Socioeconomic Influences on Cardiovascular Disease

Emphasis on the developing world

Torino 2017
### Stages of Epidemiologic Transition

<table>
<thead>
<tr>
<th>Description</th>
<th>Life expectancy</th>
<th>Proportion of death due to CVD (%)</th>
<th>Dominant form of CVD death</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stage 1</strong> Pestilence and famine</td>
<td>35 yr</td>
<td>&lt;10</td>
<td>Infectious (RHD)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Nutritional</td>
</tr>
<tr>
<td><strong>Stage 2</strong> Receding pandemics</td>
<td>50 yr</td>
<td>10-35</td>
<td>Infectious (RHD)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Stroke – hemorrhagic</td>
</tr>
</tbody>
</table>

Omran: Milbank Mem Fund Q, 1971; Olshansly: Millbank Mem Fund Q, 1986
# Stages of Epidemiologic Transition

<table>
<thead>
<tr>
<th>Description</th>
<th>Life expectancy</th>
<th>Proportion of death due to CVD (%)</th>
<th>Dominant form of CVD death</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stage 3</strong> Degenerative and man-made diseases</td>
<td>&gt;60 yr</td>
<td>35-65</td>
<td>IHD*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Stroke — Hemorrhagic</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ischemic</td>
</tr>
</tbody>
</table>

- *Greater in high socioeconomic groups

**Stage 4** Delayed degenerative diseases

<table>
<thead>
<tr>
<th>Description</th>
<th>Life expectancy</th>
<th>Proportion of death due to CVD (%)</th>
<th>Dominant form of CVD death</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stage 4</strong> Delayed degenerative diseases</td>
<td>&gt;70 yr</td>
<td>40-50</td>
<td>IHD**</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Stroke — Ischemic</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CHF</td>
</tr>
</tbody>
</table>

- **Younger pt – lower socioeconomic status; Elderly – higher socioeconomic status**
Changing Distribution of the Causes of Death in the People's Republic of China

An epidemiologic catastrophe amidst growing prosperity

Proportion of deaths (%)

Year

1973

2005

Unknown
Injury
Other noncommunicable diseases
Chronic obstructive pulmonary disease
Cerebro-cardiovascular disease
Cancer
Maternal and perinatal conditions
Communicable diseases

Yang: Lancet, 2008
Attained Education Level (AEL) and Impact on Risk Factors

- REACH registry
- 61,332 subjects
- Established CVD or multiple risk factors

- 0-8 yr
- 9-12 yr
- Trade/technical
- University/college

### Associations with AEL

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>HIC</th>
<th>LIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obesity</td>
<td>↓</td>
<td>↑</td>
</tr>
<tr>
<td>Smoking</td>
<td>↓</td>
<td>↔</td>
</tr>
<tr>
<td>Hypertension</td>
<td>↓</td>
<td>↔</td>
</tr>
<tr>
<td>Diabetes</td>
<td>↓</td>
<td>↓</td>
</tr>
<tr>
<td>Hypercholesterolemia</td>
<td>↑</td>
<td>↑</td>
</tr>
<tr>
<td>Disease in ≥2 vascular beds</td>
<td>↓</td>
<td>↑</td>
</tr>
</tbody>
</table>

* Increased among women; Goyal: Circ, 2010
Risk Factors Associated With MI in Africa
INTERHEART Study
Socioeconomic Status and OR for MI

Years of Formal Education

- Black Africans (Phase 3)
- Colored Africans
- Europeans/other (Phase 4)

Odds ratio

Income

- Black Africans (Phase 3)
- Colored Africans
- Europeans/other (Phase 4)

Steyn: Circ, 2005
Income Disparities in Absolute CV Risk and CV Risk Factors in the USA – 1999-2004

- NHANES survey
- 17,199 adults
- Aged 40-79 yrs

* No trends noted for diabetes, and serum cholesterol with absolute rates of diabetes higher in lower income groups

10 Year Trends

- Predicted 10-yr CV Risk
- Mean Systolic BP
- Smoking

NHANES survey years:
- At or below poverty level
- Middle income
- High income

Current smokers (%)

P=0.87
P=0.62
P<0.001
P<0.001
P<0.001

Current smokers (%)

P=0.02 for interaction
P=0.02 for interaction
P<0.001
P<0.001
P<0.001

Adults with ≥20% CVD risk (%)

P=0.02 for interaction
P=0.001
P=0.003

Mean Systolic BP

P=0.64
P<0.001
P<0.001
P=0.001
P=0.001

Systolic BP (mm Hg)

