Measuring quality: from the system to the provider

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Abstract

The literature on quality has often focused on process indicators. In this paper we outline a framework for describing and measuring the quality of health systems in terms of a set of desirable outcomes. We illustrate how it can be measured using data collected from a recent evaluation of health system performance conducted by the World Health Organization (WHO). We then explore the extent to which this framework can be used to measure quality for all components of the system; for example, regions, districts, hospitals, and providers.

There are advantages and disadvantages to defining quality in terms of outcomes rather than process indicators. The advantage is that it focuses the attention of policy makers on whether systems are achieving the desired goals. In fact, without the ability to measure outcomes it is not possible to be sure that process changes actually improve attainment of socially desired goals. The disadvantage is that measuring outcomes at all levels of the system poses some problems particularly related to the sample sizes necessary to measure outcomes. WHO is exploring this, initially in relation to hospitals. The paper discusses two major challenges. The first is the question of attribution, deciding what part of the outcome is due to the component of the system under discussion. The second is the question of timing, including all the effects of current health actions now and in the future.

Keywords: health system performance, measurement, quality

Health professionals and policy makers continually seek to improve quality at the level of the individual provider, the health facility, for particular interventions, and at the level of the overall system [1,2]. Despite this, there is a great deal of confusion about what is meant by quality [3]. The tradition in the literature has been for analysts to expand or contract the concept according to the specifications of the health system, organization, facility, or activity under consideration. Accordingly, in this paper we define quality at the system level, building on recent work of the World Health Organization (WHO) aimed at measuring health system performance. We then propose a standard method for measuring quality, and finally we discuss some of the challenges of measuring and monitoring quality at the provider or facility level using this method.

A framework for measuring health system quality

Health outcomes vary widely across countries, even in those with similar background characteristics such as income and education [4,5]. Some of this is due to differences in health system performance where differences in the design, content, and management of systems are reflected in differences in a variety of socially valued outcomes. To improve performance, decision-makers need to be able to measure the extent to which the systems contribute to the desired outcomes, identify factors that influence attainment, and develop policies that will achieve better results. Meaningful, comparable information on health system performance and the key factors that explain observed variations can strengthen the scientific foundations of health policy, but this requires a consistent framework which defines what systems should seek to achieve, and how to measure attainment.

WHO recently proposed a framework as the basis for reporting the performance of health systems in the 191 countries that are members of WHO [6]. It built on a body of earlier work [7–14], which had intrinsic shortcomings. Some existing frameworks were essentially long lists of desirable attributes of systems with no clear concept of how the attributes interacted or which attributes were more important. Other frameworks proposed focusing only on goals where measurable indicators were readily available, so had no overall

The views presented in this paper are those of the authors and do not necessarily represent the views of the organizations with which the authors are affiliated.

Table I Goals of the health system

	Level of attainment or quality	Distribution of attainment or equity
Optimal health for all (system members)	X	X
Responsiveness of care provision system (to individual patient needs)	X	X
Fair financing		X

concept of what systems should try to achieve. In this paper, we define first the major goals to which health systems should contribute, called intrinsic goals. We then define indicators that can be used to measure the extent to which a system is contributing to the goals and show how these indicators can be used to define quality at the level of the system.

An intrinsic goal is one for which increasing attainment is desirable in itself, holding all other goals constant. It should also be possible to raise the level of attainment of the goal while holding attainment on all other intrinsic goals constant. Each goal should be at least partially independent of all others. The WHO framework defines three intrinsic goals (Table 1).

Improving population health is the defining goal and includes the reduction of premature mortality and improving non-fatal health outcomes. Both the level of population health and the distribution of health outcomes are important; systems should contribute to reducing health inequalities as well as to improving aggregate health levels. Better health and less inequality are desirable by themselves. Moreover, it is technically possible to improve the average level of population health or reduce inequalities in health without changing other intrinsic goals.

The second goal is to enhance the responsiveness of the health system to the legitimate expectations of the population. This concept excludes expectations for the health-improving dimensions of the system, which are fully reflected in the goal of improving health. The term 'legitimate' is used to acknowledge that some individuals may have excessive expectations which the system cannot be required to fulfil. The system should seek to increase the average level of responsiveness as well as to reduce inequalities in responsiveness.

