Cancer in transition: the human development index and the global disease burden 2008 and 2030

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Global Burden of Cancer
Estimated cancer incidence, mortality and 5-year prevalence by continent

- **Incidence**
  - Europe: 25.3%
  - Asia: 48.1%
  - Africa: 5.7%

- **Mortality**
  - Africa: 7.2%
  - Asia: 53.8%
  - Oceania: 0.7%

- **Prevalence (5 years)**
  - Africa: 5.1%
  - Americas: 23.7%
  - Oceania: 1.4%

12,700,000 new cases
7,600,000 deaths
28,800,000 persons
Human Development Index 2007 (HDI)

- A country's average achievements in three basic aspects of human development:
  - Health
    - life expectancy at birth
  - Knowledge
    - adult literacy rate / primary, secondary, tertiary enrolment
  - Standard of living
    - GDP per capita (PPP US$)
A world in transition


- Norway
- Sweden
- Qatar
- Uruguay
- Russia
- Colombia
- China
- Morocco
- Kenya
- Uganda
- Congo (Dem. Rep.)

circa 2007
Human Development Index 2007 (4 levels)

- **Low HDI**: HDI < 0.5
  - 0.4 billion
  - Sub-Saharan Africa

- **Medium HDI**: 0.5 ≤ HDI < 0.8
  - 4.4 billion
  - Southern & Eastern Asia
  - Africa

- **High HDI**: 0.9 ≤ HDI < 0.8
  - 0.9 billion
  - Latin America
  - Central & Eastern Europe

- **Very High HDI**: HDI > 0.9
  - 1.0 billion
  - North America
  - Northern & Western Europe
  - Australia & New Zealand

Source: United Nations Development Programme
Incidence by HDI 2008

Bray et al, Lancet Oncol 2012
Incidence by HDI 2008

Bray et al, Lancet Oncol 2012
Incidence by HDI 2008

Bray et al, Lancet Oncol 2012
Jemal et al, Cancer 2012

Most common forms of cancer in Africa 2008.

Males
- Prostate
- Lung
- Liver
- Stomach
- Kaposi sarcoma
- Oesophagus
- Colorectum
- Bladder

Females
- Breast
- Cervix uteri

Low Human Development Index

New cases in 2008 (Thousands)
Cancer and Infection: attributable fraction (%) 2008

- Sub-Saharan Africa: 33.2%
- China: 26.8%
- Other Eastern Asia: 23.1%
- India: 20.9%
- Japan: 19.5%
- Other Oceania: 18.5%
- Other Central Asia: 17.2%
- Southern America: 17.2%
- Northern Africa & Western Asia: 13.0%
- Europe: 7.0%
- Northern America: 4.0%
- Australia & New Zealand: 3.3%
Disability-Adjusted Life Years (DALYs) = Years of Life Lost (YLD) + Years of Life with Disability.

Soerjomataram et al. Lancet 2012
World 1950: 2.53 billion

World 2010: 6.95 billion

World 2050: 9.30 billion

World 2008: 6.8 billion

World 2030: 8.3 billion
• Assuming incidence rates in 2008 do not change:
  - Approx. **20.3 million** new cases will be diagnosed in **2030**
  - Up 61% from 12.7 million in 2008
The Cancer Transition in Japan since 1951

Omer Gersten
John R. Wilmoth

<table>
<thead>
<tr>
<th>Major causes of death</th>
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<tbody>
<tr>
<td><strong>Before – Infectious disease</strong></td>
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<tr>
<td><strong>Epidemiologic transition</strong></td>
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<tr>
<td>Malaria</td>
</tr>
<tr>
<td>Tuberculosis</td>
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<tr>
<td>Smallpox</td>
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<tr>
<td><strong>Cancer transition</strong></td>
</tr>
<tr>
<td>Stomach (H. pylori)</td>
</tr>
<tr>
<td>Cervix (HPV(^1))</td>
</tr>
<tr>
<td>Liver (HBV and HCV(^2))</td>
</tr>
</tbody>
</table>

Note:
\(^1\)Human papillomavirus (HPV)
\(^2\)Hepatitis B virus (HBV) and hepatitis C virus (HCV)
Female breast cancer incidence 1967-2008

Low → Medium HDI

High → Very High HDI

Source: Cancer Incidence in Five Continents Volumes 1-9

*: Colombia (Cali), China (Hong Kong and Shanghai), India (Mumbai and Chennai), Philippines (Manila), Canada (except Quebec and Prince Edward Island), Japan (Miyagi, Osaka and Yamagata)
Prostate cancer incidence 1967-2008

Low → Medium HDI

High → Very High HDI

Source: Cancer Incidence in Five Continents Volumes 1-9

*: Colombia (Cali), China (Hong Kong and Shanghai), India (Mumbai and Chennai), Philippines (Manila), Canada (except Quebec and Prince Edward Island), Japan (Miyagi, Osaka and Yamagata)
Colorectal cancer incidence 1967-2008, men

- Low → Medium HDI
- High → Very High HDI

Source: Cancer Incidence in Five Continents Volumes 1-9

*: Colombia (Cali), China (Hong Kong and Shanghai), India (Mumbai and Chennai), Philippines (Manila), Canada (except Quebec and Prince Edward Island), Japan (Miyagi, Osaka and Yamagata)
Stomach cancer incidence 1967-2008, men

