Prevention, Public Health, and Equity

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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.

Sources:
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.

Sources:

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

- 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.
Increasing recognition that there are systematic differences in health across different population subgroups, i.e., inequity in health, has led to an expanded view of influences on health. In this view, health is viewed as both an average of individuals in the population and the way in which health is distributed in the population. In populations, community and policy contexts have a major role in influencing more proximal influences on health in communities and on individuals in communities.

These societal influences operate differently in the various subgroups of the population. It is these factors, rather than those at the community and individual level, that primarily influence distribution of health within the population rather than average of levels of health such as those that are commonly in use in health statistics.

Political contexts determine the nature of policies, which, in turn, influence the characteristics of communities: environmental; levels of income and their distribution, e.g., income inequality; power and status relationships; behavioral and cultural characteristics; and health system characteristics. Because they are all influenced by the political context, they potentiate or interact with each other and more directly (through unknown individual characteristics and exposures) influence both health levels as well as distributions of health in individuals, both of which also are affected by demographic characteristics and historical health disadvantage i.e., the tendency of good or poor health to persist for long periods of time in defined geographic areas.1

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There are only a handful but increasing number of studies concerning the influences of such characteristics on various health needs.²

A focus on influences on the health of populations does not assume a particular pattern of risks among individuals in that population. In this diagram, the individual risk factors are less salient than community and policy characteristics in a political context. Conventionally the province of public health, interventions at these levels have emphasized the extent to which societal factors can be modified to prevent the occurrence of ill health. Thus, prevention is a major thrust of pubic health efforts. Less common is consideration of the extent to which characteristics of these levels contribute to worsening of health where it has already been compromised.

In the most recent 20 years, the salience of such activities has become more visible as, for example, the role of health policy in facilitating or interfering with the practices of pharmaceutical companies in marketing retroviral medications for HIV/AIDS. In this sense, the “determinants of disease” and their progression are societal (rather than social), and they operate primarily to alter rates of discomfort, disability, and death rather than occurrence (incidence) of ill health.

The other important characteristic of a focus on populations is that it explicitly requires consideration of distributions in the population, i.e., equity in health, as well as average levels of ill health.


This diagram was proposed by the WHO Commission on the Social Determinants of Health. As such, it focuses on pathways through which inequity in health (“distribution of health and wellbeing”) is achieved. The diagram does not specifically distinguish macro political and economic forces from the policies they engender, nor does it show an impact of individual and community factors (except for the health system) on distribution of health. Its major emphasis appears to be in the reverse direction: that unequal distribution of health influences individual and social phenomena.
**What Is Prevention?**

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:


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
Preventive services are generally divided into 4 types, depending on how far back the intervention is in the "chain" (or, more appropriately, "web") of influences. Interventions may be directed at populations as a whole, individuals in whole populations, selected subpopulations, or individuals taken one by one, as in conventional clinical care.

<table>
<thead>
<tr>
<th>Target group</th>
<th>A. Health protection, promotion, avoiding risk (1&lt;sup&gt;st&lt;/sup&gt;)</th>
<th>B. Early detection (2&lt;sup&gt;nd&lt;/sup&gt;)</th>
<th>C. Remediation (3&lt;sup&gt;rd&lt;/sup&gt; &amp; 4&lt;sup&gt;th&lt;/sup&gt;)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
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<tr>
<td>As population**</td>
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<td></td>
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<tr>
<td>All individuals</td>
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<tr>
<td>Selective</td>
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<td>Indicated</td>
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*includes remediation and/or retardation of progression as well as avoidance of harm (quaternary prevention)

**or all people of a given age
This matrix indicates the possible locus of responsibility for each of the types and according to whom the intervention is generally directed.
This matrix provides examples of types of interventions that may be provided within each cell of the matrix.

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

Sources:
Russell LB. Preventing chronic disease: an important investment, but don't count on cost savings. Health Aff 2009;28:42-5.
Interventions that differ widely in cost effectiveness are often equally prioritized, and sometimes interventions of higher cost are prioritized above those with lower cost. Profitability to those who market these interventions sometimes skews recommendations for guideline adherence, e.g., hypertension prevention versus treatment of heart disease.

