Class 2 - Major Health Challenges from a Public Health Perspective
• Morbidity and mortality worldwide
• Epidemiologic transition
• Diverse perspectives on public health
Life Expectancy


Image courtesy of Global Health Action. CC BY.
Life expectancy

- Global life expectancy increased by 6.2 years, 1990-2013
- Healthy life expectancy increased by 5.4 years
Life Expectancy, 2013

Global Burden of Disease

• A loss of welfare/subjective well-being/quality of life
Figure 1 from Murray, C. J., Barber, R. M., Foreman, K. J., Ozgoren, A. A., Abd-Allah, F., Abera, S. F., ... & Abu-Rmeileh, N. M. (2015). “Global, regional, and national disability-adjusted life years (DALYs) for 306 diseases and injuries and healthy life expectancy (HALE) for 188 countries, 1990–2013: quantifying the epidemiological transition.” The Lancet, 386(10009), 2145-2191 removed. Please visit the journal to view the image.
Increasing and decreasing global DALYs for causes from 1990 to 2005 (A) and 2005 to 2013 (B). Within each tree map, the size of the rectangle for each cause is proportional to the magnitude of the decrease or increase in DALYs for each cause. Dark shading show statistically significant changes and light shading shows changes that are not significant.

25 most common causes of global DALYs for both sexes combined, 1990, 2005, and 2013, with age-standardized median percentage change

