Non-economic benefits of standards

Shanghai Shuguang Hospital, China

Country: China

ISO member body: Standardization Administration of the People's Republic of China (SAC)

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1 Target and organization of the case study

This case study to assess the non-economic benefits of standards is based on the three pillar model of sustainability advanced by John Elkington (1987). The assessment was conducted between May and August 2013, in collaboration with the Shuguang Hospital, the Standardization Administration of the People's Republic of China (SAC), the China National Institute of Standardization (CNIS) and the ISO Central Secretariat. Shuguang Hospital was chosen as the object for this study with a view to evaluating the social and environmental benefits of standards for a hospital.

2 Attitude towards standardization of the hospital

Shuguang Hospital is affiliated to the Shanghai University of Traditional Chinese Medicine (TCM). It is a non-profit organization and one of the earliest TCM hospitals in China. Founded in 1906, the hospital ranks as a national clinical teaching TCM hospital, one of the top 10 general hospitals in Shanghai, a hospital designated during the 2010 Shanghai World Expo, and a WHO traditional medicine clinical collaboration center. The hospital covers an area of 126 000 m^2, has over 2000 employees and 1320 beds. It has wards for the International Phase I Clinical Trials, and has completed the first clinical trial program entrusted by WHO in China. The departments of hepatopathy, orthopedics and trauma, nephrology, endocrinology, gastroenterology, cardiology, acupuncture and moxibustion, anus & intestine surgery, respiration, gynaecology, critical-care, clinical pharmacy and nursing have gained national reputation. As a famous century-old hospital, it is constantly evolving, with a focus on its advantages as a TCM

hospital, heading the list of the national hospitals of TCM in medical treatment, education and research.

The work of standardization has drawn great attention from the hospital management and staff. The hospital is certified to ISO 9001:2000, *Quality management system*, ISO 15189 : 2007, *Medical laboratories – Particular requirements for quality and competence*, ISO 17025:2005, *General Requirements for the competence of testing and calibration laboratories*, and has passed the Sino-US Institutional Review Board's (SIDCER) *Comparison and Analysis of Executive Supervision Mechanism*, making the hospital the only TCM hospital having passed four international qualifications in Shanghai. In addition, the hospital holds six national qualifications including the Application of Good Clinical Practice (GCP) of the China Food and Drug Administration.

Shuguang hospital participates actively in the establishment and revision of international standards, national standards, and industry sector standards. In particular, the hospital has been the main Chinese participant in the establishment of the WHO TCM Classification of Diseases (ICD-11). It has operated one of the main working groups in the national standard's project " Chinese Classification of Diseases Coding System ". The hospital has also contributed to establishing and revising the " TCM medical record homepage " of the TCM State Administration and to revising and complementing the TCM section of the Department of Health's basic database of electronic patient records (EPR).

3 Value chain analysis

3.1 The value chain of Shuguang hospital

The value chain of the hospital, including basic and support activities or functions, is shown in **Figure 1.**The corresponding relationship between the value chain and the departments is shown in **Table 1.**

