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## REVIEW ARTICLE

# Time to have a paradigm shift in health care quality measurement

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Quality measurement is important to stakeholders in providing valid information for improvement, and has been associated with hospital accreditation in most countries. The commonly used categories of indicators are structure, process, and outcome. Outcome indicators are of foremost importance as they reflect the effect of health care; structure indicators are commonly used for assessing capacities or facilities available for providing services, whereas process indicators assess how well the service is delivered, and provide essential and important information for quality improvement. For a process indicator to be valid, it should be linked to an outcome, whereas a structure indicator must be linked to a better outcome. Although there are no strict rules for usage or selection of indicators, it is important to ensure adequate coverage of relevant domains of the health care services intended to be evaluated. Because the trends in health care services and management are changing, it is time to have a paradigm shift in health care quality measurement. Although evaluating the quality had also been extended to include quality of life and patient satisfaction, the ultimate aim of health care services should be “staying healthy, getting healthy, and living healthy”. It is important for physicians to learn how to use these clinical indicators for improving service performance and organizational growth.

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**Introduction**

It has been said, “No measurement, no management.”<sup>1</sup> Comprehensive and well-designed data management is important for organization leaders, customers, and

regulatory officers in providing trustworthy information for quality improvement.<sup>2–4</sup> In the United States, the Joint Commission (JC) began its development of performance measurements in 1986<sup>5</sup>; later on, the JC initiated a so-called Hospital Core Measure Pilot Project in

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1999–2001.<sup>6,7</sup> The project aimed to develop, for major diseases or modes of service, a set of indicators, which when evaluated together can provide a robust assessment of the quality of care in a specialized area of health care facilities.<sup>8–10</sup>

In Taiwan, accreditation for teaching hospitals was started in accordance with the guidelines recommended by the Department of Health (DOH) and the Ministry of Education in 1978,<sup>11</sup> and since 1988 all hospitals were required to be accredited by the DOH. In 1999, the Taiwan Joint Commission on Hospital Accreditation (TJCHA), founded by the DOH, was established to take responsibility for hospital accreditations.<sup>11,12</sup> The TJCHA also aimed to promote patient-safety culture and quality management, and therefore, the TJCHA launched the Taiwan Quality Indicator Project system<sup>13</sup> to benchmark and assess health care performance among various hospitals in Taiwan.<sup>13,14</sup>

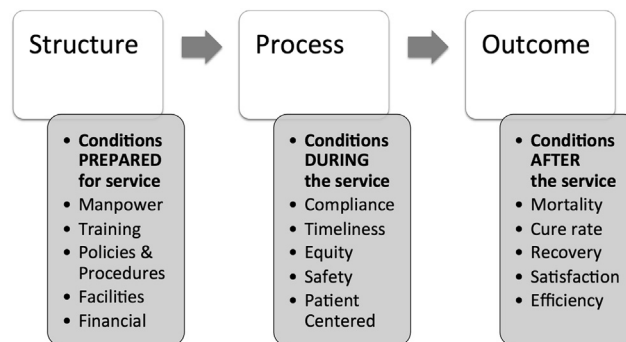
Because improvements are data driven, and modern medicine is a growing complex and could be delivered by cross-departmental teams, institutional leaders require quality indicators to measure a team’s performance.<sup>2,3,7,14–16</sup> The objective of this paper is to provide a brief review of categories and characteristics of clinical indicators for measuring quality in health care systems. Because the Taiwanese health care system accelerated its reform under the current insurance policies<sup>14</sup> or to match trends worldwide,<sup>8,10,16</sup> in the second part of this article we will describe the focus shifting of these indicators in order to cope with future needs. In this work, we would like to show you why it is time to have a paradigm shift in health care quality measurement.

### Category of quality indicators

In order to document or compare how health care services are delivered among individual hospitals, it is necessary to implement or develop different categories of quality indicators.<sup>2,3</sup> Through these indicators, we may have a more comprehensive view of how these health care services were provided, what kinds of resources and procedures were allocated, and the relationships linking hospital performance to patients or outcome of diseases.<sup>2,4,17–19</sup> The commonly used categories for classification of performance indicators are structure, process, and outcome.<sup>2,20–22</sup> A simple demonstration of the road map for choosing different domains of quality indicators is depicted in Fig. 1. Different types of indicators can be used either independently or in combination as a bundle for special situations to objectively measure staff performance or outcome for a given purpose. Examples of different types of indicators are shown in Table 1.