<table>
<thead>
<tr>
<th>Mean rank (95% UI)</th>
<th>1990 leading causes</th>
<th>2005 leading causes</th>
<th>Mean rank (95% UI)</th>
<th>Age-standardised % change 1990-2005</th>
<th>2013 leading causes</th>
<th>Mean rank (95% UI)</th>
<th>Age-standardised % change 2005-2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:1 (1-2)</td>
<td>Lower respiratory infections</td>
<td>1: Ischaemic heart disease</td>
<td>1:0 (1-1)</td>
<td>-13% (-16 to -10%)</td>
<td>1: Ischaemic heart disease</td>
<td>1:0 (1-1)</td>
<td>-11% (-15 to -6%)</td>
</tr>
<tr>
<td>2:0 (1-3)</td>
<td>Ischaemic heart disease</td>
<td>2: Cerebrovascular disease</td>
<td>2:3 (2-3)</td>
<td>-14% (-17 to -11%)</td>
<td>2: Cerebrovascular disease</td>
<td>2:3 (2-3)</td>
<td>-14% (-17 to -10%)</td>
</tr>
<tr>
<td>3:0 (3-3)</td>
<td>Diarrhoeal diseases</td>
<td>3: Lower respiratory infections</td>
<td>3:2 (2-3)</td>
<td>-39% (-42 to -35%)</td>
<td>3: Lower respiratory infections</td>
<td>3:2 (2-3)</td>
<td>-22% (-28 to -15%)</td>
</tr>
<tr>
<td>4:0 (4-4)</td>
<td>Cerebrovascular disease</td>
<td>4: Diarrhoeal diseases</td>
<td>4:8 (4-6)</td>
<td>-46% (-49 to -42%)</td>
<td>4: Diarrhoeal diseases</td>
<td>4:8 (4-6)</td>
<td>-32% (-38 to -26%)</td>
</tr>
<tr>
<td>5:2 (5-7)</td>
<td>Neonatal preterm birth</td>
<td>5: Low back and neck pain</td>
<td>5:4 (1-3)</td>
<td>-2% (-2 to 0%)</td>
<td>5: Low back and neck pain</td>
<td>5:4 (1-3)</td>
<td>-2% (-2 to 0%)</td>
</tr>
<tr>
<td>6:4 (5-8)</td>
<td>Malaria</td>
<td>6: HIV/AIDS</td>
<td>6:6 (4-9)</td>
<td>35% (14 to 60%)</td>
<td>6: HIV/AIDS</td>
<td>6:6 (4-9)</td>
<td>35% (14 to 60%)</td>
</tr>
<tr>
<td>7:1 (5-10)</td>
<td>COPD</td>
<td>7: Tuberculosis</td>
<td>7:6 (4-9)</td>
<td>360% (280 to 438%)</td>
<td>7: Tuberculosis</td>
<td>7:6 (4-9)</td>
<td>360% (280 to 438%)</td>
</tr>
<tr>
<td>8:2 (5-6)</td>
<td>COPD</td>
<td>8: COPD</td>
<td>8:8 (6-10)</td>
<td>-20% (-25 to -15%)</td>
<td>8: COPD</td>
<td>8:8 (6-10)</td>
<td>-20% (-25 to -15%)</td>
</tr>
<tr>
<td>9:2 (8-10)</td>
<td>Tuberculosis</td>
<td>9: Neonatal preterm birth</td>
<td>9:8 (5-11)</td>
<td>-33% (-39 to -24%)</td>
<td>9: Neonatal preterm birth</td>
<td>9:8 (5-11)</td>
<td>-33% (-39 to -24%)</td>
</tr>
<tr>
<td>10:2 (10-14)</td>
<td>Other neonatal</td>
<td>10: Road injuries</td>
<td>10:6 (3-11)</td>
<td>-2% (-2 to 0%)</td>
<td>10: Road injuries</td>
<td>10:6 (3-11)</td>
<td>-2% (-2 to 0%)</td>
</tr>
<tr>
<td>11:4 (10-14)</td>
<td>Road injuries</td>
<td>11: Tuberculosis</td>
<td>11:7 (3-15)</td>
<td>-35% (-42 to -30%)</td>
<td>11: Tuberculosis</td>
<td>11:7 (3-15)</td>
<td>-35% (-42 to -30%)</td>
</tr>
<tr>
<td>12:5 (9-16)</td>
<td>Tuberculosis</td>
<td>12: Neonatal encephalopathy</td>
<td>12:5 (11-16)</td>
<td>-11% (-14 to -8%)</td>
<td>12: Neonatal encephalopathy</td>
<td>12:5 (11-16)</td>
<td>-11% (-14 to -8%)</td>
</tr>
<tr>
<td>13:1 (9-19)</td>
<td>Neonatal encephalopathy</td>
<td>13: Sense organ diseases</td>
<td>13:8 (10-17)</td>
<td>-5% (-6 to -4%)</td>
<td>13: Sense organ diseases</td>
<td>13:8 (10-17)</td>
<td>-5% (-6 to -4%)</td>
</tr>
<tr>
<td>13:9 (11-18)</td>
<td>Sense organ diseases</td>
<td>14: Iron-deficiency anaemia</td>
<td>14:1 (11-18)</td>
<td>3% (0 to 6%)</td>
<td>14: Iron-deficiency anaemia</td>
<td>14:1 (11-18)</td>
<td>3% (0 to 6%)</td>
</tr>
<tr>
<td>14:8 (10-22)</td>
<td>Iron-deficiency anaemia</td>
<td>15: Depressive disorders</td>
<td>15:4 (12-16)</td>
<td>18% (15 to 22%)</td>
<td>15: Depression</td>
<td>15:4 (12-16)</td>
<td>18% (15 to 22%)</td>
</tr>
<tr>
<td>15:1 (8-15)</td>
<td>Depressive disorders</td>
<td>16: Congenital anomalies</td>
<td>16:4 (11-18)</td>
<td>-14% (-2 to 5%)</td>
<td>16: Congenital anomalies</td>
<td>16:4 (11-18)</td>
<td>-14% (-2 to 5%)</td>
</tr>
<tr>
<td>17:6 (12-24)</td>
<td>Iron-deficiency anaemia</td>
<td>18: Long cancer</td>
<td>18:9 (7-17)</td>
<td>-11% (-14 to -8%)</td>
<td>18: Long cancer</td>
<td>18:9 (7-17)</td>
<td>-11% (-14 to -8%)</td>
</tr>
<tr>
<td>18:3 (15-31)</td>
<td>Long cancer</td>
<td>19: Self-harm</td>
<td>19:16 (12-20)</td>
<td>-8% (-10 to 1%)</td>
<td>19: Self-harm</td>
<td>19:16 (12-20)</td>
<td>-8% (-10 to 1%)</td>
</tr>
<tr>
<td>19:7 (16-24)</td>
<td>Self-harm</td>
<td>20: Measles</td>
<td>20:19 (9-33)</td>
<td>0% (0 to 0%)</td>
<td>20: Measles</td>
<td>20:19 (9-33)</td>
<td>0% (0 to 0%)</td>
</tr>
<tr>
<td>20:4 (11-35)</td>
<td>Measles</td>
<td>21: Drowning</td>
<td>21:7 (2-15)</td>
<td>-7% (-8 to 0%)</td>
<td>21: Drowning</td>
<td>21:7 (2-15)</td>
<td>-7% (-8 to 0%)</td>
</tr>
<tr>
<td>21:3 (16-29)</td>
<td>Drowning</td>
<td>22: Skin diseases</td>
<td>22:7 (2-15)</td>
<td>-8% (-10 to 1%)</td>
<td>22: Skin diseases</td>
<td>22:7 (2-15)</td>
<td>-8% (-10 to 1%)</td>
</tr>
<tr>
<td>22:4 (15-31)</td>
<td>Skin diseases</td>
<td>23: Protein-energy malnutrition</td>
<td>23:7 (2-15)</td>
<td>-10% (-12 to 0%)</td>
<td>23: Protein-energy malnutrition</td>
<td>23:7 (2-15)</td>
<td>-10% (-12 to 0%)</td>
</tr>
<tr>
<td>22:6 (17-28)</td>
<td>Protein-energy malnutrition</td>
<td>24: Neonatal sepsis</td>
<td>24:9 (18-39)</td>
<td>11% (9 to 3%)</td>
<td>24: Neonatal sepsis</td>
<td>24:9 (18-39)</td>
<td>11% (9 to 3%)</td>
</tr>
<tr>
<td>23:5 (19-27)</td>
<td>Neonatal sepsis</td>
<td>25: Other neonatal</td>
<td>25:3 (20-32)</td>
<td>-38% (-49 to -24%)</td>
<td>25: Other neonatal</td>
<td>25:3 (20-32)</td>
<td>-38% (-49 to -24%)</td>
</tr>
</tbody>
</table>

