
CHAPTER 19

Population Health: New Paradigms and Implications for Health Information Systems

Barbara Starfield

Health systems everywhere face three imperatives: to increase the effectiveness of interventions, to increase the efficiency of interventions, and to increase equity in the distribution of health and health services, broadly defined. For the most part, existing health data systems do not facilitate the monitoring of these three objectives. Based largely on a conceptualization of health as the absence of specific diseases, these data systems are primarily oriented to disease as the basic “building block” of ill health, with prevention directed toward eliminating, reducing the likelihood of, or reducing the impact of specific diseases, fostering the assumption that population health can be characterized as the sum of individual health, characterized disease by disease. Thus, there are international, national, and subnational statistics that provide information on causes of death, and health objectives directed at eliminating the incidence, prevalence, or impact of specific diseases or types of diseases. Increasing specialization within the health professions predisposes to such a reductionism, as vested interests compete for resources aimed at their particular area of focus.

Both theoretical and empirical considerations make such approaches increasingly dysfunctional in providing the basis for more effectiveness, efficiency, and equity in the attainment of better health of populations.

Diseases are increasingly less important in understanding the genesis or management of health problems in populations, and in providing a basis for allocating resources (including payment for health services). Because of improved
social and economic conditions as well as more effective health services, people with specific illnesses who previously would have died are now surviving, only to become at risk for other diseases. This is leading to increasing burdens of co-morbidity (coexistence of unrelated disease). Most people, particularly as they age, develop more than one health problem, so that co-morbidity becomes a major challenge for health services providers and an important consideration for the quality of health services they provide when they focus primarily on diseases. Although guidelines and standards for care are currently written disease by disease, the extent of their relevance when co-morbidity exists is unknown. Second, there is a wide range of severity within conditions, perhaps even more so than across conditions. Simply characterizing individuals by the presence of a disease provides no information on the impact of that disease or even its likely prognosis. Third, understanding the importance of various risks for disease requires recognition that the presence of some known factors is not associated with subsequent occurrence of disease, that some risk factors predispose to more than one disease, and that some diseases can follow from exposure to any one or a number of types of risk factors (Starfield 1998). Borrowing from terminology used in understanding the risk for genetic diseases, these phenomena are known, respectively, as incomplete penetrance (Mayr 1982), pleiotropism (Cavalli-Sforza and Bodmer 1971), and etiologic heterogeneity (Holtzman 1989). Thus, the characterization of risk factors (as well as diseases) in health information systems must allow for more than is normally provided by disease description and classification.

Moreover, health statistics reflect the existence of a tension between different strategies to achieve better population health. In no society is there such a thing as average health, even though statistics make it appear so. Most distributions of health are not normal; health clusters more than would be expected (by chance distributions) in certain subpopulations (van den Akker et al. 1998). Therefore, the goal of improving health might be achieved either by strategies to reduce the occurrence or prevalence of disease overall in the population or by targeting the reduction of disparities between the disadvantaged and advantaged groups, recognizing that the interventions directed at improving overall population health might be most efficiently achieved (at least initially) by focusing on people who are least disadvantaged. That is, the goal of equity might compete with the goals of effectiveness and efficiency (Anand 2002; Wagstaff and Watanabe 2000). (Note that improving the worst-off need not worsen the position of the best-off; if optimal health can be achieved by the most advantaged group with less resources than they now receive, diverting those excess resources could improve the health of the most disadvantaged without compromising the health of the most advantaged.) National and local policies weigh heavily in such decisions; the most common outcome is usually a decision to focus attention on effectiveness and efficiency, because these are perceived to be more conducive to short-term economic growth by increasing the development of ever more sophisticated technology. Systems of health statistics reflect the relative priorities that are placed on average health versus distributions of health as national goals (Kindig 1997).
EXISTING TYPES OF MEASURES OF POPULATION HEALTH

The definition of health is the same whether the focus is on the individual or the population. It is the extent to which an individual or a group is able, on the one hand, to realize its aspirations and satisfy its needs and, on the other hand, to cope with its interpersonal, social, biological, and physical environments. It is a resource for everyday living, not the objective of living; it is a positive concept embracing physical and psychological capacities (Ottawa Charter 1986).

