



Prioritizing Medication Management Criteria of National Hospital Accreditation Standards Using FDANP Model

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: Accreditation is an evaluating tool of health care systems especially in hospitals: Iran's Ministry of Health emphasizes its importance. We attempted this descriptive study to classify medication management criteria of hospital accreditation standards using a hybrid approach of fuzzy DEMATEL based on ANP (FDANP).

Methods: This study included all Iran's hospitals. Nine medication management criteria and their sub-criteria were evaluated. AHP questionnaire was used for data collection.

Results: The following were demonstrated to be effective: The standards of safe storage of drugs and medical equipment, and providing practical procedure for reporting and controlling medication

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errors. The other factors were affected by them: Continuous monitoring of drugs and medical equipment utilization was the most affected and not independent factors/standards.

Conclusion: Focus should be made on effective standards and their related measures, not on standards affected by other factors/standards.

Keywords: Accreditation standards; medication management; hospitals.

1. INTRODUCTION

All organizations need efficient performance-evaluation systems like accreditation standards to provide productive feedbacks [1]. Accreditation standards are important tools of improving clinical practice and organizational performance [2]. These standards are defined as “desired and achievable level of performance against which actual performance is measured” [3]. These standards enable “health service organizations, large and small, to embed practical and effective quality improvement and patient safety initiatives into their daily operations [3]. In fact, without an efficient accreditation, an organization won’t be able to promote its services or products to safe, reliable and cost-effective ones [4]. Concerns about accreditation of health care services has significantly increased over the past few decades and nowadays it becomes a prerequisite of all health organizations including hospitals [5]. In short, the goal of national and international accreditation agencies, like International Society for quality in Health Care, are seeking standards for continuous quality improvement of health industry [6].

Hospital Pharmacy Services are designed to meet medical needs of all hospitalized patients [1,7]. These services include supplying required drugs considering national regulations, providing drug monitoring, drug information and educational services is necessary [8]. Considering the crucial role of hospital pharmacies in patient care cycle, it is necessary for hospitals to use proper accreditation standards to optimize their pharmaceutical care services [9]. These standards are one of the most important strategic tools to detect both defects and strong points as well as opportunities of improvement in all levels of pharmaceutical cares [10]. Pharmacy accreditation standards should cover different aspects of pharmaceutical care, from staff training to pharmacy missions [11]. Put all these together, accreditation standards will improve the efficiency and productivity of all systems, help to achieve their goals, decrease costs and significantly improve human resources [12]. This model combines fuzzy decision making trial and evaluation laboratory (DEMATEL) with fuzzy

analytical network process (ANP) to determine the global weights of each standard and their impact relation map as well as their classification and priorities [13]. The aim of our study was to classifying medication management standards of national hospital accreditation using a fuzzy hybrid quantitative approach consisting of fuzzy decision making trial and laboratory (FDEMATEL) and fuzzy analytic network process (FANP) techniques known as FDANP.

2. MATERIALS AND METHODS

This is a descriptive study on all hospitals all around Iran in 2018. We used judgmental sampling method to prioritize 9 medication management criteria and their sub-criteria using 10 accreditation experts view. These experts had Ph.D or master degree and more than 10 years related work experience. We used hybrid approach of fuzzy DEMATEL based on ANP (FDANP) method for statistical analysis of data. We used Analytic Hierarchy Process (AHP) technique to organize data collection questionnaire. Here the step by step stages of our study procedure are presented achieve aim.

1. Identification of Lean, Agile, Resilient and Green Paradigms Practices Initially, according to literature review of the research a set of practices
2. Generating the Fuzzy Direct Relation Matrix

In this step, the experts initially perform paired comparisons in terms of influencing and effectiveness of practices on each other using the linguistic variables of Table 2.

