Primary prevention of CVD

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Building Capacity for CVD Health Promotion and Chronic Disease Prevention and Control in Africa, Entebbe, 8-18 July 2009
• To understand the meaning of primary vs. secondary prevention

• To describe the main risk factors of NCD and their main characteristics

• To understand the principles of “individual-based high-risk strategy” and “population-based strategy”

• To understand why a population-based approach should be emphasized for NCD, particularly in case of limited resources
• Is CVD preventable, to which extent?
• Risk factors of CVD and their characteristics
• ‘Population’ strategies and ‘high risk’ strategies
• Limitations and opportunities for CVD prevention
• Conceptual framework for planning CVD prevention
Extremely different CVD rates over place and time underlie large potential for prevention

Trends in IHD, 1950-1987, age 45-64

Thom et al. NIH Publication 92-3988
Much lower CVD risk in individuals with healthy lifestyles

<table>
<thead>
<tr>
<th>Lifestyle characteristics</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Diet score upper 2 quintiles</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Non smoking</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Regular exercise (&gt;30 min/d)</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Body mass index &lt;25 kg/m2</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Alcohol &gt;5 g/d</td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

| Prevalence women                                      | 13% | 7% | 3% |

| Relative risk of CVD major events                     | 0.46 | 0.38 | 0.25 |

| Population Attributable Risk* (%)                     | 51   | 60  | 74 |

* Proportion of all CVD events that could have been prevented if all women were in low risk group

(Primary prevention of IHD through diet and lifestyle - Nurses’ Health Study, 89141 women)
Large proportion of CVD deaths occur out of hospital and escape any possible case management

McGovern PG et al. Minnesota Heart Survey Inv. Recent trends in acute CHD. NEJM 1996;334:884
• Is CVD preventable, to which extent?
• **Risk factors of CVD and their characteristics**
• ‘Population’ strategies and ‘high risk’ strategies
• Limitations and opportunities for CVD prevention
• Conceptual framework for planning CVD prevention
Narrowing ("stenosis") of arteries ("atherosclerosis"): the common characteristic of all cardiovascular diseases
Natural history of cardiovascular disease: long evolution without symptoms

<table>
<thead>
<tr>
<th>Age</th>
<th>Artery atherosclerosis</th>
<th>Symptoms /signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 y</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>40 y</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>50 y</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>50 y + 1 sec</td>
<td>Stroke Heart attack</td>
<td>MI: 1/3 sudden †</td>
</tr>
</tbody>
</table>

Risk factors
Continuum between health promotion, primary prevention, clinical management and secondary prevention

Normal artery $\rightarrow$ Atherosclerotic plaques (starts in children) $\rightarrow$ First event: MI, stroke (1/3 die) $\rightarrow$ Recurrence: MI, stroke, CHF

- Risk factors
- Risk factors
- Risk factors

Primordial prevention of CVD in entire population (health promotion)

Primary prevention of CVD in individuals at high risk (lifestyle & treatment)

Secondary prevention of CVD in overt CVD cases (lifestyle & treatment)

= primary prevention of risk factors, e.g. HBP, diabetes, etc
Main risk factors for CVD and other NCS
(Underlies rationale for prevention strategies)

Non-modifiable RF:
• age, sex, history

Socio-economic & cultural determinants

Early life characteristics

Behavioral RF (modifiable):
• Smoking
• Unhealthy diet (salt, sat. fat, lack fruit&veg)
• Sedentary lifestyle

Physiological RF:
• Hypertension
• High cholesterol
• Diabetes
• Obesity

CVD endpoints:
• Isch. heart disease
• Stroke
• Vascular disease
• Heart failure

NCD endpoints:
• Some cancers
• Respirat. diseases
• Renal disease

Not RHD, endocarditis, cardiomyopathies
Graded relationship between RF and CVD
« The lower the better »

Relative risk, RF prevalence and attributable fraction:

