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# Prevention, Public Health, and Equity

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Barbara Starfield, MD, MPH

Sommer Memorial Lecture (Portland, OR, 2010)

Preventive activities are generally more straightforward than care activities because they are usually routine.

Because preventive activities take time, there is less time available for responding to people's needs and problems. This will result in greater inequities in health in populations because socially disadvantaged populations have more health problems and greater difficulty in receiving care for them.

On average, adult patients in the US in the mid 1990s were estimated to have approximately 12 risk factors requiring approximately 24 preventive services – even before the explosion of the concept of risks.

In the US, routine visits to prevent disease or deterioration in disease are rapidly becoming the most frequent reason for visits to general internists.

7.4 hours a day are required to provide evidence-based care to an average practice population of 2500 patients.

In the US, the effectiveness of preventive measures on life expectancy (19 months) is less than half as great as the prolongation of life from curative measures (45 months). In the UK, the use of ACE inhibitors in heart failure has a potential gain of 308 deaths deferred per 100,000 population per year whereas screening and treatment of hypertension avoids 71 deaths per 100,000 population.

# Why Is the Concept of Prevention Much More Difficult Now Than in the Past?

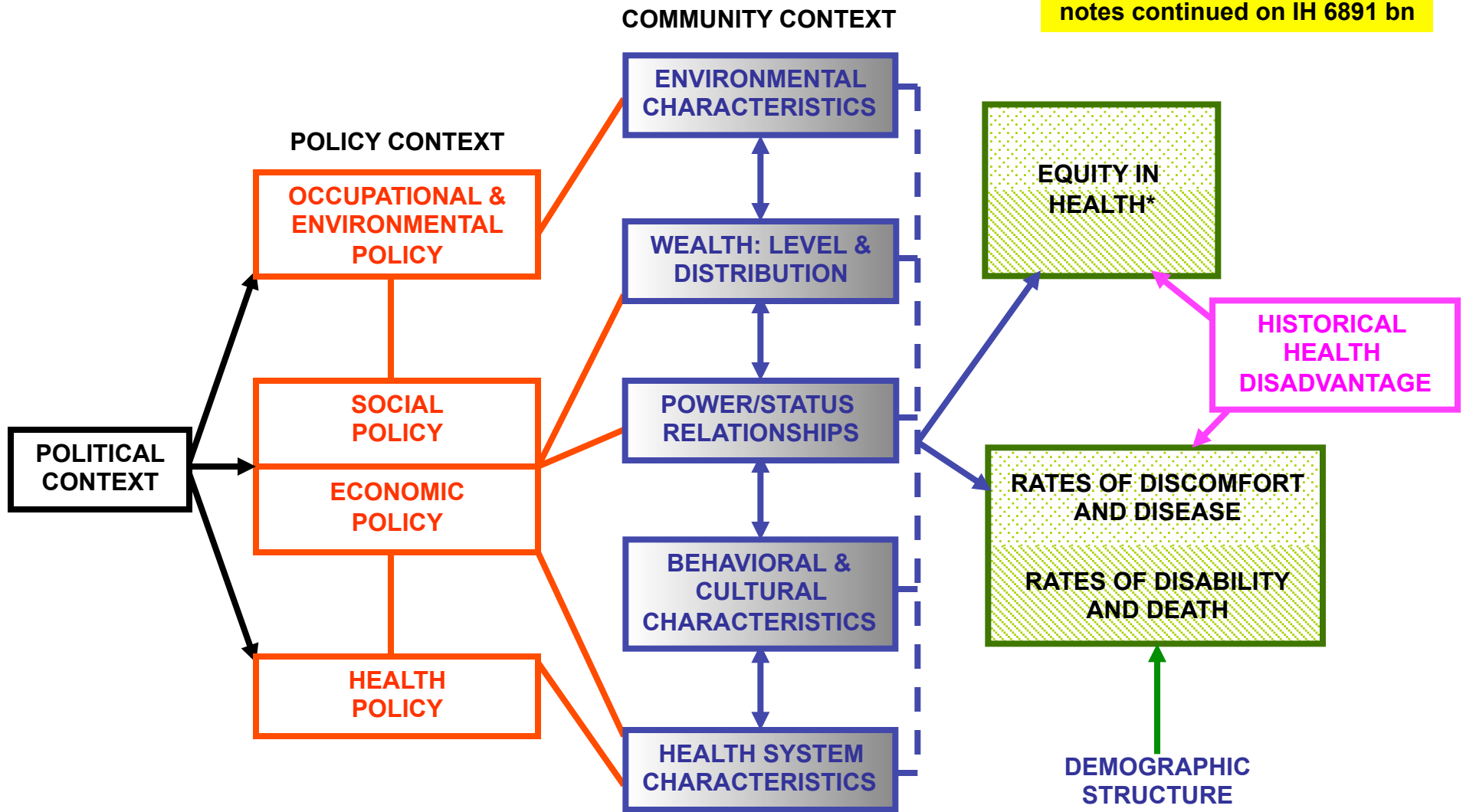
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- What we are trying to prevent is much less well-defined.
- Chain of influences is much more complex.
- Likelihood of success is less predictable.
- Likelihood of adverse events is greater.