Most existing measures of population health (as represented in health statistics) generally are not consistent with this definition of health (Institute of Medicine 2001; Wolfson 1999). Mortality statistics are based on death rates (the number of deaths per unit of population), sometimes augmented by death rates from selected causes of death, as coded by the International Classification of Diseases, or after stratification by one or more particular demographic characteristics (usually age and/or race and ethnicity).

A somewhat different metric is based on estimates of life expectancy, a method that dates to the seventeenth century and the need for calculation, by actuaries, of annuities. In a given year, given current death rates in different age groups, it provides the expected years of continued life by subtracting from the population those who die in each age range divided by the midyear population. Although it is a synthetic measure (not reflecting the experience of any specific cohort), it has proven useful in comparisons between countries and, within countries, across different population subgroups.

A related measure, years of potential life lost, provides the basis for comparing populations according to the number of years of life "lost" before a particular age (usually age 65, 70, or 75) overall or associated with particular causes of death. The General Accounting Office (GAO), the research arm of the U.S. Congress, considered 17 separate indicators of health (five concerning lifestyle characteristics such as smoking; 4 concerning employment and access to public health and medical care services; 2 concerning occupational health and safety; 3 concerning the specific disease categories of death rates from heart disease, cancer prevalence, and the acquired immunodeficiency syndrome occurrence of (AIDS), tuberculosis, and hepatitis; and 3 concerning mortality: total mortality, infant mortality, and premature mortality) and concluded that premature mortality was the most appropriate indicator for allocating federal funding for core public health functions administered by states (General Accounting Office 1997). This measure of health provides the potential for viewing population health generically (as a composite rather than disease by disease) while also allowing for the possibility of attributing premature deaths to specific diseases.

The International Classification of Primary Care (ICPC) (Lamberts et al. 1993), designed specifically for coding of reasons for visits in primary care, also codes symptoms (such as those associated with undiagnosed disease, inadequately managed diseases, deterioration in disease status, or adverse effects of interven-
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tions). Thus, it is theoretically possible to augment population health statistics by the universal coding of both diseases and states of ill health as assessed through symptomatology. To date, this approach has not been implemented.

Health is increasingly measured using reports of individuals in the population. The most common method, which is usually employed in surveys rather than in clinical situations, queries individuals as to whether their health is excellent, very good, good, fair, or poor. These individual assessments can then be aggregated to provide a population measure (the percentage of individuals who report their health in the different categories).

Alternatively, the health of individuals could be calculated as the sum of many separate indicators weighted in an appropriate way. There is no universally agreed-on way to weight the various indicators. In some approaches, such as, health-related quality-of-life assessments, standardized instruments rate the individual on various domains of health (e.g., physical functioning, emotional functioning, social functioning), from which scores are derived and then aggregated to a summary score. Health-related quality-of-life assessments are often weighted based on the values of individuals for either their own health state (patient weights) or the health status of others that are described to them (community weights). Whereas these quality-adjusted health measures (often stated as quality-adjusted life years or QALYs when combined with estimates of survival) (Mushlin et al. 2001) are sometimes used for comparing the effects of various modes of therapy in selected patient populations, they are not used for characterizing population health (Gold et al. 2002).

Disability-adjusted life years (DALYs) measure the gap between a population's health and a hypothetical ideal for health achievement based on life expectancy adjusted for rates of disability associated with individual diseases prevalent in the population. They have been used by global health researchers to quantify the burden of disease in different countries, and they formed the basis for the ranking of countries on health in the World Health Report 2000 (WHO 2000). The standard life expectancy is taken as that from Japan (as it has the longest life expectancy of any country); weights for disability rates were derived from expert judgments and vary with age. Total population disease burden is computed by summing attributable DALYs across diseases. Thus, DALYs are based on the assumption that health is dysfunction associated with individual diseases (Gold et al. 2002).