*Low impact of strategies limited to high-risk patients*

<table>
<thead>
<tr>
<th>SBP</th>
<th>No men</th>
<th>Deaths</th>
<th>Rate per 1000</th>
<th>Relative risk</th>
<th>Excess risk</th>
<th>% CHD attributable to high BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;110</td>
<td>21,379</td>
<td>202</td>
<td>10.5</td>
<td>1.00</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>110-119</td>
<td>66,080</td>
<td>658</td>
<td>11.0</td>
<td>1.05</td>
<td>33</td>
<td>1.0</td>
</tr>
<tr>
<td>120-129</td>
<td>98,834</td>
<td>1,324</td>
<td>14.3</td>
<td>1.36</td>
<td>376</td>
<td>11.5</td>
</tr>
<tr>
<td>130-139</td>
<td>79,308</td>
<td>1,576</td>
<td>19.8</td>
<td>1.89</td>
<td>738</td>
<td>22.6</td>
</tr>
<tr>
<td>140-149</td>
<td>44,388</td>
<td>1,310</td>
<td>27.3</td>
<td>2.60</td>
<td>748</td>
<td>22.8</td>
</tr>
<tr>
<td>150-159</td>
<td>21,477</td>
<td>946</td>
<td>38.1</td>
<td>3.63</td>
<td>593</td>
<td>18.2</td>
</tr>
<tr>
<td><strong>160-169</strong></td>
<td>9,308</td>
<td>488</td>
<td>44.8</td>
<td>4.27</td>
<td>319</td>
<td><strong>9.8</strong></td>
</tr>
<tr>
<td>170-179</td>
<td>4,013</td>
<td>302</td>
<td>65.5</td>
<td>6.24</td>
<td>221</td>
<td>6.8</td>
</tr>
<tr>
<td><strong>180+</strong></td>
<td>3,191</td>
<td>335</td>
<td>85.5</td>
<td><strong>8.14</strong></td>
<td>239</td>
<td><strong>7.3</strong></td>
</tr>
</tbody>
</table>

Men free of CVD at baseline; excess deaths: difference between observed and expected at lower rate (<110)
Multiplicative effect of risk factors

MRFIT Screenees' Cohort (figures among smokers)
Risk factors: main characteristics

- **Continuum** relation between RF and CVD over a wide range (rather than across arbitrary thresholds)
- **Multiplicative** risk arising from combination of RF
- **Clustering** of CVD RF is common due to similar lifestyle associations
- In any community, largest number of CVD events arises from persons with modest RF elevations (not eligible to treatment):
  - >80% of CVD could be averted if RF were very low
  - All people have some level of RF: emphasis on population strategies
  - Clustering: integrated strategies aimed at multifactorial risk reduction
• Is CVD preventable, to which extent?
• Risk factors of CVD and their characteristics
• ‘Population’ strategies and ‘high risk’ strategies
• Limitations and opportunities for CVD prevention
• Conceptual framework for planning CVD prevention
Approaches to CVD primary prevention (i.e. avoid development of new cases)

« Population strategy »
- Public health approach
- Targets entire population
- Seeks small changes in highly prevalent RF
- **Radical attempt** to deal with underlying causes

« High-risk strategy »
- Screening & treatment of RF
- Targets selected individuals
- Seeks to identify people with high risk and treat them
- **Rescue operation** (delays consequences)
Examples of population strategies for primary prevention of CVD (and other NCD)

- **Environment shaping**
  - Sidewalks, safe public green areas, cycling lanes, pedestrian zones

- **Improving available diet**
  - Alter food content (salt, sugar, trans-fatty acids)

- **Regulations**
  - Labeling food content
  - Fiscal incentives/disincentives for production/trade of healthy/unhealthy foods
  - Advertising of junk foods on TV, vending machines in schools
  - Tobacco: increasing taxes, smoke free areas, ban on advertising
High risk strategies (who to screen and treat?):
Multiplicative effect of concomitant RF on IHD incidence

<table>
<thead>
<tr>
<th>Cholesterol</th>
<th>Systolic blood pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;118</td>
<td>125-131</td>
</tr>
<tr>
<td>Non smokers</td>
<td></td>
</tr>
<tr>
<td>&lt;182</td>
<td>3.1</td>
</tr>
<tr>
<td>203-220</td>
<td>5.2</td>
</tr>
<tr>
<td>245+</td>
<td>12.4</td>
</tr>
<tr>
<td>Smokers</td>
<td></td>
</tr>
<tr>
<td>&lt;182</td>
<td>10.4</td>
</tr>
<tr>
<td>203-220</td>
<td>14.9</td>
</tr>
<tr>
<td>245+</td>
<td>25.5</td>
</tr>
</tbody>
</table>

MRFIT, 342'815 men free of CVD at baseline, FU: 11.6 y, mid 1970s

Stamler J. Established major coronary risk factors. In Marmot et al. CHD epidemiology from etiology to public health. OUP, 1992
Assessing absolute CVD risk: the New Zealand guidelines
Stratification of CV risk related to hypertension

Refers to 10 year risk of a CV fatal or non-fatal event.

