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Development and implementation of a nationwide health care quality indicator system in Taiwan

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Abstract

Quality issues. Quality is an increasingly important issue to the health care sector. The Taiwanese government also recognizes the need to implement a nationwide health care quality indicator system to strengthen quality surveillance.

Choice of solution. In 1999, the Department of Health funded a 2-year project led by the Taiwan Healthcare Executive College to develop a comprehensive performance assessment system, subsequently named as Taiwan Healthcare Indicator Series (THIS). The series includes four categories of indicators, namely outpatient, in-patient, emergency care, and intensive care, and has 139 items in total.

Implementation. The system was officially launched in 2001. Participation is voluntary. The Taiwan Healthcare Executive College processes the data and provides feedback to the participating hospitals. The information is for the participating hospitals' own use and is not released to the public.

Evaluation. Participating hospitals have increased from 45 in 2001 to 227 in 2006 and now constitute ~50% of the total hospital population in Taiwan. The reporting rate averaged 77.7% in 2004. The first five most reported indicators are the percentage of first-visit outpatients to outpatient clinics, the average length of in-patient stay, the nosocomial infection rate, the occupancy rate, and the crude mortality rate.

Lessons learned. How the data are interpreted and how data interpretation can lead to quality improvement are the principal concerns of participating hospitals. In light of the success of the indicator series, the Bureau of National Health Insurance (BNHI) of Taiwan has proposed participation in the series as being one of the criteria to be reimbursed for quality.

Keywords: health care indicator, performance assessment, quality

Quality issues

Quality is an increasingly important issue to the health care sector. Health care professionals around the world apply all sorts of methods to improve the quality of care delivery. The tools range from the very sophisticated to simpler ones. Nonetheless, the aims of all of these efforts are to increase the benefits to patients. Although most of these kinds of efforts stem from health care providers' own initiatives, those from governments and third-party payers certainly play a pivotal role in promoting improvements in quality of care.

Similar to its counterparts around the world, Taiwan's health care sector continually strives to improve quality by various means. Total quality management began to take root in Taiwan's health care industry in the 1990s. Over time, the Department of Health has undertaken several initiatives to facilitate the trend, such as the critical path and quality control circle. In 1997, the ORYX initiative of the US Joint Commission on Accreditation of Healthcare Organizations caught the eye of the Taiwanese authorities. The US Joint Commission's ORYX initiative integrates outcomes and other performance measurement data into the accreditation process, and on 1 July 2002, accredited hospitals began collecting data on core performance measures [1].

Health care indicators can be used as a mechanism of benchmarking. For instance, the Quality Indicator Project, one of the leading quality indicator systems in the United States nowadays [2], was initiated in 1985 by a group of seven member hospitals of the Maryland Hospital Association to share data on 10 in-patient care indicators to objectively ascertain their institutional profiles [3]. Recent developments in Europe are also worth noting. The World Health Organization

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Regional Office for Europe launched a performance assessment tool for quality improvement in hospitals in 2003, which aims for a comprehensive assessment of hospital performance [4]. This European initiative identified six dimensions for assessing hospital performance, namely clinical effectiveness, safety, patient centeredness, production efficiency, staff orientation, and responsive governance, and pilot programs are currently being implemented in eight countries to refine its framework.

Choice of solution

Taiwan's Department of Health realizes the importance of quality indicators and has long been thinking of the possibility of establishing a nationwide indicator system to simultaneously monitor and help improve health care quality. Although the Taiwan Joint Commission on Hospital Accreditation became the local sponsor of the Quality Indicator Project in 1999 [5], the Department of Health still aims to establish an indigenous health care quality indicator system that caters to the needs of local hospitals. The need for a local system can be exemplified by the UK experience as well. Although the Quality Indicator Project was begun in the United Kingdom in 1992, the UK Department of Health subsequently developed its own performance management indicators for National Health Services hospitals [6]. In the same year in which the Quality Indicator Project was inaugurated in Taiwan, the Department of Health funded the Taiwan College of Healthcare Executives to develop a health care indicator system, which was subsequently named the Taiwan Healthcare Indicator Series (THIS).

