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A Personnel Selection Problem in Healthcare System Using Fuzzy-TOPSIS Approach

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Abstract The methods of multiple criteria decision-making (MCDM) are increasingly becoming the most desired tools for making daily decisions in various fields of human endeavors. Staff employment in any sector requires a thorough evaluation of the applicant before selection to ensure effective and efficient service delivery. Besides, healthcare is one of the most complicated organizations dealing with human lives. This paper has developed a staff selection model considering a fuzzy environment by using the technique for order preference similar to the ideal solution (TOPSIS) method. For the delivery and promotion of quality healthcare systems, medical staff selection is crucial to the system. Therefore, the study evaluates medical staff by using the expert's linguistic judgement under the criteria of skill, experience and ability to respond to a problem. The expert's vagueness in judgments has been represented by using fuzzy triangular numbers. The study determines the closeness coefficient, the measures of separation and the ideal solutions of the TOPSIS method. The most appropriate medical staff are ranked and selected based on the available criteria. The Fuzzy-TOPSIS method is simple and can help other organizations achieve proper ranking, evaluation and selection of qualified candidates, as it takes imprecise information into account.

Keywords Fuzzy-TOPSIS, triangular fuzzy number, separation measure, closeness coefficient, ideal solution

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1. Introduction

Nowadays, MCDM methods are increasingly becoming the most desired tools for making daily decisions in various fields of human endeavors. Staff employment in any sector needs a thorough evaluation of the applicant before selecting them for

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effective and efficient service delivery. Besides, healthcare is one of the most complicated organizations dealing with human lives. Determining acceptable alternative measures and ranking prioritized needs in a medical unit/department are undoubtedly very demanding and challenging tasks that are necessary concerning various factors.

There are various multi-criteria techniques that help top managers select the right personnel from many qualified candidates to handle patients with reasonable care and services [25]. An optimum staff selection has a substantial positive impact on the effectiveness and efficiency of healthcare delivery process. Because of strategy diversity and disease characteristics among various patients, it would not be possible to consider all the criteria upon which decisions are made. Hence, a careful selection of qualified individuals in expression is needed. Medical personnel are more attracted to the recent advancement in technology, while the complexity of the system depends on an expertise selection. The healthcare industry is increasing day by day due to the exponentially growing population and the demand intensity for their global services. The need for optimal expert selection by decision-makers (DMs) is cardinal to achieving high-quality healthcare service delivery [29]. The decision to select a substantive medical expert or technologies involves evaluation on different criteria to ascertain their efficacy before selection. The challenging task before management is to adopt the evaluation technique, as the methods become increasingly important. This, in the literature, is known as a selection problem. This article presents a model for evaluating the medical staff under a fuzzy environment.

This article is organized as follows. Section 1 provides the introduction and overview of the study. The related literature on MCDM is reviewed in Section 2. Section 3 discusses the methodology of the study. Section 4 discusses preliminary fuzzy sets and TOPSIS under fuzziness. Section 5 presents the application of the methods discussed in a healthcare staff evaluation and selection. Finally, the article is concluded in Section 6.

2. Literature review

Over a decade, researchers have been using different techniques to evaluate and select criteria, suppliers and the quality of individuals. Some authors addressed the problem by using a single objective function, while others employed multiple objectives under different conditions and constraints. For instance, the requirements for selecting effective security in an engineering approach were studied by using Fuzzy logic, TOPSIS and analytic network process (ANP) [5, 6]. Fuzzy ANP has been applied in determining an organizational sectoral competition level based on "Poter's five forces analysis" [16]. Service quality, the impact of healthcare Web applications, environmental sustainability and RFID system suppliers have been evaluated in the healthcare industry by using Fuzzy TOPSIS, analytic hierarchy process (AHP) and ANP [2, 10, 11, 33, 34]. Recently, Khambhati, Patel and Kumar [20] have evaluated service quality performance and compared models of the urban public healthcare system. A hospital classification based on service quality has been studied by using AHP as an MCDM tool [4]. Similarly, an integrated approach for the TOPSIS has been studied recently in selection of pharmaceutical suppliers [23]. The performance of an operating room in a hospital has been evaluated with the help of a balanced scorecard and fuzzy linguistics to measure the service [22]. The VIKOR method, TOPSIS and fuzzy MCDM have been carried out to obtain the