Circulatory Disease Mortality Target:
Death rates in England 1993-2006 Persons under 75

A fall of 44% over 10 years

Death / 100,000 population

Target: 40% minimum reduction from 1995-97

Immortality guaranteed by 2026

Source: ONS (ICD9 390-459; ICD10 I00-I99)
Evolution of Atherosclerosis

Genetic

Environmental

Clinical Events

Age (yrs)
Coronary Heart Disease Mortality in Beijing 1984-1999

- 1822 Extra deaths Attributable to Risk Factor Changes
  - Cholesterol: 77%
  - Diabetes: 19%
  - BMI: 4%
  - Smoking: 1%
  - 642 fewer deaths by treatments
    - AMI treatments: 41%
    - Hypertension treatment: 24%
    - Secondary prevention: 11%
    - Heart failure: 10%
    - Aspirin for Angina: 10%
    - Angina: CABG & PTCA: 2%

Critchley J. Circulation, 2004;110:1236-1244
Forecasting Future CVD in USA

Indirect

Direct

Heidenreich Circ 2011; 123: 933-944
Emergence of Health Maintenance as the Business of Health Care

Eastman Kodak filed for bankruptcy on Jan 19 2012 after 131 years

“Move from product orientated industry to customer orientated one”

Asch NEJM 2012;367:888-9
Lifetime Management of Atherosclerosis Risk

Early intervention pays long term dividends
Prevalence of Atherosclerosis by Donor Age

32 Year Old Female

EEM Area 13.2 mm$^2$

Atheroma Area 8.13 mm$^2$

Prevalence of Atherosclerosis by Donor Age

<table>
<thead>
<tr>
<th>Donor Age (years)</th>
<th>Prevalence of Atherosclerosis (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20</td>
<td>17%</td>
</tr>
<tr>
<td>20-29</td>
<td>37%</td>
</tr>
<tr>
<td>30-39</td>
<td>60%</td>
</tr>
<tr>
<td>40-49</td>
<td>71%</td>
</tr>
<tr>
<td>≥50</td>
<td>85%</td>
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</tbody>
</table>
CV Risk Factors in Childhood and Carotid IMT in Adults

Risk factors measured at ages 12-18yrs

<table>
<thead>
<tr>
<th>No. of risk factors</th>
<th>Mean maximum carotid IMT (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.88</td>
</tr>
<tr>
<td>1</td>
<td>0.80</td>
</tr>
<tr>
<td>2</td>
<td>0.72</td>
</tr>
<tr>
<td>3 or 4</td>
<td>0.64</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

P<0.001

Raitakari et al JAMA 2003;290;2277-2283
Epidemiology and Prevention

Childhood Physical, Environmental, and Genetic Predictors of Adult Hypertension

The Cardiovascular Risk in Young Finns Study

Jonna Juhola, MD; Mervi Oikonen, PhD; Costan G. Magnussen, PhD; Vera Mikkilä, PhD; Niina Siitonen, PhD; Eero Jokinen, MD, PhD; Tomi Laitinen, MD, PhD; Peter Würtz, PhD; Samuel S. Gidding, MD; Leena Taittonen, MD, PhD; Ilkka Seppälä, MSc; Antti Jula, MD, PhD; Mika Kähönen, MD, PhD; Nina Hutri-Kähönen, MD, PhD; Terho Lehtimäki, MD, PhD; Jorma S.A. Viikari, MD, PhD; Markus Juonala, MD, PhD; Olli T. Raitakari, MD, PhD

Conclusions—Prediction of adult hypertension was enhanced by taking into account known physical and environmental childhood risk factors, family history of hypertension, and novel genetic variants. A multifactorial approach may be useful in identifying children at high risk for adult hypertension. (Circulation. 2012;126:402-409.)
Framingham Heart Study: Lifetime Risk

**Men**

- Adjusted Cumulative Incidence
- Attained Age
- Lloyd-Jones Circ. 2006; 113: 791-798

**Women**

- Adjusted Cumulative Incidence
- Attained Age
- Lloyd-Jones Circ. 2006; 113: 791-798
Lifetime Risk of Death from CV Disease

Berry NEJM 2012; 366: 321-329
Age and CV Risk in Diabetes

Booth Lancet 2006; 368: 29-36
Independent and Graded Association between GFR and CVD

Go et al; NEJM 2004

Estimated GFR (ml/min/1.73m²)

Age-standardized rate of death from any cause (per 100 person-yr)

≥60 45-59 30-44 15-29 <15

0.76 1.08 4.76 11.36 14.14

Age-standardized rate of CV events (per 100 person-yr)

≥60 45-59 30-44 15-29 <15

2.11 3.65 11.29 21.80 36.60
LDL Cholesterol and Coronary Heart Disease among Black Subjects by \textit{PCSK9}^{142X} or \textit{PCSK9}^{679X} Allele

Cohen NEJM 2006; 354:1264-72
Importance of Lifetime Risk

Average male non-smoker

10 year risk

Age

Average male smoker

10 year risk

Age

Average female non-smoker

10 year risk

Age

Average female smoker

10 year risk

Age

CHD

CVD

JBS2(e)
Short Term v. Lifetime Risk in USA

- Non-smoking men <45yrs
- All women <65yrs ≤10% 10yr CHD Risk

56% of US adults (87,000,000) have low (<10%) 10yr and high lifetime (≥39%) risk

Marma Circ Cardiothoracic Qual Outcomes 2010;3:8-14

Marma Circ 2009;120:384-390
Joint British Societies (JBS3): CV Risk Management
Lifetime risk calculator