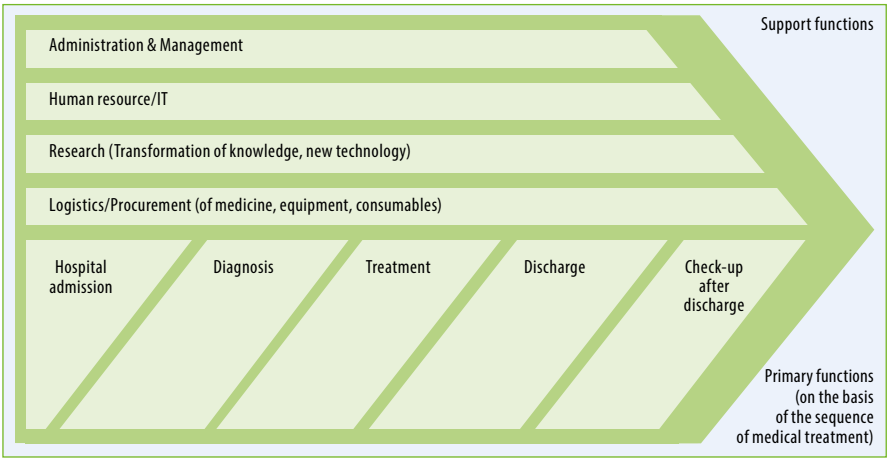

Figure 1 – The value chain of the hospital

Value chain	Hospital departments
Administration and management	Hospital Office
	Medical Affairs Department
	Nursing Department
Human resource department /IT	Human Resource Department
	IT Department
Scientific research	Office for Science and Technology
Logistics /Procurement	General Affairs Office
	Medical Equipment Department
	Pharmacy Department
	Security Department
Admission	Medical Affairs Department
	Nursing Department
	Clinical Departments
	Finance Section
Diagnosis	Medical Affairs Department
	Nursing Department
	Clinical Departments
	Medical Laboratory
Treatment	Medical Affairs Department
	Department of Infection Control
	Nursing Department
	Clinical Departments
	Medical Laboratory
	Pharmacy Department
Discharge	Medical Affairs Department
	Nursing Department
	Finance Section
	Clinical Departments
Check-up after discharge from the hospital	Hospital Office
	Clinical Departments

Table 1 – Relationship between the value chain and the departments of the Shuguang hospital

The hospital uses all kinds of resources to conduct its primary activities in providing medical services. The medical service system provides medical and healthcare services to admitted patients as well as check-ups after their discharge from the hospital.

Support activities for patients are provided by the following departments: Administration and management, Human resource department/IT, Scientific research, and Logistics/Procurement. The Administration and management service center is responsible for the organization and development of medical treatment, and for the coordination between the departments. It ensures that the hospital is operational and sustainable. The Human resource department has created a recruitment system that includes publicity, equality, competitiveness and enrolment. It promotes the training of talented people in order to boost staff skills in a particular subject and to encourage staff initiative with a view to enhancing unity and competitiveness of the hospital. Information technology is important for the enhancement of management and quality of medical care. It reduces operational costs, helps the hospital to increase its competitiveness and better serve the population. Scientific research includes transformation of achievements and application of new technology. As a knowledge-intensive organization, the hospital undertakes large amounts of research related to people's health. It constantly explores new methods and technology for treatment that meet ethical principles, improve and protect the population's state of health as well as improve the quality of its own medical service. The Logistics service provides the basic material supplies for the hospital's operation, including food, clothing, housing, transportation, water, electricity, gas, and air conditioning. The procurement of medicine, equipment and consumables complements the medical service system. All the foregoing activities support the primary activities of the hospital.

3.2 Main value drivers

3.2.1 Improvement of the medical quality

1. **Medical efficacy**
   Providing effective evidence-based treatment according to medical standards represents a non-economic benefit of the hospital. Providing quality service to the patients creates more non-economic benefit for the society. It achieves recognition of the hospital's value and increases competitiveness.

2. **Medical defects**
   The protection of people's health is of utmost importance. Reducing the rate of medical defects and increasingly resolving them is the main value-driver which leads to improvement of medical quality and raises non-economic benefits.

3. **Medical security**
   Providing medical security includes both safety of the patient and of the surroundings and is core to medical quality. Safe medical services are a cornerstone in the generation of non-economic benefit.

3.2.2 Decreasing medical costs

1. **Operational efficiency**
   Operational efficiency refers to the efficiency of input and output in medical service. The hospital provides quality services through excellent technique, its competitiveness and service capacity, but non-economic benefits can only increase through efficient allocation of resources, efficient cost control, reduced unnecessary spending, and increased operational efficiency.

2. **Time efficiency**
   Time efficiency refers to the efficiency of providing medical ser-

vice to admitted patients and the time spent. Efficient medical service is conducive to creating more non-economic benefits.

3. **Information efficiency**
   Information efficiency refers to the provision of meaningful and correct data. It ensures the connection and feedback of the departments in the medical service system, and convenient access to medical information regarding the patients. Increasing information efficiency is also a main value driver for the hospital.