3. Normalizing the Fuzzy Direct-Relation Matrix
4. Attaining the Fuzzy Total-Relation Matrix of Practices and Paradigms
5. Drawing the Cause-Effect Diagram of Paradigms and Practices
6. Forming the Initial Super Matrix
7. Obtaining the Weighted Super Matrix
8. Limiting the Weighted Super Matrix
9. Calculating Paradigm's Weight
10. Determining the Priority of criteria

Table 1. Accreditation standards and their measures

| Standards | Measures | Cod |
|--|---|------------|
| 24 hour access to drugs and medical equipment (C1) | Developing and maintaining drug formulary by hospital Drug and therapeutic Committee | C11 |
| | Availability of all drugs covered by hospital formulary in all hospital wards. | C12 |
| Safe storage of drugs and medical equipment based on national quality standards (C2) | Developing and practicing safe drug and medical equipment storage requirements | C21 |
| | store refrigerated medications correctly | C22 |
| | Storage ,distribution and administration of opioids considering national regulations | C23 |
| Safe distribution of drugs and single use medical equipment (C3) | Monitoring prescribing errors in patients files | C31 |
| | Monitoring medication errors through process of transferring drug orders from patient files to hospital information system. | C32 |
| | Safe preparation of high-risk and cytotoxic drugs by pharmacist | C33 |
| Safe procedure of providing drugs and medical equipment(C4) | providing detailed procedure of getting drugs and medical equipment | C41 |
| | Monitoring amount and storage conditions of drugs and medical equipment | C42 |
| | safe restoration of un-used drugs and medical equipment to pharmacy | C43 |
| Safe drug and medical equipment administration (C5) | Safe administering of single used medical equipment | C51 |
| | Safe administering of multiple used medical equipment | C52 |
| | Safe storage of high risk and cytotoxic drugs with alarm sins | C53 |
| Continuous monitoring of drugs and medical equipment utilization (C6) | Drug use evaluation especially for antibiotics | C61 |
| | Managing ordering procedure of drugs that are not covered by hospital formulary | C62 |
| Providing practical procedure for expired and recalled drugs disposal (C7) | Safe disposal of expired drugs and medical equipment considering national regulations | C71 |
| | Safe removing of recalled drugs | C72 |
| Patient medication review by pharmacist on doctor request (C8) | Access to patient information as name, sex, weight, age, any allergies, diagnosis and... Medication therapy review by Clinical Pharmacists at least in ICUs and CCUs | C81 |
| Providing practical procedure for reporting and controlling medication errors (C9) | Monitoring drug errors | C91 |
| | Providing information about look alike and sound alike drugs | C92 |
| | Providing preventive procedures for medication errors and adverse drug reactions in drug and therapeutic committee. | C93 |

Table 2. The values of \tilde{R} , \tilde{D} , $(\tilde{D} + \tilde{R})^{def}$, $(\tilde{D} - \tilde{R})^{def}$

