<td>Fracture of hip</td>
<td>0.058</td>
</tr>
<tr>
<td><strong>Fracture of radius or ulna</strong></td>
<td><strong>0.043</strong></td>
</tr>
<tr>
<td>Moderate traumatic brain injury</td>
<td>0.231</td>
</tr>
<tr>
<td>Fracture of vertebral column</td>
<td>0.111</td>
</tr>
<tr>
<td>Severe chest injury</td>
<td>0.047</td>
</tr>
<tr>
<td>Fracture of clavicle, scapula, humerus</td>
<td>0.035</td>
</tr>
<tr>
<td>Fracture of femur**</td>
<td>0.042</td>
</tr>
<tr>
<td>Fracture of the sternum or ribs</td>
<td>0.103</td>
</tr>
<tr>
<td>Fracture of pelvis</td>
<td>0.182</td>
</tr>
<tr>
<td>Severe traumatic brain injury</td>
<td>0.637</td>
</tr>
<tr>
<td>Spinal cord lesion at neck level</td>
<td>0.589</td>
</tr>
<tr>
<td>Spinal cord lesion below neck level</td>
<td>0.296</td>
</tr>
<tr>
<td>Minor traumatic brain injury</td>
<td>0.094</td>
</tr>
<tr>
<td><strong>Fracture of wrist and other distal part of hand</strong></td>
<td><strong>0.014</strong></td>
</tr>
<tr>
<td><strong>Fracture of face bone</strong></td>
<td><strong>0.067</strong></td>
</tr>
<tr>
<td>Amputation of one lower limb</td>
<td>0.039</td>
</tr>
<tr>
<td><strong>Dislocation of knee</strong></td>
<td><strong>0.113</strong></td>
</tr>
<tr>
<td>Amputation of one upper limb</td>
<td>0.039</td>
</tr>
<tr>
<td><strong>Amputation of both upper limbs</strong></td>
<td><strong>0.123</strong></td>
</tr>
<tr>
<td>Amputation of thumb</td>
<td>0.011</td>
</tr>
<tr>
<td><strong>Amputation of both lower limbs</strong></td>
<td><strong>0.088</strong></td>
</tr>
</tbody>
</table>
Spinal cord, below neck
Spinal cord, at neck
Fracture hip
Fracture femur
Fracture pelvis
Severe TBI
Moderate TBI
Fracture vertebral column
Severe chest injury
Fracture sternum, ribs
Fracture patella, tibia, fibula, ankle
Fracture skull
Fracture foot bones
Fracture clavicle, scapula, humerus
Fracture face bones
Dislocation shoulder
Muscle/tendon injury
Minor TBI
Fracture radius, ulna

Injury-VIBES  GBD 2013
Duration of disability

- Important for YLD calculation
- Based on expert consensus for GBD 1990
  - e.g. hip fracture disabling for 4-months
  - Disability persistent at 12-months likely to be permanent
  - 2010 durations not published and methodology not described
- Little data available previously
  - How do we define disability?
  - How do we address the delayed deaths?
- Injury-VIBES working on this as a priority
Injury requiring emergency care
- Open wounds, superficial injuries and dislocations
- Burns
- Fracture of wrist and other part of distal hand, fracture of foot except ankle
- Severe of TBI
- Fracture of hip
- Fracture of sternum, rib or face bone
- Fracture of clavicle, scapula, humerus, skull
- Injuries requiring urgent care
- Fracture of radius or ulna
- Dislocation of hip, knee or shoulder
- Severe chest injury
- Spinal cord lesion at neck level
- Spinal cord lesion below neck level
- Fracture of patella, tibia, fibula or ankle
- Fracture of vertebral column
- Fracture of pelvis
- Fracture of femur
- Fracture of sternum, rib or face bone
- Severe of TBI
- Fracture of pelvic
- Fracture of femur
- Fracture of pelvis
- Spinal cord lesion below neck level
- Fracture of vertebral column
- Fracture of patella, tibia, fibula or ankle
- Spinal cord lesion at neck level
- Severe chest injury
- Dislocation of hip, knee or shoulder
- Fracture of radius or ulna
- Injuries requiring urgent care
- Fracture of clavicle, scapula, humerus, skull
- Fracture of sternum, rib or face bone
- Fracture of hip
- Severe of TBI
- Fracture of wrist and other part of distal hand, fracture of foot except ankle
- Burns
- Open wounds, superficial injuries and dislocations
- Injuries requiring emergency care

% with self-care problems
Injury-VIBES Team

USA
Fred Rivara, University of Washington, Seattle
Kavi Bhalla, Johns Hopkins, Baltimore
Theo Vos, IHME, Seattle

Europe
Ronan Lyons, Swansea University, UK
Suzanne Polinder, Erasmus MC, Netherlands
Juanita Haagsma, Erasmus MC, Netherlands

Australia
Belinda Gabbe, Pam Simpson & Emma McDermott, Monash University
James Harrison & Clare Bradley, Flinders University

New Zealand
Shanthi Ameratunga, University of Auckland
Sarah Derrett, Massey University
Gabrielle Davie & John Langley, University of Otago