# Societal Influences on Population Health and Equity

notes continued on IH 6891 bn

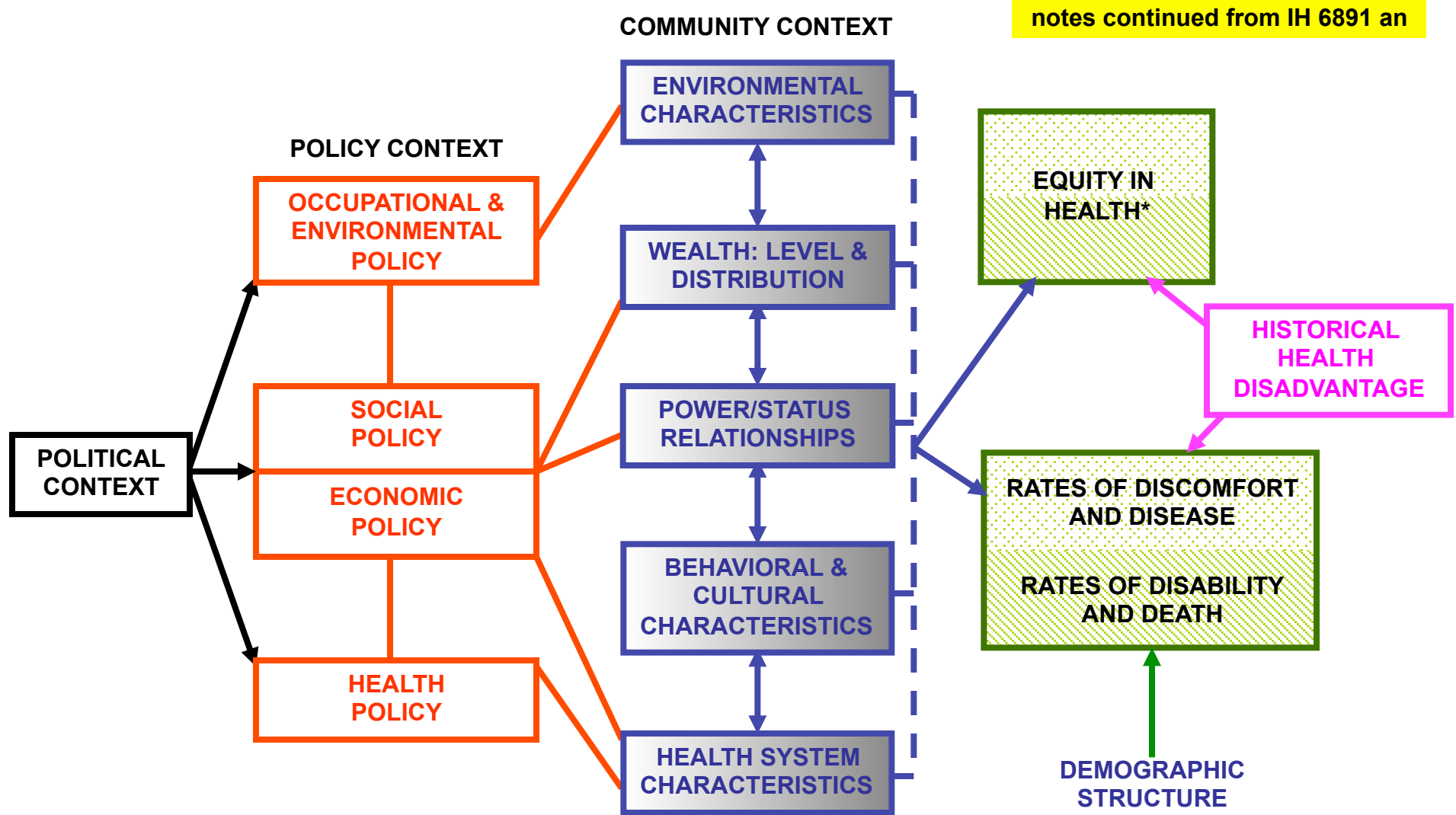


Dashed lines indicate the existence of pathways through individual-level characteristics that most proximally influence health.

Shading represents degree to which characteristics are measured at the ecological level (lighter color) or at the individual level aggregated to community.

\*\*“Health” has two aspects: occurrence (incidence) and intensity (severity).

