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Developing a Conceptual Model of the Hospital Incident Command System (HICS) Via Quality Improvement Models in Iran

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ABSTRACT

Achieving the goals of organizations requires an appropriate model for performance evaluation. Applying globally accepted methods for administration of hospital incident command system (HICS) can build a new tool for improving the quality of evaluation of real disasters and incidences. The present study seeks to develop a model through the implementation of a quality management system. This applied study was conducted in two steps in 2016. First, data collection were collected from library-printed and electronic references related to the purpose of the research .According to the inclusion and exclusion criteria, 28 articles having conducted on HICS and 50 articles on the quality management system were selected. In the next step, interviews were conducted with 23 experts and the themes were obtained through qualitative study and content analysis. Then the data were extracted. According to qualitative interviews, two themes of the proposed quality improvement models in health centers and the appropriate model of the HICS were extracted. Then, the qualitative elements of the models were determined for overlapping the HICS based on the similarities and differences in the study models. Most important dimensions examined was organization management system, management and leadership, customer focus, personal of development plan, information & communication management, non-conformity, improvement, audit. Since the HICS faced some limitations, such as insufficient attention to quality improvement, incompatibility of this system with the management structure in hospitals, weakness in system communication, and lack of a native model in Iran, this article attempts to develop a conceptual model that has the most common features among the models for filling the gaps in evaluating the HICS.

Key words: Hospital Incident Command System (HICS), Quality Improvement System, Conceptual Model, Iran.

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INTRODUCTION

Achieving aims and improving organizational performance require having an appropriate model for performance evaluation in that realizing the goals of organizations that is not possible without a comprehensive model for evaluating and reviewing plans; Otherwise organizations would not be able to apply effective management of their plans without the results obtained from their activities [1]. For their development and competition, a hospital needs a kind of performance evaluation system to assess their efficiency and efficacy of their programs, processes, and human resources. It is vital in today's competitive world to present high-quality health services with appropriate costs and on-time delivery in order to achieve competitive advantages for hospitals. To this end, assessment of hospital performance and continuous improvement of the performance play key roles [2].

Hospital evaluation is increasingly spreading out all over the world for improvements in provided services, clients' satisfaction, patients' safety, and profitability to health care providers [3]. One of the quality evaluation methods used in medical centers is the quality management system (QMS). The QMS is defined as a system employed in organizations with the aim of reducing and consequently removing incompliant cases for achieving customer standards and expectations through an economical and efficient way [4]. Quality improvement systems cover all organizational processes, cause movements towards consistent improvement, and emphasize the process attitude of efficacy of the QMS in realizing requirements of organizations and customer satisfaction [5]. The World Health Organization (WHO) knows the main approaches related to hospital evaluation, quality improvement of services, and efforts for the improvement of efficacy and efficiency of services as the use of QMS such as accreditation, ISO, and excellence models [6]. Moreover, applying models accepted by international institutions for unexpected incidents management in hospitals is necessary [7]. Health management in disasters is the most important role in healthcare systems particularly hospitals as the main unit of providing services in primary levels. With regard to the key role of hospitals in medical management of incidences and disasters, the effective reaction to incidences requires proper readiness before occurring incidences via planning, leadership, organization, and management of resources [8, 9]. The HICS has been organized for the missions of prevention, reduction of damages, reaction, and improvement in occurring disasters. Its effective application causes prevention of disorders in operations of responsible organizations [10]. Experiences indicate that paying attention to organizing the HICS for emergencies has made some aspects of quality enable to consider it. For example, this system guides activities in occurring incidences and disasters. This causes that hospitals mostly weaken in evaluation of the strength and severity of vulnerability of management systems before occurring real incidences [11]. Studies indicate that applying principles of the QMS is effective on organization quality of services provided for patients, increase in the usability of hospital information system, and reduction of risks [12]. Moreover, executive indicators of evaluation in the QMS in hospitals can be a new instrument for quality improvement of evaluation of incidences and disasters [13]. In his study, Ardalan concluded that the most important weaknesses in the disaster reduction management system in the healthcare system are no observance of standards of disaster management and the lack of a system proper for cooperation and disasters command in the healthcare system [14]. In another study, the absence of a model for evaluation of the HICS [15, 16] is considered as one of the limitations of applying the system. Djalali (2015) considered the increase in hospital performance in occurring disasters as the application of the modified HICS [17]. These discussions indicate the necessity of appropriate planning, priority of policies and activities in crisis management, and the design of a required system [18].