ROAD TRAUMA IN VICTORIA, AUSTRALIA

DALY example
# Road traffic fatality rates - Australia

<table>
<thead>
<tr>
<th>Year</th>
<th>NSW</th>
<th>VIC</th>
<th>QLD</th>
<th>SA</th>
<th>WA</th>
<th>TAS</th>
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<table>
<thead>
<tr>
<th>Year</th>
<th>Ave. annual change $^a$</th>
<th>1999-2010 change $^b$</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>-4.4%</td>
<td>-35.5%</td>
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<td>-36.5%</td>
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<tr>
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<td>-2.8%</td>
<td>-38.5%</td>
</tr>
<tr>
<td></td>
<td>-4.5%</td>
<td>-28.8%</td>
</tr>
<tr>
<td></td>
<td>-1.7%</td>
<td>-28.7%</td>
</tr>
<tr>
<td></td>
<td>-2.1%</td>
<td>-45.7%</td>
</tr>
<tr>
<td></td>
<td>-2.0%</td>
<td>-16.1%</td>
</tr>
<tr>
<td></td>
<td>-1.9%</td>
<td>-17.6%</td>
</tr>
<tr>
<td></td>
<td>-3.6%</td>
<td>-34.4%</td>
</tr>
</tbody>
</table>
Road traffic fatality by road user in Australia

- Drivers
- Passengers
- Pedestrians
- Motorcyclists
- Pedal cyclists
- All road users
Applying the DALY approach

- **Trauma deaths**
  - National Coroner’s Information System
  - Victorian State Trauma Registry (VSTR)

- **Incidence of serious injury**
  - VSTR

- **Disability weights**
  - VSTR routinely follows up patients at 6, 12 and 24 months post-injury
  - EQ-5D responses and summary scores used to develop weights
  - Mean weights by injury group at each time point

- **Duration of disability**
  - VSTR global rating of disability at each time point
  - Disability at 24 months considered permanent
Incidence of major trauma and death in Victoria, Australia
Risk-adjusted in-hospital mortality

**FIGURE 2.** Adjusted odds of mortality for hospitalized road transport–related major trauma in Victoria (July 2001 to June 2011).
<table>
<thead>
<tr>
<th>Injury Group</th>
<th>n</th>
<th>6 mo (SE)</th>
<th>12 mo (SE)</th>
<th>24 mo (SE)</th>
<th>Final Short-Term Weight</th>
<th>Final Long-Term Weight</th>
<th>% (95% CI) With Disability at 24 mo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolated head injury</td>
<td>623</td>
<td>0.245 (0.017)</td>
<td>0.238 (0.016)</td>
<td>0.272 (0.016)</td>
<td>0.257</td>
<td>0.272</td>
<td>63.8 (59.3–68.3)</td>
</tr>
<tr>
<td>Head and other region injuries</td>
<td>915</td>
<td>0.269 (0.012)</td>
<td>0.247 (0.012)</td>
<td>0.252 (0.012)</td>
<td>0.255</td>
<td>0.252</td>
<td>66.9 (63.5–70.2)</td>
</tr>
<tr>
<td>Spinal cord injury</td>
<td>108</td>
<td>0.644 (0.042)</td>
<td>0.547 (0.040)</td>
<td>0.550 (0.038)</td>
<td>0.572</td>
<td>0.550</td>
<td>93.6 (88.7–98.6)</td>
</tr>
<tr>
<td>Spinal column and/or extremity injuries</td>
<td>140</td>
<td>0.296 (0.031)</td>
<td>0.250 (0.032)</td>
<td>0.215 (0.034)</td>
<td>0.244</td>
<td>0.215</td>
<td>60.7 (50.3–71.2)</td>
</tr>
<tr>
<td>Chest/abdominal injuries only</td>
<td>91</td>
<td>0.142 (0.033)</td>
<td>0.101 (0.036)</td>
<td>0.107 (0.035)</td>
<td>0.114</td>
<td>0.107</td>
<td>45.3 (34.1–56.6)</td>
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<tr>
<td>Chest and spinal column/extremity injuries</td>
<td>630</td>
<td>0.225 (0.014)</td>
<td>0.190 (0.014)</td>
<td>0.174 (0.014)</td>
<td>0.191</td>
<td>0.174</td>
<td>61.4 (57.2–65.6)</td>
</tr>
<tr>
<td>Other/multi-trauma not involving neurotrauma</td>
<td>663</td>
<td>0.257 (0.014)</td>
<td>0.231 (0.013)</td>
<td>0.214 (0.013)</td>
<td>0.229</td>
<td>0.214</td>
<td>64.8 (60.8–68.8)</td>
</tr>
</tbody>
</table>

SE indicates standard error.
Costs of health loss and DALYs per case

Chart showing the costs (in AUD) and DALYs per case from 2001-02 to 2010-11. The chart displays the following trends:

- The costs fluctuate over the years, with a general decreasing trend from 2001-02 to 2010-11.
- DALYs per case remain relatively stable over the years.

Legend:
- Total cost - GDP per capita
- Total cost - VSLY
- DALYs per case
Closing Comments

- Measuring burden is challenging
- DALY is not a perfect measure but it can be useful
- Expectation is that Injury-VIBES will release recommended groupings, weights and durations for YLD calculations early 2016
- Non-hospitalised injury still under-represented in burden estimates
- Need to better understand recurrent injuries
- LMIC data needed