



## Decision Support System for Choosing the Best General Practitioner with Additive Ratio Assessment (ARAS) Method

Nursaka Putra<sup>1</sup>, Khairul Imtihan<sup>2</sup>, Partogi Simanjuntak<sup>3,\*</sup>, Mesran<sup>3</sup>, Hetty Rohayani<sup>4</sup>

<sup>1</sup> Prodi Teknologi Rekayasa Elektro-Medis, Institut Kesehatan dan Teknologi Al Insyirah (IKTA) Pekanbaru, Riau, Indonesia

<sup>2</sup> Information System, STMIK Lombok, Lombok, Indonesia

<sup>3</sup> Informatics Techniques, Universitas Budi Darma, Medan, Indonesia

<sup>2</sup> Informatics, Universitas Muhammadiyah Jambi, Jambi, Indonesia

Email: <sup>1</sup>nursakaputra@gmail.com, <sup>2</sup>khairulimtihan31@gmail.com, <sup>3,\*</sup>partogi.simanjuntak78@gmail.com,

<sup>4</sup>mesran.skom.mkom@gmail.com, <sup>5</sup>hettyrohayani@gmail.com

Coresponding Author: partogi.simanjuntak78@gmail.com

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**Abstract**—A general practitioner is a medical practitioner who focuses on treating sudden or chronic illnesses, and is often considered a first-line doctor. In health services in hospitals, doctors are an important asset. Previously, the selection of the best general practitioner at Bhakti Medan Hospital was done manually, namely through an evaluation of the number of patients cured and the opinions of the nurses who worked with the doctor. However, this method is not effective enough in assessing the professionalism and quality of a doctor. However, determining the best doctor is not easy and requires many criteria, such as communication skills, ability to listen to patients, compliance with the obligations and rights of doctors and patients, rational use of drugs, and adherence to professional ethics. Therefore, a computer-based decision support system is used to assist in selecting the best doctor effectively. Decision support systems are part of a computer-based information system that is used to assist decision making within an organization or company. In this study the authors used the Additive Ratio Assessment (ARAS) method. With the ARAS method the problem of determining the best general practitioner will be easier because the ARAS method in general does a lot of ranking by comparing with other alternatives so as to get the ideal and best results. Based on the results of calculations that have been done previously, in this study it can be concluded that alternative A3 is with a value of 0.1855 on behalf of Dr. Lenny Tampubolon as the best general practitioner at Bhakti General Hospital.

**Keywords:** Decision Support System; ARAS Method; General Practitioners

### 1. INTRODUCTION

A general practitioner is a medical practitioner who focuses on treating sudden or chronic illnesses, and is often considered a first-line doctor. In contrast to specialist doctors, general practitioners provide holistic care to patients and play an important role in the medical world because they are often the first doctors to come into contact with patients[1]. Although not tied to any particular specialty, general practitioners have a wide range of knowledge that assists them in treating patients of all ages, genders, and health problems. To become a doctor requires special education and training as well as a degree in medicine[2].

In health services in hospitals, doctors are an important asset. Previously, the selection of the best general practitioner at Bhakti Medan Hospital was done manually, namely through an evaluation of the number of patients cured and the opinions of the nurses working with the doctor. However, this method is not effective enough in assessing the professionalism and quality of a doctor. Therefore, to improve the quality of health services, efforts are needed to motivate general practitioners' performance by awarding them as the best doctor. However, determining the best doctor is not easy and requires many criteria, such as communication skills, ability to listen to patients, compliance with the obligations and rights of doctors and patients, rational use of drugs, and adherence to professional ethics. Therefore, a computer-based decision support system is used to assist in selecting the best doctor effectively.

Decision support systems are part of a computer-based information system that is used to assist decision making within an organization or company [3]–[6]. In this study the authors used the Additive Ratio Assessment (ARAS) method. With the ARAS method the problem of determining the best general practitioner will be easier because the ARAS method in general does a lot of ranking by comparing with other alternatives so as to get the ideal and best results.

The related research in this article was conducted by Agus Iskandar in 2023 researching the application of the ARAS and ROC methods in selecting Teleservice Representative acceptance to produce the best alternative, namely Nisa Fadillah in alternative A4 with a value of 1.0000[7]. Research conducted by Chrisnatanus et al in 2022 examined the application of the ARAS method in determining teacher performance to produce the best alternative with a value of 0.0753 in alternative A5[8]. Research conducted by Juniar et al in 2022 examined the use of the ARAS method for BPNT receipts to produce 2 prioritized alternatives for obtaining assistance [9]. Research conducted by Delpiah et al in 2022 examined the application of the ARAS method in selecting new students to produce an alternative with the highest score, namely 0.790 on A1[10].