During the research and development stage, the college gathered local experts, including physicians, nurses, pharmacists, health care administrators, epidemiologists, and so on, from diverse sectors to select and modify indicators in terms of the validity, reliability, and local context. The college also stressed the importance of clinician participation throughout the process because indicators have to be practical to be useful. The quality indicator system was designed in line with Donabedian's structure, process, and outcome definitions [7] and classified according to hospital functions, primarily encompassing acute care functions at present. The series includes four categories of indicators, namely outpatient ($n = 17$), emergency ($n = 40$), in-patient ($n = 56$), and intensive care ($n = 26$), and has 139 items in total (Appendix). The recent trend in the development of performance measures is tilted toward outcome and process measurements rather than structural measurements. For instance, one of the performance measurement system requirements for the US ORYX listing in each performance measure is a defined process or outcome measure [8]. In keeping with this trend, we tried to design the indicators to be more process- and outcome-oriented rather than structure-oriented with only one exception in the outpatient category, which still has slightly more structural indicators (Appendix).

Although it is debatable as to how one can best classify quality indicators, Donabedian's original article enunciating this quality assessment classification is one of the most cited [9] and is said to have influenced the quality assessment/quality assurance movement of the 1970s, the total quality management of the 1980s, and the more recent performance measurement initiatives, such as HEDIS, ORXY, and CONQUEST in the United States [10]. Therefore, adopting this trilogy in our system became the consensus of our local experts.

Implementation

After 2 years of research and development, THIS was officially launched in 2001. Participation is voluntary. Participating hospitals can choose whichever indictors they feel are suitable for their own settings and report them to the Taiwan College of Healthcare Executives monthly via a web-based interface. The college processes the data, provides feedback to them, and is responsible for the statistical analyses by applying the overall data or the data of subgroups, according to ownership, accreditation level, and so on. Participating hospitals learn the statistical distributions of all indicators, including the mean, standard deviation, range, percentile, and so on. The information derived from the database is for participating hospitals' own uses and is not yet meant to be released to the general public. Hospitals are allowed to publicize their participation in the system, but not the results.

Participation is not free but quite affordable. Hospitals have to pay annual fees ranging from US$300 to US$2000 according to the accreditation level. The Taiwan College of Healthcare Executives regularly holds workshops and user group meetings to help member hospitals implement the system and initiate quality improvements. In its annual user group meetings, the college encourages member hospitals to submit their actions that resulted from implementing this system for a poster competition. The number of submissions increased from 44 at the third annual user group meeting to 182 at the fourth meeting.

Evaluation

Participating hospitals increased from 45 in 2001 to 227 in 2006 and constitute ~50% of the total hospital population in Taiwan. Of these 227 institutions, 8 are medical centers, 53 are regional hospitals, 33 are district teaching hospitals, and 133 are district hospitals. According to Taiwan's *Medical Care Act* and its implementing regulations, hospitals have to be accredited and, according to the results, are assigned as a medical center, regional, district teaching, or district hospital [11]. Most medical centers and regional hospitals are teaching hospitals at the same time. Medical centers are supposed to be tertiary care hospitals, whereas regional hospitals are secondary care hospitals, and district teaching and district hospitals are responsible for primary care. Medical centers are generally larger hospitals in terms of bed number, whereas district hospitals are likely smaller. Although most of the member hospitals are district hospitals, district teaching hospitals are generally more interested in joining our system in terms of the percentage of the same accreditation level at 89.2%, followed by regional hospitals at 75.7% (Table 1).

Table I Distribution of participating hospitals according to accreditation level

Type of hospital by accreditation level	Number of hospitals	Number of participating hospitals	Percentage of the same accreditation level
Medical centers	17	8	47.1
Regional hospitals	70	53	75.7
District teaching hospitals	37	33	89.2
District hospital	338	133	39.3
Total	462	227	49.1

Till 10 March 2006.