Responsiveness to legitimate non-health-related expectations has two components: respect for the person and client orientation. Respect for people, for their dignity, their autonomy, and their needs for confidentiality and information captures aspects of the interaction of individuals with the health system that have an important ethical dimension. Client orientation (prompt attention, provision of basic amenities, access to social support networks, and choice) includes the major components of consumer satisfaction that are not direct determinants of health improvement. Although the goals of health and responsiveness interact, responsiveness to non-health expectations is still largely independent of the health goal; it is possible to increase confidentiality, for example, while holding constant levels of health.

The third intrinsic goal is fairness in financing, which includes financial risk protection for households. To be fair, a household's contributions to the system should not impoverish its members. In addition, poor households should pay a lower proportion of their disposable income on health than rich households. Fairness in financing is concerned only with distribution (Table 1). There is no universally desirable level of financing; it is not necessarily better to allocate more resources to health than less or vice versa. Certainly it is important that the available resources are used efficiently and we return to this question subsequently.

A number of goals that appear in other frameworks do not appear here. They do not fulfil the criteria for defining intrinsic goals. An example is access to services where more access, by itself, is not necessarily desirable. It is only desirable when it contributes to improving an intrinsic goal. It is defined as an instrumental goal; something that is desirable if it contributes to improving attainment of one or more of the intrinsic goals.

In this framework, we separate system quality from system equity in the same sense that philosophers separate goodness from fairness [15]. The level of health and the level of responsiveness to legitimate non-health-related expectations form the subset of intrinsic goals linked to the quality of the system – how much health and responsiveness are produced in total. This closely parallels the traditional division of quality of care into its technical and interpersonal aspects [16]. The equity of the system is the other subset of goals, the distributions of health, responsiveness, and financial burden.

Measuring quality

In our framework efficiency is an instrumental goal, a way of ensuring that the best outcomes are achieved for the available resources. This is illustrated in Figure 1, which is also used to show the relationship between efficiency and quality.

In Figure 1, the vertical axis measures attainment of the health system goal while the horizontal axis represents the inputs used to produce the output. The upper line, MM′, shows the maximum possible attainment that could be achieved for each level of inputs. The lower line, LL′, shows the minimum possible goal attainment. The diagram could represent a single country over time, or a cross section of countries.

Assume a country is at A^2. In economics, technical efficiency would be defined as A^0A^2/A^0A^3 – the output achieved
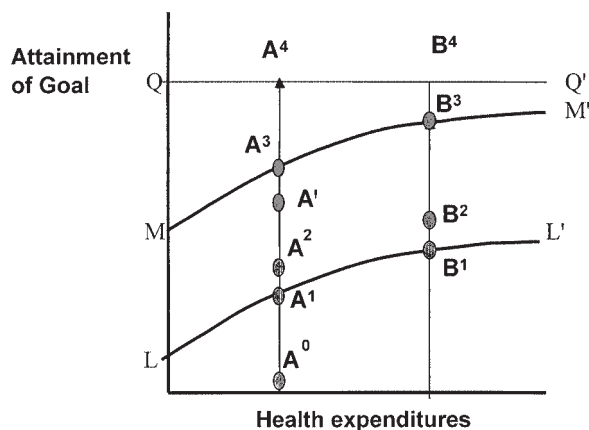
Figure 1 QQ′, maximum possible level of attainment of goal that is technologically feasible in a population if no constraints on resources. MM′, maximum possible attainment of goal. LL′, minimum possible attainment of goal. A^2, attainment of health system of country X at its current level of health expediture. A^0A^2/A^0A^3, technical efficiency of health system of country X. A^1A^2/A^1A^3, performance of health system of country X. A^1A^2/A^1A^4, quality index for health system of country X. $A^2 \rightarrow A′$, quality is improved through better use of existing resources. $A^2 \rightarrow B^2$, quality is improved through contribution of additional resources. $A^1 \rightarrow B^2$, quality is decreased with additional resources spent on cost-ineffective or harmful technologies.

compared with the maximum possible output attainable for those inputs [17]. However, where LL′ exists and is >0, we define performance as A^1A^2/A^1A^3. For any given level of resources, it is the actual achievement above the minimum possible divided by the maximum achievable (above the minimum).

QQ′ represents the maximum possible level of goal attainment that is technologically feasible in a population if resources were no constraint. The quality index for a country is defined as A^1A^2/A^1A^4 – what is achieved for the level of resources available compared with the maximum technologically feasible in the absence of resource constraints. QQ′ could be defined for each goal separately: for the level of health attainment alone or for the level or responsiveness alone, or for a composite index of the two goals. QQ′ is drawn above MM′ for the level of resources currently committed to health in countries for two reasons. The first is an acknowledgement that even with the current goal attainment of the most 'efficient' countries at different levels of per capita spending on health, there is still a potential for becoming more efficient, eliminating waste and attaining more. Secondly, with the available technology it is still possible to invest more than the currently observed highest per capita spending on health, and achieve higher levels of health or responsiveness.