4 Scope of the asssessment study

The organization chosen for this assessment is the Shuguang Hospital which is affiliated to the Shanghai University of TCM. The assessment covers the use of external standards developed by standards organizations (including relevant governmental documents) and internal standards which are based on external standards (such as the ISO 9001 quality management system). Since the transition of the quality management system to the 2008-edition of the ISO 9001 standard in 2010, the hospital has made significant breakthroughs in every aspect of its operations. The focus of this study is the assessment of non-economic benefits from standards that result from the transition of the previous to the new set of ISO 9001 standards and covers the period 2010-2012. Hospitals constitute a special service industry, and their value is represented by the creation of non-economic benefits and public welfare, while the supporting activities of the value chain enable the hospital to complete its basic activities and create value for the hospital. This project assesses the influence of standards on the primary activities of the value chain, including hospitalization, diagnosis, treatment, discharge and check-up in the

generation of non-economic benefits. The relationship between the assessed activities and the related departments is shown in **Table 1.**

5 Application of standardization in the hospital value chain

5.1 ISO 9001 Quality management system

The hospital attaches great importance to standardized quality management and makes wide use of its quality management system. The director of the hospital and the medical deputy director serve as the managers of the quality management system, and an "ISO Office" has been established for its maintenance and supervision. The quality management system embraces management, medical care, nursing, medical technology, and logistics. It manages and optimizes key projects, related to medical care, nursing services, scientific experimentation, the development of new technology, medical equipment, logistics and procurement, as well as financial management. Normative, accurate and full procedures are used to refine operations and processes and establish an operating mechanism based on standards whereby a procedure is developed for a task. Working according to the standard and managing on the basis of measurement, results in efficiency and fast responsiveness which the management strives to attain through innovative improvement management of the procedures.

Through the ISO 9001 Quality management system, external standards (including relevant governmental documents) are applied in the hospital value chain and include both the primary activities and the support activities.

The quality management system is put into practice, the hospital establishes the quality policy, quality objectives and a common understanding among the entire staff. In the process of medical work, 18 program series such as the file control program, the record control program and the medical service program are established. Different departments establish their respective files of rules and quality records.

External standards (or governmental documents) are checked before being sent to the relevant departments. They are adapted to the specific characteristics of the hospital and sent to the appropriate regulation file. For example, the "Hygienic Standard for Disinfection in Hospitals" (GB 15982:2012), is transferred to the "Work System of Disinfection and Isolation" (SGH-Medical-Regulation-024 C/1), which ensures that the external standard (or governmental document) is conscientiously implemented throughout every stage of the hospital value chain.

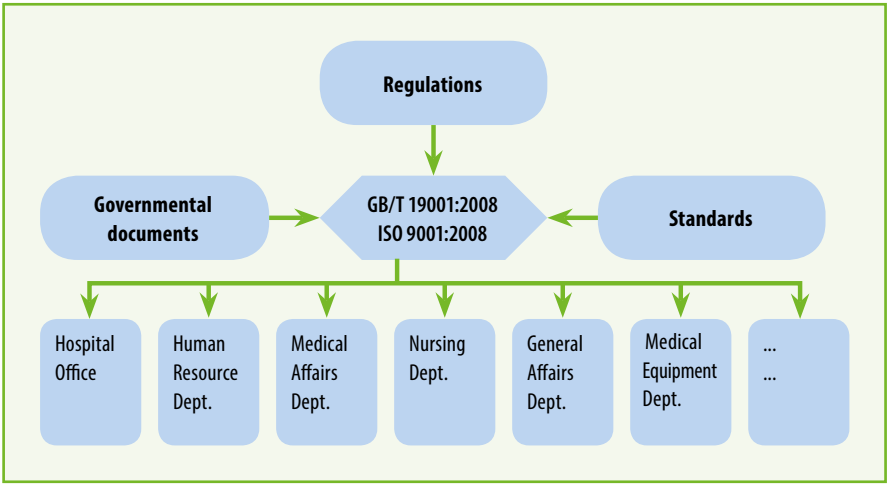

Figure 2 – The standardized operation

5.2 Standards applied in the hospital

The hospital uses 22 external standards that are relevant in the framework of this project, 14 governmental documents , and 11 regulations which are mandatory. The main standards and other documents used within the primary activities of the value chain are as follows :

