

# Performance Evaluation of Medical Records Departments by Analytical Hierarchy Process (AHP) Approach in the Selected Hospitals in Isfahan

Medical Records Dep. & AHP

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**Abstract** Medical Records Department (MRD) is an important unit for evaluating and planning of care services. The goal of this study is evaluating the performance of the Medical Records Departments (MRDs) of the selected hospitals in Isfahan, Iran by using Analytical Hierarchy Process (AHP). This was an analytic of cross-sectional study that was done in spring 2008 in Isfahan, Iran. The statistical population consisted of MRDs of Alzahra, Kashani and Khorshid Hospitals in Isfahan. Data were collected by forms and through brainstorm technique. To analyze and perform AHP, Expert Choice software was used by researchers. Results were showed archiving unit has received the largest importance weight with respect to information management. However, on customer aspect admission unit has received the largest weight. Ordering weights of Medical Records Departments' Alzahra, Kashani and Khorshid Hospitals in Isfahan were with 0.394, 0.342 and 0.264 respectively. It is useful for managers to allocate and prioritize resources according to AHP technique for ranking at the Medical Records Departments.

**Keywords** Performance · Medical records department · Evaluating · Analytical hierarchy process

## Introduction

The health care industry is going through an information explosion, and there is increasing pressure to organize and categorize this data. Hospitals are looking for ways to reduce their exposure to potential liability suits through proper internal controls. One of the most important phases of a hospital's administrative operations is its Medical Records Department (MRD) activities. In order to do this, MRD must be organized by setting goals and objectives. An operational audit of a hospital's MRD can go a long way toward ensuring an orderly, efficient, and potentially liability-free operation. Compliance with standards established by the joint Commission on Accreditation of Healthcare Organizations (JCAHO) may provide a starting point for measuring MRDs effectiveness. Further determination of medical record economy and efficiency requires a more probing analysis undertaken by a well-planned operational auditing program [1]. Performance measurement is a mean for monitoring and controlling of organizational activities to ensure they achieve predefined objectives [2]; it is used to quantify both the efficiency and effectiveness of activities [3, 4]. AHP is used to formulate the decision problem in the form of a hierarchical structure and solve complex decision-making problems in different areas, such as planning, resources evaluation, measuring performance, allocating resources, choosing the best policy after finding a set of alternatives, setting priorities. To meet such challenges, many varied performance measurement

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systems have been proposed, such as the activity based costing system, the Balanced Score Card approach, the SMART System, the Performance Measurement Questionnaire, and Analytical Hierarchy Process (AHP) [5–12]. Analytical Hierarchy Process enables one to study the problem as a whole while taking into consideration the interactions between the components within the hierarchy [13]. AHP developed by Saaty (1980) provides a suitable and appropriate way of the analyzing this situation because AHP is a multiple criteria decision-making technique that allows subjective as well as objective factors to be considered in a decision-making process [14]. AHP allows the active participation of stakeholders and gives managers a rational basis on which to make decisions [15, 16]. AHP structures the decision problem in levels which correspond to one understands of the situation: goals, criteria, sub-criteria, and alternatives. By breaking the problem into levels, the decision-maker can focus on smaller sets of decisions. In a typical hierarchy, the top level reflects the overall objective (focus) of the decision problem.

Ataei, Jamshidi, Sereshki, and Jalali [17] have argued that “Once a hierarchy is constructed, the decision-maker begins a prioritization procedure to determine the relative importance of the elements in each level of the hierarchy. The elements in each level are compared as pairs with respect to their importance in making the decision under consideration. A verbal scale is used in AHP that enables the decision-maker to incorporate subjectivity, experience, and knowledge in an intuitive and natural way. After comparison, matrices are created, and relative weights are derived for the various elements. The relative weights of the elements of each level with respect to an element in the adjacent upper level are computed as the components of the normalized eigenvector associated with the largest Eigen value of their comparison matrix. Composite weights were determined by aggregating the weights throughout the hierarchy. This is done by following a path from the top of the hierarchy down to each alternative at the lowest level, and multiplying the weights along each segment of the path. The outcome of this aggregation is a normalized eigenvector of the overall weights of the options”.