- New metrics for communication
- Heart age
- Age at 1st CV event
New UK JBS3 Lifetime Risk Calculator

Your heart age is about 57

On average, expect to survive to age 66 free of heart attack or stroke

Interventions

- Systolic Blood Pressure: 160 → 160
- Cholesterol Ratio: 5.6 → 5.6
- Weight (Kg): 94 → 94
- Future smoking category: Moderate smoker

Expected heart attack or stroke free years remaining
What we expect to happen in 10 years to 100 people like you:

**carrying on as usual**

- 88 living without heart attack or stroke
- 8 suffered a heart attack or stroke
- 5 died before heart attack or stroke

**after interventions**

- 93 living without heart attack or stroke
- 4 suffered a heart attack or stroke
- 3 died before heart attack or stroke

**Interventions**

- Systolic Blood Pressure: 160 → 130
- Cholesterol Ratio: 5.60 → 4
- Weight (Kg): 94.0 → 75
- Future smoking category: Quit smoking

**Intervention start age**: 44
**Target interval**: 10
What we expect to happen in 20 years to 100 people like you

**carrying on as usual**
- Living without heart attack or stroke: 61
- Suffered a heart attack or stroke: 25
- Died before heart attack or stroke: 15

**after interventions**
- Living without heart attack or stroke: 77
- Suffered a heart attack or stroke: 13
- Died before heart attack or stroke: 10

**Interventions**
- Systolic Blood Pressure: 160 → 130
- Cholesterol Ratio: 5.60 → 4
- Weight (Kg): 94.0 → 75
- Future smoking category: Quit smoking

**Intervention start age**: 44
**Target interval**: 20
How early should prevention start?
Benefit of Smoking Cessation

Graph showing survival rates for doctors born between 1900 and 1930, comparing cigarette smokers and non-smokers. The graph on the left indicates a survival benefit of 10 years for non-smokers compared to cigarette smokers.

Graph on the right shows the impact of stopping smoking at age 35-44, with a marked improvement in survival rates for those who quit smoking.
Obesity in the Young

13 year old boy weighing 11.2kg more than normal runs 33% increased probability of a CV event < 60Yrs

“The commonest instruments of suicide are a knife and fork”

Martin Fischer
Childhood Adiposity, Adult Adiposity, and Cardiovascular Risk Factors

BACKGROUND

Obesity in childhood is associated with increased cardiovascular risk. It is uncertain whether this risk is attenuated in persons who are overweight or obese as children but not obese as adults.

Persons who were overweight or obese during childhood but were nonobese as adults had risks of the outcomes that were similar to those of persons who had a normal BMI consistently from childhood to adulthood (P>0.20 for all comparisons).
Responsibility for Childhood Obesity?

Who is at fault for obesity? Who is responsible for addressing it?

<table>
<thead>
<tr>
<th></th>
<th>Parents</th>
<th>Food and drink manufacturers</th>
<th>The individual</th>
<th>The state</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who is at fault for obesity?</td>
<td>76</td>
<td>48</td>
<td>22</td>
<td>12</td>
</tr>
<tr>
<td>Who is responsible for addressing it?</td>
<td>31</td>
<td>40</td>
<td>30</td>
<td>69</td>
</tr>
</tbody>
</table>

‘Sell health as a valued commodity’

Henley Centre (2007)
Potential Benefit of CV RF treatment in Obesity

Excess Total CHD Events

Excess Deaths from CHD

Bibbins-Domingo NEJM 2007; 357: 2371-2379
Number of Prescriptions for Statins each Quarter in England

Items (000s)
Polypill Concept

A pill to prevent 80% of heart attacks

Polypill would contain a statin, three antihypertensives, folic acid, and aspirin.
Consider statins for younger persons, perhaps starting at 30 in those with risk factors that convey high lifetime risk (as opposed to 10 yr risk) for CHD.
Ideal CV Health: How Often Do We Get There?

1933 participants in Heart SCORE-only 1 with 7 components

AHA Definition
Non smoking
BMI <25kg/m²
Physical Activity
Recommended diet
Untreated TC <200 mg/dl
Untreated BP <120/80 mmHg
Untreated FBG <100 mg/dl

Roger Circ 2011; 123: 459-463
Cost Effectiveness of Preventive Interventions

Proportion of published cost-effectiveness ratios

- Cost-saving
- <10,000
- 10,000 to <50,000
- 50,000 to <100,000
- 100,000 to <250,000
- 250,000 to <1,000,000
- >1,000,000

Environmental intervention
Non-clinical, person-directed intervention
Clinical intervention

Increases cost and worsens health

Chokshi NEJM 2012;367:295-6
Sugar, rum and tobacco are commodities which are nowhere necessaries of life, which are become objects of almost universal consumption, and which are therefore extremely proper subjects of taxation.

*Adam Smith, The Wealth of Nations, 1776*
CV disease is preventable

“Life-long Rx likely to be cost-effective and often cost saving”

Circulation 2011;124:967-990
“It should be the function of medicine to have people die young as late as possible”

Ernest L. Wynder M.D.