From this explanation, in this study the researchers applied a decision support system by implementing the ARAS method which could produce the right decisions in selecting the best general practitioner at Bhakti General Hospital.

## 2. RESEARCH METHODOLOGY

### 2.1 Decision Support System

Decision support systems are computer-based software that has specific capabilities to produce the best decisions for management in solving the problems at hand[11]–[17].

### 2.2 General Practitioner

General practitioners have a focus on the treatment of acute and chronic diseases and are known as first-service doctors. In contrast to specialist doctors, general practitioners provide holistic services to patients. The role of general practitioners in medicine is critical, particularly as they are often the first point of contact between patients and the health system. Because general practitioners are not tied to the treatment of any particular organ or body part, they have a wide range of knowledge to help patients of all ages, genders, and health problems. To become a general practitioner, special education and training is required as well as obtaining a degree in medicine [18]–[20].

### 2.3 ARAS Method

ARAS is a method that can be used to obtain the results of ranking criteria to produce optimal solutions. The stages used in the ARAS method, namely [21]–[25]:

1. Formation of a Decision Making Matrix

$$X = \begin{bmatrix} X_{01} & X_{0j} & \dots & X_{0n} \\ X_{i1} & X_{ij} & \dots & X_{in} \\ \vdots & \vdots & \ddots & \vdots \\ X_{n1} & X_{mj} & X_{mj} & X_{mn} \end{bmatrix} \quad (1)$$

2. Normalization of the decision matrix

Benefit Criteria:

$$X_{ij}^* = \frac{x_{ij}}{\sum_{i=0}^m x_{ij}} \quad (2)$$

Non-Benefit Criteria:

$$\text{Step-1: } X_{ij}^* = \frac{1}{x_{ij}} \quad (3)$$

$$\text{Step-2: } R = \frac{x_{ij}}{\sum_{i=0}^m x_{ij}^*} \quad (4)$$

3. Determine the matrix weights that have been normalized

$$D = [d_{ij}]_{m \times n} = r_{ij} \cdot W_j \quad (5)$$

4. Determine the value of the optimization function (Si)

$$S_i = \sum_{j=1}^n d_{ij}; (i = 1, 2, \dots, m; j = 1, 2, \dots, n) \quad (6)$$

5. Determine the highest rank level of the alternatives

$$U_i = \frac{S_i}{S_0} \quad (7)$$

## 3. RESULT AND DISCUSSION

### 3.1 Determination of Alternative

To get the right decision in selecting the best general practitioner at Bhakti General Hospital, the hospital can take advantage of the research results. In this study, the ARAS method was applied to determine the best general practitioner. The study found 5 alternative general practitioners at Bhakti General Hospital.

**Tabel 1.** Data of Alternative

Alternative	Description
A <sub>1</sub>	Dr. Irna Wati
A <sub>2</sub>	Dr. intan
A <sub>3</sub>	Dr. Lenny Tampubolon
A <sub>4</sub>	Dr. Alsyah Nasution
A <sub>5</sub>	Dr. Naeni

### 3.2 Determination of Criteria

To find a comparison for each general practitioner, there is a table of criteria such as character, length of service, ability, responsibility. The weight values obtained from the AHP method are used to find comparisons of each alternative.

**Table 2.** Data of Criteria

Criteria	Description	Type	Weight (%)
C <sub>1</sub>	Character	Benefit	0,324
C <sub>2</sub>	Experience	Benefit	0,348
C <sub>3</sub>	Ability	Benefit	0,348
C <sub>4</sub>	Responsibility	Benefit	0,292

The following is data from each alternative used in this study.

**Table 3.** Data of Alternative

Alternative	Character	Experience	Ability	Responsibility
A <sub>1</sub>	Good	Very Good	Good	Very Good
A <sub>2</sub>	Very Good	Good	Good	Good
A <sub>3</sub>	Very Good	Good	Very Good	Good
A <sub>4</sub>	Good	Pretty Good	Good	Very Good
A <sub>5</sub>	Good	Good	Good	Good

Data from each alternative requires weighting using the following table 4 to produce a suitability rating table.

**Table 4.** Criteria Value Weight

Value	Value of Weighted
Very Good	5
Good	4
Pretty Good	3
Bad	2
Very Bad	1

The next step is to determine alternative suitability ratings for each criterion based on the criteria weighting table as follows.