Activity	Reference number	Title	Source
Hospital admission	33	Evaluation criteria for a three-grade general hospital (2011)	Ministry of Health
	148	Guidelines on the evaluation criteria for a three-grade general hospital (2011)	Ministry of health
	95	Evaluation criteria for a three-grade TCM hospital (2012)	State administration of TCM
	29	Guidelines on the evaluation criteria for a three-grade TCM hospital (2012)	State administration of TCM
	ISO 9001:2008	Quality management systems – Requirements	Shuguang hospital Quality management system
	Decree No. 351	Regulations regarding the management of medical malpractice	State Council of the People's Republic of China and other state agencies
Diagnosis	33	Evaluation criteria for a three-grade general hospital (2011)	Ministry of health
	148	Guidelines on the evaluation criteria for a three-grade general hospital (2011)	Ministry of health
	95	Evaluation criteria for a three-grade TCM hospital (2012)	State administration of TCM
	29	Guidelines on the evaluation criteria for a three-grade TCM hospital (2012)	State administration of TCM
	GB/T 19001-2008/ ISO 9001-2008	Quality management systems – Requirements	
	ISO 15189:2007	Medical laboratories – Particular requirements for quality and competence	
	ICD-10	International statistical classification of diseases and related health problems	
	GB/T 15657-1995	Classification and codes for TCM diseases	

Activity	Reference number	Title	Source
Diagnosis	ISO 9001:2008	Quality management systems – Requirements	Shuguang hospital
	Decree No. 351	Regulations regarding the management of medical malpractice	State Council of the People's Republic of China
	Other		
Treatment	33	Evaluation criteria for a three-grade general hospital (2011)	Ministry of Health
	148	Guidelines on the evaluation criteria for a three-grade general hospital (2011)	Ministry of health
	95	Evaluation criteria for a three-grade TCM hospital (2012)	State administration of TCM
	29	Guidelines on the evaluation criteria for a three-grade TCM hospital (2012)	State administration of TCM
	GB/T 19001-2008/ ISO 9001-2008	Quality management systems – Requirements	
	ISO 15189:2007	Medical laboratories – Particular requirements for quality and competence	
	ICD-10	International statistical classification of diseases and related health problems	
	GB/T 15657-1995	Classification and codes for TCM diseases	
	ISO 9001:2008	Quality management systems – Requirements	Shuguang hospital
	41	Verification regime on preoperative patient safety	Health Office Medical Care Administration
	Decree No. 351	Regulations regarding the management of medical malpractice	State Council of the People's Republic of China, etc.
	WS/T 310.3-2009	Disinfection and sterilization effect in hospital sterilization and supply center	
	GB 15982-2012	Hygienic standard for disinfection in hospitals	
	GB 26345-2010	Standard for control and elimination of malaria	
	GB 28235-2011	Safety and sanitary standard for ultraviolet appliance of air disinfection	
	GB 26367-2010	Hygienic standard for biguanides disinfectants	

Activity	Reference number	Title	Source
Treatment	GB 26368-2010	Hygienic standard for iodine disinfectants	
	GB 26370-2010	Hygienic standard for disinfectants with bromine	
	GB 26369-2010	Hygienic standard for quaternary ammonium disinfectant	
	GB 26372-2010	Hygienic standard for glutaraldehyde disinfectant	
	GB 26373-2010	Hygienic standard for alcohol disinfectants	
	GB 28232-2011	Safety and sanitation standard for ozone generator	
	GB 28233-2011	Safety and hygienic standard for disinfection by sodium hypochlorite generator	
	GB 26366-2010	Hygienic standard for chlorine dioxide disinfectant	
	GB 26371-2010	Hygienic standard for peroxide disinfectants	
	32	Basic standards for the hemodialysis room in medical service (interim)	Health Office Medical Care Administration
	GB 15979-2002	Hygienic standard for disposable sanitary products	
	2	Diagnosis standard for nosocomial infection	Health Office Medical Care Administration
	WS/T 312-2009	Standard for nosocomial infection surveillance	
	YY-NY-20070924055	Standard and management for the hospital graded in China (supplements the evaluation criteria for a three-grade general hospital)	
	Other		
Discharge	33	Evaluation criteria for a three-grade general hospital (2011)	Ministry of Health
	148	Guidelines on the evaluation criteria for a three-grade general hospital (2011)	Ministry of health