# Societal Influences on Population Health and Equity (continued)

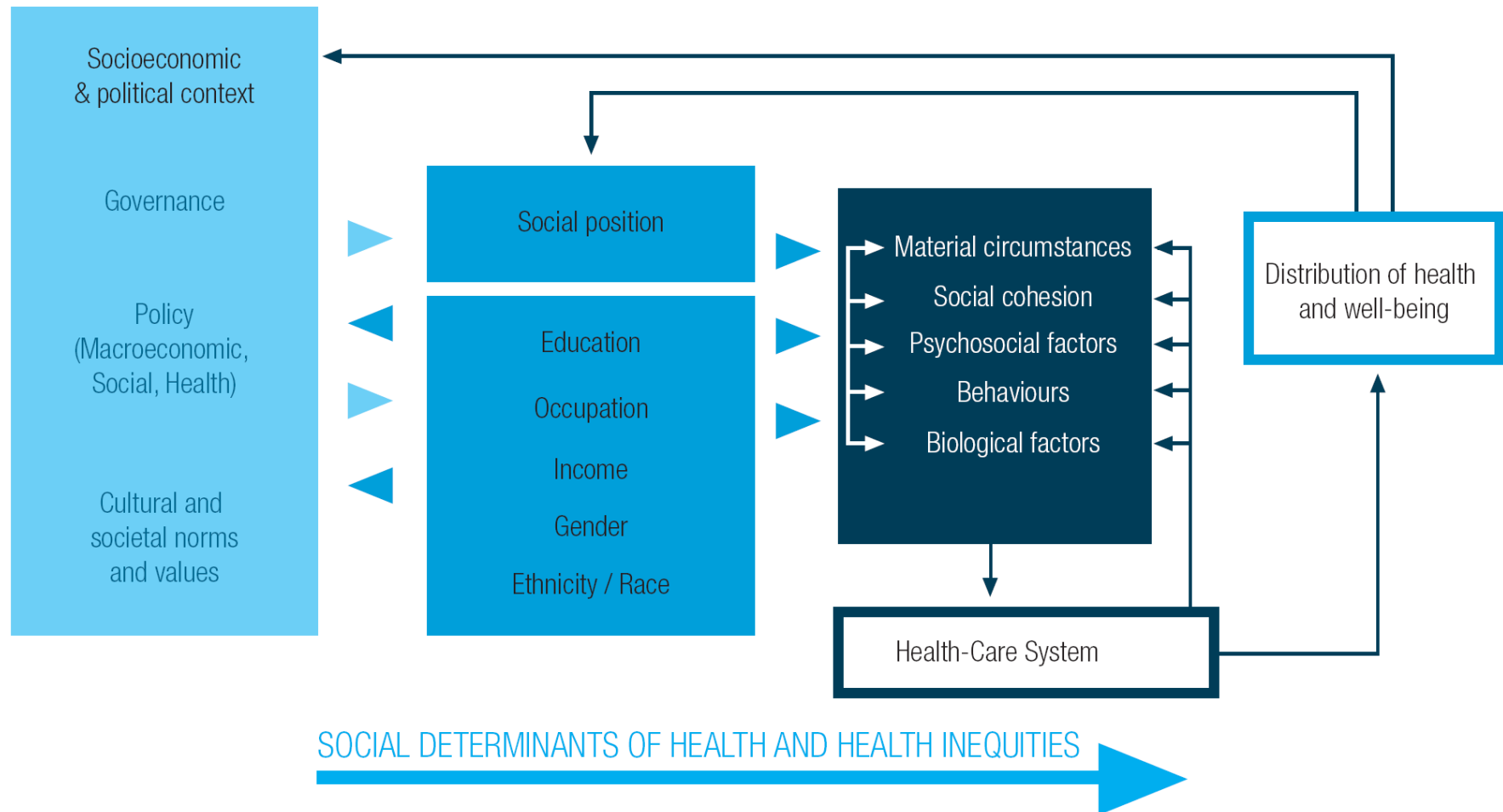


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# Commission on Social Determinants of Health Conceptual Framework



# What Is Prevention?

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- 1967 measures that limit the progression of a disease at any stage of its course
- 1978 primary (promote health), secondary (early detection), tertiary
- 1998 includes risk factor reduction
- 2003 includes quaternary prevention (avoid over-medicalization)

Sources: Clark & MacMahon. Preventive Medicine. Little, Brown & Co., 1967. Nightengale et al. Perspectives on Health Promotion & Disease Prevention in the United States. Institute of Medicine, National Academy of Sciences, 1978. National Public Health Partnership. Preventing Chronic Disease: A Strategic Framework. Background Paper. National Public Health Partnership, 2001. Bentzen. WONCA Dictionary of General/Family Practice. Laegeforeningens Forlag, 2003.