MATERIALS AND METHODS

This applied and qualitative study was conducted in 2016

Research strategy

The main research strategy is the integration of qualitative elements in the areas of quality management and HICS with respect to structural similarities in the quality improvement models and the shortcomings of the hospital incident command system in its qualitative approach.

Data collection

The data were collected in two steps; a broad review of the literature was first undertaken through reviewing the journals related to the articles and reports carried out via the library research technique, the Internet survey, and note-taking instrument in valid domestic and international databases during the years 2000 through 2016 through databases such as ISI Web of Science, PubMed, Science Direct, Scopus, Wiley Online Library, Google Scholar and other government, national, and international databases and websites.

Keywords related to the Hospital Incident Command System (HICS) and quality improvement models in healthcare centers and hospitals were implemented.

Inclusion and exclusion criteria

Articles and studies enjoying the inclusion criteria were those approved by the WHO and related to the hospital, as well as articles highlighting the advantages and disadvantages of the models in question, so that they can be used to compare the models and select the reference model.

The exclusion criteria cover topics that were not related to research objectives, no access to the full text of articles, and duplication. In this regard, out of the 50 articles examined on the incident command system, only 28 domestic and international articles that were eligible for inclusion in the study. Among the 130 articles examined, only about 50 articles had the inclusion criteria in terms of the quality improvement.

Data collection

In the next step, a questionnaire consisting of specialized questions in the field of quality improvement models in the health system and the HICS was prepared for the interview by conducting a qualitative study. The members of the panel included experts in the field of health management in disaster, health information management and experts in the field of the quality improvement selected via a theoretical sampling method. the snowball sampling technique continued until people saturation. The number of participants was 23. The MAXQDA 2010 software was employed to manage the data in this study. Depending on the content analysis performed on the codes, the two tables were finally extracted.

Among the reviewed quality improvement models, ISO, Accreditation, clinical governance, and EFQM were selected as the most common quality improvement models in health care centers.

In the final step of data collection, and considering the determination of similarities and differences in selected models, identifies the main points and areas in the quality improvement models, the main characteristics of the HICS, and comparative tables for conducting a design study. Then relevant data was extracted, summarized and classified. To design a conceptual model, the content analysis technique was carried out through the creation of classified data along with the extraction of the initial features presented by the models. Finally, by incorporating them, components of the conceptual model of the quality management system were formulated in the HICS.

RESULTS

Features / Bases and axes used in the HICS and quality improvement models

- **HICS**

The HICS is a valuable method or instrument, which has an effective role in empowering services in healthcare centers for hospitals' responses to occurring disasters [19]. The ICS has been founded on the basic principles which in one hand result ensure the effective application of resources, and on the other hand cause the reduction in disorders of policy making and operations of the responsible organizations. Those principles should be applied for each kind of crisis at each level [20]. One of the most important goals of applying the HICS is timely reaction of incidences, achieving operational aims, managing incidences, and ensuring the efficient and efficient use of resources [21]. One of the most important main characteristics taken in the Hospital Accident Command system are Common Terminology, Modular Organization، Chain of Command, Unity of Command, Span of Control, Management by Objectives, Incident Action Plan and Incident Facilities[20].