Activity	Reference number	Title	Source
Discharge	95	Evaluation criteria for a three-grade TCM hospital (2012)	State administration of TCM
	29	Guidelines on the evaluation criteria for a three-grade TCM hospital (2012)	State administration of TCM
	GB/T 19001-2008/ ISO 9001-2008	Quality management systems – Requirements	
	ISO 15189:2007	Medical laboratories – Particular requirements for quality and competence	
	ICD-10	International statistical classification of diseases and related health problems	
	GB/T 15657-1995	Classification and codes for TCM diseases	
	ISO 9001:2008	Quality management systems – Requirements	Shuguang hospital
	Decree No. 351	Regulations regarding the management of medical malpractice	State Council of the People's Republic of China, etc.
	YY-NY-20070924055	Standard and management for the hospital graded in China (supplements the evaluation criteria for a three-grade general hospital)	
	Other		
Check-up after discharge	33	Evaluation criteria for a three-grade general hospital (2011)	Ministry of Health
	148	Guidelines on the evaluation criteria for a three-grade general hospital (2011)	Ministry of health
	95	Evaluation criteria for a three-grade TCM hospital (2012)	State administration of TCM
	29	Guidelines on the evaluation criteria for a three-grade TCM hospital (2012)	State administration of TCM
	GB/T 19001-2008/ ISO 9001-2008	Quality management systems – Requirements	
	ISO 9001:2008	Quality management systems – Requirements	Shuguang hospital
	Other		

Table 2 – Main standards and other documents used within the primary activities of the value chain

6 Selection of key indicators to measure the impact of standards

6.1 Establishment of an indicator set for the assessment of non-economic benefits

This project applies the value chain approach. To identify the impacts of standards and the non-economic benefits generated by them, we need to define indicators to measure impacts of standards on segments of the hospital value chain. Following a literature review, the consultation of an expert panel and using the Delphi method through which we interviewed 50 qualified experts, we developed a set of indicators as shown in **Table 3** below.

Value driver	First level indicator	Second level indicator
Quality		
Medical efficacy	Service capacity	# annual diagnoses
		# discharges per year
		# inpatient surgeries per year
		# prescriptions for Chinese medicine
	Quality of service	# successful critical rescues in emergency department
		Compliance of diagnosis at admission and discharge
		# successful rescues of critically ill patients in hospital
		Recovery rate
		Improvement rate
		Accuracy of diagnosis after 3 days
		Accuracy rate of final report from the pathology department
	Services to the public	Satisfaction rate of out-patients
		Satisfaction rate of discharged patients
Medical errors	Unexpected events	Complications due to surgery
		Total # of operated patients who return for secondary surgery
	Critical medical accidents	# medical accidents in second, first class care and above
	Medical complaints	# complaints by patients

Value driver	First level indicator	Second level indicator
Medical safety	Patient safety	Rate of infectious cases conceived in hospital
		Rate of hospital infections
		Hospital patients with pressure sores
		# falls and bed falls in hospital
	Environmental protection	Disposal rate of medical waste
Consumption		
Operational efficiency	Efficient use of assets	Bed occupancy rate
		Bed turnover frequency
		Bed/nurse ratio
		Doctor/nurse ratio
Time efficiency	Length of patient's stay in hospital	Average # of hospitalization days per patient
Informational efficiency	Information support	Use of specialized information systems

Table 3 – Indicator set for non-economic benefits of standards

6.2 Choice of key indicators for the primary activities in the value chain

Standards have a role in each stage of the value chain. In order to further illustrate the influence of standards on non-economic benefits, a step-by-step analysis of the assessment indicators for each stage of the value chain's primary activities has been carried out. The corresponding indicators for each stage are as follows:

Primary activities in the value chain	Key indicators
Hospital admission	**Figures per year**
	# diagnoses per year
	# discharges per year
	Satisfaction rate of out-patients

Primary activities in the value chain	Key indicators
Hospital admission	Satisfaction rate of discharged patients
	# complaints by patients
	Use of specialized information system
Diagnosis	**Figures per year**
	Total # of visits
	# discharges
	# in-patient surgeries
	Compliance of diagnosis at admission and discharge
	Accuracy of diagnosis after 3 days
	Accuracy rate of final report from the pathology department
	Satisfaction rate of out-patients
	Satisfaction rate of discharged patients
	# medical accidents in second and first class care and above
	# complaints by patients
	Use of specialized information system
Treatment	**Figures per year**
	# annual diagnoses
	# discharges
	# in-patient surgeries per year
	# prescriptions for Chinese medecine
	# successful rescues in emergency department
	# successful rescues in hospital from critical conditions
	Recovery rate
	Improvement rate
	Satisfaction rate of out-patients
	Satisfaction rate of discharged patients
	# complicatons in surgery
	Total # of operated persons who return for secondary surgery
	# medical accidents in second and first class care and above
	# complaints by patients
	Rate of infectious cases conceived in hospital