Saaty has been suggested that in performance measurement is usually a team effort, and AHP is one available method for forming a systematic framework for group interaction and group decision making [18].

Neely, Borne, and Kennerley [19] argue that “however, one of the common key weaknesses of performance measurement systems adopted by many firms is being overly narrow or even uni-dimensional in focus”.

Healthcare delivery has been evaluated by three categories of measurement: structure, process and outcome [20]. The progress report “America’s Best Hospitals” released annually since 1990 uses these three quality dimensions to

rate the best hospitals in the USA [21]. The human and material resources available in each hospital are used to assess structure of the hospitals. Outcomes are usually evaluated by the Standardized Mortality Ratio (SMR) which is the ratio of the observed to expected mortality rate in each hospital. This research focuses specifically on the performance measurement of the MRDs. According to high patient admitting in MRDs and in order to justify increased productivity, standards and measurements needed to be evaluated performance MRDs.

The use of AHP let medical records manager with new viewpoint evaluates MRDs by skills, technology, and innovation. Nowadays, healthcare managers have to change their attitudes and use new methods of mathematics plus management sciences for planning [22]. To make the best choice among the alternative usage fields for the resources and to allocate the resources optimally, public hospital managers need to make decisions by evaluating investment proposals not only financially but also in the frame of future benefits. Therefore they have to make related decisions by considering a great number of qualitative and/or quantitative criteria. This study aims to develop a multi-dimensional quantitative performance measurement model using the analytic hierarchy process (AHP) approach initially developed by Saaty (1980) and to demonstrate its effectiveness using the MRDs of three different hospitals in Isfahan, Iran.

To do this purpose researchers tracked these steps as follows;

- First, AHP is a PROCESS: the process requires elucidating personal criteria and evaluating the relative importance of each criterion and then determining how the alternatives achieve each of the criteria.
- Second, AHP organizes the decision into a HIERARCHY of criteria and alternatives: the criteria are organized according to perceived logical and natural groups to improve the clarity and usability of the model and to create properly proportioned subcategories that ensure all important criteria are accounted for and receive the proper weight in the decision.
- Third, AHP is ANALYTIC: it uses pair wise comparisons to help the user express the perceived relative importance of every criterion against every other criterion within each hierarchical group to establish the proportional weight each criterion should receive in the decision, and it uses the relative importance of each group to establish that group’s weighted importance. [23]

The main goals of this study were ordering performance criteria and evaluating performance of Medical Records Departments (MRDs) which fulfilled through two points of views: customer and information management and in four units of the selected hospitals in Isfahan, Iran by using Analytical

Hierarchy Process (AHP). These units include Admission, Archive, Statistics and Coding with special functions.

**Methods**

This is an analytic of cross-sectional study that done in spring 2008 in MRDs of Alzahra, Kashani and Khorshid Hospitals in Isfahan, Iran. These hospitals are teaching hospitals which have got first rank in hospitals’ evaluation program. The numbers of patients’ records which have been stored in archive units in 2008 were 352240, 163522 and 120000 at Alzahra, Khashani and Khorshid hospitals respectively. The number of personnel who were working at MRDs in 2008 was 29, 16 and 12 at Alzahra, Khashani and Khorshid hospitals respectively. For data gathering, researchers founded a team of 15 experts, which consists of MRD personnel, faculty members of MRD in Isfahan Medical Sciences University, and hospitals auditors. Team determined the criteria of MRDs according to international (JCAHO) and local (Ministry of Health) standards have been considered for illustrating performance measurement model for MRDs of hospitals in AHP framework. The criteria were organized according to improve the clarity and usability of the model and to create properly proportioned subcategories that ensure all important criteria are accounted for and receive the proper weight in the decision by them. The team determined the AHP hierarchy that contains 5 levels as follows: factors covering entire MRDs (customer and information management), sub-factors (archiving, coding, admission, and statistical units), sub-sub factors (More criteria included equipment, staff, customer, and process), and alternatives (MRDs of Alzahra, Kashani and Khorshid Hospitals). The pair-wise comparison matrices of elements were filled by participants and through brainstorm technique. First, the factors in Level 2 were pair-wise compared in order to derive their importance. Similarly, the critical success factors and sub-factors were also pair-wise compared in order to determine their local importance. Then, the alternative services were compared with respect to each

critical sub-sub-factor. Subsequently, the results are synthesized across the hierarchy in order to derive the relative performance of alternative options for the services under study. A nine-point numerical scale has been used for the comparison (Table 1). To analyze and perform AHP, Expert Choice software was used by researchers.