In 2003, the National Center for Health Statistics reported on the results of a workshop to identify summary measures for monitoring Healthy People 2010 (Molla et al. 2003). It reviewed the advantages and disadvantages of several measures, including healthy life expectancy (HLE), health-adjusted life expectancy (HALE), health-adjusted life years (HALY), and disability-adjusted life years (DALY), as well as newer measures such as years of healthy life (life without disability), years of healthy life (developed for Healthy People 2000), years of life without functioning problems; years of life without specified diseases, years of life in excellent or very good health, and years of life lived with good health
behavior. All are constructed with data now available (in the United States) from the National Health Interview Survey, the annual life table for the population, and life tables for the subpopulations of interest. The monograph provided examples of data, by age and sex, for the U.S. population.

A FRAMEWORK FOR HEALTH STATISTICS SYSTEMS

The widespread improvement in individual and population health, consequent to social as well as medical advances, is providing impetus for basing health statistics on a broader conceptualization of health and determinants of health. Figures 19.1 and 19.2 provide one such conceptualization. Figure 19.1 is a parsimonious depiction of types of risks for ill health. Risk factors are not independent of each other; many risk factors predispose to other risk factors. Summing of individual risk factors provides no information on the magnitude of risks in the population, either those for specific diseases or for general states of health. Figure 19.2 provides an equally parsimonious depiction of the web of causation of illness in populations. It differs from Figure 19.1 in two respects: the greater salience of contextual (not individual) influences and the critical features of illness distributions (Diez-Roux 1998; Susser 1998; Susser and Susser 1996). The distinctions between a focus on individuals, aggregated individuals, and populations (or subpopulations) are at the heart of the distinctions among clinical medicine, clinical epidemiology, social medicine, community medicine, and public health. Consider the following questions:

- What disease might this patient have?
- What is the relative likelihood that this patient has or is at risk for this disease?
- Why does this patient have this disease at this particular time?
- Is this disease important? If so, to whom and how important is it?
- What characteristics are most salient in improving overall health and the distribution of health in populations?

The first question is the conventional clinical question; the second is an issue for clinical epidemiology; the third is the subject of social medicine; the fourth is the concern of community medicine; the fifth is the critical concern for public health.

The recognition of the broad range of factors that influence both current health and the potential for future health provides the justification for augmenting conventional health statistics with newer systems that better reflect new imperatives in population health. These include (1) increasing disparities across population subgroups; (2) increasing recognition of the importance of the social and political contexts in understanding and overcoming their adverse ef-
FiguRe 19.1
Influences on health: individual level. Shading represents the degree to which characteristics are measured at the ecological level (lighter color) or at the individual level aggregated to the community level. *Health has two aspects: occurrence (incidence) and intensity (severity).

Effects as well as maximizing their salutary effects; (3) a focus on population-attributable risk as well as relative risk; (4) increasing co-morbidity in the population; and (5) the need for better coordination between public health and clinical medicine in an effort to better protect and promote health and prevent ill health.

DISPARITIES ACROSS POPULATIONS AND POPULATION SUBGROUPS

Disparities across countries and across subpopulations within countries are a worldwide concern (Braveman 1998). Consideration of disparities is an important aspect of the distinction between the population health focus and the individual health focus (Fig. 19.2 vs. Fig. 19.1). No system of national or subnational population health statistics is adequate without attention to characterizing the differences across major population groups. In the past, interpretation of health differences across different areas was made possible by statistically adjusting for differences in the demographic characteristics of populations, thus obscuring the existence of disparities across them. Increasingly, population health statistics will contain mechanisms to stratify populations so that systematic differences across...
them will be sufficiently visible to draw policy attention to them. Although the major subpopulations will differ from country to country and from area to area, each jurisdiction will have to develop a rational plan for analyzing and presenting data according to the most relevant considerations for elucidating existing health disparities.