Low → Medium HDI

High → Very High HDI

Source: Cancer Incidence in Five Continents Volumes 1-9

*: Colombia (Cali), China (Hong Kong and Shanghai), India (Mumbai and Chennai), Philippines (Manila), Canada (except Quebec and Prince Edward Island), Japan (Miyagi, Osaka and Yamagata)
Cervical cancer incidence 1967-2008

Low → Medium HDI
High → Very High HDI

Source: Cancer Incidence in Five Continents Volumes 1-9

*: Colombia (Cali), China (Hong Kong and Shanghai), India (Mumbai and Chennai), Philippines (Manila), Canada (except Quebec and Prince Edward Island), Japan (Miyagi, Osaka and Yamagata)
Cervical cancer incidence: age-adjusted rates vs. cohort analyses

Japan: Miyagi, Osaka and Yamagata

Vaccarella et al. Manuscript in preparation

Males

- Prostate
- KS
- Oesophagus
- Liver

Females

- Cervix
- Breast
- KS
- Oesophagus

Parkin et al, Int J Cancer 2010
Figure 2 | Trends in cigarette consumption and male lung cancer rates, 1920–2005. The number of cigarettes consumed per adult (males are used as the appropriate denominator for cigarette smoking as few females currently smoke in Asia) and the age-standardized lung cancer rates over time by country. The widespread automation of cigarette production in the early twentieth century turned cigarettes into a global commodity. Lung cancer was a rare disease before the Second World War, and the large increase in lung cancer rates lagged behind consumption by three or more decades. The mean consumptions in Chinese men were 1, 4 and 10 cigarettes per day in 1952, 1972 and 1992, respectively, which were similar to the increases in cigarette consumption that were reported 40 years earlier in the United States (US). China has reported a marked increase in cigarette production since 2000. Increases in exposure to smoking at very young ages, combined with prolonged exposure, would be likely to increase the age-specific death rates in the future in China, Indonesia and other countries.
Scenario-based prediction for 2030*

<table>
<thead>
<tr>
<th>Tumour</th>
<th>Prediction</th>
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<tbody>
<tr>
<td>Stomach</td>
<td>2.5% annual decrease in all HDI areas per year</td>
</tr>
<tr>
<td>Cervix uteri</td>
<td>2% annual decrease in all HDI areas per year</td>
</tr>
<tr>
<td>Lung</td>
<td>1% annual decrease in high HDI and very high HDI areas (men) 1% annual increase in high HDI and very high HDI areas (women)</td>
</tr>
<tr>
<td>Liver</td>
<td>Difficult to generalise, assume no change</td>
</tr>
<tr>
<td>Colorectum</td>
<td>1% annual increase in all HDI areas per year</td>
</tr>
<tr>
<td>Breast</td>
<td>2% annual increase in all HDI areas per year</td>
</tr>
<tr>
<td>Prostate</td>
<td>3% annual increase in all HDI areas per year</td>
</tr>
</tbody>
</table>

*Source: Bray et al, Lancet Oncol 2012*
### Assuming trend-based scenarios for six cancers continue:

- Approx. 22.2 million new cases diagnosed by 2030
  - Up 75% from 12.7 million in 2008

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<table>
<thead>
<tr>
<th>Population in 2008 (millions [% of world population])</th>
<th>Population in 2030 (millions [% of world population])</th>
<th>Incidence in 2008 (millions [% of total global burden])</th>
<th>Incidence in 2030*: demographic (millions [absolute % increase from 2008])</th>
<th>Incidence in 2030†: demographic plus trend (millions [absolute % change from 2008])</th>
</tr>
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<tbody>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low HDI</td>
<td>394 (5.8%)</td>
<td>664 (8.0%)</td>
<td>0.25 (2.0%)</td>
<td>0.48 (93%)</td>
</tr>
<tr>
<td>Medium HDI</td>
<td>4442 (65.6%)</td>
<td>5533 (66.6%)</td>
<td>5.7 (45.1%)</td>
<td>10.1 (78%)</td>
</tr>
<tr>
<td>High HDI</td>
<td>922 (13.6%)</td>
<td>1031 (12.4%)</td>
<td>1.9 (14.9%)</td>
<td>3.0 (60%)</td>
</tr>
<tr>
<td>Very high HDI</td>
<td>1010 (14.9%)</td>
<td>1074 (12.9%)</td>
<td>4.8 (38.0%)</td>
<td>6.7 (39%)</td>
</tr>
<tr>
<td>Worldwide</td>
<td>6768</td>
<td>8302</td>
<td>12.7</td>
<td>20.3 (61%)</td>
</tr>
</tbody>
</table>
How can we reduce the increasing burden?
- the need for evidence-based implementation scenarios

• Impact of reduction in risk factors:
  • Tobacco
  • Alcohol
  • Obesity
  • Physical activity
• Impact of vaccination programmes (HBV, HPV)
• Impact of early diagnosis programmes
  • Cervix, breast, colorectal
References


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