Upstream and Downstream Approaches to Inequalities in Health: Challenges and Opportunities

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Upstream and Downstream Approaches to Inequalities in Health

• The Context
  • The 800 lb. genome gorilla, health, and health inequalities
  • Social Epidemiology and Population Health
  • Socioeconomic inequalities in health
• Some current explorations (briefly)
  • The downstream/bloodstream side of inequality
  • The life course and cumulative disadvantage
  • Communities as crucibles for growing health inequality
  • Economic equity and health
Upstream and Downstream Approaches to Inequalities in Health

- Challenges and Opportunities
  - Metaphors and Models
  - Need for Theory
  - Analytic and Methodologic Pitfalls
  - Perils and Promise of Interdisciplinarity
  - Personalizing Populations
  - Moderating Essentialism
  - Lost Opportunities

At the end of a century in which the average life expectancy in the United States has increased by nearly thirty years, victory over disease and disability has become an understandably popular and realistic goal. (emphasis added)

Harold Varmus, 1999
More than 150 years ago Rudolf Virchow, the great German pathologist, journeyed to Upper Silesia to investigate a great typhus epidemic. In his report to the Prussian government he focused not on a search for the critical bacilli, or the necessary animal vectors for transmission to humans. Instead, he called attention to the social, economic, and cultural factors responsible for the epidemic. In education and full employment, he argued, lay the cures for the prevention of future epidemics.

The primary determinants of disease are mainly economic and social, and therefore its remedies must also be economic and social. Medicine and politics cannot and should not be kept apart.

41 year range in life expectancy between the shortest (AI males in 6 counties in SD) and the longest (A/PI females in Bergen County, NJ) is equal to 90% of the global range in life expectancy (males in Sierra Leone vs. females in Japan) (Murray et al., 1998)

Heart Disease Death Rates, Age 25-64
Average Annual 1979 - 1989, Men

<table>
<thead>
<tr>
<th>Income 1980$</th>
<th>White</th>
<th>Black</th>
<th>B/W Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than $10,000</td>
<td>324.1</td>
<td>390.8</td>
<td>1.21</td>
</tr>
<tr>
<td>$10,000 - $14,999</td>
<td>255.4</td>
<td>292.8</td>
<td>1.15</td>
</tr>
<tr>
<td>$15,000 - $24,999</td>
<td>136.9</td>
<td>142.2</td>
<td>1.04</td>
</tr>
</tbody>
</table>

Source: Mokdad et al. JAMA 1999; 282(16):1519-1522
Source: Health, United States, 1998
Determinants of Population Health and Health Inequalities

- Social and Economic Policies
  - Institutions (including medical care)
- Living Conditions
- Social Relationships
- Individual Risk Factors
  - Genetic/Constitutional Factors
  - Pathophysiologic pathways
- Physical Environment
- Individual/Population Health
- Life Course

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Publications with Social Epidemiology in title, abstract, or descriptors: MEDLINE, 1966-2002

What Do we Mean by Inequalities in Health?

- Inequality
- Disparity
- Inequity

There are many potential types of inequality/disparity/inequity. In what follows I will focus on socioeconomic inequalities.
Socioeconomic Position and Health

• Widespread
• All age groups affected
• Affects multiple organs and risk factors
• Not fixed in time

Davey Smith et al.
Fatality Rates for Women Passengers on the *Titanic*

![Graph showing fatality rates for women passengers on the Titanic by cabin class.](image)

Number of publications per month with social class, socioeconomic factors, income or poverty listed as descriptors: MEDLINE search, 1969 through mid-2000.