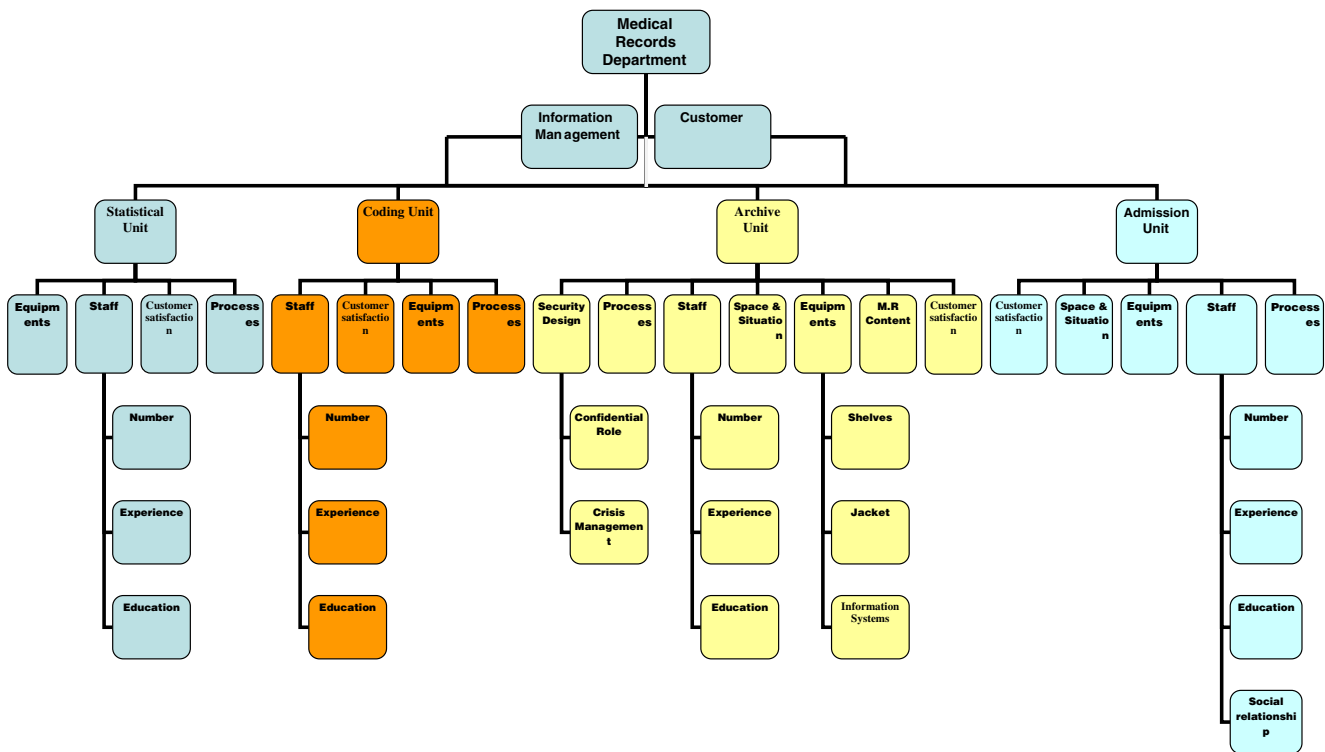
**Results**

Findings showed the factors, which affect entire system of MRDs, have the hierarchy structure as shown in Fig. 1. According to goal of this research which was performance assessment from two points of views: customer and information management and in four units. These units are Admission, Archive, Statistics and Coding with special functions as follows:

- 1) Admission: Registration of all patients who admit in the hospitals, and registration of patients in the Accident & Emergency Department that runs 24 h; issuing the birth notifications for the newborn babies and death notification for those who died in hospital.
- 2) Archive: Checking to ensure that all records had a complete discharge summary and all other necessary notes and reports are present; assembling and organizing the patient records and filling them in an orderly and timely manner; retrieving these records for treatment and providing services for medical student, doctors, nurses and other paramedical staff who need to perform retrospective research or study.
- 3) Statistics: Preparing statistics for administration, hospital departments, and outside agencies such as the Ministry of Health; providing health information for physicians, nurses and students for medical research purposes.
- 4) Coding: Analyzing all inpatient’s discharge records and assigning a set numeric code to diagnostic data based on (ICD-10) the International Classification of Diseases classification system and (ICPM) for procedures).

**Table 1** nine point scale for pair-wise comparison

Intensity of pair-wise	
Comparison	Importance
1	Equal importance, two activities contribute equally to the object
3	Moderate importance, slightly favors one over another
5	Essential or strong importance, strongly favors one over another
7	Demonstrated importance, dominance of the demonstrated importance in practice
9	Extreme importance, evidence favoring one over another of highest possible order of affirmation
2, 4, 6, 8	Intermediate values, when compromise is needed



**Fig. 1** the hierarchy of the performance assessment factors at MRDs of hospitals

As shown in Fig. 1, the common sub-factors in all units are staff, process, equipment and customer satisfaction. Some sub-factors have been further divided into sub-sub-factors. For example, staff has been affected by: number, experience, level of education and social relationship skill.

First, the factors in Level 2 were pair-wisely compared in order to derive their relative importance. Similarly, the critical success factors and sub-factors were also pair-wisely compared in order to determine their local importance. Then, the alternative services were compared with respect to each critical sub-sub-factor. Subsequently, the results are synthesized across the hierarchy in order to derive the relative performance of alternative options for the services under study. The comparison for the factors in the nine-point scale has been extracted through a process of consensual discussion, voting, and averaging in brainstorming meetings. The overall importance of the factors is the geometrical average of all the weights for each factor (Table 2).

The priority results indicated that MRD provision is most affected by “Information Management” (85.7%) compared to “customer” (14.3%). From information management point of view, archive unit is the most important unit in compare with others. On the other hand, from customer aspect, admission unit has the maximum grade of importance. Research findings indicate that in *archive unit*, the most important sub-factor is “content of each medical records file” and the least important sub-factor is “security

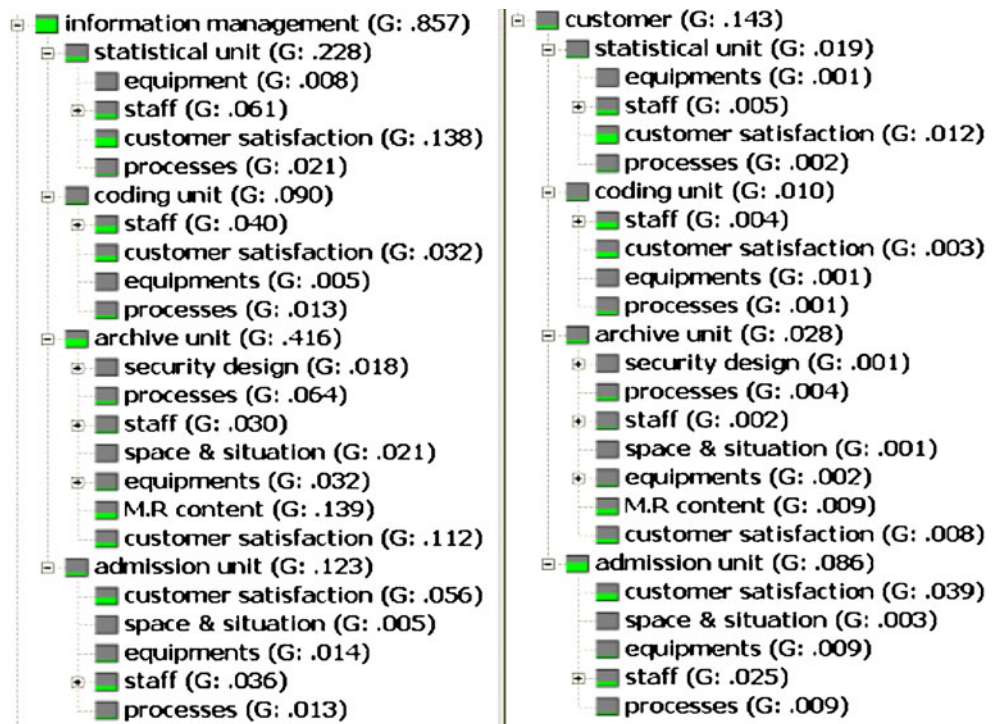
designs”; but in *admission* unit, “customer satisfaction” is the most important and “place and space” is the least important. In addition, for *coding unit*, the most important sub-factor is “staff”, but in *statistics unit*, the most important sub factor is “customer satisfaction”. Figure 2 shows the global weights or importance for the factors.