Primary activities in the value chain	Key indicators
Treatment	Rate of hospital infections
	# patients with pressure sores
	# Falls and bed falls in hospital
	Rate of bed occupancy
	Bed turnover frequency
	Average # days in hospital of discharged patients
	Use of specialized information systems
Discharge	**Figures per year**
	# diagnoses
	# discharges
	Satisfaction rate of out-patients
	Satisfaction rate of discharged patients
	# complaints by patients
	Rate of bed occupancy
	Bed turnover frequency
	Average # of days in hospital per patient
	Use of specialized information systems
Check-up after discharge	Based on the use of specialized information systems

Table 4 – Operational indicators for each stage of the value chain's primary activities

7 Qualitative and quantitative assessment of standards contributing to non-economic benefits in each stage of the value chain's primary activities

7.1 Evaluation method of important degree level

In order to assess the impacts of standards on the various indicators, we have applied the following weighting method: We divide the impact into 4 levels: no impact, limited impact, moderate impact, significant impact and respectively allocate 0, 2, 4, 6 points to each level of impact.

The maximum total impact can be calculated as the number of indicators multiplied by 6 (=maximum score for an indicator). The impact following an assessment can then be expressed as a percentage of the maximum total impact. As an example: if there are 10 indicators, the maximum total impact is 60 points. If an organization receives 48 points, then it has obtained 80 % (48/60*100) of the total. The following formula is used to calculate the impact of standards which can be expressed for each stage of the primary activities in the value chain.

Impact (%) = score1 (for indicator1) + score 2 (for indicator 2) +…… score n (for indicator n)/(n*6)*100 %

The indicators for measuring the degree of impact of standards have been assigned following discussions with experts from the Shuguang hospital, who are familiar with the set and use of standards, and on the basis of their experience in hospital management.

Change in data (%)	Level of standards' impact	Assigned points
1 % max.	No impact	0
1-5 %	Limited impact	2
5-10 %	Moderate impact	4
Over 10 %	Significant impact	6

Table 5 – Weighting system for impacts of standards 2010 to 2012

Standards have not the same effect on all of the primary activities in the hospital value chain. The specific impact and degree of impact of the standards is shown in **Table 5.** A "no impact" does not necessarily mean that standards have no effect on an indicator, but rather that the hospital's performance has already improved through the use of the 2000 edition of the ISO 9001 and that the 2008 edition of the ISO 9001 contributed to maintaining the indicator at that level between 2010 and 2012 as no difference due to the transition to the new edition of ISO 9001 could be found.

Driving factor	First level indicator	Second level indicator	Impact of standard	Influence degree of the standard for each indicator(score)	Influence degree of the standard for each stage
Hospital admission					
Medical efficacy	Service ability	Total # of diagnoses per year	Increase 28.30 %	Significant impact(6)	83.33 %
		# of annual discharges	Increase 28.30 %	Significant impact(6)	
	Public service	Satisfaction rate of out-patients	Increase 1.94 %	Limited impact(2)	
		Satisfaction rate of discharged patients	Increase 1.12 %	Moderate impact(4)	
Medical defects	Medical complaints	# complaints by patients	Decrease by 11.54 %	Significant impact(6)	
Information efficiency	Information support	Use of specialized information systems	Increase 57.14 %	Significant impact(6)	

Driving factor	First level indicator	Second level indicator	Impact of standard	Influence degree of the standard for each indicator(score)	Influence degree of the standard for each stage
Diagnosis					
Medical efficacy	Service ability	Total # visits per year	Increase 28.30 %	Significant impact(6)	57.58 %
		# discharges per year	Increase 28.30 %	Significant impact(6)	
		# of in-patient surgeries per year	Increase 73.89 %	Significant impact(6)	
	Service quality	Compliance between diagnoses at admission and discharge	Increase 0.21 %	No impact(0)	
		Accuracy of diagnosis after 3 days	Increase 0.38 %	Limited impact(2)	
		Accuracy rate of the final report from the department of pathology	Stabilization	No impact(0)	
	Public service	Satisfaction rate of out-patients	Increase 1.94 %	Limited impact(2)	
		Satisfaction rate of discharged patients	Increase 1.12 %	Moderate impact(4)	
Medical defects	Critical medical negligence	# accidents in second and first class care and above	No increase	No impact(0)	
	Medical complaints	# complaints by patients	Decrease 11.54 %	Significant impact(6)	
Information efficiency	Information support	Use of specialized information systems	Increase 57.14 %	Significant impact(6)	