![Graph showing publications per month from 1969 to 2000.](image)

All-cause Mortality by Income
NLMS, 25+ Years

Relative Risk of Death by Income & the Distribution of Income: USA, NLMS

Wolfson, Kaplan, Lynch, Ross, Backlund, BMJ, 1999
Deaths/10,000 in 300,685 Men: MRFIT, Age 35-57

Davey Smith et al.,
1996

Socioeconomic Position and Health

- Widespread
- **All age groups affected**
- Affects multiple organs and risk factors
- Not fixed in time

CSEPH
Infant Mortality Rates by Years of Education: United States, 1995, Mother 20+ years of age

Stunting* by Age and Poverty Status

USDA/HHS, 1986

*height<5th percentile
Asthma Hospitalization Rate among children 1-4 years: U.S., 1989-91

Survival from Age 65 by Pre-Retirement Earnings Quintile
546,759 Canadian Males in Canada Pension Plan

Wolfson et al., 1993
Socioeconomic Position and Health

• Widespread
• All age groups affected
• Affects multiple organs and risk factors
• Not fixed in time

Chronic Conditions more Prevalent among those with < 12 Years of Education: NHIS, 1989, 65+ years

Arthritis  Gastritis  Cerebrovascular dis.
Gout  Kidney dis.  Hardening of the arteries
Intervertebral disc dia.  Indigestion  Varicose veins
Bunions  Diverticulitis  Chron. bronchitis
Psoriasis  Constipation  Asthma
Visual impairment  Goiter  Hay fever
Cataracts  Diabetes  Chron. sinusitis
Hearing impairment  Anemia  Emphysema
Speech impairment  Migraine
Abs. of extremities  Neuralgia/Neuritis
Paralysis  Kidney trouble
Deformity or orth. Impairment  Ischemic heart dis.
Ulcer  Other heart dis.
Abd. hernia  Hypertension

Series 10, No. 129
4-year Progression of Plaque Height by Education and Income Level

<table>
<thead>
<tr>
<th>4-Year Change in Max IMT (mm)</th>
<th>&lt;High School</th>
<th>Some High School</th>
<th>High School+</th>
<th>I(Lowest)</th>
<th>I</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>0.30</td>
<td>0.28</td>
<td>0.24</td>
<td>0.31</td>
<td>0.26</td>
<td>0.24</td>
<td>0.23</td>
</tr>
<tr>
<td>Income</td>
<td>0.30</td>
<td>0.28</td>
<td>0.24</td>
<td>0.31</td>
<td>0.26</td>
<td>0.24</td>
<td>0.23</td>
</tr>
</tbody>
</table>

Lynch et al., 1997
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**Fibrinogen and TPA by Income Quartiles**
*Kuopio Ischemic Heart Disease Risk Factor Study*

![Fibrinogen and TPA by Income Quartiles](image)

---

**Total Serum Cholesterol and LDL by Income Quartiles**
*Kuopio Ischemic Heart Disease Risk Factor Study*

![Total Serum Cholesterol and LDL by Income Quartiles](image)
Systolic Blood Pressure and Fasting Glucose by Income Quartiles
Kuopio Ischemic Heart Disease Risk Factor Study

Systolic Blood Pressure

Fasting Blood Glucose

Everson-Rose et al., in progress
Behavioral Risk Factors by Level of Education
Kuopio Ischemic Heart Disease Risk Factor Study

Primary or less
Some High School
High School or more

Dietary Consumption by Income Quartiles
Kuopio Ischemic Heart Disease Risk Factor Study

Vegetables
Fruits & Berries
Sodium
P/S Ratio

Lynch, Kaplan & Salonen, 1997
Prevalence (%) of Psychosocial Factors by Education
Kuopio Ischemic Heart Disease Risk Factor Study: 42-60 year-old men

![Bar chart showing prevalence (new) of psychosocial factors by education, with labels for Depression, Hopelessness, Hostility, Sense of Coherence.]

Prevalence (%) of Psychosocial Factors by Education
Lynch, Kaplan & Salonen, 1997

Prevalence of Depressive/Hopelessness Symptoms by Income Tertiles

![Bar chart showing prevalence of depressive/hopelessness symptoms by income tertiles, with labels for Consumers Survey, Detroit Study, Alameda Study, Kuopio Study.]