#### Structure

Structure indicators are most commonly used for assessing capacities or facilities available for providing a given type of health care service.<sup>14,22</sup> In hospital accreditations, these indicators usually mean whether the specific accredited hospital has the necessary equipment, program, technology, supplies, or staff to deliver related services.<sup>14,17,18,23,24</sup>



**Figure 1** Road map for selection of indicators based on factors that might contribute to different domains of measurement for the quality of health care during the whole process of service.

Structure indicators seem to be more appealing, as they are clearly defined and easy to collect or evaluate; in addition, surveys/questionnaires to evaluate structure indicators are usually in a yes/no pattern.

#### Process

Unlike structure indicators, process indicators are used for assessing how well a given health care service was

**Table 1** Examples of different types of quality indicators.

Indicator type	Example
Structure	Number of board-certified physicians
	Nurse/bed ratio
	Percentage of full-time attending physicians
Process	Average year of experience at work for staff
	Average hospital days for inpatients
	Surgical operation numbers
	Bed-occupation rate for inpatient service
	Rate of thrombolytic therapy for acute ischemic stroke patients
	Rate of coronary intervention for acute myocardial infarction
	Adequate timing for prophylactic antibiotics before surgery
Rate of admission via emergency department	
Outcome	Completion rate of discharge summary
	Mortality rate for all inpatients
	Mortality rate for the intensive care unit patients
	Surgical mortality
	Readmission within 14 d after discharge for inpatients
	Return to the intensive care unit within 48 h
	Revisit the emergency department 72 h after leaving
	Hospital-acquired infection rate
	Incident report numbers
	Adverse drug reaction numbers
Satisfaction of the patients	

delivered. It provides essential and important information for quality improvement.<sup>14,23,24</sup> However, the most time-consuming and difficult area during quality measurement is that not all actions of the process are written down or recorded. Some information about certain health care services relies on simultaneous observations or needs manual abstraction retrospectively.<sup>25–27</sup> For example, to reduce drug-dispensing error at an outpatient pharmacy, we need to check the related processes prior to and during drug dispensing to patients.<sup>28,29</sup> In addition, we also need to review the drug-dispensing scene at the pharmacy, in combination with an on-site interview with staff, or even using live recordings. For instance, to improve the performance of an in-hospital rapid response team, we might use these management tools for data collection.<sup>30–32</sup>

Because of the increasingly popular methods used for electronic collection of medical records in Taiwan and in various countries worldwide, it is now much easier to measure in advance what is actually done at a health care service, by transforming activities carried out for data collection into a set of process indicators.<sup>16,26,27</sup>

## Outcome

Outcome indicators are given primary importance, as they reflect the effect of health care or therapy.<sup>33</sup> Outcome indicators also reflect the validity of process defined, or the adequacy of structure designed.<sup>34</sup> For a process indicator to be valid, it should be linked to an outcome effect. For a structure indicator to be adequately defined, it must be linked to a better outcome.<sup>20</sup> The most commonly used outcome indicators are mortality and morbidities. However, multiple factors may also contribute to patient outcome as well as the results or effectiveness of a certain therapy.<sup>35,36</sup> Therefore, before comparing outcome indicators across different hospitals or health care institutes, we need to control potential confounding factors using risk adjustment or other suitable statistical methods.<sup>33,37,38</sup>

Recently, the definitions of outcome had been extended to include quality of life (QOL)<sup>39–42</sup> and patient satisfaction.<sup>43,44</sup>

## Usage of quality indicators

There are no general rules about the usage or selections of indicators. The most important point is to ensure adequate coverage of relevant domains of the health care services that you intend to evaluate.<sup>45,46</sup> A simplified and reasonable approach is to divide further the purpose of measurement into three dimensions. First, we should assess the “outcome” of the service, that is, what is the effect and impact of the service? Second, we might want to know how the services were provided. That is what “process indicators” are for. Third, whether we are concerned about the sustainability of a similar performance for other or future patients? We can then assess what resources were used for the related service and whether they fit into the characteristics of “structure indicators”.

