Population Health: New Paradigms and Implications for Health Statistics

Barbara Starfield, MD, MPH

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Challenges of 21st Century Health Systems

- The poor and worsening position of US population health indicators
- Quality of health services
  - Responsiveness to needs
  - Comorbidity
  - Coordination of care
  - Overuse
- Quality of health systems
  - Population outcomes
  - Disparities (inequities)
Is population health the sum of individual health?
Distinction between focus on individuals and populations or subpopulations is at the heart of distinctions among the branches of medicine.
Clinical Medicine
What disease might this patient have, and how should it be managed?

Clinical Epidemiology
What is the relative likelihood that this patient has, or is at risk for, this disease, and what is the evidence to support its management?
Social Medicine
Why does this patient have this disease at this particular time, and how might this affect management?

Community Medicine
Is this disease important? If so, how important is it, to whom, and what is the overall benefit of management to the community?
Public Health

What characteristics are most salient in improving overall health and the distribution of health in populations, and what does evidence suggest should be priorities for intervention?
Clinical, Epidemiological, and Social Views towards Health
In the vast literature on social determinants, the focus is on describing the influence of factors at the individual or individual family level on the health of individuals or individuals in families. Thus, we know very clearly that income, education, and occupation influence individual health. Equity research, however, is concerned with differences at the subpopulation level. Influences at the individual level are often expressed as increases in relative risk of compromised health. Influences at the population level are influenced not only by the extent of increased risk at the individual level but also by the relative frequency of influences in the subpopulation, i.e., by attributable risk. An influence that is very highly disadvantageous, i.e., has a high relative risk, may not be an influence on equity in health if it does not exist in the subpopulation of interest.

This field of endeavor is usually known as “social medicine”, which, in contrast to biomedical orientation taught in most medical schools, takes into consideration influences such as the overall physiologic vulnerability of the individual as a result of various exposures, material resources such as income or education, social resources such as social support networks and friendships, risky behaviors, chronic stress, and exposure to health services.

Extending this even further distally from health, these individual characteristics are influenced by community characteristics, such as exposures at the community level, distributions of wealth in the community, influences of powerful groups within the community, behavioral and cultural characteristics maintained by the community, and the type and extent of health services in the community. This level of influence on health is commonly known as "community medicine or community-oriented medicine, a term made popular by the Karks in South Africa in the middle of the 20th century."
Community Medicine and Public Health Views towards Health
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 public 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.

Implications for Data/Information Systems: I. Linkages

- Linking individual/aggregated individual data with contextual/ecological data
  i.e., clinical approaches with systems approaches
Implications for Data/Information Systems:
II. Areas

• Characteristics of areas in which people live and work
• Social and political (power) characteristics of the people in an area
• Characteristics of health system
Implications for Data/Information Systems: III. Health Services

- Problems (ICPC)
- Diagnoses (comorbid diagnoses)
- Management (disease or morbidity-oriented?)
- Reassessment (disease or problem-oriented?)

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Implications for Data/Information Systems:
IV. Disease, Morbidity, or Health Oriented?

- Comorbidity
- Concept of health
Comorbidity

Diseases, risk factors, and influences are not independent of one another. Data systems must allow for coordination among different providers and types of providers.
This diagram uses data from a Dutch study of diagnoses in general practice. The line shows the overall observed to expected (based on chance distribution of each diagnosis) ratios of numbers of diagnoses in a population of patients in general practice. Observed to expected ratios of no disease is 1 for all ages combined. There are fewer people than expected who have one or two diagnoses, about the same for people who have three, MORE people who have 4 different diagnoses than expected by chance distributions of each of 4, and many more people who have 5 or more different diagnoses in a year than would be expected if diagnoses were distributed by chance across the population. The bars in the diagram show the observed to expected ratios for different age groups. Among the very elderly (80 or over) and non-elderly older adults (ages 60-79), more people have no diagnoses than would be expected by chance distribution. At higher degrees of multimorbidity (3 or more diagnoses in a year) and especially at 4 or 5 or more diagnoses, a much higher percentage of children have multimorbidity whereas a smaller percentage of those above age 50, despite the overall higher rates of diagnoses in the older age group. That is, multimorbidity is not distributed randomly in the population, and its non-chance occurrence is much greater in children and young adults. This reality supports the conclusion that illness is not only biologic degradation associated with aging but, rather, a pattern that results from increased vulnerability to all or many types of illnesses in individuals and groups of individuals in the population.