Prevalence of Depressive/Hopelessness Symptoms by Income Tertiles
Everson et al., 2000
Prevalence of Hopelessness by Income Quintiles

Kuopio Ischemic Heart Disease Study, Everson et al., 1997

4-Year Progression of Carotid Atherosclerosis by Hopelessness Adjusted for Age and Baseline IMT

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“The childhood shows the man, As the morning shows the day”

![Diagram](image)

**Coronary Heart Disease Mortality in Hertfordshire**
**Adults by Weight at Birth (lbs)**

Osmond et al., 1993
Early Environmental Events and Later Development

Various studies indicate the following more common for poor children:
- Homelessness
- Poor and unaffordable housing
- Residential mobility
- Inadequate heating
- Crowding
- Cold, dampness, mold
- Cockroaches, rats, mice
- Poor quality child care
- Decreased verbal interactions with adults
- Inadequate schools
- Fewer educational opportunities at home
- Few stimulating activities at home
- Parental stress and depression
Cognitive Function at Age 58 & 64 and Life Course Socioeconomic Disadvantage

Increasing Life Course Economic Disadvantage

29-year Cumulative Impact of Economic Disadvantage on Five Health Outcomes

Lynch, Kaplan & Shema, NEJM, 1997
Grandmothers of the Current Generation

New York City, 1952
Washington, DC 1952
Barrington, 2003

Childhood and Adult SES and Mortality from All Causes
Kuopio Ischemic Heart Disease Risk Factor Study

Lynch et al., 1994
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**Age-adjusted Survival by Poverty Area Residence: Alameda County Study, 1965-1974**
Those who lived in the poverty area over the next 9 years:

- had twice the decrease in physical activity
- were more likely to become depressed
- were twice as likely to become disabled
- were less likely to be “successfully” aging

Those in the Poverty neighborhoods

- Were 5.8-8.0 lbs (M and F) heavier and gained 2.4-3.0 lbs (M & F) more over the next 9 years
  (after adjustment for age, race, education & income)
- They were 3-8 times (depending on gender, race, and income) to develop NIDDM over the next 34 years
Diabetes Mortality Differences between Whites and African-Americans before and after adjustment for Median Income of Area of Residence:
MRFIT: 320,909 men aged 35-47

<table>
<thead>
<tr>
<th>Age</th>
<th>Age+Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>2.63</td>
</tr>
<tr>
<td>1.00</td>
<td>1.43</td>
</tr>
</tbody>
</table>

75% reduction in risk with adjustment for median income of area

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U.S. Income Inequality

“The gap between rich and poor has grown into an economic chasm so wide that this year the richest 2.7 million Americans, the top 1 percent, will have as many after-tax dollars to spend as the bottom 100 million.”

NY Times, Sept 5, 1999
Between 1980 and 1990, states that had the biggest increase in income inequality had the smallest decrease in mortality rates.

Kaplan et al. *BMJ* (1996) Income Share Held by Poorest 50% of the Population

### Income Inequality and Selected Educational Indicators

<table>
<thead>
<tr>
<th></th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>% &lt; High School Diploma</td>
<td>-0.71</td>
</tr>
<tr>
<td>% High School Dropout</td>
<td>-0.50</td>
</tr>
<tr>
<td>4th Grade Reading Scores</td>
<td>-0.58</td>
</tr>
<tr>
<td>4th Grade Math Scores</td>
<td>-0.64</td>
</tr>
<tr>
<td>Education / Total Spending</td>
<td>-0.32</td>
</tr>
<tr>
<td>Library Books Per capita</td>
<td>-0.42</td>
</tr>
</tbody>
</table>
How large are these mortality effects?

High Income Inequality
Low Average Income
925.8 per 100,000

Low Income Inequality
High Average Income
785.9 per 100,000

140 deaths per 100,000
Equivalent to the combined loss of life from lung cancer, diabetes, motor vehicle crashes, HIV infection, suicide and homicide in 1995.