UNDERSTANDING THE IMPORTANCE OF SOCIAL AND POLITICAL CONTEXT

Although the importance to health of the social context has been recognized for centuries, it is only in the most recent quarter-century that systematic attention has been devoted to clarifying the types and mechanisms of effects of various aspects of the social milieu. The vast literature on the subject has recently been summarized by Berkman and Kawachi (2000). Less well researched is the effect of the political context, although its relevance to policy formulation is self-evident (Fig. 19.2). Szreter (1999) suggested that the state has a role in promoting participatory citizenship, which has direct implications for the design of government and of policies that will determine the relative balance among the various impacts on health. Similarly, Lynch and colleagues (2000) argue for a framework that “embraces structural as well as interpersonal social relationships.” Navarro and Shi’s (2001) analysis of the impact of the nature of governance on infant mortality is a factor in the statistics with influences of measures past and present, as they and Marce Linka;

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mortality is one of the first to consider the relationship between this most distal factor in the web of causality on one aspect of the health of populations. Health statistics will increasingly require expansion to a much wider range of possible influences on the health of populations and subpopulations and a wider variety of measures of health, obtained in ways very different from those used in the past and present. Many of these influences cannot be obtained from individuals, as they are characteristics of environments (Hancock et al. 1999; McKinlay and Marceau 2000; McMichael 1999).

Linkages of different types of statistical data sets will become the imperative in health data systems of the future: individual characteristics linked with characteristics of the areas in which they live and work will provide a much broader base for understanding why some people and some population groups are more ill than others. This will provide the basis for more effective and more efficient interventions to improve overall health as well as to reduce disparities in health.

Policymaking and planning for the deployment of health services require information not only about the types of challenges to health but also about the relative frequency of their distribution in the population. In clinical decision making, relative risks generally dominate: if one risk factor has a higher likelihood of being associated with an adverse outcome, it generally becomes a higher priority for intervention than does a risk factor with a lower relative risk. In planning for population health, the frequency of risks demands consideration; a factor with high relative risk may have little importance as an influence on health if it is very uncommon in the population. Thus, the concepts of relative risk and attributable risk are of different salience, depending on whether interest is focused on an individual's health or on a population's (or subpopulation's) health.

**CO-MORBIDITY**

Co-morbidity is the coexistence of two or more unrelated illnesses or types of illness. The clustering of different types of illness within certain individuals and within certain population subgroups has always been a feature of illness, but has only recently been recognized as an important challenge to thinking about the genesis, prevention, and improvement of ill health. An accumulating literature (Starfield 2001a) documents the co-occurrence of otherwise unrelated diseases, and conceptualizations of disease causation provide the theoretical basis for expecting that co-occurrence is of greater magnitude than would be expected by random co-occurrence of two or more unrelated diseases. Figures 19.1 and 19.2 show how risk factors are not independent of one another; many risk factors predispose to other risk factors, and various different risk factors will be represented differently in determining the overall risk for a given health problem (Koopman and Lynch 1999). Summing of individual risk factors provides no information on the magnitude of illness risks in the population; there are many
interactions across risk factors and different relative impacts of individual risk factors in different populations and population subgroups. Moreover, simply having a health condition changes the vulnerability to other health problems, usually by increasing it (as a result of debilitated health states with less resistance to new illnesses) but sometimes by decreasing it (through developing biological or psychological coping mechanisms).

As co-morbidity is a major new challenge in characterizing health, it is also a major challenge in characterizing different types of health service interventions. Services received from only one provider or one provider type no longer suffice when people have combinations of different illnesses or types of illnesses; multiple providers are now the rule. This requires the availability of data that are shared across providers and different types of providers. Without shared data, coordination of care becomes impossible. Moreover, a focus on both co-morbidity and co-occurrence of risk factors in populations, as well as on their distribution within populations, calls for an increased role of public health and for coordination of the public health role with the clinical role of health practitioners. The next section discusses the imperative for coordination of these two roles in health services systems using new types of data systems.

DATA REQUIREMENTS FOR COORDINATING PUBLIC HEALTH AND CLINICAL MEDICINE FUNCTIONS

Table 19.1 describes the major types of health activities and their targets. On one axis are the types, divided into three categories: health protection and promotion and primary prevention (improving health and reducing the level of threats to health); secondary prevention (interfering with the progression of ill health at a point where an abnormality can be detected but before manifestations are overt); and tertiary prevention (interfering with progression of ill health after overt manifestations occur and remediation of the overt effects). On the other axis are the targets of activities, divided into those that are addressed at the population level as a whole, those addressed to all individuals within the population (or subpopulations), those addressed uniformly only for individuals in selected subpopulations, and those directed only at individuals with a particular need for them.