Having clarified the core concept of quality, the next challenge is to measure it. The World Health Report 2000 (WHR 2000) [6] reported the achievements of the health systems of 191 countries in terms of each of the five indicators of Table 1. It also combined them into a composite index

of goal attainment. Then the efficiency with which these outputs were achieved, taking into account health system and non-health system determinants, was estimated. Here we focus only on the components of the composite index relating to quality: the levels of health and responsiveness.

Attainment in terms of the level of population health was calculated using healthy life expectancy. This is the time, in healthy year equivalents, that a child born today can expect to live if faced with the same age- and gender-specific mortality and morbidity patterns as people alive today. It is based on the same concept as life expectancy at birth, with adjustments made for the time lived in less than perfect health. In 1997, healthy life expectancy varied between 25.9 years in Sierra Leone and 74.5 years in Japan (70.0 in the USA), on average seven years lower than life expectancy across the 191 countries. Estimates of healthy life expectancy will be revised and reported each year by WHO.

Responsiveness was measured for the WHR 2000 [6] based on key informant interviews in which the respondents were asked the extent to which their systems were responsive to people's legitimate non-health-related expectations. They were asked to rate their systems on each of the seven dimensions described earlier: dignity, autonomy, confidentiality, information, prompt attention, provision of basic amenities, access to social support networks, and choice, as well as overall. It was not possible to undertake these surveys in each country. For those with missing data, estimates were made based on the factors found to explain responsiveness in countries where the surveys were undertaken [18].

We recognize that the responses of key informant interviews might not be representative of the experience of the population as a whole and that responsiveness should ideally be measured from representative household surveys. The results reported here should be regarded as first estimates of responsiveness of the systems in the 191 countries. We have subsequently designed instruments for measuring responsiveness in household surveys and they are being tested in a multi-country study involving 63 countries. In addition, a second round of key informant surveys is under way. This will allow a comparison of the results of key informant surveys with those of the 'gold standard' household surveys as a way of testing whether the cheaper, more convenient key informant surveys provide valid results.

In the WHR 2000 the composite index of goal attainment was the weighted sum of scores for the five indicators in Table 1. The weights were obtained from a web-based survey. The sum of the weights adds to 1.0. The level of population health was valued at 0.25, the level of responsiveness at 0.125, inequalities in health outcomes at 0.25, inequalities in responsiveness at 0.125, and fairness of financial contributions at 0.25. These numbers can be used to compute a new subindex for each country's attainment solely on the level of health and responsiveness, which are the components of the proposed quality index. With quality constituting the whole entity under consideration and given a weight of 1.0, and preserving the same relative scale of weights in the full composite index, level of health is assigned 0.67 and responsiveness 0.33.

Table 2a Quality levels attained for population health and responsiveness to expectations

Score	Country	Rank
84.2	Japan	1
83.4	Switzerland	2
82.8	USA	3
82.1	Sweden	4
82.0	France	5
81.6	Luxembourg	6
81.4	Canada	7
81.3	Monaco	8
81.1	Netherlands	9
81.0	Italy	10
80.9	Norway	11
80.6	Australia	12
80.4	Austria	13
80.4	Belgium	14
79.9	Germany	15

Table 2b Quality index or quality attained compared with maximum quality possible

Index	Country	Rank
0.845	France	1
0.835	Japan	2
0.835	Italy	3
0.820	Switzerland	4
0.814	Monaco	5
0.811	Andorra	6
0.809	Austria	7
0.809	San Marino	8
0.804	Spain	9
0.803	Norway	10
0.796	Sweden	11
0.794	Singapore	12
0.793	Netherlands	13
0.792	Luxembourg	14
0.783	Malta	15