Regardless of what indicators were selected or chosen, the feasibility and validity of indicators are the most fundamental and essential components.<sup>15,26,27</sup> Besides, indicator validity

and reliability are two crucial aspects of clinical measurement.<sup>47</sup> Sometimes we should also consider the frequency and reporting burden. We should better know in advance whether the cost of data collection and reporting outweigh the value of the measurement for obtaining information.

### Example 1: Quality indicators for thrombolytic therapy in acute ischemic stroke

To improve the quality of care and outcome of patient with acute ischemic stroke presenting at the emergency department, the multidisciplinary team for treatment of acute stroke at the National Taiwan University Hospital, Taipei, Taiwan established a stroke protocol based on the Taiwan Guidelines for the Management of Acute Stroke 2008, proposed by the Taiwan Stroke Society.<sup>48,49</sup> For evaluating staff performance and for continued quality improvement, we use quality indicators for measuring this critical service. We selected indicators for screening, diagnosis, treatment, and follow-up implementation of this guideline. Table 2 illustrates the categories of indicators and rationale of indicators chosen for measuring acute stroke thrombolytic therapy service. Through a series of improvement actions, we established process–outcome indicators for this implementation. We also found that process indicators are especially useful if improvement is the goal and an explanation is sought as to why the expected outcomes could or could not be achieved.

### Example 2: Care for pediatric patients with newly diagnosed asthma

Quality assessment of asthma care for evaluating staff performance had been tested elsewhere.<sup>50</sup> To improve service of asthma care in pediatric patients, we implemented the Global Initiative for Asthma guidelines for the management of chronic asthma in children. Again, we selected indicators for screening, diagnosis, treatment, and follow-up implementation of this guideline. Table 3 illustrates the categories of indicators and rationale of indicators chosen for pediatric asthma patients.

To summarize our recommendations on the selection and usage of indicators, there are three points. First, outcome indicators may be sufficient for measuring total effect, but they should be linked to process indicators, which can identify improvement areas in order to make the delivery of health care services better. Second, revised or redesigned organizational structure or processes nearly always promise better outcomes. The relationship between structure–process–outcome should be evidence based, and needs to be demonstrated through continued actions on quality improvement for sustainability. The third and the final point is to rethink the cost and effectiveness of such a measurement.

## Paradigm shift of quality indicators in health care

The future of health care services and their management is changing.<sup>16</sup> Over the past decades, the health care services had witnessed a vast variety of quality improvement

**Table 2** Examples of quality indicators for measuring acute stroke thrombolytic therapy service.

Name of the indicator	Indicator type	Definition
Stroke screening tool use	Structure	Validated tool used to screen for stroke by ambulance staff in patients with neurological symptoms.
Brain CT within 25 min after arrival	Process	<i>Numerator:</i> Number of patients with brain CT performed within 25 min after arrival at ER. <i>Denominator:</i> Number of patients with stroke who arrive at ER within 3 h of symptom onset.
Rate of door-to-needle time <60 min	Process	<i>Numerator:</i> Number of ischemic stroke patients who receive thrombolytic therapy within 60 min after arrival at ER. <i>Denominator:</i> Number of patients with ischemic stroke who receive thrombolytic therapy.
Rate of thrombolytic therapy of ischemic stroke patients	Process	<i>Numerator:</i> Number of patients who receive thrombolytic therapy. <i>Denominator:</i> Number of ischemic stroke patients who come to the hospital within 10 d of symptom onset.
Symptomatic intracranial hemorrhage after thrombolytic therapy	Outcome	<i>Numerator:</i> Number of patients who developed intracranial hemorrhage with increase of NIHSS score for more than 2 points within 36 h after thrombolytic therapy. <i>Denominator:</i> Number of ischemic stroke patients who receive thrombolytic therapy.
Rate of minimal sequelae after thrombolytic therapy	Outcome	<i>Numerator:</i> Number of patients with Modified Rankin Scale 0–1 3 mo after thrombolytic therapy. <i>Denominator:</i> Number of ischemic stroke patients who receive thrombolytic therapy.