Significant Quality Improvement Models in Healthcare Systems

- **ISO 9001-2015**

ISO standard series 9000 have been developed for assisting organizations in operationalization and implementation of a quality management system via presenting executive principles, polices, and methods and formulating a strategic document. These standards have significant successes in organizations. They are employed as instruments effective on controlling and ensuring quality of production and provision of services for reducing deficits and inefficiencies of a system [22]. These standards also try to identify all activities affecting quality, transcribe them, and execute what has been transcribed after making them compliant with standard requirements all over an organization- from high management to the staff- affecting perceived quality based on deep studies and investigations [23]. In newer and modified editions of ISO, more tendencies towards organizational development and more similarity to the quality excellence model and accreditation program are observed [3]. The last edition Emphasis on the risk-based thinking, changes in the general concept of preventive measures to risk management and risk management standards, more applicability of organizations providing services, development of knowledge and technologies, deeper intra- and inter-organizational contents of the QMS are the most reasons for revising standards. The structure of ISO 9001 standard consists of ten axes of application scope, mandatory references, terms and definitions, nature of the organization, leadership, planning, support, operations, performance evaluation, and improvement as requirements of

the system. The ISO Organization develops the sequence of paragraphs and subparagraphs. This standard has become more appropriate for integration with other management standards so that all new management standards are developed based on this 10-section structure [24].

- **Accreditation**

Accreditation is one of the main domains of evaluation of healthcare services through which an organization evaluates healthcare organizations such hospitals and makes decisions about their qualifications using a series of elites and independent evaluators based on developed and predetermined standards [25, 26]. The aim of accreditation in healthcare organizations is to improve quality of healthcare services, develop integrity in healthcare management, increase the safety, reduce dangers of patients and the staff, and reduce costs with the focus on increasing efficiency and efficacy of services [27]. The fifth edition of accreditation was published in 2014. It contains patient-centered standards (Access to care and continuity of care , Patient and family rights, Assessment of patients ,Care of patients ,Anesthesia and surgical care, Medication and management use) and organizational-centered standards (Quality improvement patient safety. Prevention of control of infections, Management of communication and information , Patient and family education , Governance, leadership and direction , Staff qualifications and education , Facility management of safety [28].

- **Clinical Governance**

One of the diverse methods and instruments for improvement of quality of healthcare in clinical governance is healthcare organizations that are responsible for permanent improvement of quality. By building an environment in which excellence in clinical services, develop protecting excellence standards of services [29]. Clinical governance includes concepts such as improving quality of information, promoting patient participation and collaboration, improving teamwork and implanting evidence-based medicine. As an umbrella, clinical governance covers all things protecting and improving healthcare standards. It covers all activities of quality improvement considered daily by the clinical staff in healthcare [30]. This model tries to move the performance of all healthcare organizations towards the best standards hoping to reduce heterogeneities exiting in quality of healthcare presented to patients [31]. One of the models of clinical governance is a seven-axis one that covers Risk Management, Clinical Effectiveness, Education & Training, Patient and Public Involvement, Staff Management, Use of Information and Clinical Audit [32]. These axes are founded on five necessary columns of Awareness of Systems, Leadership, Ownership, Group Work, and Communications [33].

- **European foundation quality management**

The excellence model views organizations compressively and holistically. It can be used for the issue of how those diverse methods can be used complementarily and coordinately. As a result, this model, depending on the nature and needs of organization, can be used with any number of other management methods and instruments so that a compressive framework for achievement of sustainable excellence can be obtained [34]. It also paves the path for thinking about organizational advantages having effective and efficient relationships among ideas both inside and outside organizations and generates existing programmed innovations and deletion of rework and existing gaps in organizations as well as a basic structure for the organizational management system [35]. This model has nine main criteria including five enabler criteria of leadership, policy and strategy, staff participations and resources, and processes as well as four result criteria including customer results, staff results, society results and key performance results [36].

