Global Burden of Viral Hepatitis

19 March 2010
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WHO Geneva
The Short Story

- Estimated 2.7% all deaths due to acute hepatitis B/C, cancer/cirrhosis of liver with increasing trend over time

- Estimated 57% of liver cirrhosis and 78% of primary liver cancer due to hepatitis B or C virus infection

- About 2000 million (2 billion) have been infected with HBV worldwide, > 350 million chronically HBV infected, ~600,000 deaths/yr as a result of HBV infection

- Approximately 130–170 million chronically infected with HCV, > 350,000 deaths/yr as a result of HCV infection
The "Am I Number 12?" Campaign

Am I Number 12?

All over the world people have been asking the question 'Am I Number 12?'

Why ‘Am I Number 12?’

Because shockingly one in 12 people worldwide are living with either chronic hepatitis B or chronic hepatitis C. While this is far higher than the prevalence of HIV or any cancer, awareness is inexplicably low and the majority of those infected are unaware.

'Am I Number 12?' is the theme of World Hepatitis Day, which takes place annually on 19th May. The World Hepatitis Alliance hopes that 'Am I Number 12?' will prompt people to think about the huge scale of hepatitis infection globally, about whether they may be at risk (and if so, to get tested) and also about how to avoid becoming infected.

You can show your support by joining 'Am I Number 12?' groups

[Links to Bebo and Facebook]
Global GBD Estimates

- GBD I produced hepatitis B and C estimates only
- Estimates reflected acute disease burden only
- Viral hepatitis prevalence maps commonly used (WHO and US CDC) not well referenced and dated
Previous Estimates of VH Burden (WHO GBD 2004 Update)

- HBV/HCV burden from acute disease

- Deaths (% of total)
  - Hepatitis B: 105,000 (0.2%)
  - Hepatitis C: 54,000 (0.1%)
  - HCC: 610,000 (1.0%)
  - Cirrhosis: 772,000 (1.3%)

- Disability Adjusted Life Years (DALYs) (% of total)
  - Hepatitis B: 2,068,000 (0.1%)
  - Hepatitis C: 955,000 (0.1%)
  - HCC: 6,712,000 (0.4 %)
  - Cirrhosis: 13,640,000 (0.9 %)
Previous Estimates of HBV Burden

- **WHO Immunization Dept internal model**
  - HBV-related deaths: 600,000 (500,000 – 700,000)

- **US CDC Model**
  - HBV-related deaths in 2000: 620,000
<table>
<thead>
<tr>
<th>Region</th>
<th>Total Deaths</th>
<th>Percent Global Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFRO</td>
<td>69,000</td>
<td>11%</td>
</tr>
<tr>
<td>AMRO</td>
<td>12,000</td>
<td>2%</td>
</tr>
<tr>
<td>EMRO</td>
<td>21,000</td>
<td>3%</td>
</tr>
<tr>
<td>EURO</td>
<td>51,000</td>
<td>8%</td>
</tr>
<tr>
<td>SEARO</td>
<td>143,000</td>
<td>23%</td>
</tr>
<tr>
<td>WPRO</td>
<td>325,000</td>
<td>52%</td>
</tr>
<tr>
<td><strong>Global</strong></td>
<td><strong>620,000</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

*HBV Deaths by WHO Region (US CDC)*

- *AFRO*: 69,000 deaths, 11% of global deaths
- *AMRO*: 12,000 deaths, 2% of global deaths
- *EMRO*: 21,000 deaths, 3% of global deaths
- *EURO*: 51,000 deaths, 8% of global deaths
- *SEARO*: 143,000 deaths, 23% of global deaths
- *WPRO*: 325,000 deaths, 52% of global deaths
- *Global*: 620,000 deaths, 100% of global deaths
## Future Hepatitis B Disease Burden

<table>
<thead>
<tr>
<th>Region</th>
<th>Total Infections (millions)</th>
<th>Chronic Infections</th>
<th>Total Deaths²</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFRO</td>
<td>18.5</td>
<td>2,915,000</td>
<td>276,000</td>
</tr>
<tr>
<td>AMRO</td>
<td>1.3</td>
<td>174,000</td>
<td>28,000</td>
</tr>
<tr>
<td>EMRO</td>
<td>5.3</td>
<td>663,000</td>
<td>96,000</td>
</tr>
<tr>
<td>EURO</td>
<td>2.9</td>
<td>365,000</td>
<td>56,000</td>
</tr>
<tr>
<td>SEARO</td>
<td>17.4</td>
<td>2,386,000</td>
<td>368,000</td>
</tr>
<tr>
<td>WPRO</td>
<td>19.3</td>
<td>3,230,000</td>
<td>581,000</td>
</tr>
<tr>
<td><strong>Global</strong></td>
<td><strong>64.8</strong></td>
<td><strong>9,733,000</strong></td>
<td><strong>1,405,000³</strong></td>
</tr>
</tbody>
</table>

¹ 2000 birth cohort over course of lifetime without vaccination  
² Acute hepatitis B and chronic HBV infection  
³ 95% from chronic infection and 5% from acute hepatitis B  

Bridging from Cirrhosis/HCC to Hepatitis

- Major drivers of HBV/HCV burden are cirrhosis/HCC


- 57% of cirrhosis was attributable to either HBV or HCV
  - 30% of cirrhosis was attributable to HBV
  - 27% of cirrhosis was attributable to HCV

- 78% of HCC was attributable to HBV or HCV
  - 53% of HCC was attributable to HBV
  - 25% of HCC was attributable to HCV
Estimates of Total HBV Burden (WHO GBD and Perz et al)