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  - Lost Opportunities
Material, Psychosocial

Social Structure

Work

Social Environment

Health Behavior

CNS

Neuroendocrine

Immune

Pathophysiology

Organ Impairment

Social, Political, and Economic Conditions and Policy

Psychosocial Risk Factors
1. Health Behaviors
2. Social Relationships and Supports
3. Chronic and Acute Stress
4. Psychological Dispositions
5. Social Roles and Productive Activities

Medical Care and Insurance

Physical/Chemical and Social Environmental Hazards

EXPLANATORY VARIABLES

Race-Ethnicity

Gender

Socioeconomic Status

Social, Political, and Economic Conditions and Policy

Health Outcomes
1. Mortality
2. Institutionalization
3. Morbidity (Chronic)
4. Functional Limitations
5. Self-rated Health
6. Cognitive Function
7. Depression

Marmot, 2001

House, 2002
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In a world of science in which the proximal and molecular explanation is seen as the “best,” a complete, satisfying, and useful understanding of inequalities in health may require the methodologic lens of complex systems and systems biology (even), the sensitivity and insights of the historian, poet and ethnographer, the knowledge of the biologist and ecologist, and the tools of the policy analyst and public health practitioner.
While there are many challenges, the study and remediation of inequalities in health could serve as a model for a new scientific paradigm—bridging the social and the biological.

A tall order, but an exciting one that holds promise for breaking the link between the social divides in society and the health divides, and in doing so perhaps (???) even helping to decrease the social divides…….
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  – Globalization and health
  – How do we understand?

• 1.2 billion people (20% of world’s population) are estimated to live on less than $1 per day

• 3 billion (49% of world’s population) on less than $2 per day

• 110 million primary school age children are out of school (60% of them girls)

• Many more live without adequate food, shelter, safe water, and sanitation.

Social Impacts of 1998 Asian Financial Crisis in Thailand

Increases in:
- poverty
- unemployment
- divorce rates
- child abandonment
- drug use

Shivakumar et al., 2000

Debt Service vs. Other Expenditures in Pakistan

Bhutta, 2000
### Cash Flow in and out of Pakistan from World Bank and IMF, 1999-2000

<table>
<thead>
<tr>
<th></th>
<th>Into</th>
<th>Out of</th>
<th>Net</th>
</tr>
</thead>
<tbody>
<tr>
<td>World Bank</td>
<td>250</td>
<td>514.2</td>
<td>-264.2</td>
</tr>
<tr>
<td>IMF</td>
<td>0</td>
<td>329.1</td>
<td>-329.1</td>
</tr>
</tbody>
</table>

Bhutta, 2000

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**Globalization of the Economy**
- Capital Concentration
- Leveraged buy-outs, etc.
- Changes in Occupational Structure
- Downsizing/Job Losses
- Migrant Workers

**Social Resources**
- Real Wages
- Work Hours
- Job Insecurity
- Income and Wealth Inequality

**Other Risk Factors**
- Stress & Time Pressure

**Cardiovascular Disease**
- Consequence of Fast Food
- Poor Nutrition
- High-strain, minimum wage jobs

**Social Cohesion**
- Blood Pressure
- Smoking
- Obesity

**Deforestation**
- Fue-curing of tobacco

**Meat Production**
- Farming

**Epidemiologic Transition in Developing Countries**
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  - How do we understand?
New Urbanism
Small, self-contained neighborhoods with the center no more than a quarter of a mile from the edge — a reasonable walking distance. Improved public transit systems and greater integration of different types of land uses at the neighborhood level.