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Prevention can be addressed at the

- Individual level, by changing individual behaviors and food choices
- Social level, by support groups (unions, clubs)
- Community level, by modifications in housing, neighborhood facilities, retail establishments, availability of community services
- Societal (policy) level, by laws and regulations

# Types of Interventions

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Target group	A. Health protection, promotion, avoiding risk (1°)	B. Early detection (2°)	C. Remediation (3° & 4°)*
Population			
As population**			
All individuals			
Selective			
Indicated			

\*includes remediation and/or retardation of progression as well as avoidance of harm (quaternary prevention)

\*\*or all people of a given age

# Types of Interventions

Target group	A. Health protection, promotion, avoiding risk (1°)	B. Early detection (2°)	C. Remediation (3° & 4°)
Population			
As population*	PH	PH	PH (PC)
All individuals	PH/PC	PH/PC	PH/PC
Selective	?	PC/PH	PC/PH
Indicated	PC/PH	PC/PH	PC (PH)

\*or all people of a given age

# Types of Interventions

Target group	Primary	Secondary	Tertiary & Quaternary
Population			
As population	Environmental planning	Environmental monitoring and product control	Public advocacy Community mobilization (legal and social remedy)
All individuals	Health education campaigns Immunizations	PKU screening Breast cancer screening	Information systems: data standardization, collection, analysis and dissemination
Selective	Genetic engineering	Blood lead screening	Outreach/access, e.g., home visiting
Indicated	Communicable disease control Prophylactic antibiotics Practice guidelines	Frequent follow-up for disease recurrence	Address problems: quality assessment of clinical services, including adverse events



Currently, in both the US and the UK, the locus of responsibility for preventive services has shifted to prevention as a clinical function, signaling an increasing emphasis on the role of individual behavior and a rejection of the role of social, community, and society-wide public health interventions in prevention.

A review of 1500 individual-level interventions\* for prevention and treatment found that about one in five lowered costs. The rest (80%) added more costs than they saved.

\*279 preventive; 1221 treatment

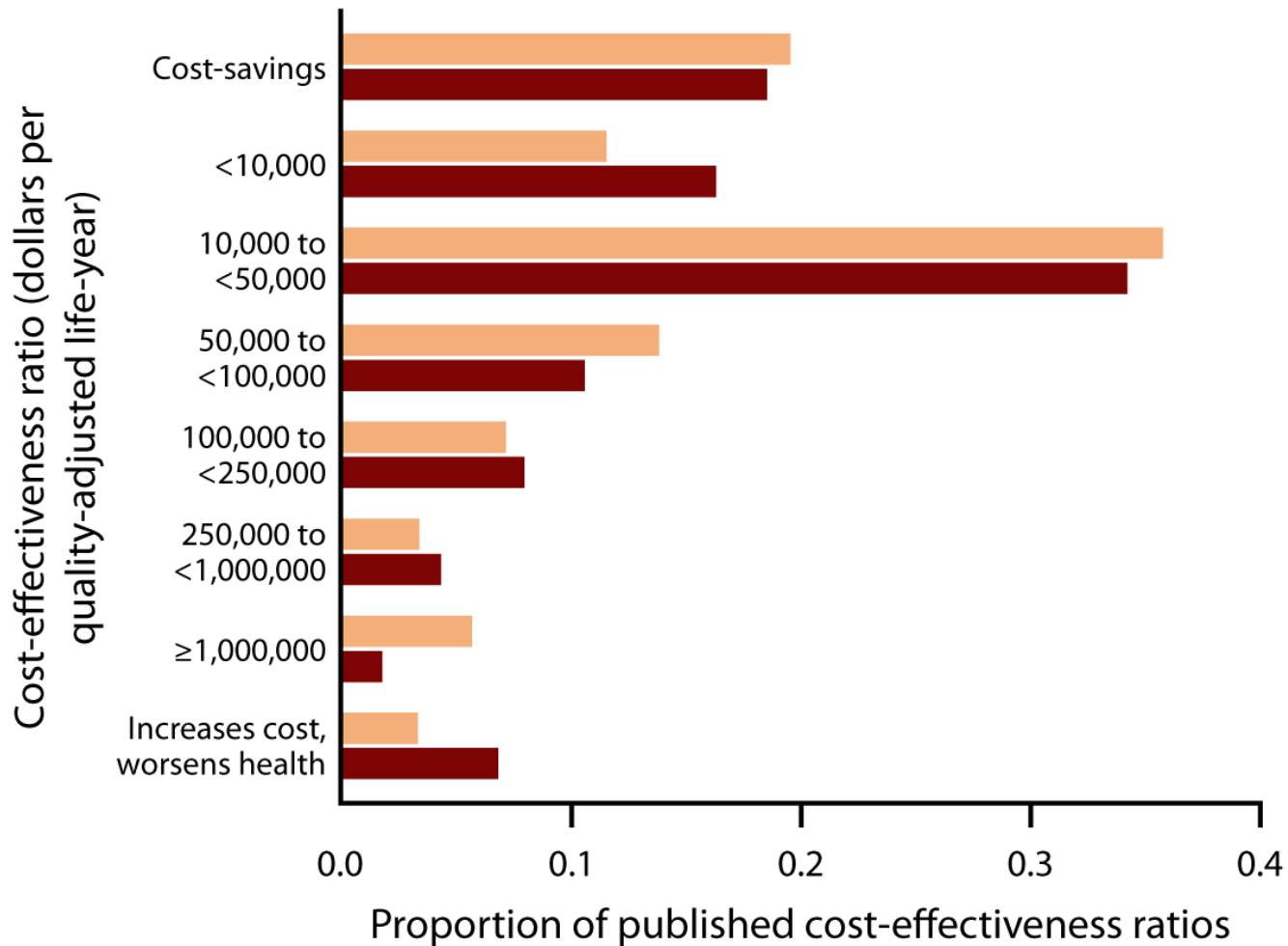
# Cost Effectiveness of “Clinical Prevention”