Only in the case of the top row (activities that benefit all individuals in the population) is the locus of responsibility for activities unarguably primarily in the jurisdiction of population medicine (public health). Activities in all other cells in the matrix may be a function of clinical medicine or public health, depending on place and time. A major aspect of policy development, and thus of data systems, concerns decisions on what types of functions are primarily under the aegis of public health or clinical medicine; countries and smaller political jurisdictions face different situations with regard to the occurrence of threat to other countries are which involve groups in the

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TABLE 19.1
Types of Interventions

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<th>Target Group</th>
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<th>Secondary</th>
<th>Tertiary</th>
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<tr>
<td>Population</td>
<td>Environmental planning</td>
<td>Environmental monitoring</td>
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<td>All individuals</td>
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<td>Breast cancer screening</td>
<td>dissemination</td>
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<td>Selective</td>
<td>Genetic engineering</td>
<td>Blood lead screening</td>
<td>Outreach/access (e.g.,</td>
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<td>Indicated</td>
<td>Communicable disease control</td>
<td>Frequent follow-up</td>
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<td>Prophylactic antibiotics</td>
<td>for disease recurrence</td>
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<td>Practice guidelines</td>
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<td>clinical services</td>
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Jurisdictions differ in their decisions. For the most part, activities in the bottom row are in the purview of clinical medicine, although in some countries the activities may be carried out by public health professionals, particularly when the occurrence of disease (such as tuberculosis) in particular individuals carries a threat to other individuals in the population. Differences across jurisdictions and countries are particularly notable in the second and third rows of the matrix, which involve all individuals in the population or individuals in selected target groups in the population.

Although differences among countries or localities in the extent to which the various types of activities are under the jurisdiction of public health or clinical medicine have not been studied or described, some health systems have confronted the issue explicitly. In the United Kingdom, primary care trusts (which are clinical entities) have increasingly been given responsibility for public health functions. This delegation of conventionally public health activity to clinical entities, and hence the responsibility for collecting health statistics, has no strong empirical basis. In fact, there is considerable concern about its likelihood of success, as there are increasing questions about the adequacy of intervention when the populations covered by the clinical entity are too small to support an effective public health function, including health statistics (Gillam et al. 2001).

Clinical medicine rarely covers populations large enough or sufficiently representative for their data systems to show the systematic differences in distribution.
of risks across population subgroups. Therefore, population health statistics play a critical role in monitoring the existence and degree of disparities across population subgroups. They also can help to provide the basis for deciding which level of services is best suited to carrying out specific activities. Health needs shared by all individuals in the population, such as the need for health protection, are likely to be better served by public health data systems that are derived from intersectoral activities at the population level. The need for preventive activities that are common to all individuals in the population may also be best served by public health data, particularly in countries and areas where health services are not uniformly or equally available to all segments of the population. The new brand of health statistics can greatly inform decisions about the most appropriate locus of action by shedding light on the existence and magnitude of various aspects of health.

- POPULATION HEALTH IS MORE THAN THE SUM OF INDIVIDUAL HEALTH

The key to understanding the incidence and prevalence of disease and risk factors lies in characterization of populations, not individuals (Rose 1985; Schwartz et al. 2001).

Is population health the sum of individual health? Although this is commonly assumed, it is not the case, except for very specific aspects of illness and where distributions of health are not of interest.

For each separate manifestation of ill health or health, including predispositions (risks and resiliences, respectively), the sum of individual health measures, properly adjusted or standardized by sociodemographic characteristics that are inherently related to the occurrence of illness, accurately describes individual aspects of the state of health for a population. Although these sums are accurate, they are increasingly irrelevant for policy and decision making, either because they are not accurate representations of health as now conceptualized or because they assume that the separate components of health and the influences on various aspects of health are randomly distributed in the population. Neither is the case. Morbidity and mortality are not randomly distributed in the population; there is no such characteristic as an average health level. Moreover, risk factors are not evenly or randomly distributed in the population; some population groups have more risks factors than are explainable by chance distributions, and some have fewer.