This branching tree algorithm shows the approximately 40 terminal ACGs that result from this process. In only a few end groups is age and gender separation necessary to distinguish people who have common patterns of disease burden according to their pattern of diagnoses and number of types of diagnoses.
What Is Health?

Health is the extent to which an individual or group is able, on the one hand, to realize aspirations and satisfy needs and, on the other hand, to cope with the interpersonal, social, biological, and physical environments. It is a resource for everyday life, not the objective of living; it is a positive concept embracing social and personal resources as well as physical and psychological capacities.

How Is Population Health Measured?

- Infant mortality rates vs. neonatal and postneonatal mortality rates
- Cause-specific mortality
- Life expectancy
- Years of potential life lost (GAO choice among 17)
- Disease occurrence/severity
  - All diseases
  - Target diseases (Popular in US and worldwide)
  - Self-reported health
- DALYs

Which of these represent health?
Alternatives for Characterizing Population Health

1. Diagnosed morbidity case mix by age
2. DALYs
3. Profiles of health derived from combinations of separate domains
### Criteria for Defining Profile Types

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<thead>
<tr>
<th>Profile</th>
<th>Type</th>
<th>Criteria</th>
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<tbody>
<tr>
<td>A</td>
<td>Excellent health</td>
<td>Excellent health on 3 or 4 domains, with no domains of poor health</td>
</tr>
<tr>
<td>B</td>
<td>Good health</td>
<td>At least average health on all domains, with excellent health on no more than 2 domains</td>
</tr>
<tr>
<td>C</td>
<td>Dissatisfied</td>
<td>Poor health only on satisfaction</td>
</tr>
<tr>
<td>D</td>
<td>Discomfort</td>
<td>Poor health only on discomfort</td>
</tr>
<tr>
<td>E</td>
<td>Low resilience</td>
<td>Poor health only on resilience</td>
</tr>
<tr>
<td>F</td>
<td>High risks</td>
<td>Poor health only on risks</td>
</tr>
<tr>
<td>G</td>
<td>Dissatisfied/high discomfort</td>
<td>Poor health on satisfaction &amp; discomfort</td>
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<tr>
<td>H</td>
<td>Dissatisfied/low resilience</td>
<td>Poor health on satisfaction &amp; resilience</td>
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<td>I</td>
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<td>J</td>
<td>Discomfort/low resilience</td>
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<tr>
<td>K</td>
<td>Discomfort/high risks</td>
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</tr>
<tr>
<td>L</td>
<td>Low resilience/high risks</td>
<td>Poor health on resilience &amp; risks</td>
</tr>
<tr>
<td>M</td>
<td>Worst health</td>
<td>Poor health on 3 or 4 domains</td>
</tr>
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Dealing with Disparities

Stratified analysis rather than statistical adjustment
Social and Political Context

Important future direction to understanding the variety of influences on health
Directions for Population Health Data

Information systems moving towards characterizing

• Health
• Contexts
• Comorbidity as well as disease
• Disparities (systematic differences)
• Bridging clinical medicine and public health to use knowledge about health, risks, and resiliencies
Data Systems for Bridging Public Health and Clinical Medicine

Boundaries between public health and clinical medicine are fluid. Data systems are needed to coordinate the activities of both sectors.
Population health is **not** the sum of any individual measure of health because of

**NON-RANDOM DISTRIBUTION OF HEALTH AND INFLUENCES ON HEALTH**

- Age and gender distributions
- Political/economic/social/environmental contexts

**INDIVIDUAL MEASURES OF HEALTH DO NOT REPRESENT HEALTH.**
Summary: Health

Population health is NOT the sum of individual health. Averages do not represent population health or provide information about the context in which systematic differences in health occur and how they can be remedied.
Summary: Why Population Health Is NOT the Sum of Individual Health, in Any Useful Sense

- Comorbidity: individual measures of health do not represent health
- Non-random distribution of health, e.g., age, geography, societal differences cause systematic differences in population subgroups