There remains the task of defining the maximum possible (QQ′) and the minimum possible (LL′) in Figure 1. As suggested above, QQ′ will be above the maximum MM′ frontier derived from currently observed levels of health expenditures. As it is difficult to determine how far above, we used the currently estimated frontier as the yardstick to define what could be achieved. MM′ was estimated econometrically for the period 1993–1997 by relating overall attainment to observed levels of health and non-health system inputs. Health expenditure per capita was used as the health system input and the average years of schooling of the adult population captured non-health system inputs to the production of the intrinsic goals. MM′ describes the maximum possible outputs that could be achieved for the observed levels of inputs [19]. To obtain QQ′ we entered a health expenditure per capita of $4000 (international dollars), which is slightly above the level observed in the USA, into the frontier (MM′) equation and estimated attainment. This can be interpreted as the highest level of attainment possible for a level of health expenditure in excess of the highest currently observed in the world. LL′ for responsiveness would be zero in the absence of a health system. However, health levels would not be zero; the entire population would not be dead if there were no health system. We used a similar procedure for estimating the minimum possible. The lowest possible attainment from the frontier, for the lowest possible health expenditure was estimated. This was used to define the minimum possible levels of quality at the system level in the same way as the current attainment on quality was outlined above.

Table 2 reports quality attainment and the quality index for the top 15 countries using data reported in the WHR 2000 [6]. Quality attainment shows the levels achieved for health and responsiveness in each country. Not surprisingly, the richest countries achieve higher levels of quality. The quality index, on the other hand, measures attainment compared with the maximum possible as described above. By controlling for the efficiency of the system in producing outcomes as well as for the non-health system determinants of those outcomes, the ranks change. The USA, for example, ranks second in terms of levels of health and responsiveness, but does not achieve as close to its potential maximum as other countries for its observed health expenditure and education levels. Accordingly, it falls out of the top 15 on the quality index. It should be remembered that this analysis is preliminary and that the data used in the WHR were of variable quality; some data were obtained from good quality systems for registering births and deaths, for example, and others were estimated from the available covariates. However, the purpose of presenting the results here is to illustrate that measuring system quality in this way is possible.

Measuring quality at lower levels of the system

In 1980, Donabedian defined quality care as 'that kind of care which is expected to maximize an inclusive measure of patient welfare, after one has taken account of the balance of expected gains and losses that attend the process of care in all its parts [21]. Ten years later, the Institute of Medicine (IOM), after thorough review and extensive consultation [21], defined quality of care as 'the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge'. The IOM narrowed the goal from improving total patient welfare to improving health outcomes but moved the focus from patients to individuals and populations, thus allowing quality of care to incorporate promotion and prevention and not just cure and rehabilitation. It also added two qualifiers: 'desired (health outcomes)', to emphasize the need to consider the perspective of the recipients of the services, and consistent with current professional knowledge, to define the standard of the service.

The IOM also differed from Donabedian in the treatment of resource constraints. Donabedian's initial definition was absolutist, reflecting what was maximally feasible for the patient given current medical knowledge. Subsequently, he allowed for an individualized or socially optimal definition, incorporating the concept of value so that quality was the maximum possible for the inputs available [22]. The IOM returned to the original Donabedian definition and explicitly rejected the inclusion of resource constraints in the definition of quality on the grounds that it should not fluctuate just because resources are constrained or unavailable [23]. There have been many attempts to translate these definitions into measurable indicators and to do this, several domains of quality have been proposed (Table 3).

These dimensions include some outcomes, but mostly encompass all possible determinants of outcome (welfare or health according to Donabedian and the IOM respectively) apart from those that are biological or environmental. The multiplicity of dimensions makes it impossible to define a single measurable indicator of quality and to assess whether a component of the system is of high quality. It may well score highly on some of these indicators and badly on others. This was the same problem we faced in trying to measure health system performance and quality.

The difficulty posed by multiple dimensions and indicators has been widely recognized [31]. We believe that the solution is to apply the same definition of quality used for the system as a whole to all components, i.e. region, district, facility, provider, or intervention. This approach builds on work of people such as Williamson who tried to develop a framework for measuring outcomes at lower levels of the system [32].

Table 4 maps the dimensions of quality of care from Table 3 into the intrinsic goals of the health system of Table 1. Most of the dimensions are determinants of either level of health or responsiveness; they are instrumental rather than intrinsic goals. Access is a determinant of both the level and distribution of health. It also interacts with financial fairness so is included in that box as well. The dimensions listed in Table 3 mix outcomes and determinants of those outcomes whereas our proposed framework considers first the outcomes, searches for ways of measuring them, then for ways of improving them.