Qualitative interview with experts

The second step in the present study was conducting qualitative interviews with experts. The researcher attempted to identify the components used in the HICS and quality management models and extracted the main themes and patterns among the data using the content analysis technique. In this method, coding and categorization were directly derived from raw data through thematic analysis. After summarizing the initial codes based on the relationship of the concept and meaning to the secondary code, the multi-coder eventually became a conceptual code. Accordingly, sub floors were created in the form of 4 sub themes. The number of main floors is 2 categories. The first theme was the quality improvement models in healthcare centers. This theme examines selected quality improvement models that are employed in healthcare centers. The main category extracted in this theme is the qualitative elements contained in the quality management system derived from the deployment

of the system, and two subcategories were extracted in this main category. Under the exploited classes were the achievements and limitations derived from the deployment of implemented models of the Quality Excellence Model, Clinical Governance, Accreditation, and ISO. According to the participants' views, and after the interviews were completed, the appropriate model of the HICS was selected as the second theme. The themes extracted from the participants' contributions in this theme attempted to identify the appropriate model for the HICS. The main category extracted in this theme was process management and quality improvement. The two subcategories extracted were the use of components of the quality management system and their relationship between them and the relationship between the HICS and the quality management models.

Determining Commonalities and Differences in the Selected Models

After identifying each model, the table of comparing axis of the QMS and elements used in the HICS were prepared. Identification of elements in the ISO standard, EFQM, and clinical governance was conducted based on requirements exiting in axes and sub-axes of the standard. In addition, identification of elements in the accreditation model was conducted based on organization-centered, patient-centered, and sub-axes. Considering the lack of an evaluation model in the HICS, components and characteristics and concepts close to qualitative elements extracted from axes of quality improvement models were considered and explained in the table. After preparing elements, axes, and sub-axes of each model, elements were matched. Given that, the ISO is considered as a quality management standard, and a series of standards of quality management systems for integrating and developing international standards regarding different fields is conducted via this institute. In addition, the focus of this standard is on risk-based thinking, changes in the general concept of preventive actions of risk management, and Risk Management Standard [24]. Therefore, the comparative table of the requirements of this standard was considered as the foundation of formation of axes and sub-axes. Then, qualitative elements were identified in the HICS and mentioned in the tabled base on paragraphs of the ISO standard. After that, each quality improvement model was separately investigated and completed based on axes and sub-axes mentioned in the table. A comparison was made between paragraphs of the quality improvement models and elements used in the HICS.

Integrated Conceptual Model based on the HICS

Conceptual model (CM) can be defined as "an abstract representation of something generalized from particular instances" [37]. Robinson defines conceptual modeling as "the abstraction of a model from a real or proposed system, which includes simplification of reality [38]. Therefore, in this section, the conceptual model of the research was designed using elements existing in quality improvement models which were not observed explicitly, were not systematically available, or there were some deficits in the qualitative approach of the HICS. As observed in figure 1, first, significant models of quality improvement in the hospital system and ICS were reviewed in the studies. Then, the HICS was analyzed and its qualitative elements as well as selected models were identified. In the next step, a comparison of paragraphs of the QMS and elements used in the ICS was made. After that, characteristics and components, which had the possibility of applying the HICS, were extracted. In the last step, the nature of the integrated model generated based on the standards of the structure, process, and results was designed (5, 39).

The Nature of Standards in the Conceptual Model

One of the conceptual approaches for determining quality criteria is the Donabedian model. This model is principally used for evaluation, control, and improvement of quality of healthcare systems. It has three dimensions of structure, process, and results affecting each other directly [40]. The structural dimensions are particularly related to the personnel who provide healthcare services. It refers to the classification, which systems use for production and providing services including human forces, classification of equipment, facilities, and organizational structure [41], whilst the process dimensions refer to all activities and measures conducted during caring patients for achievement of favorable results. The last nature presented in this structure is related to results. Result refers to evaluation of healthcare quality based on predetermined goals. It includes parts of cost-related healthcare indicators and those related to customer satisfaction [39].