Source: Russell LB. Preventing chronic disease: an important investment, but don't count on cost savings. Health Aff 2009;28:42-5.
In this chart, the proportions across the preventive measures and across the interventions add to 100; the chart shows what proportions are cost saving, of different degrees of cost effectiveness, and those that actually worsen health. Only about 70% of all recommended interventions are cost effective at conventional levels (less than $50,000 per QALY), 10 to 15% are borderline, and the rest (about 20%) cannot be justified either by cost or by evidence of benefit. Preventive interventions are no more likely to be justified by cost effectiveness than are treatments for existing conditions.

Source: Russell LB. Preventing chronic disease: an important investment, but don’t count on cost savings. Health Aff 2009;28:42-5.
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.

Sources:
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.

Sources:

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.
This example of risks for tuberculosis in Russia indicates how powerful individual risks may not be most appropriate for interventions to reduce the occurrence of a disease in populations.

In a college population, about one-fifth of students report not drinking at all and about three in five report drinking only moderately. Nevertheless, about two in five alcohol-related injuries are in those relatively low drinkers. That is, although the likelihood of deaths associated with alcohol intake is lower in people who drink only lightly or moderately, these individuals combined account for a non-trivial proportion of such deaths in the population. These findings raise issues for policy makers. 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?


<table>
<thead>
<tr>
<th>Usual number of drinks</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>9 or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent of students surveyed</td>
<td>21</td>
<td>11</td>
<td>17</td>
<td>14</td>
<td>12</td>
<td>9</td>
<td>6</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Percent of drinkers injured</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>9</td>
<td>14</td>
<td>18</td>
<td>23</td>
<td>26</td>
<td>30</td>
</tr>
</tbody>
</table>
| 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”.

Starfield 07/07
PREV 6788
In both of these instances, routine treatment to increase survival of newborns through high concentrations of oxygen and hormone replacement therapy to prevent osteoporosis in postmenopausal women had rates of adverse effects (blindness in the first instance, and high rates of ischemic heart diseases in the second) that outweighed the benefits for which they were intended.
The hazards of conducting routine screening in asymptomatic people can be considerable, as shown in this hypothesized example of the estimates of adverse events or death following from exercise stress testing in prospective joggers. One-tenth were estimated to have an abnormal stress test leading to angioplasty; almost two in five of these would have an abnormal finding on angioplasty, of whom about a tenth were estimated to die from complications of the procedure. Two thirds of these people would be found to have multiple-vessel disease and undergo surgery, with an associated 20 deaths per thousand and 40 post-operative infarcts per thousand. (This is equivalent to a 2% death rate and an 8% infarct rate.) That is, over 25 per ten-thousand prospective joggers screened for occult heart disease are estimated to have serious side effects of death ensuing from screening. Although the safety of surgical interventions has improved since these estimates were made, increasing intervention rates (especially including the placement of stents instead of coronary artery bypass) have increased greatly. The example shows that preventive interventions can have rates of side effects that can approach or exceed the rates of poor outcome from the natural history of illness.
Errors of Commission: Coronary Angiography

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


This diagram indicates the caution required before deciding to conduct any intervention. It has been said that “a healthy person is one who has not had enough tests”. Whether preventive or therapeutic, any increase in testing leads to more diagnosis and more treatment – its intended purpose when there is likelihood of a health need. However, ailments that are occult may never progress to a harmful stage: interventions will discover pathology that need not be discovered. Their mere discovery may lead to an unnecessary cascade of other tests and interventions, each with its own chance of adverse effects, with consequent worry, discomfort, and/or disability.
Adverse effects in the US now are estimated to account for more deaths than all other causes except for heart disease and cancer. In fact, deaths associated with adverse events far exceed the number of deaths associated with the third-leading disease cause of death (stroke).

Sources:

The Special Case of Neonatal Mortality

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<tbody>
<tr>
<td>Low birth weight</td>
<td>7.9% and rising</td>
</tr>
<tr>
<td>Rate of preterm birth</td>
<td>10.1% and rising</td>
</tr>
<tr>
<td>Neonatal mortality</td>
<td>4 per thousand and rising</td>
</tr>
<tr>
<td>Induced deliveries</td>
<td>9% in 1989; 19.2% in 1998</td>
</tr>
</tbody>
</table>

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


These data from the United States indicate that unwarranted and excessive interventions lead to higher rates of preterm births and neonatal mortality.
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”

“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

- 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

Sources:

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.

Sources:
Starfield 2005