Global Burden of Surgical Disease

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The problem*

• **Pregnancy related complications**
  - ~800 deaths per day (287,000 /year)
  - For every woman who dies in childbirth: ~ 20 more who suffer a complication
  - Obstetric fistula (2 million /yr)

• **Injuries**
  - 5 million deaths/year due to injuries
  - Road traffic accidents
    • 1.2 million deaths
    • 50 million injured
  - ~2400 childhood deaths/day due to injuries

• **Congenital anomalies**
  - 100,000 children with club feet

*Source: WHO
Improving surgical care in LMICs

*Estimating the global burden of surgical diseases*

**Goal**
- Define the burden of surgical conditions amongst other global health problems
- Measure the impact of surgical care on population health

**Expectation**
- If surgical care can be more accurately represented then it is more likely to receive its fair share of the resources
Global burden of surgical disease

Metric

Disability adjusted life years

\[ \text{DALY} = \text{YLL} + \text{YLD} \]

Time is used as the common metric for mortality and health states

YLL: Years of life lost due to mortality

YLD: Equivalent years of healthy life lost due to disability

Disability Weight: Health state valuation expressed on an interval scale between 0 and 1
Global burden of surgical disease

Outline

• Challenges estimating the global burden of surgical disease
• Public health impact of scaling-up surgical care in LMICs
• Where does surgical care fits amongst other global health priorities?
Global burden of surgical disease

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• Challenges estimating the global burden of surgical disease
• Public health impact of scaling-up surgical care in LMICs
• Where does surgical care fits amongst other global health priorities?

• Data from Global Burden of Diseases, Injuries, and Risk Factors Study 2010

Challenges of estimating the global burden of surgical disease
Challenges

*Problem #1:* Defining surgical care

*Problem #2:* How to assign DALY averted values to surgical procedure

*Problem #3:* Distinguishing between ‘surgical’ and ‘non-surgical’ conditions
Challenges

‘Surgical’ versus ‘non-surgical’ conditions

• Queried a large inpatient database to determine operative rates for the GBD 2010
  – NIS is the largest all payer inpatient database in the USA (10 mil inpatient operations, 34.8 mil hospital admissions)
• Aggregated admissions into GBD 2010 disease categories
• Operation: procedure done in the operating room according to the AHRQ list
• Results expressed as the fraction of admitted patients that underwent an operation
### Challenges

**Surgical** versus **non-surgical** conditions

<table>
<thead>
<tr>
<th>GBD Disease Sub-Category</th>
<th>ICD-9 Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIDS and tuberculosis</td>
<td>020-04-98</td>
</tr>
<tr>
<td>Cholera</td>
<td>010-06-27</td>
</tr>
<tr>
<td>Dengue</td>
<td>020-04-98</td>
</tr>
<tr>
<td>Pertussis</td>
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<td>'Surgical' versus 'non-surgical' conditions</td>
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Source: Table 4, Lozano et al, 2012

**Neonatal disorders**

- Source: Table 4, Lozano et al, 2012
Challenges

‘Surgical’ versus ‘non-surgical’ conditions

- Operations were performed in every GBD subcategory
- Overall frequency: 28.6%
- The GBD framework did not capture 19.9% of inpatient operations
- Integrative nature of surgery in a broad range of clinical problems

Source: Rose et al, submitted PLOS
Public health impact of scaling-up surgical care in LMICs
Scaling-up surgical care in LMICs

Methodology

- Utilized data from GBD 2010
- Overall concept was to split reported DALYs from surgical conditions into ‘avertable burden’ and ‘non-avertable burden’

\[
\text{Avertable burden} = \text{DALY}_{\text{Current}} - \text{DALY}_{\text{cf}}
\]

- Counterfactual state refers to situation where the entire population has access to appropriate and safe surgical care at a level equivalent to high-income countries
- Estimates were made for six LMIC super-regions
# Scaling-up surgical care in LMICs

## Methodology

<table>
<thead>
<tr>
<th>Basic surgical care delivered at first-level hospitals</th>
<th>Digestive diseases</th>
<th>Appendicitis, paralytic ileus and intestinal obstruction, inguinal and femoral hernia, gallbladder and bile duct disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal-neonatal</td>
<td>Maternal hemorrhage, obstructed labor, abortion, neonatal encephalopathy</td>
<td></td>
</tr>
<tr>
<td>Injuries treated with simple interventions</td>
<td>Resuscitation, surgical airway, peripheral venous access, suturing, laceration and wound management, chest tube/needle decompression, fracture reduction, escharotomy, fasciotomy, skin grafting, trauma-related amputation, trauma-related laparotomy, etc.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Advanced surgical care delivered in specialized clinics</th>
<th>Congenital anomalies</th>
<th>Cleft lip and palate, congenital heart anomalies, neural tube defects</th>
</tr>
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<tbody>
<tr>
<td>Maternal</td>
<td>Obstetric fistula</td>
<td></td>
</tr>
<tr>
<td>Eye</td>
<td>Cataract</td>
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## Scaling-up surgical care in LMICs

### Results

<table>
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<tr>
<th>Surgical conditions</th>
<th>Preventable deaths (millions)</th>
<th>Burden</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Avertable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DALYs per year (millions)</td>
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<td>Treatable by basic surgical care delivered at first-level hospitals</td>
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### Results

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<td>1.4</td>
<td>77.2</td>
<td>3.5%</td>
<td>238.5</td>
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<td>38.9</td>
<td>1.7%</td>
<td>46.5</td>
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<tr>
<td>TOTALS</td>
<td>1.8</td>
<td>116.1</td>
<td>5.2%</td>
<td>285.0</td>
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</tbody>
</table>

1.8 million deaths/year = One death every 18 seconds
Scaling-up surgical care in LMICs

Distribution of avertable burden

Basic surgical care delivered at first-level hospitals:
- Injuries: 68%
- Digestive diseases: 6%
- Maternal-neonatal conditions: 26%

Advanced surgical care provided in specialized clinics:
- Congenital heart anomalies: 58%
- Cataract: 11%
- Obstetric fistula: 3%
- Neural tube defect: 15%
- Cleft lip & palate: 13%

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Distribution of surgical burden by LMIC super regions

- Non-Avertable
- Avertable

Per cent of total regional GBD

LMIC Super Region:
- Eastern Europe & Central Asia
- Sub-Saharan Africa
- North Africa & Middle East
- Asia South
- East Asia Pacific
- Latin America & Caribbean
Where does surgical care fit amongst other global health priorities?
Surgery amongst other global health priorities

Burden targeted by the Global Fund to Fight AIDS, Tuberculosis and Malaria

- Malaria 39%
- HIV 38%
- TB 23%

214 million DALYs/year

Burden associated with a group of surgically treatable conditions in LMICs

- Avertable burden = 116 million DALYs/year
- Non-avertable burden = 285 million DALYs/year

Burden of ischemic heart disease

( #1 ranking on the GBD 2010 cause list)

- Ischemic heart disease

130 million DALYs/year

Avertable

Non-avertable

401 million DALYs/year
Conclusions

- Surgically treatable conditions are an important public health problem in LMICs
- Magnitude of surgically avertable burden exceeds the burden of some of the most widely recognized global health problems
- The large non-avertable burden related to injuries (200.5 million DALYs per year; 70.3% of total) suggests a critical need for injury prevention programs in LMICs
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