DISCUSSION

According to findings obtained from the studies, in spite of the existing advantages in applying the

HICS [16, 42, & 43], its incompliance with the management structure exiting in hospitals and the weakness in the systemic communications caused barriers in applying it [44].

According to what was stated, the most important barriers existing in the HICS is the negligence to new challenges in this system [45], insufficient attention to quality improvement, and the lack of a localized model [44, 17], attention to the role of leadership and the need to a management organization in operationalizing the ICS [17], attention to the existence of a teamwork as a main element of the system, and the relationship with social partners for reinforcing workforces [16].

One study indicated that using quality instruments for compensating gaps existing in the HICS is necessary [10]. Some studies also indicated that accreditation, ISO, Quality Foundation Excellence Model, and clinical governance are considered as the most important models applied in healthcare organizations in Iran and the world. They are standards related to the healthcare system with similarity in quality elements [2, 3, 46, 47, 48, 49, & 50]. In studies conducted by Shaw, four models were presented in the US, Europe, and Australia evaluate medical standards: Standard of Inspection, Accreditation, ISO, and Quality Foundation Excellence Model [51].

Sedghiani investigated the evaluation system and accreditation of medical institutions. He identified and analyzed different systems for improving independent external evaluation quality. This project investigated those standards more commonly used in Europe such as Accreditation, Total Quality Management, Inspection, and ISO standards [52]. The above studies are consistent with the conceptual model of the present study in terms of using the selected models.

In some other studies, the necessity of applying quality management models included efficacy of processes, customer focus, and control of standards related to infrastructure and workplaces, the increase in the staff's satisfaction, risk assessment, disaster prevention, risk reduction and preparedness [39, 53, & 54]. Furthermore, the proper use of ICT, staff training regarding the accurate recording of data and information, the use of hospital information in decision making, planning and evaluation [23], increase in performance, improvement in productivity and service quality, increase in management commitment, and positive effects on achieving hospital goals and managing resources [55] were observed. Nevertheless, some of their studies show the failure in institutionalization of elements of the QMS in the HICS as well as the lack of consistent improvement in quality of services, customer satisfaction, and productivity of healthcare organizations in applying inappropriate quality models [50]. All in all, majority of the studies indicate the efficacy of establishment of the selected quality models in healthcare centers.

CONCLUSION

Some of the main problems of healthcare organizations are low level of quality of provided services and the decrease in satisfaction expected from them. Therefore, achievement of the goals and improvement in performance of hospitals require having an appropriate model for performance evaluation in that realization of their goals is impossible without the existence of a comprehensive model for evaluation and review of their plans. For their development and completion in the performance evaluation system, hospitals require assessment of the efficacy and efficiency of their plans, processes, and human forces.

Different models of hospital management systems have been presented. Each of the models have focused on certain aspects of hospitals. Those models evaluate the organization from different perspectives. Accordingly, most of these models need to be more comprehensive over time to cover more criteria and complete themselves in terms of different perspectives.

With regard to the challenges of implementing and performance evaluating of the HICS as completely as possible in Iranian hospitals, lack of a comprehensive QMS model covering all merits of other models and paying attention to vital criteria in establishing the HICS including an appropriate organizational management system, planning process, monitoring methods, and process control for evaluating. The efficacy of the HICS, the above conceptual model (figure 1) was designed. The outcome was a compensation for the gaps existing in the HICS by focusing on standards of process, structure, and outcome and applying the components of quality improvement models, which enjoyed the highest commonalties of the previous models.

