Estimation of burden of disease -
Sharps injuries in health-care workers

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Content

• Context of estimation
• Basic model
• Input data
• Results
• Other occupational groups at increased risk
Estimation of disease burden

- It is the quantification of health impacts caused by various environmental risk factors at population level, using a comparative framework, definitions and outcome measures.

- In 2000-2005, WHO has estimated the disease burden of 25 risk factors to health (including unsafe injections).

- Purpose: To raise awareness on the size of the problem, and to estimate potential of interventions.
The model

• Why a model: because little data on prevalence and other risks in HCW at global level

Basis of the model: Probability of infection after sharps injury:

\[ P = p_v \times p_t \times p_s \]

• \( p_v \) = prevalence of active infection in patients
• \( p_t \) = Probability of infection after percutaneous injury
• \( p_s \) = Proportion of HCW susceptible to infection

Probability of at least 1 infection/year = Incidence (infection):

\[ I_n = 1 - (1 - p)^n \] (= probability of at least one "success")
Calculated outcome

In terms of

- Incidence of HBV, HCV and HIV due to sharps in health-care workers

- Attributable fraction (values in HCW):

\[
AF(occ) = \frac{\text{Incidence (occ)}}{\text{Incidence (occ)} + \text{incidence (other causes)}}
\]
Additional model details

- Model for 14 regions of the world
- 4 age groups in working age (15-69 years)
- Gender

Difficulties:
- Susceptibility changes with age, and different in GP and HCW
- Poor data on HBV vaccination coverage
- Poor data in certain regions on needlestick injuries
- Prevalence of active infection not always the same in GP and patients
Estimation of number of deaths – assumptions

HBV
- Progression to chronic infection of 6% for adults (McMahon et al. 1985)
- Annual clearance of infection of 1% following chronic infection (Alward et al. 1985)
- Age-dependent mortality according to African and Asian Studies (Gay et al. 2001)

HCV
- Rate of progression to chronic infection of 63% before age 40, and 80% after age 40 (Alter and Seeff 2000)
- Cumulated incidence rate of cirrhosis of 5% (20% after age 40) at 20 years among patients with chronic infection (Alter and Seeff 2000, Freedman 2001)
- Yearly mortality rate associated with hepatocellular carcinoma and chronic liver disease of 2.7% after onset of cirrhosis (Alter and Seeff 2000)
Uncertainties

Uncertainties are reflected in the lower and upper boundaries

Main uncertainties:
- Annual incidence of sharps injuries
- HBV immunization coverage
- Prevalence among hospital populations
  - (factor 3.4 for HCV, 1.9 for HBV, 5.9 for HIV)
### Input data (with focus on industrialized regions)

<table>
<thead>
<tr>
<th></th>
<th>Amr A</th>
<th>Eur A</th>
<th>World</th>
<th>Sear D</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of HCW</strong></td>
<td>7 mio</td>
<td>6 mio</td>
<td>35 mio</td>
<td>1.4 mio</td>
</tr>
<tr>
<td><strong>Prop. of HCW in GP</strong></td>
<td>2.5%</td>
<td>1.4%</td>
<td>0.6%</td>
<td>0.11%</td>
</tr>
<tr>
<td><strong>Annual number of sharps injuries</strong></td>
<td>0.18</td>
<td>0.64</td>
<td>0.18 - 4.7</td>
<td>2.3</td>
</tr>
<tr>
<td><strong>HCW exp. to contam. sharp (thousands)</strong></td>
<td>22 HCV</td>
<td>16 HCV</td>
<td>900 HCV</td>
<td>57 HCV</td>
</tr>
<tr>
<td></td>
<td>7 HBV</td>
<td>43 HBV</td>
<td>2 100 HBV</td>
<td>109 HBV</td>
</tr>
<tr>
<td></td>
<td>8 HIV</td>
<td>9 HIV</td>
<td>327 HIV</td>
<td>23 HIV</td>
</tr>
<tr>
<td><strong>Proportion exp. to contam. sharps</strong></td>
<td>&lt; 0.4%</td>
<td>&lt; 1.1%</td>
<td>&lt; 9%</td>
<td>&lt; 14%</td>
</tr>
</tbody>
</table>
**Input data** (with focus on industrialized regions)

<table>
<thead>
<tr>
<th>% immunization HBV in HCW</th>
<th>Amr A</th>
<th>Eur A</th>
<th>World</th>
<th>Sear D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>67%</td>
<td>71%</td>
<td>18 - 77%</td>
<td>39%?</td>
</tr>
</tbody>
</table>

Assumed **risk of transmission** after percutaneous exposure:
- 0.3% for HIV, 18% for HBV, 1.8% for HCV

Assumed **PEP efficacies**:
- 90% for HBV, 81% for HIV
## Results, for the year 2000

<table>
<thead>
<tr>
<th>Infections attributable to occ., HCV</th>
<th>Amr A (240-1800)</th>
<th>Eur A (100-2600)</th>
<th>Global (5900-86000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HBV</td>
<td>40</td>
<td>210</td>
<td>65 000 (2400-240000)</td>
</tr>
<tr>
<td>HIV</td>
<td>5</td>
<td>6</td>
<td>1000 (200-5000)</td>
</tr>
<tr>
<td>HBV without PEP</td>
<td>400</td>
<td>2100</td>
<td></td>
</tr>
<tr>
<td>AF in HCW for HCV and HBV</td>
<td>8 and 1%</td>
<td>25 and 8%</td>
<td>39 and 37%</td>
</tr>
</tbody>
</table>
## Results, for the year 2000

<table>
<thead>
<tr>
<th></th>
<th>Amr A</th>
<th>Eur A</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deaths, HCV</td>
<td>6 (4-27)</td>
<td>4 (1-23)</td>
<td>145 (53-766)</td>
</tr>
<tr>
<td>Deaths, HBV</td>
<td>0 (0-1)</td>
<td>1 (0-3)</td>
<td>261 (86-923)</td>
</tr>
<tr>
<td>Deaths, HIV</td>
<td>3 (1-14)</td>
<td>4 (1-18)</td>
<td>736 (129-3578)</td>
</tr>
</tbody>
</table>
Results – attributable fractions in HCW

Regions

HCV
HBV
HIV

Percentage
Conclusions

• Globally, relatively small burden, however:

• Important burden in the specific occupational groups of concern

• All of this burden is preventable

• Over a couple of years, a very large proportion of health-care workers gets exposed

• This burden concerns those who provide health-care for others and thus affects the health-care system in regions where this problem is important