<table>
<thead>
<tr>
<th>Metropolitan area</th>
<th>Total local governments</th>
<th>Population living in central city (%)</th>
<th>Geopolitical fragmentation index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pittsburgh</td>
<td>418</td>
<td>14.5</td>
<td>12.0</td>
</tr>
<tr>
<td>St. Louis</td>
<td>312</td>
<td>13.8</td>
<td>8.8</td>
</tr>
<tr>
<td>Cincinnati</td>
<td>235</td>
<td>18.0</td>
<td>6.7</td>
</tr>
<tr>
<td>Minneapolis–St. Paul</td>
<td>344</td>
<td>22.4</td>
<td>5.3</td>
</tr>
<tr>
<td>Cleveland</td>
<td>267</td>
<td>17.1</td>
<td>5.4</td>
</tr>
<tr>
<td>Boston</td>
<td>296</td>
<td>9.6</td>
<td>5.3</td>
</tr>
<tr>
<td>Detroit</td>
<td>335</td>
<td>16.4</td>
<td>3.3</td>
</tr>
<tr>
<td>Kansas City</td>
<td>182</td>
<td>34.6</td>
<td>3.1</td>
</tr>
<tr>
<td>Atlanta</td>
<td>127</td>
<td>11.4</td>
<td>3.1</td>
</tr>
<tr>
<td>Philadelphia</td>
<td>442</td>
<td>24.7</td>
<td>3.0</td>
</tr>
<tr>
<td>Chicago</td>
<td>567</td>
<td>31.7</td>
<td>2.1</td>
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<tr>
<td>Milwaukee</td>
<td>113</td>
<td>36.1</td>
<td>1.9</td>
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<tr>
<td>Dallas</td>
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<td>23.1</td>
<td>1.8</td>
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<td>87</td>
<td>23.2</td>
<td>1.8</td>
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<tr>
<td>Seattle</td>
<td>94</td>
<td>15.9</td>
<td>1.8</td>
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<tr>
<td>Miami</td>
<td>57</td>
<td>10.5</td>
<td>1.5</td>
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<tr>
<td>San Francisco</td>
<td>114</td>
<td>11.1</td>
<td>1.5</td>
</tr>
<tr>
<td>Denver</td>
<td>76</td>
<td>21.9</td>
<td>1.5</td>
</tr>
<tr>
<td>Tampa</td>
<td>39</td>
<td>13.0</td>
<td>1.4</td>
</tr>
<tr>
<td>Washington, D.C.</td>
<td>158</td>
<td>17.1</td>
<td>1.3</td>
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<tr>
<td>New York</td>
<td>736</td>
<td>37.3</td>
<td>1.0</td>
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<td>Houston</td>
<td>123</td>
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<td>0.7</td>
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<tr>
<td>Los Angeles</td>
<td>182</td>
<td>23.0</td>
<td>0.5</td>
</tr>
<tr>
<td>Phoenix</td>
<td>34</td>
<td>42.1</td>
<td>0.3</td>
</tr>
<tr>
<td>San Diego</td>
<td>19</td>
<td>43.7</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Source: U.S. Census Bureau.
Total Tax Base Per Household
by Municipality and County Unincorporated Area, 1996

$137 vs $13,995
100-fold difference!!
Interactions Between Neighborhood and Individual
Risk Factors for Low Birth Weight

**Neighborhood Level**
- Per Capita Crime
- Unemployment
- Wealth
- Low Per Capita Income

**Individual Level**
- Low Maternal Education
- Maternal Age
- Prenatal Care
- Health Insurance

LBW

O’Campo et al. 1997
Civic Culture
Social Values
Individual Income
Morbidity by Cause
Mortality by Cause

Neo-Material Context
Education System
Working Conditions
Industry Base
Public Health Services
Environmental Controls
Land Use & Zoning
Recreation Facilities
Transportation Systems
Affordable Quality Housing
Access to Optimal Nutrition
Child Care
Advertising - cigarettes, etc
Discrimination

Historical Factors
Political Economy
Political Institutions

Distribution of Income
Individual Income
Perception of Place in the Social Hierarchy
Disrespect
Social Cohesion
Social Capital
Morbidity Mortality by Cause

Note: The term 'institutions' refers to property tax in 1996.