| Effect status | $(\tilde{D} - \tilde{R})^{def}$ | $(\tilde{D} + \tilde{R})^{def}$ | \tilde{R} | \tilde{D} | Standards and measures |
|---------------|---------------------------------|---------------------------------|-------------------------------|-------------------------------|------------------------|
| Effective | 0.0409 | 1.6185 | (0.1974,0.4862,1.9854) | (0.2103,0.5208,2.0668) | C1 |
| Effective | 0.0078 | 0.3647 | (0.0432,0.1069,0.4568) | (0.0501,0.1153,0.4642) | C11 |
| Affected | -0.0078 | 0.376 | (0.0517,0.1192,0.4775) | (0.0448,0.1108,0.4701) | C12 |
| Affected | -0.0178 | 1.5675 | (0.2048,0.4874,1.9909) | (0.1928,0.474,1.9587) | C2 |
| Effective | 0.0003 | 0.5975 | (0.0859,0.1908,0.727) | (0.0966,0.1974,0.7041) | C21 |
| Affected | -0.005 | 0.5171 | (0.0688,0.1608,0.6538) | (0.0635,0.154,0.6528) | C22 |
| Effective | 0.0047 | 0.519 | (0.0671,0.1561,0.6493) | (0.0617,0.1563,0.6732) | C23 |
| Affected | -0.0148 | 1.4207 | (0.1729,0.4266,1.8448) | (0.1735,0.4137,1.8108) | C3 |
| Affected | -0.0028 | 0.4488 | (0.0561,0.1305,0.5861) | (0.0574,0.1308,0.5731) | C31 |
| Effective | 0.0217 | 0.4488 | (0.0503,0.1201,0.5638) | (0.0654,0.1391,0.5973) | C32 |
| Affected | -0.0189 | 0.3892 | (0.0406,0.1069,0.5618) | (0.0242,0.0876,0.5413) | C33 |
| Affected | -0.0465 | 1.5184 | (0.1981,0.4779,1.976) | (0.1723,0.4396,1.8923) | C4 |
| Effective | 0.0111 | 0.4679 | (0.0474,0.1266,0.6131) | (0.0545,0.1377,0.628) | C41 |
| Effective | 0.0258 | 0.5412 | (0.059,0.1512,0.6694) | (0.0684,0.1712,0.7231) | C42 |
| Affected | -0.0368 | 0.4507 | (0.0599,0.1432,0.6288) | (0.0434,0.1121,0.5602) | C43 |
| Affected | -0.0503 | 1.3766 | (0.1704,0.4221,1.8392) | (0.1514,0.3801,1.7411) | C5 |
| Affected | -0.0053 | 0.3097 | (0.0235,0.0704,0.4658) | (0.025,0.0684,0.447) | C51 |
| Effective | 0.0034 | 0.4133 | (0.0391,0.1073,0.566) | (0.0391,0.1101,0.574) | C52 |
| Effective | 0.0019 | 0.4286 | (0.0401,0.1144,0.5844) | (0.0386,0.1136,0.5952) | C53 |
| Effective | 0.0835 | 1.4906 | (0.1668,0.4161,1.8151) | (0.2095,0.4844,1.9698) | C6 |
| Affected | -0.0068 | 0.3022 | (0.0362,0.0883,0.4051) | (0.0305,0.0802,0.4) | C61 |
| Effective | 0.0068 | 0.3042 | (0.0313,0.081,0.4016) | (0.037,0.0891,0.4067) | C62 |
| Affected | -0.0424 | 1.3601 | (0.1722,0.4113,1.8102) | (0.1514,0.3771,1.7299) | C7 |
| Effective | 0.0044 | 0.2578 | (0.0249,0.0647,0.3526) | (0.0281,0.0688,0.3587) | C71 |
| Affected | -0.0044 | 0.2547 | (0.0277,0.0672,0.3561) | (0.0245,0.0631,0.35) | C72 |
| Affected | -0.0185 | 1.5186 | (0.1944,0.4657,1.9484) | (0.1895,0.4531,1.9044) | C8 |
| Effective | 0.0032 | 0.2897 | (0.032,0.0792,0.3826) | (0.0374,0.0833,0.3817) | C81 |
| Affected | -0.0032 | 0.3552 | (0.0444,0.1065,0.4593) | (0.039,0.1024,0.4602) | C82 |
| Effective | 0.0659 | 1.6689 | (0.2015,0.4959,2.0127) | (0.2278,0.5464,2.1489) | C9 |
| Effective | 0.0053 | 0.6531 | (0.0951,0.2117,0.7771) | (0.0965,0.2141,0.7921) | C91 |
| Affected | -0.026 | 0.5556 | (0.0797,0.183,0.7175) | (0.0704,0.1634,0.6619) | C92 |
| Effective | 0.0207 | 0.6374 | (0.0864,0.1976,0.7517) | (0.0943,0.2148,0.7923) | C93 |