Not every hospital that signs up with the series reports its data regularly. The reporting rate is 100% for medical centers, 94.8% for regional hospitals, 75.8% for district teaching hospitals, and 70.2% for district hospitals, with an overall average of 77.7% in 2004. The range of reported items varied from 3 to 123. It appears that hospitals that are more teaching-oriented and tertiary care-oriented are more likely to report data. Twenty-seven of the indicators were reported by >60% of the participating hospitals in the fourth quarter of 2004. The first five most reported indicators were the percentage of first-visit outpatients to outpatient clinics, the average length of in-patient stay, the nosocomial infection rate, the occupancy rate, and the crude mortality rate (Table 2).

The college conducted a survey in 2002 to assess how member hospitals reacted to and implemented THIS. Of the respondents, 65.6% thought the leadership of their hospitals supported the implementation of the indicator system. Administrative departments are in charge of data collection in 52.7% of the hospitals, as opposed to medical departments being in charge in 32.4%. The data collection process is mostly done semiautomatically (87.7%), whereas 9.6% is done manually and 2.7% totally by computer [12]. It appears that the data collecting processes are still very labor intensive, and this might contribute to the fact that there are low reporting rates for a substantial portion of our indicators.

Lessons learned

Data interpretation and quality improvement

After 5 years, the indicator system's database has accumulated a significant amount of information that can be analyzed to improve the delivery of services. How the data are interpreted and how data interpretation can lead to quality improvement are the principal concerns of participating hospitals. For instance, the Cesarean section rate of participating hospitals averaged 32% in 2004, which is similar to the national average of 33% [13]. Apart from first timers, the repeat Cesarean section rates ranged from 72.2 to 90.7% in 2004. Unavoidably, hospitals ask how such data should be interpreted. Do they need to decrease or increase the rate?

The same confusion arose in 2002 in the United States as well, when the US Joint Commission designated the rate of vaginal births after a prior cesarean section as one of the core measures of pregnancy care. The average cesarean section rate in the United States was ~20% from 1981 to 1997, whereas the rate of successful vaginal births after a prior cesarean section delivery rose from 3 to 27.4%. However, owing to the possibility of increased uterine rupture, the American College of Obstetricians and Gynecologists revised standards to subsequently restrict vaginal births after a prior cesarean section attempts to patients with only one or two prior cesarean deliveries. The trend has decreased since 1997. Therefore, the US Joint Commission declared that vaginal birth after a prior cesarean section rate was configured as a neutral measure and that it did not intend to promote vaginal birth after a prior cesarean section [14].

Similar to the US Joint Commission's intentions, our indicator series was configured to contain neutral measures as well. Most of the health care indicator systems are designed along two distinct dimensions: measurement and evaluation; measurement is value-free, whereas evaluation is value-laden [15]. There is no predetermined threshold value for any given indicator of this system. The interpretation of the measurement results is therefore customized. Hospitals can look at their own data in comparison with their peers to determine whether there is a need to improve their care delivery. Furthermore, one should not readily make value judgments without carefully scrutinizing each hospital's particular situation.

The college's hope is that the adoption of a quality indicator system will lead to improvements in individual hospitals. Therefore, the effect of quality improvement can demonstrate itself at two levels: the individual hospital level and the aggregate level. It has been demonstrated that the scope of quality improvement implementation in hospitals is significantly associated with hospital-level quality indicators [16]. Likewise, there were notable efforts within the participating hospitals, and the college, as the sponsor, does not intervene. Hospitals share their own experiences in communications and user group meetings. Fortunately, the college has also noted a few changes in trends at the aggregate level over the years. For instance, the 3-year average of nosocomial infection rate is at 3% for all participating and reporting hospitals. In comparison with other countries' relevant rates, for instance, the point prevalence rate in Thailand's hospitals in 2001 was 6.4% [17], and it was 12% in Auckland in the 1990s [18]; so, our hospitals' performance is quite acceptable as a

Table 2 Reporting frequencies of selected indicators in the fourth quarter of 2004