Total DALYs, crude DALY rates, and age-standardised DALY rates from 1990 to 2013
Changes in global DALYs caused by communicable, maternal, neonatal, and nutritional disorders, non-communicable diseases, and injuries shown in terms of numbers of DALYs (A), DALY rates per 100 000 people (B), and age-standardised DALY rates per 100 000 people (C). The difference in trends between A and B is caused by population growth and the difference between B and C because of changes in the percentage distribution of the population by age. Shaded areas show 95% uncertainty intervals. DALY=disability-adjusted life-years.

Figure 2 from Murray, C. J., Barber, R. M., Foreman, K. J., Ozgoren, A. A., Abd-Allah, F., Abera, S. F., ... & Abu-Rmeileh, N. M. (2015). "Global, regional, and national disability-adjusted life years (DALYs) for 306 diseases and injuries and healthy life expectancy (HALE) for 188 countries, 1990–2013: quantifying the epidemiological transition." The Lancet, 386(10009), 2145-2191 removed. Please visit the journal to view the image.
FIGURE 1. Crude death rate* for infectious diseases — United States, 1900–1996†

*Per 100,000 population per year.
Epidemiological Transition – Urban India

YLL and YLD cause composition of DALY rates by sociodemographic status vigintile. The epidemiological transition based on predicted YLL and YLD rates per 100,000 people as a function of the level of sociodemographic status by vigintile and broken down into GBD level 2 causes. These predicted levels control for variation explained by year and country. YLL= years of life lost. YLD=years lived with disability. GBD=Global Burden of Disease.
Obesity Trends* Among U.S. Adults
*BM ≥30, or ~ 30 lbs overweight for 5’4" person
BRFSS, 1985

Map and data via the Centers for Disease Control. This image is in the public domain.
Obesity Trends* Among U.S. Adults
BRFSS, 1988

Map and data via the Centers for Disease Control. This image is in the public domain.
Obesity Trends* Among U.S. Adults
BRFSS, 1990

Map and data via the Centers for Disease Control. This image is in the public domain.
Obesity Trends* Among U.S. Adults

BRFSS, 1991

Map and data via the Centers for Disease Control. This image is in the public domain.
Obesity Trends* Among U.S. Adults
BRFSS, 1993

No Data           <10%          10%–14%     15%–19%

Source: Behavioral Risk Factor Surveillance System, CDC

Map and data via the Centers for Disease Control. This image is in the public domain.
Obesity Trends* Among U.S. Adults

BRFSS, 1995

Map and data via the Centers for Disease Control. This image is in the public domain.
Obesity Trends* Among U.S. Adults
BRFSS, 1996

Source: Behavioral Risk Factor Surveillance System, CDC

Map and data via the Centers for Disease Control. This image is in the public domain.
Obesity Trends* Among U.S. Adults
BRFSS, 1997

Map and data via the Centers for Disease Control. This image is in the public domain.
Obesity Trends* Among U.S. Adults

BRFSS, 1999

Source: Behavioral Risk Factor Surveillance System, CDC

Map and data via the Centers for Disease Control. This image is in the public domain.
Obesity Trends* Among U.S. Adults
BRFSS, 2000

Map and data via the Centers for Disease Control. This image is in the public domain.
Obesity Trends* Among U.S. Adults
BRFSS, 2001

Source: Behavioral Risk Factor Surveillance System, CDC

Map and data via the Centers for Disease Control. This image is in the public domain.
Obesity Trends* Among U.S. Adults
BRFSS, 2002

