Nuclear weapons: catastrophic impacts on health

Conference on Humanitarian Impact of Nuclear Weapons
Oslo March 4th 2013
Prof. Andy Haines,

With thanks to
Liz Waterston, Joseph Mutti, Frank Boulton, Marion Birch, the late Douglas Holdstock, MEDACT Richard Moyes Article 36, Phil Webber SGR, John Loretz, Ira Helfand IPPNW
The effects depend on:

- Size and numbers of explosions
- Height of explosion (including ground level)
- Distance of subject from ground zero (centre of explosion)
Hiroshima, 6 August 1945

90,000-160,000 dead by 2-4 months after the bombing from immediate effects and later effects of burns, radiation and related disease.
"I looked toward the Honkawa Elementary School. All of the schoolchildren, who appeared to have been at a morning assembly in the schoolyard, were burned black, squatting in orderly lines, motionless. A relief party was removing the corpses."
Nagasaki, 9 August 1945

- 60,000 – 80,000 Dead by 2-4 months after the bombing from immediate effects and later effects of burns, radiation and related disease.
Health effects –2

• Immediate deaths from the fire ball – the centre of which is several million degrees C

• An intense flash of heat radiation causes lethal burns and flash blindness over a wide area

• Immediate deaths from the shock wave which travels at supersonic speed and results in falling buildings and lethal flying objects
Ranges from ground-zero at which burns would be inflicted by explosions of various magnitudes in the atmosphere*

<table>
<thead>
<tr>
<th>Degree of burn</th>
<th>Distance in km from effective explosion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 kt</td>
</tr>
<tr>
<td>First-degree burn (reddening of skin)</td>
<td>1.12</td>
</tr>
<tr>
<td>Second-degree burn (blistering of skin)</td>
<td>0.8</td>
</tr>
</tbody>
</table>

*In the case of surface explosions, the corresponding distances would be approximately 4/5 those for an aerial explosion of the same effectiveness.
Serious casualties and blast pressure

1 psi ~ 6.9 kPa

From "Nuclear Weapons Effects Computer"
Damage from 100 kt nuclear weapon exploded over Oslo

Richard Moyes Article 36
Health effects - 3

- Initial radiation (one third)
- Radioactive fallout is caused especially by a groundburst explosion which draws debris into the fireball, irradiating it and spreading it in a cigar-shaped area down-wind
(100 rad equivalent to 1 Gray) exposure to 500 rads usually causes death within 14 days.

### Fallout 1Mt surface burst, assuming 50% fission

<table>
<thead>
<tr>
<th>Accumulated dose at 2 weeks (rads.)</th>
<th>Downwind distance (km)</th>
<th>Max. width (km)</th>
<th>Ground zero width (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6000</td>
<td>34</td>
<td>4.7</td>
<td>2.3</td>
</tr>
<tr>
<td>1500</td>
<td>65</td>
<td>11.0</td>
<td>5.0</td>
</tr>
<tr>
<td>300</td>
<td>162</td>
<td>20.0</td>
<td>8.9</td>
</tr>
<tr>
<td>75</td>
<td>321</td>
<td>38.6</td>
<td>11.4</td>
</tr>
</tbody>
</table>
Exposure to ionizing radiation: Acute radiation syndrome

Large external doses of X-rays, gamma rays, and neutrons

Destruction of bone marrow; gastrointestinal, cardiovascular, and central nervous system damage

Death can occur in days or weeks

In the medium term radiation exposure would cause immunosuppression, decreasing resistance to infection

International Physicians for the Prevention of Nuclear War
## Number of Medical Personnel Killed or Injured in Hiroshima

<table>
<thead>
<tr>
<th>Profession</th>
<th>Number of Casualties</th>
<th>Percentage of Total Profession</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physicians</td>
<td>270</td>
<td>90</td>
</tr>
<tr>
<td>Dentists</td>
<td>132</td>
<td>86</td>
</tr>
<tr>
<td>Pharmacists</td>
<td>112</td>
<td>80</td>
</tr>
<tr>
<td>Nurses</td>
<td>1,650</td>
<td>93</td>
</tr>
</tbody>
</table>
Health effects - 4

• Health services (burns, blood transfusion etc) would be overwhelmed
• Economic and social infrastructure would be wrecked and supply chains broken
• In Hiroshima and Nagasaki 15–20% died from radiation sickness, 20–30% from burns, and 50–60% from other injuries, compounded by illness.
• A nuclear war would have disproportionately greater effects
Can civil defence preparations protect populations?
The most important function of the physician, however, relates to prevention. So very little can be done in the area in which a bomb or a series of bombs has been exploded that the employment of every reasonable means to prevent such a catastrophe becomes the concern of everyone, and not least the physician.

Joseph Garland, NEJM editorial 1962