Number	Category	Indicator name	Reporting frequency (%)
1	Outpatient	The percentage of first-visit outpatients to outpatient clinics	88.8
2	In-patient	The average length of stay of in-patients	84.9
3	In-patient	The nosocomial infection rate	83.8
4	In-patient	The occupancy rate	83.2
5	In-patient	The crude mortality rate	81.6
6	In-patient	The readmission rate within 14 days of discharge for in-patients	81.0
7	In-patient	The physician/bed ratio	75.4
8	In-patient	The in-patient turnover rate	74.3
9	Outpatient	The average weekly outpatient clinic numbers of each attending physician	74.3
10	Outpatient	The in-patient admission rate of outpatients	73.7
11	In-patient	The nurse/bed ratio	73.2
12	Outpatient	The percentage of full-time attending physicians of outpatient clinics	72.1
13	In-patient	The incidence of falls of in-patients	71.5
14	Emergency	The transfer-out rate of the emergency room	71.0
15	Outpatient	The percentage of outpatient clinics with >60 patients	70.4
16	In-patient	The attending physician/bed ratio	69.8
17	Outpatient	The percentage of part-time attending physicians of outpatient clinics	69.3
18	Emergency	The percentage of in-patients admitted from the emergency room	66.5
19	In-patient	The rate of in-patient length of stay exceeding 30 days	66.5
20	Outpatient	The percentage of specialists of attending physicians of outpatient clinics	65.9
21	In-patient	The incidence of pressure sores of in-patients	65.4
22	In-patient	The incidence of needle sticks for all staff	65.4
23	Outpatient	The average number of patients in the outpatient clinic for each attending physician	64.8
24	In-patient	The paramedic/bed ratio	63.1
25	Outpatient	The average number of patients in the outpatient clinic for each full-time attending physician	62.6
26	Emergency	The percentage of in-patients admitted from the emergency room	62.0
27	In-patient	The administrative staff/bed ratio	61.5

Only those exceeding 60% are listed.

whole, although this comparison is probably not justified on account of variations of definitions across studies. There appears to be a downward trend in the overall nosocomial infection rate from 2003 to 2005 (Figure 1). District hospitals seemed to have contributed the largest share of improvement, from an average of 4.1% in the first quarter of 2003 to 1.4% by the end of 2005. What prompted this change remains to be ascertained. The best scenario is that district hospitals might have benchmarked with other levels of hospitals to improve their infection-control measures after joining the indicator system. However, the college is cautious in interpreting these self-reported data. Underreporting whether intentionally or unintentionally is a major limitation. There are also many other confounding factors [such as the Severe Acute Respiratory Syndrome (SARS) epidemic] that might have caused this phenomenon, and further studies are warranted.

The recognition of national health insurance

Taiwan adopted a national health insurance system in 1995. Pursuant to the *National Health Insurance Act* [19] and associated regulations, the government established the Bureau of National Health Insurance (BNHI), and all citizens were required to be insured by and pay premiums to the Bureau, which is responsible for the management of premiums and has become the single purchaser in Taiwan's health care market. Starting from 2005, 0.155% of the annual total reimbursement budget was to go to the pay-for-performance initiative; in light of the success of the indicator series, the BNHI has proposed participating in our series as being one of the criteria to be reimbursed for quality [20]. In fact, owing to expectations of moving in this direction, the number of our participating hospitals surged from 138 to 247 in 2004.

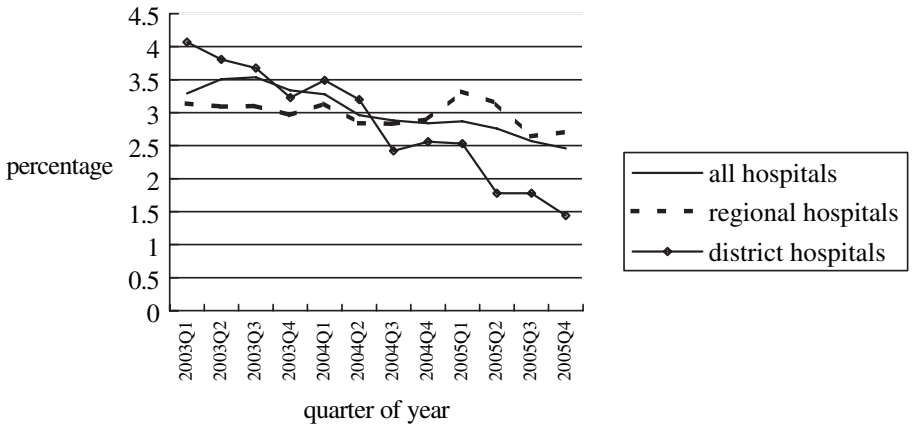

Figure 1 Trends of quarterly average percentage distribution of nosocomial infection rates of participating hospitals since 2003.