Health statistics are not a heuristic exercise. They are collected for specific purposes. Descriptions of averages, by themselves, provide no useful information. The most basic purpose of health statistics is to provide clues to unmet needs so that resources can be directed appropriately. At the most simple level, needs are manifested as differences in levels of health across populations. This is why the
earliest statisticians adjusted their health statistics for differences in major demographic characteristics of populations, so that they could more confidently conclude that any differences were due to health rather than to differences in, for example, the age distribution in the populations that were compared. At their earliest stages, then, health statistics were not simple additions of individual health statistics. However, average health levels, even if age and/or gender adjusted, provide no information on the distribution of health needs in populations; as noted above, consideration of disparities in populations now carries equal weight with poor overall health as a consideration for modern societies. Population health, when characterized as separate disease states, is most certainly not the sum of individual health because of the presence of co-morbidity and the concentration of clusters of types of diseases in particular individuals and population subgroups.

The critical recognition of social and political contexts as determinants of disease is the final reason for considering population health statistics as distinct from a compilation of individual health statistics. If health is determined by factors outside of and separate from the individual, an understanding of the genesis and malleability of population health cannot be obtained by considering population health as a composite of individual health. Many risks and resiliencies derive from factors outside the individual; understanding their impact on population health requires levels of aggregation and analyses that extend to ecological characteristics as well as individual ones.

The recent redefinition of health statistics as “numerical data that characterize the health of a population and the influences that affect it” provides clear challenges for future health statistics endeavors (see Chapter 1). First, it addresses the issue of health, not separate aspects of health. It therefore poses the challenge of developing measures that represent or summarize the state of health of people, many of whom have more than one conventional health condition, as well as maintaining an interest in the individual conditions. Second, it mandates decisions on the nature of these summary measures of health, particularly whether they are to be morbidity indices composed of conventional measures of health mortality and morbidity or whether these are to be replaced with alternative constructions of health based on functional disability. Third, the redefinition also speaks to influences on health, not only the end results of these influences. Until recently, the concept of health has not included these influences, instead regarding them as of concern for future health and not health per se. Fourth, the worldwide imperative, expressed in many countries as national health goals, not only to improve the overall state of health of the population but also to reduce disparities in health within the population, provides another challenge. Until very recently, health statistics were almost always presented as average values for populations. The fact that these data are often presented separately by age and gender sets the stage for additional stratifications, particularly by social class groupings, ethnicity, and, where relevant, race. Equity is increasingly regarded as equally salient to effectiveness in improving levels of health. Thus, from
the viewpoint of health policy, health statistics should not be limited to average levels of health, however measured or specified (Sassi et al. 2001).

Relevance in a world of changing criteria for health provides the imperative for innovation in health statistics. Originally these systems were developed to categorize causes of death. Over time, they were modified to categorize causes of hospitalization and then to categorize diagnoses in visits to physicians. No similar system exists for any other facet of health, although recently, the World Health Organization has developed a new system for classifying functioning. Known as the International Classification of Functioning (ICF) (WHO 2001), it sets out aspects of health that represent the manifestations of activity limitation and disability in the context of people’s daily living, including mental and social as well as physical dimensions. As is the case with the International Classification of Diseases, each functional compromise is considered separately.

The World Health Organization has taken the position that health is an attribute of individuals, best measured as deviations from a “threshold level of ability to carry out physical and mental actions and tasks in the current environment” (Chatterji et al. 2002). It recommends that health be understood as a multidimensional phenomenon that can be narrowed to a core set of health domains (such as pain, affect, mobility, cognition, self-care, and usual activities), each characterized by a single cardinal scale of capacity (measured, observed, or self-reported) with the use of currently available personal aids (as distinguished from environmental modifications). A single measure for each individual could be obtained by carrying out health state evaluations for the domains. In this conceptualization of health, inherent capacities (including those modified by personal aids) are distinguished from performance measures, which are dependent on the nature of the environment of the person.