**Table 5.** Alternative Match Rating on each Criterion.

Alternative	Character	Experience	Ability	Responsibility
A <sub>1</sub>	4	5	4	5
A <sub>2</sub>	5	4	4	4
A <sub>3</sub>	5	4	5	4
A <sub>4</sub>	4	3	4	5
A <sub>5</sub>	4	4	5	4

### 3.3 Implementation of ARAS Method

After the alternatives, criteria and weights have been weighted to obtain a decision matrix, the ARAS method is calculated as follows.

#### 1. Formation of a Decision Making Matrix

**Table 6.** Decision Matrix

Alternative	C1	C2	C3	C4
A <sub>0</sub>	5	5	5	5
A <sub>1</sub>	4	5	4	5
A <sub>2</sub>	5	4	4	4
A <sub>3</sub>	5	4	5	4
A <sub>4</sub>	4	3	4	5
A <sub>5</sub>	4	4	5	4
Criteria Type	Max	Max	Max	Max

#### 2. Normalization of the Decision Matrix

$$C_1 = R_{01} = \frac{5}{27} = 0,1851$$

$$R_{11} = \frac{4}{27} = 0,1481$$

$$R_{21} = \frac{5}{27} = 0,1851$$

$$\begin{aligned}
 R_{31} &= \frac{5}{27} = 0,1851 \\
 R_{41} &= \frac{4}{27} = 0,1481 \\
 R_{51} &= \frac{4}{27} = 0,1481 \\
 C_2 = R_{02} &= \frac{5}{25} = 0,2 \\
 R_{12} &= \frac{5}{25} = 0,2 \\
 R_{22} &= \frac{4}{25} = 0,16 \\
 R_{32} &= \frac{4}{25} = 0,16 \\
 R_{42} &= \frac{3}{25} = 0,12 \\
 R_{52} &= \frac{4}{25} = 0,16 \\
 C_3 = R_{03} &= \frac{5}{27} = 0,1851 \\
 R_{13} &= \frac{4}{27} = 0,1481 \\
 R_{23} &= \frac{4}{27} = 0,1481 \\
 R_{33} &= \frac{5}{26} = 0,1851 \\
 R_{43} &= \frac{4}{27} = 0,1481 \\
 R_{53} &= \frac{5}{27} = 0,1851 \\
 C_4 = R_{04} &= \frac{5}{27} = 0,1851 \\
 R_{14} &= \frac{5}{27} = 0,1851 \\
 R_{24} &= \frac{4}{27} = 0,1481 \\
 R_{34} &= \frac{4}{27} = 0,1481 \\
 R_{44} &= \frac{5}{27} = 0,1851 \\
 R_{54} &= \frac{4}{27} = 0,1667
 \end{aligned}$$

So from the calculation results obtained Decision Matrix that has been normalized:

$$X^* = \begin{pmatrix} 0,1851 & 0,2 & 0,1851 & 0,1851 \\ 0,1481 & 0,2 & 0,1481 & 0,1851 \\ 0,1851 & 0,16 & 0,1481 & 0,1481 \\ 0,1851 & 0,16 & 0,1851 & 0,1481 \\ 0,1481 & 0,12 & 0,1481 & 0,1851 \\ 0,1481 & 0,16 & 0,1851 & 0,1667 \end{pmatrix}$$

3. Determine the matrix weights that have been normalized

D<sub>1</sub>

$$\begin{aligned}
 D_{01} &= X^*_{01} * W_1 = 0,1851 * 0,324 = 0,0599 \\
 D_{11} &= X^*_{11} * W_1 = 0,1481 * 0,324 = 0,0479 \\
 D_{21} &= X^*_{21} * W_1 = 0,1851 * 0,324 = 0,0599 \\
 D_{31} &= X^*_{31} * W_1 = 0,1851 * 0,324 = 0,0599 \\
 D_{41} &= X^*_{41} * W_1 = 0,1481 * 0,324 = 0,0479 \\
 D_{51} &= X^*_{51} * W_1 = 0,1481 * 0,324 = 0,0479
 \end{aligned}$$

D<sub>2</sub>

$$\begin{aligned}
 D_{02} &= X^*_{02} * W_2 = 0,2 * 0,348 = 0,0696 \\
 D_{12} &= X^*_{12} * W_2 = 0,2 * 0,348 = 0,0696 \\
 D_{22} &= X^*_{22} * W_2 = 0,16 * 0,348 = 0,0556 \\
 D_{32} &= X^*_{32} * W_2 = 0,16 * 0,348 = 0,0556 \\
 D_{42} &= X^*_{42} * W_2 = 0,12 * 0,348 = 0,0417 \\
 D_{52} &= X^*_{52} * W_2 = 0,16 * 0,348 = 0,0556
 \end{aligned}$$