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Hypertension	For those with very high blood pressure; depends on age and particular drug cost
Statins	For established heart disease in men
Aspirin	If ten-year risk of death is 5% or greater, in men
Diabetes (lifestyle change)	Borderline, at best
Screening (cervical cancer, colorectal cancer, breast cancer)	Are cost-increasing
Osteoporosis	Over age 65 in women; depends on cost of bisphosphonates
DISEASE management	
Asthma	Self management costs more than traditional care.
Pneumococcal pneumonia vaccination	Adults with chronic diseases

Comment: A major problem with prevention is that interventions are not prioritized. Perhaps contributions to increasing equity in health should be a major consideration in setting priorities?

# Distribution of Cost-effectiveness Ratios for Preventive Measures and Treatments for Existing Conditions



Adapted by CTLT from Russell, Health Aff 2009;28:42-5. Starfield 02/09, PREV 7078 n.

Most evidence for the benefit of preventive interventions derives from observations of relationships between a presumed risk factor and a poor outcome. However, those who are observed to have a risk factor may be different from those without the risk factor in other health-influencing ways. These “confounders” are often not observed or recognized.

In the presence of these unobserved confounders, preventive activities can increase rates of ill health and disability (e.g., bicycle riding in the infirm; diet restriction in the presence of certain illnesses).

Prescribed exercise, for women ages 40-74 over 12 months in New Zealand, increased rates of physical activity and increased SF-36 physical functioning and mental health but reduced physical fitness, did not change intermediate outcomes (BP, serum lipids, HBA1c, glucose, insulin), and significantly increased rates of falls and injuries.

The PSA screening test for prostate cancer is unable to distinguish prostate cancers that are serious or lethal from those that are not.

Not everyone with a diagnosis of prostate cancer detected on screening needs treatment.

Preventive activities may conflict with each other or have interacting effects.

Therefore, more prevention is not necessarily better.

Benefits of prevention differ across population subgroups. Prediction of benefit depends on the population targeted.



Statins have utility in preventing recurrent myocardial infarction in males but not in females.

Screening for abdominal aneurysms might be useful in some males but not in females.

There is no association between type A behavior and heart disease in Japan.

That is, the relationship between type A behavior and subsequent heart disease is culture-contingent.

“Risks” have no universal meaning.

In the Seven Countries study, the relative increase in long-term mortality due to coronary artery disease for a given increase in blood pressure was similar across countries, but the absolute risk at the same level of blood pressure varied substantially.

Benefits of prevention at younger ages are less efficient than at older ages, and the hazard-benefit ratio may be unacceptable.

A new guideline calls for physicians who screen asymptomatic men for prostate cancer to advise them about a multiyear regimen that may reduce their risk of developing the disease. The guideline also states that current evidence suggests that the medication offers no benefit in reducing prostate cancer or overall mortality.

The Associate Director for Disease Prevention at NIH said that this is a “milestone in medicine” because “the diagnosis of cancer is in and of itself so life-changing” that “intervention that reduces treatment related morbidity is a successful strategy”.

(Note: 70 men would have to be treated for 7 years at a cost of half a million dollars to prevent one case of prostate cancer.)

(Note that prevention of treatment-related morbidity has never been a focus of evaluation of interventions.)

Population benefit depends not only on reducing relative risks of any given influence but also on the frequency of that risk in the population.

# Population versus Clinical Bases for Health Policy Decisions: an Example

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Individual risk factors for tuberculosis in Russia, in order of salience: low household wealth, incarceration in prison or detention, drug misuse, financial insecurity, unemployed, overcrowded living, living with a tubercular person, heavy drinking

Population risk factors for tuberculosis in Russia, in order of salience: unemployment, consumption of raw milk

Conclusion: Health policy decisions should be targeted with consideration of risk factors that are common in populations. The differences between societal and social influences is the difference between population and individual approaches to risk factors.