Total Tax Base Per Household
by Municipality and County Unincorporated Area, 1996

Tax Base per Household
Regional Value: $67,542
$8,138 to $27,409 (9)
$35,708 to $47,131 (16)
$49,708 to $67,958 (20)
$67,542 to $82,953 (11)
$89,316 to $110,493 (9)
$120,386 or more (4)
No data (1)
### Trends in Inequality and Child Poverty 1967-1992

<table>
<thead>
<tr>
<th></th>
<th>%Change in Inequality</th>
<th>%Change in Child Poverty</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>+ 30</td>
<td>+ 30</td>
</tr>
<tr>
<td>USA</td>
<td>+ 15 - 29</td>
<td>+ 30</td>
</tr>
<tr>
<td>Sweden</td>
<td>+ 15 - 29</td>
<td>- 5</td>
</tr>
<tr>
<td>Australia</td>
<td>+ 10 - 15</td>
<td>0</td>
</tr>
<tr>
<td>Denmark</td>
<td>+ 10 - 15</td>
<td>- 5</td>
</tr>
<tr>
<td>Canada</td>
<td>0</td>
<td>- 5</td>
</tr>
<tr>
<td>Finland</td>
<td>0</td>
<td>- 5</td>
</tr>
<tr>
<td>Spain</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Israel</td>
<td>0</td>
<td>+ 5 - 10</td>
</tr>
<tr>
<td>W. Germany</td>
<td>0</td>
<td>+ 5 - 10</td>
</tr>
</tbody>
</table>

### How large are these mortality effects?

- **High Income Inequality**
  - Low Average Income
    - 925.8 per 100,000

- **Low Income Inequality**
  - High Average Income
    - 785.9 per 100,000

- **140 deaths per 100,000**
  - Equivalent to the combined loss of life from lung cancer, diabetes, motor vehicle crashes, HIV infection, suicide and homicide in 1995.

### Trends in Inequality and Child Poverty 1967-1992

<table>
<thead>
<tr>
<th>Country</th>
<th>%Change in Inequality</th>
<th>%Change in Child Poverty</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>+ 30</td>
<td>+ 30</td>
</tr>
<tr>
<td>USA</td>
<td>+ 15 - 29</td>
<td>+ 30</td>
</tr>
<tr>
<td>Sweden</td>
<td>+ 15 - 29</td>
<td>- 5</td>
</tr>
<tr>
<td>Australia</td>
<td>+ 10 - 15</td>
<td>0</td>
</tr>
<tr>
<td>Denmark</td>
<td>+ 10 - 15</td>
<td>- 5</td>
</tr>
<tr>
<td>Canada</td>
<td>0</td>
<td>- 5</td>
</tr>
<tr>
<td>Finland</td>
<td>0</td>
<td>- 5</td>
</tr>
<tr>
<td>Spain</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Israel</td>
<td>0</td>
<td>+ 5 - 10</td>
</tr>
<tr>
<td>W. Germany</td>
<td>0</td>
<td>+ 5 - 10</td>
</tr>
</tbody>
</table>

### Neo-Material Context

- Education System
- Working Conditions
- Industry Base
- Public Health Services
- Environmental Controls
- Land Use & Zoning
- Recreation Facilities
- Transportation Systems
- Affordable Quality Housing
- Access to Optimal Nutrition
- Child Care
- Advertising - cigarettes, etc
- Discrimination

### Historical Factors

- Civic Culture
- Social Values
- Individual Income
- Morbidity by Cause
- Smoking
- Diet
- Exercise
- Hostility
- Isolation

### Distribution of Income

- Perception of Place in the Social Hierarchy
- Disrespect
- Lack of Trust
- Social Cohesion
- Social Capital

### Political Institutions

- Political Economy
- Political Economy Distribution of Income