The next step was to derive weights for each MRDs (Alzahra, Kashani and Khorshid Hospitals) with respect to the hierarchy of all factors. The overall result indicates that Alzahra MRD is the first rank with 50.4%, Kashani MRD is the second rank with 27.5% and Khorshid MRD is the last with 22%. However, the participants agreed that although Alzahra MRD outranked other MRDs, there are still sub-factors for improvement in some areas of: staff social relationship, place and space in admission unit; the number of staff in archive unit; staff experiences in coding unit; number of staff in statistics unit.

**Table 2** Pair-wise comparison and normalized matrix of the factors in Information management aspect at medical records department

Factors	Admission	Archive	Coding	Statistics
Admission	1	0.35	2.08	0.49
Archive	2.86	1	2.08	1.58
Coding	0.48	0.48	1	0.2
Statistics	2.04	0.63	5	1

**Fig. 2** Expert choice screen shot of factors weights for medical records department



As shown in Table 3, Archive unit has received the highest weight with 0.416 in comparison to other units in aspect of information management. While, admission unit has gotten the highest weight with 0.086 in comparison to other units in aspect of customer (Table 4).

According to results, managers generally need to have some plans to solve weaknesses in all units of MRD in all hospitals (Tables 5 and 6), especially in customer satisfaction in Admission and Statistical units and Medical Records content in Archive unit.

The next step was to derive preferences for each MRDs (Alzahra, Kashani and Khorshid Hospitals) with respect to the hierarchy of all factors. The overall result indicates that Alzahra MRD is the first rank with 50.4%, Kashani MRD is the second rank with 27.5% and Khorshid MRD is the last with 22%. However, the participants agreed that although Alzahra MRD outranked other MRDs, there are still sub-factors for improvement in some areas of: staff social relationship, place and space in admission unit; the number of staff in archive unit; staff experiences in coding unit; number of staff in statistics unit.

**Discussion**

This study proposes a multi-criteria quantitative performance measurement model based on AHP. The factors which affects on MRD performance consists of “equipment”, “staff”, “customer satisfaction”, “space and situation”, “processes”, “MR content”, and “security and Design”. The specific and primary responsibilities of any MRD are to make the patients’ records organized and available as well as customer satisfaction.

As it can be seen in Fig. 1, the sub-criteria of archive unit that means M.R. content did not have enough score and did not have enough useful data in it (The global priority is 0.009 in customer aspect). That problem is share in other hospitals in other country such as Jordan and, Malaysia. For example; in a study in Jordan, researchers indicate that setting up and maintaining an efficient filing system is the most important single task of the MRD. Finding in this study illustrates that Medical Records files have missed the laboratory, X-Ray, and pathology reports or received them with delay [24]. Other study at Sultan