P=0.41
P=0.02
P=0.06

P=0.44
P=0.44
P=0.02 for interaction

P=0.02 for interaction
P=0.02

Odutayo et al: JAMA Cardiol, 2017

©2017 MFMER | 3653016-01
Socioeconomic Status and Outcome Following Acute Myocardial Infarction in Elderly Patients

Sunil V. Rao, MD; Kevin A. Schulman, MD; Lesley H. Curtis, PhD; Bernard J. Gersh, MB, ChB, DPhil; James G. Jollis, MD

Arch Intern Med, 2004

- 132,130 Medicare beneficiaries
- Cooperative Cardiovascular Project

Unadjusted Mortality by Deciles of Income

“Wealth is independently associated with health”

Adjusted Relative Risk
(Reference is Middle Income Group)

<table>
<thead>
<tr>
<th></th>
<th>Lower mortality</th>
<th>Higher mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High-Income group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income level</td>
<td>0.91</td>
<td></td>
</tr>
<tr>
<td>Income level + clinical predictors</td>
<td>0.88</td>
<td></td>
</tr>
<tr>
<td>Income level + clinical predictors + treatment +</td>
<td>0.89</td>
<td></td>
</tr>
<tr>
<td><strong>Low-Income group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income level</td>
<td></td>
<td>1.07</td>
</tr>
<tr>
<td>Income level + clinical predictors</td>
<td>1.10</td>
<td></td>
</tr>
<tr>
<td>Income level + clinical predictors + treatment +</td>
<td>1.09</td>
<td></td>
</tr>
</tbody>
</table>

Mortality (%)

- Admission to 30 d
- 30 d to 1 yr
Associations Between Neighborhood Socioeconomic Status and All-Cause Mortality

Swedish Primary Care Population With AFib

Potential Explanations

**Confounders**
- Education
- Marital status
- Age
- Comorbidities

**Mediators**
- Lifestyle
- Psychosocial stress
- Comorbidities

**Exposure**
- Neighborhood SES

**Outcome**
- Mortality

Phase 5
(phase of increasing CV mortality)

- The negative impact of social upheaval and health regression
- The age of inactivity and obesity
Declining Life Expectancy in Russia

Life Expectancy at Birth


U.S. females
Russian females
U.S. males
Russian males

Heart disease and stroke – 65% of decline in life expectancy
Anti-alcohol campaign
Perestroika
Economic and social instability
• ↑ alcohol
• ↑ tobacco

Notzon: JAMA, 1998
Time course of the epidemic

Rapid onset but control of risk factors can have surprisingly positive and early benefits
Spectrum of Heart Disease in Urban Blacks in S Africa – 2006
The Heart of Soweto Study

- 1.1 million est.
- 85% black
- 59% women
- Mean age 52-8 yr
- CV risk factors – 87%

1,593 New Cases of Cardiovascular Disease

- Hypertension 19%
- Heart failure 44%
- Other diagnoses 9%
- CAD 10% (6% – blacks 38% – other)
- Valvular heart disease (17%) (58% – rheumatic)

Sliwa: Lancet, 2008
Trends in Age-Adjusted Mortality in Cuba
Economic Crisis 1989-2000

Type 2 Diabetes

Diabetes mortality (per 100,000)

Year


Coronary Heart Disease

CHD mortality (per 100,000)

Year


Cancer

Cancer mortality (per 100,000)

Year


All Causes

All-cause mortality (per 100,000)

Year


Population-Wide Weight Loss and Regain in Relation to Diabetes Burden and CV Mortality in Cuba

- Cross-sectioned surveys
- 1980-2010

Franco: BMJ 2013

Diabetes prevalence and obesity prevalence graphs showing trends from 1980 to 2010.
The Positive Model of the Hunter-Gatherer Life Style

- 10 Aborigines
- Derby, Western Australia
- Diabetics

Baseline

7 weeks as hunter-gatherers

“The major metabolic abnormalities of diabetes were either greatly improved or completely normalized”

O’Dea: Diabetes, 1984
Brown, 2011
Proportion of Reduction in Deaths Due to CHD Attributable to Treatments and Changes in Risk Factors

- IMPACT Poland, 1991-2005
- IMPACT England and Wales, 1981-2000
- IMPACT Sweden, 1986-2002
- IMPACT Iceland, 1981-2006
- IMPACT Scotland, 1975-1994
- Holland, 1978-1985
- New Zealand, 1974-1981

* IMPACT Finland, 1982-1997
* IMPACT Iceland, 1981-2006

*North Karelia
73% ↓ in IHD mortality from 1971-1995

Treatments        Risk factors          Unexplained

%
Socioeconomic status and health

It is a complex relationship with risk factor control, access to care and adherence to therapy the common denominators