## POTENTIALLY PROMISING NEW APPROACHES TO CHARACTERIZATION OF POPULATION HEALTH—A RESEARCH AGENDA

Two main challenges to characterizing population health require attention. The first is a need for a focus on the person rather than on separate diseases or dysfunctions. The second is a need to advance the knowledge of positive health, which includes not only the absence of illness but also the presence of wellness (Singer and Ryff 2001). Two new measures that address these two imperatives are presented next.

### Disease Case Mix

The first method, based on clinical data, is the Adjusted Clinical Groupings (ACG) method of characterizing the case mix of diagnoses in individual and populations. Th...
Diseases of the positive health, the classification of health, and the classification of diseases. The classification of health is an important tool in epidemiology and public health. It helps to identify and monitor the health status of populations and to evaluate the effectiveness of public health interventions. The classification of diseases is used in clinical practice to diagnose and treat patients. The ACG system is a classification system that is used to identify and group patients with similar health conditions. The system is designed to be used by clinicians to improve the quality of care for patients. The ACG system is based on the premise that patients with similar health conditions will have similar health outcomes. This allows for the development of treatment plans that are tailored to the specific needs of each patient. The ACG system is also used to identify patients who are at risk for developing health problems. This allows for the development of interventions that can prevent the development of health problems. The ACG system is a useful tool for improving the quality of care for patients and for identifying patients who are at risk for developing health problems.
For example, a morbidity index based on the ACG case mix system was a far better predictor of premature mortality in a Canadian province than a socioeconomic risk index or use rates in the population (Reid et al. 2002).

Profiles of Health

A second approach, which so far has been developed only for children and youth of ages 6–17, is similar in assuming that population health can be described as the percentage of individuals who fall into each of several mutually exclusive profiles of health. The conceptualization of health that underlies the development of profiles is based on the pattern of scores on the first four of the following domains of health: Symptoms (Discomfort); Satisfaction with Health; Risks; Resilience; Diseases (Disorders); and Achievement of Social Expectations related to health (including Development in Childhood). The profile types were characterized primarily by the number of domains in which health is poor, identifying the unique combinations of problems that characterize different subgroups of children and adolescents. The profiles of health were constructed from the data obtained on the Child Health and Illness Profile–Adolescent Edition (CHIP-AE) and the Child Edition (CHIP-CE), which elicit self-reports of health across these six domains. Several sets of mutually exclusive profile types were defined; 13 profiles can be defined in terms of whether there are zero, one, two, three, or four domains of health need. The actual distributions into these 13 types are significantly different from chance distributions. The best and worst profiles have a much higher proportion of individuals than expected by chance (Riley et al. 1998a). Thus, this profile method not only describes the health of populations generically but also provides the basis for describing the clustering of good and bad health within and across populations and population subgroups. Tests of its validity confirm that it adequately portrays differences in health by age, gender, and social class groupings (Riley et al. 1998b; Starfield et al. 2002a, 2002b).

Many research challenges remain before such alternative or complementary approaches can be converted into useful population health statistics. However, these new alternatives have characteristics that address major challenges for future health statistics. Although the ACG system considers only medically coded diagnoses, it explicitly tackles the issue of characterizing co-morbidity. The profiles-of-health approach addresses the need to go beyond diseases to consider functioning, and to include consideration of the potential for future health as represented by risks and resilience. Its special advantage is its characterization of individuals and populations as patterns of deviation from maximal health in its various categories, thus making it possible to tailor both health policies and clinical services to patterns of needs rather than to needs in separate aspects of health. The eventual utility of any of these innovative methods will be based on wider acceptance of their potential contributions to character-
ORIZING population health and more widespread testing of their usefulness in different population subgroups and populations.

**SUMMARY**

New paradigms for health and changing characteristics of health call for an augmented approach to the design of health statistics. The phenomenon of comorbidity demands a person-oriented rather than a disease focus for depicting the health of people and populations and a new characterization of health services deriving from the increasing need for coordination of care across multiple providers and levels of care, including that between public health and clinical medicine. Increasing and systematic disparities in health across population subgroups and the requirement, in health statistics systems, of a wider variety of political, social, and environmental factors that either predispose to or interfere with the achievement of higher health levels in individuals and populations provide the imperative for a new conceptualization of health data and health statistics systems as the twenty-first century progresses.

**REFERENCES**


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