## Alcohol-attributable Injury by Usual Number of Drinks: Relative Risks (Individual) and Attributable Risks (Population)

Usual number of drinks	0	1	2	3	4	5	6	7	9	9 or more
Percent of students surveyed	21	11	17	14	12	9	6	3	2	4
Percent of drinkers injured	0	2	4	9	14	18	23	26	30	33
Cumulative percent of students injured	0	2	10	22	38	54	69	78	85	100

That is: Even though the rate of injury from drinking is low at low levels of drinking, over 2/3 of injuries occur at relatively low numbers of drinks. Should policy decisions about prevention be based on individual risks or population risks? Who should be responsible for carrying out policy at each level – clinical services or public health?



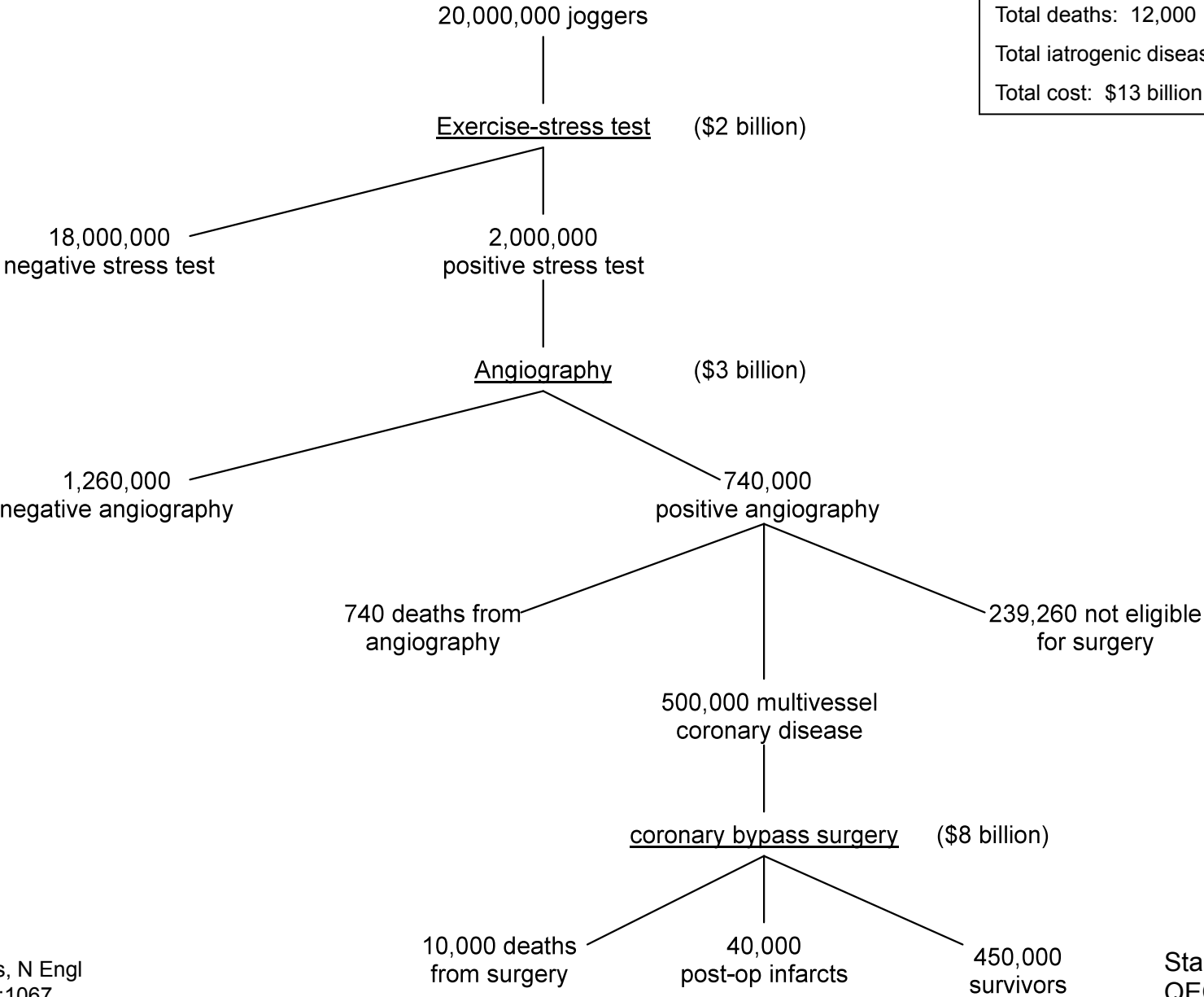
As is the case with all medical interventions, each intervention runs the risk of initiating a cascade of interventions, each of them with a risk of adverse effect, thus violating the principle of “do no harm”.