Driving factor	First level indicator	Second level indicator	Impact of standard	Influence degree of the standard for each indicator(score)	Influence degree of the standard for each stage
Treatment					
Medical efficacy		Total # of diagnoses per year	Increase 28.30 %	Significant impact(6)	65.15 %
		# discharges per year	Increase 28.30 %	Significant impact(6)	
		# of in-patient surgeries	Increase 73.89 %	Significant impact(6)	
		# prescriptions for Chinese medicine	Increase 33.83 %	Significant impact(6)	
	Service quality	# successful rescues in emergency department	Increase 38.05 %	Significant impact(6)	
		# successful rescues in hospital from critical conditions	Increase 103.55 %	Significant impact(6)	
		Recovery rate	Decrease 1.98 %	No impact(0)	
		Improvement rate	Increase 1.79 %	Moderate impact(4)	
	Public service	Satisfaction rate of out-patients	Increase 1.94 %	Limited impact(2)	
		Satisfaction of discharged patient	Increase 1.12 %	Moderate impact(4)	
Medical defects	Unexpected happenings	# complications in surgery	No increase	No impact(0)	
		Total # operated patients returning for secondary surgery	No increase	No impact(0)	
	Critical medical negligence	# of medical accidents in second and first class care and above	No increase	No impact(0)	
	Medical complaints	# complaints by patients	Decrease 11.54 %	Significant impact(6)	

Driving factor	First level indicator	Second level indicator	Impact of standard	Influence degree of the standard for each indicator(score)	Influence degree of the standard for each stage
Medical safety	Patient safety	Rate of infectious cases conceived in hospital	Decrease 31.47 %	Significant impact(6)	65.15 %
		Rate of infections in hospital	Decrease 30.96 %	Significant impact(6)	
		# hospital patients with pressure sores	No increase	No impact(0)	
		# falls and bed falls in hospital	No increase	No impact(0)	
Operating efficiency	Efficient use of assets	Bed occupancy rate	Increase 2.34 %	Moderate impact(4)	
		Frequency of bed turnover	Increase 27.35 %	Significant Impact(6)	
Time efficiency	Length of patients' stay in hospital	Average # hospitalization days per patient	Decrease 17.61 %	Significant impact(6)	
Information efficiency	Information support	Use of specialized information systems	Increase 57.14 %	Significant impact(6)	
Discharge					
Medical efficacy	Service quality	Total # diagnoses per year	Increase 28.30 %	Significant impact(6)	85.19 %
		# annual discharges per year	Increase 28.30 %	Significant impact(6)	
	Public service	Satisfaction rate of out-patients	Increase 1.94 %	Limited impact(2)	
		Satisfaction of discharged patients	Increase 1.12 %	Moderate impact(4)	
Medical defects	Medical complaints	# complaints by patients	Decrease 11.54 %	Significant impact(6)	

Driving factor	First level indicator	Second level indicator	Impact of standard	Influence degree of the standard for each indicator(score)	Influence degree of the standard for each stage
Operating efficiency	Efficient use of assets	Bed occupancy rate	Increase 2.34 %	Moderate impact(4)	85.19 %
		Bed turnover frequency	Increase 27.35 %	Significant impact(6)	
Time efficiency	Length of patients' stay in hospital	Average # hospitalization days per patient	Decrease 17.61 %	Significant impact(6)	
Information efficiency	Information support	Use of specialized information systems	Increase 57.14 %	Significant impact(6)	
Check-up after discharge					
Information efficiency	Information support	Use of specialized information systems	Increase 57.14 %	Significant impact(6)	100 %

Table 6 – Effect of standards on each stage of the hospital value chain's primary activities

7.2 Example : Impacts of standards on hospital admission

The admission process is used as an example to calculate the difference in impact of the quality management system before and after transition to the 2008 edition of the standard. The impact of the standard for the specific indicators relevant for the admission process is shown in **Table 7.**

Driving factor	First grade index	Second grade index	2010	2012	Change rate
Medical efficacy	Service ability	Total # diagnoses per year	2 206 165	2 830 418	Increase 28.30 %
		# of discharges per year	37 328	47 891	Increase 28.30 %
	Public service	Satisfaction rate of out-patients	96.12 %	97.96 %	Increase 1.94 %
		Satisfaction rate of discharged patients	97.8 %	98.9 %	Increase 1.12 %
Medical defects	Medical complaints	# complaints by patients	0.026 %	0.023 %	Decrease 11.54 %
Information efficiency	Information support	Use of specialized information systems	7	11	Increase 57.14 %