- **GBD 2004 Deaths**
  - Hepatitis B: 105,000 (0.2%)
  - Hepatitis C: 54,000 (0.1%)
  - HCC: 610,000 (1.0%)
  - Cirrhosis: 772,000 (1.3%)

- **DALYs**
  - Hepatitis B: 2,068,000 (0.1%)
  - Hepatitis C: 955,000 (0.1%)
  - HCC: 6,712,000 (0.4%)
  - Cirrhosis: 13,640,000 (0.9%)
## Estimates of Total HCV Burden (WHO GBD and Perz et al)

### GBD 2004 Deaths
- Hepatitis B: 105,000 (0.2%)
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<td>54,000</td>
<td>0.1%</td>
</tr>
<tr>
<td>HCC</td>
<td>610,000</td>
<td>1.0%</td>
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<tr>
<td>Cirrhosis</td>
<td>772,000</td>
<td>1.3%</td>
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<td>Hepatitis B</td>
<td>54,000</td>
<td>/ 0.25 = 152,500</td>
</tr>
<tr>
<td>Hepatitis C</td>
<td>955,000</td>
<td>/ 0.27 = 194,940</td>
</tr>
<tr>
<td>HCC</td>
<td>6,712,000</td>
<td>/ 0.4% = 401,440</td>
</tr>
<tr>
<td>Cirrhosis</td>
<td>13,640,000</td>
<td>/ 0.9% = 6,315,800</td>
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### DALYs
- Hepatitis B: 2,068,000 (0.1%)
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- HCC: 6,712,000 (0.4%)
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GBD II (To be published 2010/2011)

- Phase I: Systematic review of the literature
  - HAV complete, HBV and HCV search complete, abstracting and meta-analysis in progress, HEV nearly complete, unsafe injection in progress

- Phase II: Disease modelling
  - HAV complete, HBV complete, HCV in progress, HEV in progress, unsafe injection to be done

- Phase III: Final validation and generation of mortality and DALY estimates
  - To be done by completed by UW IHME (Murray et al)
Initial Data Needs for GBD

- **Hepatitis A**
  - anti-HAV marker of past infection that is commonly available
  - cohort-specific HepA coverage used as protective factor

- **Hepatitis B**
  - anti-HBc marker of past infection
  - HBsAg marker of current or chronic infection, since acute infection is rare this is used as proxy for chronic infection
  - HBeAg marker for highly infectious persons and prevalence in women of child bearing age used to estimate perinatal HBV transmission
  - Cohort-specific HepB coverage used as protective factor
Initial Data Needs for GBD

- **Hepatitis C**
  - prevalence anti-HCV

- **Hepatitis E**
  - anti-HEV: past infection can be determined by anti-HEV

- **Unsafe Injection**
  - prevalence of unsafe injections
Hepatitis A Model

Probabilities
Incident Infection: Vary by WHO Region. Calculated from age-specific prevalence as complied by Jacobsen (2009), report. See next slide.

Disease outcomes vary by age category (0 to 4, 5 to 14, 15+)
- Anicteric infection: 0.15 to 0.93 (Armstrong and Bell, 2002)
- Mild icteric infection: 0.55 to 0.65 (Armstrong and Bell, 2002)
- Moderate icteric infection: 0.017 to 0.157 (Armstrong and Bell, 2002; CDC surveillance)
- Severe icteric, non-fulminant: .001 to .032 (Armstrong and Bell, 2002; CDC surveillance)
- Fulminant, death, and transplant states: <.001 to .008 (Armstrong and Bell, 2002; CDC surveillance; U.S. United Network for Organ Sharing 1990 -2003)
Overall approach (1)

DisMod II

Inputs
- Input Prevalence
- Input Incidence Trends
- RR Mortality=1
- Remission=0.01

Outputs
- Output Incidence
- Output Prevalence

To Natural History Program
Overall approach (2)

Natural History Program

- Incidence
- Incidence Trends
- Natural Hx Model
- Modeled Cirrhosis Burden
- Modeled HCC Burden
- Overall Cirrhosis Burden (from GBD)
- Overall HCC Burden (from GBD)
Theoretically, HEV would use the same model as HAV

However, we lack data to differentiate between illness states other than to identify cases as:
- Asymptomatic
- Symptomatic & Deaths
Use a simplified model
Maintain ability to add categories given new information

Probabilities of outcomes vary by age and pregnancy status

<table>
<thead>
<tr>
<th>Age group</th>
<th>Anicteric</th>
<th>Icteric</th>
<th>Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>0.58</td>
<td>0.42</td>
<td>0.00/?</td>
</tr>
<tr>
<td>5-14</td>
<td>0.58</td>
<td>0.41</td>
<td>0.01</td>
</tr>
<tr>
<td>15+ Non-pregnant</td>
<td>0.32</td>
<td>0.67</td>
<td>0.01</td>
</tr>
<tr>
<td>15+ Pregnant</td>
<td>0.32*</td>
<td>0.60</td>
<td>0.09</td>
</tr>
</tbody>
</table>

*Assumed equal to the estimate of those 15+, non-pregnant
Source: Outbreak investigation data. (Guthmann, 2006; Bile 1994)
Burden of Disease—Plans

- Publication of systematic literature reviews
- Estimations of uncertainty
- Publication of models
- Country consultation for country-specific estimates
- Revision of prevalence/risk maps
- Publication of burden estimates
Thanks