Source: Behavioral Risk Factor Surveillance System, CDC

Map and data via the Centers for Disease Control. This image is in the public domain.
Obesity Trends* Among U.S. Adults
BRFSS, 2003

Source: Behavioral Risk Factor Surveillance System, CDC

Map and data via the Centers for Disease Control. This image is in the public domain.
Obesity Trends* Among U.S. Adults

BRFSS, 2005

No Data          <10%        10%–14%     15%–19%           20%–24%          25%–29%           ≥30%

Source: Behavioral Risk Factor Surveillance System, CDC

Map and data via the Centers for Disease Control. This image is in the public domain.
Obesity Trends* Among U.S. Adults

BRFSS, 2006

Source: Behavioral Risk Factor Surveillance System, CDC

Map and data via the Centers for Disease Control. This image is in the public domain.
Obesity Trends* Among U.S. Adults
BRFSS, 2007

Source: Behavioral Risk Factor Surveillance System, CDC

Map and data via the Centers for Disease Control. This image is in the public domain.
Obesity Trends* Among U.S. Adults

BRFSS, 2008

Source: Behavioral Risk Factor Surveillance System, CDC

Map and data via the Centers for Disease Control. This image is in the public domain.
Obesity Trends* Among U.S. Adults
BRFSS, 2009

No Data       <10%      10%–14%     15%–19%     20%–24%     25%–29%     ≥30%

Source: Behavioral Risk Factor Surveillance System, CDC

Map and data via the Centers for Disease Control. This image is in the public domain.
Obesity Trends* Among U.S. Adults
BRFSS, 2010

Source: Behavioral Risk Factor Surveillance System, CDC

Map and data via the Centers for Disease Control. This image is in the public domain.
Prevalence\(^1\) of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2011

\(^1\) Prevalence estimates reflect BRFSS methodological changes started in 2011. These estimates should not be compared to prevalence estimates before 2011.

Source: Behavioral Risk Factor Surveillance System, CDC

*Sample size <50 or the relative standard error (dividing the standard error by the prevalence) \(\geq\) 30%.

Map and data via the Centers for Disease Control. This image is in the public domain.
Prevalence\(^1\) of Self-Reported Obesity Among
U.S. Adults by State and Territory, BRFSS, 2012

\(^1\) Prevalence estimates reflect BRFSS methodological changes started in 2011. These estimates should not be compared to prevalence estimates before 2011.
Prevalence\(^1\) of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2013

\(^1\) Prevalence estimates reflect BRFSS methodological changes started in 2011. These estimates should not be compared to prevalence estimates before 2011.

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Prevalence of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2014

*Prevalence estimates reflect BRFSS methodological changes started in 2011. These estimates should not be compared to prevalence estimates before 2011.

Source: Behavioral Risk Factor Surveillance System, CDC

*Sample size <50 or the relative standard error (dividing the standard error by the prevalence) ≥ 30%.

Map and data via the Centers for Disease Control. This image is in the public domain.
Poor Health by Income and Race/Ethnicity

Percent of Adults, Ages ≥25 Years, with Poor/Fair Health

- **Black, Non-Hispanic**
  - <100% FPL: 9.8%
  - 100-199% FPL: 14.4%
  - 200-299% FPL: 18.0%
  - 300-399% FPL: 26.3%
  - ≥400% FPL: 36.1%

- **Hispanic**
  - <100% FPL: 9.7%
  - 100-199% FPL: 13.2%
  - 200-299% FPL: 16.7%
  - 300-399% FPL: 22.5%
  - ≥400% FPL: 30.8%

- **White, Non-Hispanic**
  - <100% FPL: 6.2%
  - 100-199% FPL: 9.7%
  - 200-299% FPL: 13.5%
  - 300-399% FPL: 20.7%
  - ≥400% FPL: 30.8%

Image by MIT OpenCourseWare.
Evolution of Public Health Models

Paradigms for explaining disease
- Religious; fate
- Social circumstances; poverty
- Environment; socio-political
- Microbiological
- Lifestyle; risk factors
- Inequalities

Paradigms for disease control

Prevalent diseases
- Infectious disease
- Non-communicable disease

Years
1500 1600 1700 1800 1900 2000

Public health
Community health
Health promotion

Courtesy of University of Ottowa. Used with permission.

Index of Conceptual Models of Population Health; Society, the Individual and Medicine. The University of Ottowa.
http://www.med.uottawa.ca/sim/data/Models/Default_models_e.htm
Theories of disease distribution

• Germ theory
• Lifestyle
• Psychosocial
• Social production of disease/political economy of health
• Risk factor epidemiology
• Ecosocial theory
Health + Planning

Medical approach: Treat the sick
Health: a population perspective

Population approach: Shift the curve