Table 1. A comparison of axes of the quality management system and elements used in the HICS

Axe	ISO	Clinical governance	accreditation	EFQM	*HICS
1	**Quality management system**	-	-	-	-
2	**Normative reference**	-	-	-	*Resources and References
3	**Terms &definition**	-	-Terminology	-Terminology	***Common terminology**
4	**Context of the organization**	-Organizational integration -functional model	-Functional /departmental model	- Radar management structure	* **modular organization**
4-1	-strategic direction	-Strategy program	-Strategy program	**policy &strategy**	* Goals / Strategies / Tactics
4-2	-Interested parties	-Stakeholders	-Stakeholders	-Stakeholders	*Stakeholders
4-3	-Scope of QMS	-	-	-	
4-4	-QMS and its processes	- Process approach	- processes	**processes**	* Incidences-related processes
5	**Leadership**	- Leadership & management	**Governance, leadership and direction**	**Leadership**	* **unity of command** * **chain of command** ***Leadership**
5-1	-Customer focus	**Interacting with patient & community**	**Patient and Family Rights**	**Customer focus**	* Helping families of the staff / patients
5-2	-policy	-policy	-policy & procedure	**policy**	* Policy development
5-3	Roles, responsibilities, and authority	-Responsibility	-Authority &responsibility	-The responsibility to the society	* delegation of Authority
6	**planning**	-Programming and organizing	-planning	-planning	* **incident action plan**
6-1	-Actions for dealing with risks and opportunities	**Risk management** -Risk Identification -Risk analysis -Risk assessment -Risk reduction/transfer	-Risk management -Risk assessment	Risk management	* Risk Management * Identification of risk factors * Risk analysis * Risk assessment *risk mitigation
6-2	- quality objectives and planning to achieve them	-Determining Objectives &Standards	-mission, goals& plans	-Goals	***Management by objective**
7	**support**	-	-	-Support strategies and procedures	***Support**
7-1	-resources	-resources	-resource supply	**Resource**	*Allocation of resources / equipment
	--people	**Staff management** -Cooperation culture -Job description	-human resources -job description	**staff participations** **Patient & Public Involvement**	* Personnel employed in the accident * job description *Staff Health and Safety
	--infrastructure --buildings & associated utilities --equipment (hardware & software) -- transportation, information systems	**Use of Information** -Creating and providing information	**Management of information** **Facility management of safety**	-Technology Management -information management	***incident facility** * Infrastructure Management * Equipment and reserves * Personal protective equipment *Transportation
	--environment for the operation of processes -- Social / psychological /Physical	-	- Environment -Technical protection / work hygiene - Occupational health	-	* Environment * staff's health and safety *Individual protection

Axes	ISO	Clinical governance	accreditation		*HICS
	--organizational knowledge	**Education & Training** -training management **- personal of development plan**	**Patient & family education** **Staff qualifications & education** -personal development Program	-Identification of knowledge& competence of the staff & development them	* Management training & the staff *Theoretical / practical/ exercise
7-2	-competence	-Competent staff	-Professional ability -professional competence	-Individuals' skills, competencies &qualifications	*Competence
7-3	awareness				*awareness
7-4	-communication -Internal / external communication	-Communication management	**Communication management**	-communication	*Internal / external communication &coordination
7-5	-document ed information -- Creating and updating -- Distribution, access, retrieval -- storage &preservation	-Documentation -Record keeping	-Documentation - Record keeping	-documentation	* Documentation * Collecting documents *Archiving and keeping records
8	**operation**	-	-	-	*operation
8-1	-operational planning &control	-	-	-Product design and development	***Span of control**
2-8	-requirement product & service specified by the customer and by the organization -customer communication	-	**Access to care & continuity of care** **Assessment of patients** **Care of patients**	- Production, delivery & support -Products& services	* key requirement
8-3	Design& development of product	-	-	-	-
8-4	Control of externally provided processes & services	-	-	-	*Integration of HICS with external Ics
8-5	-Production & services provision --Identification &traceability --preseration --costumer property --Product tracking	-healthcare services	-healthcare services	-	*services branch *patient tracking
8-6	release of products &services	-	-	-	*demobilization
8-7	-control of nonconforming outputs	-	-	-	-
9	**Performance evaluation**	-Monitoring & evaluation	- performance evaluation and analysis --Data collection and analysis / Monitoring of processes	**Key performance results customer results society results**	* Evaluation / Reporting
9-1	-monitoring , measurement ,analysis and evaluation -Product compliance -customer satisfaction	**Clinical Effectiveness**	-Analysis of the results of performance indicators	-Analysis of performances	* Analysis of the operational plan * Assessment of the vulnerability severity
9-2	-Internal audit	**Clinical audit**	-self-evaluation / internal / external evaluation	-self-evaluation	*Evaluation
9-3	-Management review	-	-Management review	-	-