<table>
<thead>
<tr>
<th>Blood pressure (mmHg)</th>
<th>Other risk factors, OD or Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal SBP 120–129 or DBP 80–84</td>
</tr>
<tr>
<td>No other risk factors</td>
<td>Average risk</td>
</tr>
<tr>
<td>1–2 risk factors</td>
<td>Low added risk</td>
</tr>
<tr>
<td>3 or more risk factors, MS, OD or Diabetes</td>
<td>Moderate added risk</td>
</tr>
<tr>
<td>Established CV or renal disease</td>
<td>Very high added risk</td>
</tr>
</tbody>
</table>

Prescribing treatment is no guarantee of result…
Potential benefit for population vs. high-risk interventions

<table>
<thead>
<tr>
<th>Variable</th>
<th>Population strategy</th>
<th>High-risk strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood pressure</td>
<td>↓ 2-3 mm Hg in entire population</td>
<td>~treatment to <em>all</em> hypertensives</td>
</tr>
<tr>
<td>Blood cholesterol</td>
<td>↓ 10% in entire population</td>
<td>~treatment in <em>all</em> persons in top blood cholesterol decile</td>
</tr>
<tr>
<td>Alcohol</td>
<td>↓ 30% in average consumption</td>
<td>~ elimination of <em>all</em> heavy drinking</td>
</tr>
</tbody>
</table>

## High-risk and population strategies

<table>
<thead>
<tr>
<th></th>
<th>High risk (individual)</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need to identify individuals</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Benefit for individual</td>
<td>Large</td>
<td>Small</td>
</tr>
<tr>
<td>Benefit for population</td>
<td>Small</td>
<td>Large</td>
</tr>
<tr>
<td>Cooperation required (understanding, motivation)</td>
<td>Large</td>
<td>Little</td>
</tr>
<tr>
<td>Cost</td>
<td>High</td>
<td>Potentially low</td>
</tr>
</tbody>
</table>
What explains sharp decline in CVD in Western countries?
USA, 1980-2000

Deaths prevented or postponed in 2000

Risk Factors worse +17%
- Obesity (increase) +7%
- Diabetes (increase) +10%

Risk Factors better - 65%
- Population BP fall -20%
- Smoking -12%
- Cholesterol (diet) -24%
- Physical activity -5%

Treatments - 47%
- AMI treatments -10%
- Secondary prevention -11%
- Heart failure -9%
- Angina: CABG & PTCA -5%
- HBP therapies -7%
- Statins (prim. prev.) -5%

Unexplained -9%

Capewell S, O’Flaherty M. What explains declining coronary mortality?
Population vs. high-risk approaches: need for both

- High-risk and population interventions are mutually supportive
- High-risk counseling extends to relatives, friends, work colleagues
- Population strategy is essential if attempts of individuals to change their lifestyles are not to turn them into social outcasts
- High-risk individuals are quantitatively but not qualitatively different people: tail of a continuous distribution of RF

• Is CVD preventable, to which extent?
• Risk factors of CVD and their characteristics
• ‘Population’ strategies and ‘high risk’ strategies
• **Limitations and opportunities for CVD prevention**
• Conceptual framework for planning CVD prevention
Important issues in CVD prevention

• Cumulative lifelong exposure to RF: start interventions early
• Importance of different settings
• Most causes of CVD ("causes of the causes") beyond the health sector: need multisectoral interventions (partnerships)
• Interventions: need for enough dose & multiple strategies
• Individual behaviour change vs. structural changes
CVD control through primary prevention: Some limitations in developing countries

- Limited recognition of magnitude of CVD epidemic - scarcity of data
- Myths that CVD are diseases of the old, the rich and personal choices
- Double burden of disease: “finish infectious diseases agenda first”?
- Prevention not given priority (market pressure favors therapy)
- Powerful vested interests (tobacco, food industry, car, agriculture)
- (pop strat) Failure to influence policy of non-health departments
- (HR strat) Stroke/CHD/HBP/DM considered diseases for the specialist
- High costs of CVD management & dwindling resources
- Lack of global funding for CVD (vs CD): need to build the case
CVD prevention in developing countries

Good news

• Levels of some risk factors are still low in some countries
• Knowledge for effective primary prevention is available
  – ≠ to western countries: CVD epidemics understood at its peak and addressed mainly through clinical management
• Prevention of CVD is likely to be less costly than case-management

Bad news

• Levels of RF often higher and rise steeper than in HIC
• Rapid demographic transition (aging populations)
• Global epidemic of overweight and diabetes
• Is CVD preventable, to which extent?
• Risk factors of CVD and their characteristics
• ‘Population’ strategies and ‘high risk’ strategies
• Limitations and opportunities for CVD prevention
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Prevention of CVD: a simple framework

**Modifiable FR (lifestyles and environment):**
- Tobacco
- Physical inactivity
- Unhealthy diet
  (↑salt, ↑fats & sugar, ↓fruits/veg)