Conclusions

THIS has become the largest health care quality indicator system in Taiwan. The Taiwan College of Healthcare Executives instilled unique elements of National Health Insurance and local culture into an international consensus in the field of performance measurement. After 5 years, the indicator series has been used and analysed among various levels of hospitals. Although this system has proved its utility in Taiwan's acute care settings, the college's immediate goals are to facilitate Taiwan's hospitals benchmarking internationally with other world-renowned systems, such as the US ORYX initiative and the performance indicators of the Australian Council on Healthcare Standards, and to expand the applications of our series to other health care settings, such as psychiatric care and long-term care.

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Appendix: Distribution of indicators according to functional department and Donabedian's stratification

Category	Donabedian's stratification	Number	Indicator
Outpatient (n = 17)	Structure	1	The percentage of full-time attending physicians in outpatient clinics
		2	The percentage of part-time attending physicians in outpatient clinics
		3	The average weekly outpatient clinic numbers of each attending physician
		4	The average number of patients in the outpatient clinic for each attending physician
		5	The average number of patients in the outpatient clinic for each full-time attending physician
		6	The average number of patients in the outpatient clinic for each part-time attending physician
		7	The percentage of outpatient clinics with >60 patients
		8	The percentage of first-visit outpatients to outpatient clinics
		9	The percentage of specialists of attending physicians of outpatient clinics
	Process	1	The in-patient admission rate
		2	The cancellation rate of ambulatory operations by patients
		3	The cancellation rate of ambulatory operations by the hospital
		4	The cancellation rate of ambulatory examinations by patients
		5	The cancellation rate of ambulatory examinations by the hospital
	Outcome	1	The rate of prescription errors for outpatients by physicians
		2	The rate of dispensing errors for outpatients by the pharmacy
		3	The satisfaction rate of outpatients
Emergency (n = 40)	Structure	1	The percentage of emergency medicine specialists of emergency room attending physicians
		2	The percentage of resident physicians of emergency room physicians
		3	The average length of each shift for emergency medicine specialists
	Process	1	The percentage of category I patients of emergency patients
		2	The percentage of category II patients of emergency patients
		3	The percentage of category III patients of emergency patients
		4	The percentage of category IV patients of emergency patients
		5	The transfer-out rate
		6	The rate of observation of <24 h
		7	The rate of observation within 24–48 h
		8	The rate of observation within 48–72 h
		9	The rate of observation exceeding 72 h
		10	The consultation rate
		11	The rate of late in responding to consultations
		12	The rate of emergency room stays of <2 h
		13	The rate of emergency room stays of 2–4 h
		14	The rate of emergency room stays of 4–6 h
		15	The rate of emergency room stays exceeding 6 h
		16	The in-patient admission rate to wards
		17	The in-patient admission rate to intensive care units
		18	The average waiting time in the emergency room
		19	The average waiting time for emergency room examinations
		20	The average waiting time for emergency room laboratory reports
		21	The rate of waiting times exceeding 30 min for operations