Table 3. The final weight of medication management standards

| Final weight and prioritization of standards | Cod | Final weight of measures and prioritization | | Relative weight of measures and prioritization | | |
|--|---------------|--|--------|---|--------|-----|
| 24 hour access to drugs and medical equipment (C1) | 0.1177 | 3 | 0.0569 | 2 | 0.4834 | C11 |
| | | 2 | 0.0608 | 1 | 0.5166 | C12 |
| Safe storage of drugs and medical equipment based on national quality standards (C2) | 0.1202 | 9 | 0.0443 | 1 | 0.3686 | C21 |
| | | 14 | 0.0383 | 2 | 0.3186 | C22 |
| | | 15 | 0.0376 | 3 | 0.3128 | C23 |
| Safe distribution of drugs and single use medical equipment(C3) | 0.104 | 20 | 0.0356 | 1 | 0.3423 | C31 |
| | | 22 | 0.0335 | 3 | 0.3221 | C32 |
| | | 21 | 0.0349 | 2 | 0.3356 | C33 |
| Safe procedure of providing drugs and medical equipment (C4) | 0.1172 | 18 | 0.0366 | 3 | 0.3123 | C41 |
| | | 10 | 0.0434 | 1 | 0.3703 | C42 |
| | | 17 | 0.0372 | 2 | 0.3174 | C43 |
| Safe drug and medical equipment administration (C5) | 0.1037 | 23 | 0.0272 | 3 | 0.2623 | C51 |
| | | 16 | 0.0375 | 2 | 0.3616 | C52 |
| | | 13 | 0.039 | 1 | 0.376 | C53 |
| Continuous monitoring of drugs and medical equipment utilization (C6) | 0.1019 | 7 | 0.0502 | 2 | 0.4926 | C61 |
| | | 4 | 0.517 | 1 | 0.5074 | C62 |
| Providing practical procedure for expired and recalled drugs disposal (C7) | 0.1026 | 6 | 0.0509 | 2 | 0.4961 | C71 |
| | | 5 | 0.0517 | 1 | 0.5039 | C72 |
| | | 8 | 0.0467 | 2 | 0.4107 | C81 |
| Patient medication review by pharmacist on doctor request (C8) | 0.1137 | 1 | 0.067 | 1 | 0.5893 | C82 |
| Providing practical procedure for reporting and controlling medication errors (C9) | 0.1197 | 11 | 0.0429 | 1 | 0.3584 | C91 |
| | | 19 | 0.0359 | 3 | 0.2999 | C92 |
| | | 12 | 0.0409 | 2 | 0.3417 | C93 |

The medication management criteria and their sub – criteria are described in Tables 1, 2, 3.

Fuzzy Direct Relation Matrix described in Table 2.

The final weight of each criteria and related sub-criteria are shown in Table 3.

3. RESULTS

As shown in Table 4, safe storage of drugs and medical equipment, (weighting 0.1202) and Continuous monitoring of drugs and medical equipment utilization (weighing 0.1019) has the highest and lowest priorities respectively.

4. DISCUSSION

In his regard, nine criteria and 23 related sub-criteria were evaluated. The impact of accreditation programs on different aspects of health care systems as patient safety, cost, quality managements have been investigated in several studies [14-18]. Their results proved accreditation as an important tool for improving standards of patient care. So focus on implementation accreditation standards in different health care settings as well as optimizing its measures is one of the most

serious concerns of all health regulatory systems[19, 20]. In this study we initially identified, influencing and effectiveness of criteria and sub - criteria on each other using fuzzy dematel method [21]. The results of this study showed that paradigms of safe storage of drugs and medical equipment's and providing practical procedure for reporting and controlling medication errors are effective and the other paradigms are affected. On the other hand paradigm of continuous monitoring of drugs and medical equipment utilization is the most affected one that is affected by all other paradigms [22].

According to the results, safe storage of drugs and medical equipment's is the most important paradigms among medication management criteria of hospital accreditation standards, on one hand, and has the most interaction with other paradigms, on the other hand [22, 23]. Since it is believed that safe storage of drugs and medical equipment's is pre-requisite for other pharmacy related services, therefore hospitals should be more focused on implementing and employing practical procedures of its principles, to provide appropriate infrastructures [24-26]. It is also recommended to concentrate and invest more on affective paradigms and review their measures more often to improve pharmaceutical care and also hospitals final ranking level evaluated by national accreditation standards.