Discussion

Our framework defines quality in a consistent way at all levels of the system, in terms of the outcomes people value. The search for ways of improving quality would certainly focus on many of the instruments listed in Table 3, but in a way that is directly linked to the desired outcomes. Quality can be improved in one of two ways; through better use of existing resources or through the contribution of additional resources. In Figure 1, the two options are represented by moves from A^2 to A', or from A^2 to B^2. On the other hand, spending additional resources need not lead to improvements in quality, for example, if additional resources are devoted to harmful technologies or interventions or if a less cost-effective

mix of interventions results from the additional resources. This is depicted by a move from A' to B^2 in Figure 1.

The first step required to apply this approach to lower levels of the health system is to define the population addressed. The second is to measure levels of health attained and responsiveness of the system to patients' needs. Measuring outcomes at lower levels of the system is not trivial, in part because of the dwindling sample size at levels such as the care group or individual physician. Defining quality, the composite of health and system responsiveness poses a number of additional challenges. The first is to define the minimum of Figure 1, or the counterfactual; what would have happened to that population without the intervention, facility, or provider. For responsiveness, it would be zero. For health, it would not be. The minimum could be established by aggregating from the natural history of every possible condition for all people coming into contact with that part of the system. However, this would be computationally difficult and we are currently trying to determine alternative approaches.

The maximum also poses measurement problems. It could be defined in two ways. The micro-approach would be to aggregate information on the effectiveness of all possible actions that could be taken at that level of the system. The macro-approach would compare across facilities (or other levels of the system) in the same way as done in the previous section for countries, and would derive a maximum technologically possible frontier econometrically. WHO is currently working on defining maxima and minima for hospitals as a way of testing the applicability of the framework at lower levels of the system.

Two further questions deserve discussion. Firstly, comparing a quality index across providers (or other system levels such as hospitals and districts) raises the question of accountability. Some of the differences in outcome, perhaps those associated with different case mixes of patients, are beyond the control of the individual provider. It will be necessary to control for selected variables that are outside the influence of the component of the health system addressed in the comparisons. Secondly, the question of timing is important. Current actions of providers can effect health outcomes over the lifetime of an individual patient. The ideal outcome would be the increase in the healthy life expectancy for the population group under consideration, but this would be difficult to measure. Again, WHO is searching for ways to measure health outcomes in a way that accounts for the long-term impact of individual components of the health system.

The practical problems of measurement are considerable, perhaps one of the reasons why the quality literature has focused so much on instrumental rather than intrinsic goals. Focusing on process indicators, however, runs the risk of losing sight of the fact that processes are only important to the extent that they improve outcomes. Without outcome measurement, there is no way of being sure that the processes have the desired impact. We do not believe that these measurement problems are insurmountable and this will be the focus of ongoing work at WHO.

Table 3 Domains of quality

Indicator set	New South Wales indicator framework [24,25] Australia, 1999	National Health system indicators [24,26] UK, 1998	NLHI of the JCAHO [24,27] USA, 1999	Canberra Indicators [24,28] Australia, 1997	Global Quality Assurance Project [2] USA, 1998	Maxwell [29] Klein [3] UK, 1998	Institute of Medicine [30] USA, 2001
Domains	Safety	Health Outcomes	Appropriateness	Access	Technical competence	Effectiveness	Safety
	Effectiveness	Health improvement	Availability	Efficiency	Access to service	Efficiency	Effectiveness
	Appropriateness	Fair access	Continuity	Safety	Effectiveness	Equity	Responsiveness to patients or patient-centredness
	Consumer participation	Effective delivery of appropriate health care	Effectiveness	Effectiveness	Interpersonal relations	Access	Timeliness
	Access	Efficiency	Prevention/early detection	Acceptability	Efficiency	Acceptability	Efficiency
	Cross dimensional	Patient/carer experience	Respect and caring	Continuity	Continuity	Appropriateness	Equity
			Safety	Technical proficiency	Safety	Respect	
			Timeliness	Appropriateness	Amenities	Choice	
						Availability of information	
						Technical competence	

JCAHO, Joint Commission on Accreditation of Healthcare Organizations; NLHI, National Library of Healthcare Indicators.

Table 4 Mapping of domains of quality to health system goals

Goal	Level (Quality)	Distribution (Equity)
Health	Health outcomes/improvement Technical quality/proficiency/competence Appropriateness Effectiveness Safety Timeliness Prevention/early detection Access/availability/continuity	Access/availabilty/continuity
Responsiveness	Consumer participation/choice Patient/carer experience Acceptability Respect and caring Availability of information Timeliness	
Fair financing		Affordability Access/availability/continuity

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