continued

Appendix *continued*

Category	Donabedian's stratification	Number	Indicator
	Outcome	1	The percentage of in-patients admitted from the emergency room
		2	The cardiopulmonary resuscitation rate
		3	The revival rate of dead-on-arrival patients
		4	The mortality rate
		5	The rate of unexpected returns within 24 h
		6	The rate of unexpected returns within 48 h
		7	The rate of unexpected returns within 72 h
		8	The rate of in-patient admissions from unexpected returns within 24 h
		9	The rate of in-patient admissions from unexpected returns within 48 h
		10	The rate of in-patient admissions from unexpected returns within 72 h
		11	The incidence of accidents and adverse event injuries
		12	The incidence of falls
		13	The incidence of blood transfusion errors
		14	The rate of emergency room prescription errors by physicians
		15	The rate of emergency room dispensing errors by the pharmacy
		16	The satisfaction rate of emergency patients
In-patient (n = 56)	Structure	1	The physician/bed ratio
		2	The resident physician/bed ratio
		3	The attending physician/bed ratio
		4	The nurse/bed ratio
		5	The paramedic/bed ratio
		6	The administrative staff/bed ratio
	Process	1	The nosocomial infection rate
		2	The rate of transfer to intensive care units
		3	The cancellation rate of in-patient operations
		4	The surgical wound infection rate for cesarean sections
		5	The surgical wound infection rate for uterine myomectomies
		6	The surgical wound infection rate for appendectomies
		7	The surgical wound infection rate for inguinal hernias
		8	The surgical wound infection rate for prostatectomies
		9	The surgical wound infection rate for cardiac catheterization
		10	The rate of surgical prophylaxis 2 h before surgery
		11	The rate of surgical prophylaxis for 3 days after surgery
		12	The rate of surgical prophylaxis for 4–7 days after surgery
		13	The rate of surgical prophylaxis for >7 days after surgery
		14	The consultation rate
		15	The rate of late in responding to consultations
		16	The rate of consistency of the clinical diagnosis and pathological diagnosis
		17	The rate of similarity of the clinical diagnosis and pathological diagnosis
		18	The rate of incompatibility of the clinical diagnosis and pathological diagnosis
		19	The autopsy rate
	Outcome	1	The occupancy rate
		2	The turnover rate
		3	The average length of stay
		4	The readmission rate within 14 days of discharge
		5	The readmission rate within 15–29 days of discharge
		6	The readmission rate within 30 days of discharge

continued

Appendix *continued*

Category	Donabedian's stratification	Number	Indicator
		7	The rate of length of stay exceeding 30 days
		8	The crude mortality rate
		9	The mortality rate for in-patients <44 years old
		10	The mortality rate for in-patients between 45 and 64 years old
		11	The mortality rate for in-patients >65 years old
		12	The discharge against medical advice rate
		13	The medication error rate
		14	The unexpected reoperation rate
		15	The rate of post-operative mortality within 24 h
		16	The rate of post-operative mortality within 48 h
		17	The recovery room reintubation rate
		18	The mortality rate for delivery
		19	The cesarean section rate
		20	The repeat cesarean section rate
		21	The rate of vaginal birth after a prior cesarean section
		22	The neonatal mortality rate
		23	The rate of newborns transferred in
		24	The perinatal mortality rate
		25	The newborn readmission rate within 14 days of discharge
		26	The incidence of pressure sores
		27	The rate of nursing medication errors
		28	The incidence of falls
		29	The incidence of blood transfusion errors
		30	The incidence of needle sticks for all staff
		31	The satisfaction rate of in-patients
Intensive care (n = 26)	Structure	1	The full-time attending physician/bed ratio
		2	The full-time resident physician/bed ratio
		3	The full-time nurse/bed ratio
		4	The full-time respiratory therapist/bed ratio
		5	The ventilator/bed ratio
		6	The percentage of intensive care unit staff completing advanced cardiac life support training
		7	The percentage of pediatric intensive care unit staff completing pediatric advanced life support training
	Process	1	The utilization rate of central venous catheters
		2	The utilization rate of Foley catheters
		3	The utilization rate of ventilators
		4	The central venous catheter-associated bloodstream infection rate
		5	The Foley catheter-associated urinary tract infection rate
		6	The ventilator-associated respiratory tract infection rate
		7	The central venous catheter slippage rate
		8	The Foley catheter slippage rate
		9	The endotracheal tube slippage rate
	Outcome	1	The occupancy rate
		2	The crude mortality rate
		3	The rate of unexpected returns within 24 h of being transferred out
		4	The rate of unexpected returns within 48 h of being transferred out
		5	The rate of unexpected returns with the same condition
		6	The rate of length of stay exceeding 14 days
		7	The cardiopulmonary resuscitation survival rate
		8	The discharge against medical advice rate
		9	The average length of stay
		10	The incidence of pressure sores