**Table 3** Performance of admission, archive, statistics and coding units in MRD in aspect of information management

Coding	Admission	Statistics	Archive
0.090	0.123	0.228	0.416

**Table 4** Performance of admission, archive, statistics and coding units in MRD in aspect of customer

Coding	Admission	Statistics	Archive
0.010	0.086	0.019	0.028

**Table 5** Ratio performance of MRD in selected hospitals in aspect of information management

Khorshid Hos	Alzahra Hos	Kashani Hos
0.217	0.515	0.268

Qaboos University Hospital with 500 beds that entitled “Developing quality healthcare software using quality function deployment” reveals the factors as continuous backup capability, the access to the information system, security category necessitate proper and adequate authentication on the users’ part before using the information system [25]. According of findings, we capture much information about current situation in MRD by using AHP model. On the other hand, other researches prove utility of AHP in healthcare. Meanwhile, Min, Amitava and Oswald made one of the notable researches for health care decisions by considering qualitative measurements. They proposed an AHP framework that can help medical clinics formulate viable service improvement strategies in the increasingly competitive health care industry. Their AHP model formed with two main criteria (technical quality and functional quality) and three sub-criteria (clinic management, medical equipment and facilities, and patient satisfaction). To develop a meaningful set of guidelines for competitive benchmarking, and determine comparative measures of health care quality of medical clinics, they constituted the process with the data from expert opinions, self-reports of the clinics included and a 22-item questionnaire patient survey [26].

Other research findings that entitled “Assessing Hospital Information Systems (HIS) in MRD in 2009” showed the total mean of similarity’s rate between MRDs and requirements HIS were as follows; general requirements of HIS 65.4%, general requirements of MRD 50.3%, MR management 85.7%, admission 59.6%, discharge 75.8%, statistics 64%, coding 32%, and archive 28.7% [27]. These results practically are similar to the findings of this research that “information management” is more effective than “customer” is.

Overall, the sensitivity analysis of the results revealed that MRD functions (social relationship, sedation and staff behavior to patients) should be improved. To improve patient comfort would substantially improve the performance of the admission unit of MRD. Additionally, the performance of MRD was very sensitive to factors like

**Table 6** Ratio performance of MRD in selected hospitals in aspect of customer

Khorshid Hos	Alzahra Hos	Kashani Hos
0.243	0.446	0.311

patient care sedation, staff social relationship, equipment availability, and experience factor.

## Conclusions

The Analytic Hierarchy Process for MRD and hospital decision supporters allow the user to design a hierarchical structure and weigh the trade-offs between decision criteria and alternatives to facilitate improved clinical and management decisions. The Analytic Hierarchy Process, is a proven, valuable, and versatile decision support tool that hospital CIOs (chief information officers), CTOs (Chief Technology Officers), IT/IS (Information Technology/ Information Systems) specialists, and clinical engineers should consider using to improve the analysis, organization, and implementing important decisions at MRDs. When medical staff properly designed and applied, the AHP methodology can help to elicit the relevant criteria, assess each criterion’s relative importance for decisions, and structure document the evaluation of the alternatives.

The resulting scores allow relative comparison of the alternatives. The AHP model can also be used to easily assess the relative impact that new information may have on the decision. As with any decision support tool, proper training and care must be used to build competent and reliable models that accurately reflect the unique experience and needs of the participants.

The above steps generated a number of improvement recommendations for each MRD that can be used by manager in MRD for assessing their performance.

## Comments

From the findings, researchers recommend some issues, corresponding to each unit, to improve MRD as follows:

- 1) Admission unit: In order to increase customer satisfaction managers should hold workshops for staff to learn how to communicate to clients especially at Accident & Emergency Admission unit.
- 2) Archive unit: To prevent miss files and track security policies it is better to use RFID (Radio Frequency Identification) that is the newest tool for security of M.R for tracking of patients’ records. In order to increase quality of M.R. content it must be checked that all records have a complete discharge summary and all other necessary notes and reports and records are assembled in an orderly and timely manner and signed-in in the system.
- 3) Statistics unit: In order to satisfy managers it is better to submit them statistical information along with the analysis comparing the outcomes with local indicators and previous data.

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