Table 7 – Calculation of the impact of ISO 9001 before and after the transition to the 2008 edition

7.3 Results

By analyzing the impacts of the ISO 9001 Quality management systems, on each of the primary activities of the value chain, it has been found that the new edition of the standard plays a role in each. Compared with the previous edition, the impacts in decreasing order are as follows : Check-up after discharge (100 %), Hospital discharge (85.19 %), Hospitalization (83.33 %), Treatment (65.15 %), Diagnosis (57.58 %).

As can be seen from **Table 6,** standards have important impacts on the main indicators chosen in the evaluation.

The impacts of standards are also visible in the total annual number of diagnoses, and discharges, the satisfaction rate of out-patients, the satisfaction rate of discharged patients, complaints by patients and use of the specialized information systems which are all part of the hospital's primary activities.

Thus, external standards and the ISO 9001 Quality management system, of the hospital make a definitive contribution to non-economic benefits resulting from the primary activities of the hospital value chain. The hospitals uses the 2008 edition of ISO 9001 and other standards to ensure stability. According to the basic indicators, the service level and service efficiency of the hospital significantly improved, creating more non-economic benefits and promoting its core competitiveness. Results of the assessment show a clear difference in the impacts between the two editions of ISO 9001 on the generation of non-economic benefits for the hospital. However, as hospitals are complex systems, it needs to be noted that the impacts from standards and how they impact the hospital value chain requires further research.

8 Conclusions

8.1 Hospital standardization work – a pillar for strengthening competitiveness

Hospitals have a major responsibility for the life, safety and health of patients. Therefore, technical and administrative activities must be timely and effective, safe and reliable. However, the organizational structure of a hospital is complex, the division of labour is highly developed, many technologies are applied, quality requirements are strict and the activities of departments need to be coordinated effectively. Standards are a pillar for hospital competitiveness and using standards is an effective way of achieving value and obtaining the best non-economic benefits. Standards facilitate the quantification, materialization, and routinization of all activities. They facilitate quality supervision, serve as an efficient management mechanism, promote competitiveness and create non-economic benefits to the greatest extent resulting in better medical services.

8.2 Assessments of the non-economic benefits of standards can lead to further development of standardization

The research and analysis involved in this assessment to determine the non-economic benefits of standards for human health and environmental protection can serve policy makers and encourage hospital managers to further engage in standardization work. It will improve awareness of policy makers, business, and society as to the importance of how standards are a foundation for achieving an international level of performance.

8.3 Improvement suggestions regarding the evaluation method

Through this research project we found that:

1. The Delphi method can be used to evaluate impacts of standards in order to establish an indicator system for assessing the non-economic effect of standards.
2. As hospitals are complex organizations, it is difficult to explain the impacts of a standard on a single stage of activity. A comprehensive evaluation method can be used to evaluate the non-economic impacts of standards on the hospital as a whole.
3. Value drivers are the basis for the existence and development of an organization. The incorporation of value drivers into the indicator system for assessing the non-economic benefits of standards would help to better understand the impacts of standards on the value chain.
4. If, in addition to external standards, an organization uses governmental documents that have characteristics similar to standards, then these need also to be included in the scope of the assessment.

Biographical references :

1. Yi X M, Jin J, Song C Y. Research of hospital value chain. Hospital administration journal of Chinese people's liberation army, 2008, 15(6):540-542.
2. Niu S F. Value chain management in the application of hospital competitiveness. Contemporary nurse, 2011 ,4:187-188.
3. Ren W J. Based on the service value chain management of the hospital culture construction and practice. Chinese hospital management, 2005,25(12):82-83.
4. Chen Y Y, Ni M, Hu X Z, et al. Public hospital institutions public welfare evaluation index selection–Based on the Dephi expert consultation method. Chinese health policy, 2012, 5(1):6-10.
5. Zeng G. Modern epidemiology methods and application[M]. Beijing:Joint publishing house of Beijing medical university, the union medical college,1996.
6. Zhan Q,Wei S Y,Gu W H. The application of Delphi method in the pharmacy[J]. The journal of Pharmaceutical Practice,2002,20(2):122-124.