**Patho-physiological RF:**
- Hypertension
- High cholesterol
- Diabetes
- Obesity

**CVD**
- IHD
- Stroke
- Peripheral artery dis.
- Heart failure
- (some cancers)

**Population strategy:**
- Environment
- Policy
- Education

**High-risk strategy:**
- Screening and treatment of high-risk individuals

**Primary prevention** (decrease incidence of new cases)

**Surveillance**
- Guide & evaluate intervention
State Non-Communicable Diseases Control Programme

Surveillance of Risk factors- Tobacco, Alcohol, Diet, Physical Inactivity

- Policy
- Legislation
- Taxation
- Health Promotion

Primary prevention National initiative

Risk reduction-Tobacco cessation, Counseling, Diet Guidelines, Abn Lipids, Hypertension

Disease specific programmes- at District Hospital level

- CANCER
  - Early detection
  - CYTOLOGY
  - EBM
  - PAIN & PALL Care

- DM
  - Early detection
  - EBM
  - Insulinavailability
  - Prevent complications

- HT
  - Early detection
  - EBM
  - Compliance to trtmnt

- A/c MI
  - Immediate intervention
  - EBM
  - Prevent relapse
  - Rehab

- COPD
  - Early diag
  - EBM
  - Prevent compl
  - Rehab
## Prevention of CVD: outline of Seychelles National Program

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Objective</th>
<th>Policy instruments</th>
<th>Activities</th>
</tr>
</thead>
</table>
| Public health interventions targeting the entire population | Change of personal behavior for primary and secondary prevention          | Education (IEC)                          | • Logo for CVD prevention program  
• Intensive use of mass media with several hours of heart health programs on TV and radio every year  
• Heart health education program integrated in curriculum of primary schools  
• Health messages in all public buses  
• Nation-wide high-profile events organized for World No Tobacco Days, World Diabetes Day and WHD  
• Production of various leaflets & billboards on CVD related conditions |
| Taxes & subsidies                                 |                                                                           |                                          | • Several increases in taxes on cigarettes  
• Various fiscal measures to favor production and trade of health foods |
| Regulation & legislation                          |                                                                           | Research, surveillance                   | • Legislation on tobacco, including:  
• No smoking policy in all premises of Ministry of Health and Min Education  
• Ban (well implemented) on advertising tobacco products in all local mass media and billboards  
• Warning labels on cigarette packs  
• Ban on sponsorship by tobacco companies  
• National policy on food and nutrition (ongoing) |
| To adjust and expand the range of interventions   |                                                                           | Direct expenditures                      | • Population based surveys of CVD risk factors in adults 1989, 1994, 2004  
• Screening program of weight and BP in 4 levels in all schools since 1998  
• Interaction with international networks and academic institutions |
| To supply resources that facilitate the provision of interventions | Screening of cases and referral for secondary prevention                 | Direct expenditures                      | • Installation of a Unit for Prevention of CVD within Ministry of Health as focal point to stimulate and coordinate multisectoral and community-based activities for heart health  
• This Unit also conducts surveillance and research on CVD |
| Public health interventions targeting high risk subjects | Screening of cases and referral for secondary prevention                 | Direct expenditures                      | • Frequent risk factor screening in public places  
• Frequent risk factor screening in work places  
• Routine risk factor screening in children in school health program  
• PHC-based ‘Heart Health Clubs’ (interactive education sessions) for high-risk patients  
• National register of hypertension & diabetes patients  
• NHS (free health care), availability of at least 1 drug in each of all major medication classes |
| Clinical interventions targeting patients with disease | To improve case management for effective secondary prevention           | Education of patients & service providers | • Heart health training to health professionals (e.g. nursing schools, PHC doctors, etc)  
• Elaboration of guidelines on blood pressure, dyslipidemia and diabetes management (2002)  
• NHS (free health care), availability of at least 1 drug in each of all major medication classes |
Relation between population strategies and high-risk strategies for CVD prevention

**High-risk strategy:**
Screening and treatment in individuals at increased CVD risk

**Population strategy:**
Health education
Healthy policy
Healthy environment

+ surveillance of RF for guiding & monitoring interventions
Conclusions

• The burden of NCD is high in MIC and LIC and likely to increase if not addressed
• NCD occur at earlier age (vs HIC) and among the poor
• Double burden of disease
• Low resources preclude emphasis on individual treatment
• Prevention strategy must focus on prevention, particularly policy (multisectoral) addressing roots of NCD (diet, tobacco, exercise) apply the knowledge (Q: not what, but how)
• Need for cost effective based case-management for high risk individuals
• Need to monitor trends in CVD risk factors (surveillance)

IUMSP- 25 Nov 2008
STATUS QUO INVEST NOW

THE CAUSES ARE KNOWN.
THE WAY FORWARD IS CLEAR.
IT’S YOUR TURN TO TAKE ACTION.

Preventing CHRONIC DISEASES
a vital investment
Thank you