# Preventive Interventions Can Be Harmful

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- Retrolental fibroplasia
- Hormone replacement  
(postmenopausal)

# Consequences of Exercise-Stress Testing in Joggers Over 35 Years Old



Total deaths: 12,000  
 Total iatrogenic diseases: 40,000  
 Total cost: \$13 billion

Source: Graboys, N Engl J Med 1979; 301:1067.

# Errors of Commission: Coronary Angiography

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Only 50% of tests for coronary angiography are done competently.

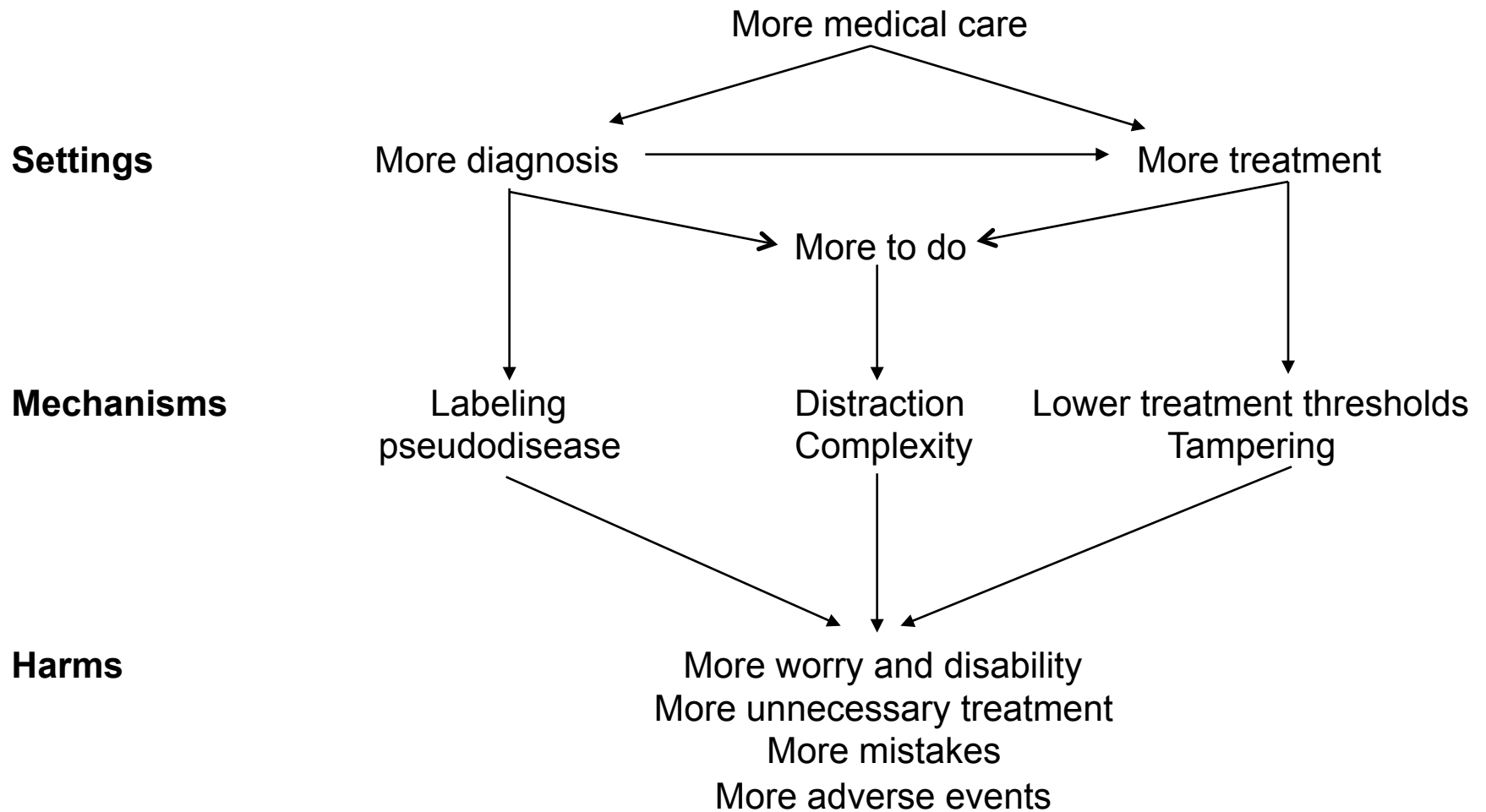
- One-fourth of those read as having severe illness do not have it.
- 6% informed that test was negative had severe abnormalities.
- One-third of those with mis-read tests had surgery that was of uncertain benefit or inappropriate.