Table 4. Hospitals calculated points and final level

| Level | University Type | Criteria | | | | | | | | |
|---------|-----------------|---------------|--------------|---------------|----------------|----------------|----------------|--------------|----------------|----------------|
| | | C9 (88.1%) | C8 (100%) | C7 (72.2%) | C6 (69.72%) | C5 (82.54%) | C4 (88.88%) | C3 (%100) | C2 (90.49%) | C1 (75.45%) |
| Level 1 | Legal Private | 15.55 | 14.58 | 16 | 17.86 | 15.07 | 17.69 | 15.87 | 15.49 | 40.85 |
| | Real Private | 6.67 | 5.56 | 6 | 3.57 | 5.48 | 4.62 | 7.94 | 8.45 | 8.45 |
| | Charity | 2.22 | 4.86 | 3.33 | 1.79 | 2.05 | 1.54 | 4.76 | 2.82 | 5.63 |
| | Public | 67.78 | 68.06 | 66 | 64.29 | 65.07 | 66.92 | 53.97 | 62.68 | 29.58 |
| | Private | 7.78 | 6.94 | 8.67 | 12.5 | 12.33 | 9.23 | 17.46 | 10.56 | 15.49 |
| Level | University Type | Criteria | | | | | | | | |
| | | C9 (88.1%) | C8 (100%) | C7 (72.2%) | C6 (69.72%) | C5 (88.88%) | C4 (88.88%) | C3 (100%) | C2 (90.49%) | C1 (86.1%) |
| Level 2 | Legal Private | 5.41 | 9.33 | 8.05 | 0 | 0 | 7.55 | 11.43 | 10.94 | 0 |
| | Real Private | 10.81 | 2.67 | 4.03 | 0 | 0 | 0 | 2.86 | 6.25 | 0 |
| | Charity | 0 | 1.33 | 2.68 | 0 | 0 | 5.66 | 5.71 | 0 | 0 |
| | Public | 75.68 | 80 | 75.17 | 94.12 | 100 | 69.81 | 60 | 70.31 | 100 |
| | Private | 10.81 | 6.67 | 10.07 | 5.88 | 0 | 16.98 | 20 | 12.5 | 0 |

| Level | University Type | C9 (88.1%) | C8 (100%) | C7 (72.2%) | C6 (69.72%) | C5 (82.54%) | C4 (88.88%) | C3 (100%) | C2 (90.49%) | C1 (75.45%) |
|---------|-----------------|---------------|--------------|---------------|----------------|----------------|----------------|--------------|----------------|----------------|
| Level 3 | Legal Private | 0 | 5.26 | 8.82 | 0 | 0 | 13.33 | 20 | 6.67 | 50 |
| | Real Private | 0 | 0 | 2.94 | 0 | 0 | 0 | 0 | 6.67 | 0 |
| | Charity | 0 | 0 | 2.94 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Public | 87.5 | 89.47 | 76.47 | 85.71 | 94.12 | 86.67 | 80 | 73.33 | 0 |
| | Private | 12.5 | 5.26 | 8.82 | 14.29 | 5.88 | 0 | 0 | 13.33 | 50 |
| Level | University Type | C9 (88.1%) | C8 (100%) | C7 (72.2%) | C6 (69.72%) | C5 (82.54%) | C4 (88.88%) | C3 (100%) | C2 (90.49%) | C1 (75.45%) |
| Level 4 | Legal Private | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Real Private | 0 | 0 | 14.3 | 0 | 0 | 25 | 0 | 12.5 | 50 |
| | Charity | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Public | 100 | 100 | 85.7 | 100 | 100 | 75 | 100 | 87.5 | 50 |
| | Private | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

5. CONCLUSION

The results of the study showed that some standards ranked first with highest score and other standard had lowest score in different hospitals all over Iran. We also observed public hospitals affiliated to Ministry of Health and Medical Education had highest points in each scored level.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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