CT = computed tomography; ER = emergency room; NIHSS = National Institutes of Health Stroke Scale.

activities. In a number of instances, there are some novelties that contribute to changes in fundamental viewpoints in the health care system. For example, the advocating for patient safety was one of the changes that significantly

altered our view on patient management.<sup>51,52</sup> Another evolutionary change is to apply the management of quality indicators in evaluating the efficiency of a patient-centered care.<sup>53,54</sup> In addition, the widespread use of information

**Table 3** Examples of quality indicators for caring for pediatric asthma patients.

Name of indicator	Indicator type	Definition
Nurses trained for asthma education and monitoring	Structure	Presence of dedicated nurses trained for education and monitoring of patients referred for asthma care.
Completion rate of initial assessment of asthma	Process	<i>Numerator:</i> Number of patients with documentation of asthma control status in the electronic medical records. <i>Denominator:</i> Number of newly included patients with bronchial asthma.
Completion rate of chest auscultation	Process	<i>Numerator:</i> Number of patients with documentation of breathing sounds in the electronic medical records. <i>Denominator:</i> Number of newly included patients with bronchial asthma.
Patient education rate for asthma	Process	<i>Numerator:</i> Number of patients with documentation of education for asthma care in the electronic medical records. <i>Denominator:</i> Number of newly included patients with bronchial asthma.
Rate of adherence to follow-up appointment	Process	<i>Numerator:</i> Number of patients who return to the appointed clinic within 3 mo. <i>Denominator:</i> Number of included patients with bronchial asthma.
Rate of good asthma control	Outcome	<i>Numerator:</i> Number of patients with Asthma Control Test score >20 upon the first follow-up visit. <i>Denominator:</i> Number of newly included patients with bronchial asthma.
Rate of visit to the ER	Outcome	<i>Numerator:</i> Number of visits to the ER due to exacerbation of bronchial asthma. <i>Denominator:</i> Number of all included patients.

ER = emergency room.

technology in managing and sharing the health care data has also significantly contributed to changing the shape of the health care practice.<sup>55,56</sup> These changes and new applications might contribute to the so-called paradigm shift in the health care philosophy and system,<sup>57</sup> which essentially depicted a revolution that “one conceptual world view is replaced by another”.<sup>57</sup>

To cope with the rapid emergence of new models of clinical services, it is time to consider a paradigm shift in quality measurement of health care services. For example, patients or payers may need to know how to measure or make comparison across medical cosmetology centers, or to evaluate the cost and efficiency of robotic surgery (the da Vinci Surgical System). Both fields have become popular worldwide in the recent decade. The ultimate aim of a health care service should be staying healthy, getting healthy, and living healthy. Therefore, the interest and focus of payers and policy makers are likely to have a paradigm shift from disease therapy to disease prevention, or further to health promotion. In addition to these fields or new applications, other new dimensions, such as patient satisfaction,<sup>43,44,58</sup> patient experience data,<sup>59–63</sup> or QOL, are attracting more attention of epidemiologists and health care service providers. Recently, an analysis of outcomes reported in high-impact surgical journals demonstrated the emerging needs.<sup>64</sup> Of the 770 articles analyzed in the report, only 36% had reports for symptom outcomes, 13.4% for functional status outcomes, 10.6% for general health status outcome, and 14.8% for overall QOL as outcomes. These were in contrast to the 91.6% reporting for biological and physiological outcomes, which underscored the need for the applicability of the measures.<sup>64</sup> From the quality point of view, these findings might also suggest an emerging need for a paradigm shift toward patient-centered measurements. The advocating for patient-reported outcomes by the U.S. Food and Drug Administration<sup>65</sup> and a recent report from the Consolidated Standards of Reporting Trials<sup>66</sup> also provide an example of current thinking. The traditional concept about structure, process, or outcome indicators may need to be revised and extended further with regard to the current thinking.

## Conclusion

Data on clinical indicators are of interest to clinicians, organizational providers, and patients as they can be used to achieve improvements in health care and to understand areas that can be improved. In general, outcome data are of the greatest benefit as they directly reflect the effectiveness of diagnostic or therapeutic actions. However, the health care providers need more detailed information to understand how the health care services are delivered. It can be accomplished by applying process and structure indicators for measurement.

To fit real patient perceptions, a new category of quality indicators are evolving, such as the indicators for patient satisfaction, QOL, or those for measuring huge amounts of data in the field of public health issues or for the interest of epidemiologists. It is important that physicians learn to use these clinical indicators for self-improvement in service performance and for organizational growth.

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