Impact of 1.3 million coronary angiographies (1998)

- Cost: \$12,450 per test
- 650,000 too poor to interpret
- \$8 billion in wasted expense

# Pathways by Which More Medical Care May Lead to Harm

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# Iatrogenesis as a Major Cause of Mortality

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	Estimated number of deaths per year	
Harm from unnecessary surgery (1/200)	12,000	
Medication errors in hospital	7,000	
Other errors in hospital	20,000	
Nosocomial infections in hospital	80,000	
Non-error adverse effects of drugs	106,000	
Total	225,000	deaths, or, in other words, the third leading cause of death in the US

Sources: Leape, Annu Rev Public Health 1992; 13:363-83.  
McCarthy & Widmer, N Engl J Med 1974; 291:1331-5. Phillips et  
al, Lancet 1998; 351:643-4. Lazarou et al, JAMA 1998; 279:1200-5.

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# The Special Case of Neonatal Mortality

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Low birth weight	7.9% and rising
Rate of preterm birth	10.1% and rising
Neonatal mortality	4 per thousand and rising
Induced deliveries	9% in 1989; 19.2% in 1998

For non-Hispanic white singleton births, 59% of the increase is accounted for by pre-term inductions.

Despite evidence that tight control of blood pressure does not decrease risk of cardiovascular complications, a recent study recommended even tighter control, finding that the risk for cardiovascular deaths increases with increasing blood pressure over 115 mm Hg (instead of the long-standing level of 120).

No studies have investigated the utility of antihypertensive treatment down to this level.



The current focus on prevention is on

- creating diseases from risk factors
- transferring the major responsibility for prevention from public health to clinical services, although the major concern for equity is population benefit
- building markets for the pharmaceutical and other new health industries (new professionals, new professional roles, consulting activities)

The benefits of human papilloma virus vaccine are being vastly exaggerated and the risks under-played because of successful marketing by the vaccine manufacturer.

# “Swine Flu: Public Health Has Become a Public Nuisance”

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“The moralising propaganda of public health has a generally demoralising effect on society – encouraging fear and anxiety – and attendant sentiments of stigma and blame. It has a degrading effect on medical practice and is corrosive of good relationships between doctors and patients. As the swine flu scare confirms, it is also disruptive of day-to-day medical practice.”

# Principles in Thinking about Priorities for Prevention in Populations

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- The frequency of risk is at least as important as the degree of added risk.
- Not all abnormalities signify impending health problems.
- Rates of adverse events are rising and countries that do more interventions have higher rates of adverse events.

The main issues in prevention are:

- Who pays, and how progressive is the system of payments?
- What social groups are more at risk from suffering from lack of the preventive activity?
- What are the tradeoffs between spending money for prevention versus spending it for better or more equitable treatments?
- What is the ADDED value (in terms of HALE or a similar measure) of prevention? (This would explicitly take into account discomforts and adverse effects from preventive activities.)

Defining risk factors as diseases changes the balance of activities in health services from treatment of manifest illness, alleviation of dysfunction, and prevention of progression to an increasing focus on

- avoidance of risk factor in individuals
- management of the risk factor in individuals

In some countries (e.g., US, UK), prevention by public health activities is being replaced by care directed at individuals in clinical settings, with unknown effect on population health.

It is not possible to evaluate the benefit of prevention in individuals because it is not possible to predict the outcome in the absence of prevention. Most interventions have unintended and unpredictable effects; we can never know if these are worse than what is being prevented, in individuals.

Even population-based interventions carried out on individuals can be harmful (e.g., oxygen given to premature babies). They must be tested on large populations over long periods of time. For example, do bicycle helmets prevent death and/or disability?

Among people\* without any risk factors (by traditional definitions\*\*), only 8% of acute CHD events occur in people with multiple borderline risk factors†. That is, there is not much advantage in lowering the thresholds for intervention to prevent coronary heart deaths.

The arguments of Geoffrey Rose (concerning the benefits of shifting the curve so that more people are targeted for intervention) were never intended to be used when the costs were high, when the interventions are invasive, or when the treatments are aggressive and potentially dangerous.

\* non Hispanic whites of ages 35-74

\*\*new definitions for prediabetes, pre-hypertension, mildly elevated LDL

† conventional levels for increased risk including elevated blood pressure, fasting blood glucose, abnormal LDL or HDL



Recommendations for clinical prevention are made independently and without regard to patients' individual characteristics. There are few data that can inform decisions about what preventive interventions are of highest priority and in which patients.

A greater prevalence of “chronic disease” in the US compared to its European counterparts, and higher rates of medication treatment of chronic diseases are believed to underlie some of the health care cost differences between the US and its European counterparts.

Preventive activities, including screening for disease, will increase disease rates, but the hazards of “early diagnosis” need to be considered.

Prevention is only useful if it reduces the likelihood of occurrence of ill health and retards its progression to disability and addresses the multiplicity of influences on health.

Cost, feasibility, and likelihood of decreasing or increasing equity should be the major considerations in choosing a strategy from among the myriad types and levels of influences on health.