Axes	ISO	Clinical governance	accreditation	EFQM	*HICS
10	**improvement** -production &service improvement -correction& Prevention	Quality improvement	**Improvement in patients' quality and safety**	Improvement and innovation in processes	*preventin
10-1	-nonconformity & correction action	-	-Noncompliance -implementation of corrective actions	-	-
10-2	-continuous improvement	Continuous improvement	**Quality improvement standard**	Continuous management and improvement	-

** characteristics, Components, concepts, and related to axes of the model in the HICS*

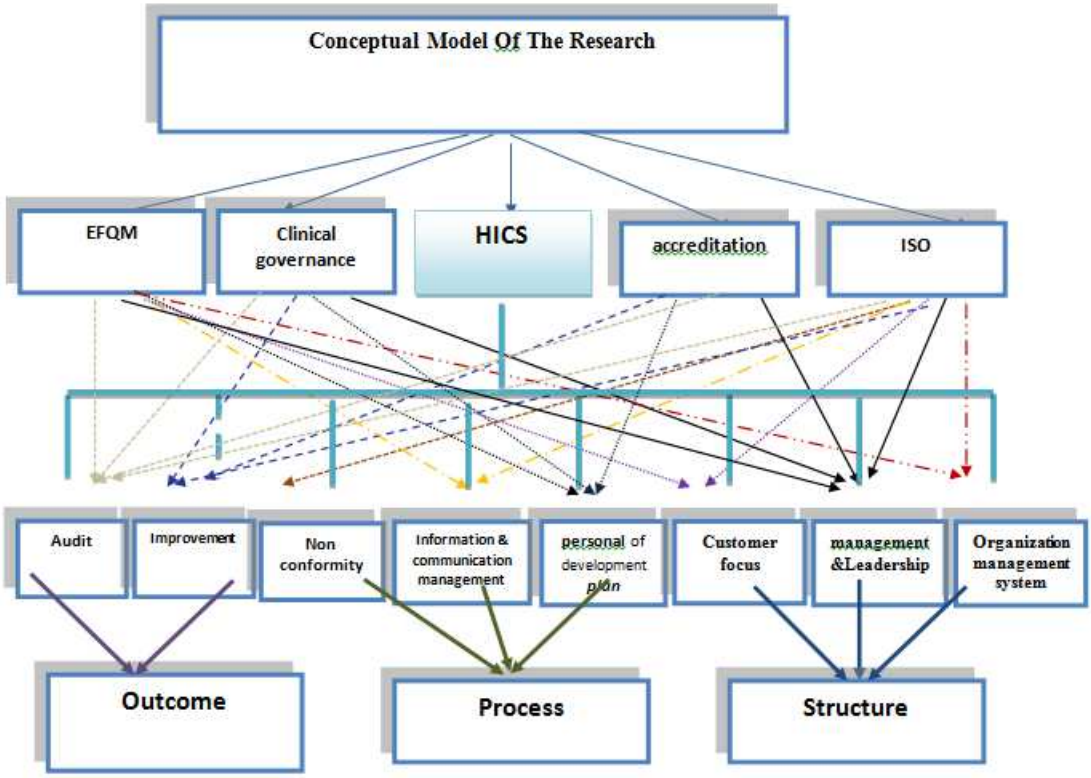

Figure 1. The conceptual model of the QMS in the HICS

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