D<sub>3</sub>

$$\begin{aligned}
 D_{03} &= X^*_{03} * W_3 = 0,1923 * 0,348 = 0,0669 \\
 D_{13} &= X^*_{13} * W_3 = 0,1538 * 0,348 = 0,0535 \\
 D_{23} &= X^*_{23} * W_3 = 0,1154 * 0,348 = 0,0401 \\
 D_{33} &= X^*_{33} * W_3 = 0,1923 * 0,348 = 0,0669
 \end{aligned}$$

$$D_{43} = X_{43}^* * W_3 = 0,1923 * 0,348 = 0,0669$$

$$D_{53} = X_{53}^* * W_3 = 0,1538 * 0,348 = 0,0535$$

D<sub>4</sub>

$$D_{04} = X_{04}^* * W_4 = 0,2083 * 0,292 = 0,0608$$

$$D_{14} = X_{14}^* * W_4 = 0,125 * 0,292 = 0,0365$$

$$D_{24} = X_{24}^* * W_4 = 0,125 * 0,292 = 0,0365$$

$$D_{34} = X_{34}^* * W_4 = 0,2083 * 0,292 = 0,0608$$

$$D_{44} = X_{44}^* * W_4 = 0,1667 * 0,292 = 0,0486$$

$$D_{54} = X_{54}^* * W_4 = 0,1667 * 0,292 = 0,0486$$

From the calculation above, the matrix results can be obtained as follows:

$$D = \begin{pmatrix} 0,0599 & 0,0696 & 0,0669 & 0,0608 \\ 0,0479 & 0,0696 & 0,0535 & 0,0365 \\ 0,0599 & 0,0556 & 0,0401 & 0,0365 \\ 0,0599 & 0,0556 & 0,0669 & 0,0608 \\ 0,0479 & 0,0417 & 0,0669 & 0,0486 \\ 0,0479 & 0,0556 & 0,0535 & 0,0486 \end{pmatrix}$$

4. Determine the value of the optimization function

$$S_0 = 0,0599 + 0,0696 + 0,0669 + 0,0608 = 0,2572$$

$$S_1 = 0,0479 + 0,0696 + 0,0535 + 0,0365 = 0,2075$$

$$S_2 = 0,0599 + 0,0556 + 0,0401 + 0,0365 = 0,1921$$

$$S_3 = 0,0599 + 0,0556 + 0,0669 + 0,0608 = 0,2432$$

$$S_4 = 0,0479 + 0,0417 + 0,0669 + 0,0486 = 0,2051$$

$$S_5 = 0,0479 + 0,0556 + 0,0535 + 0,0486 = 0,2056$$

$$S = 0,2075 + 0,1921 + 0,2432 + 0,2051 + 0,2056 = 1,3107$$

Determine the high rank level of each alternative

$$K_0 = \frac{0,2575}{1,3107} = 0,1964$$

$$K_1 = \frac{0,2075}{1,3107} = 0,1583$$

$$K_2 = \frac{0,1921}{1,3107} = 0,1465$$

$$K_3 = \frac{0,2432}{1,3107} = 0,1855$$

$$K_4 = \frac{0,2051}{1,3107} = 0,1564$$

$$K_5 = \frac{0,2056}{1,3107} = 0,1568$$

From the application of the ARAS method, the results of the ranking table 7, for each alternative are as follows:

**Table 7.** Value for Each Alternative

Alternative	C1	C2	C3	C4	S	K
A <sub>0</sub>	0,1851	0,2	0,1851	0,1851	0,2572	0,1964
A <sub>1</sub>	0,1481	0,2	0,1481	0,1851	0,2075	0,1583
A <sub>2</sub>	0,1851	0,16	0,1481	0,1481	0,1921	0,1465
A <sub>3</sub>	0,1852	0,16	0,1851	0,1481	0,2432	0,1855
A <sub>4</sub>	0,1481	0,12	0,1481	0,1851	0,2051	0,1564
A <sub>5</sub>	0,1481	0,16	0,1851	0,1667	0,2056	0,1568

Then the calculation of the highest rank level of the alternative with the highest value selected can be seen in the table 8.

**Table 8.** Alternatives are Classified from the Highest Value

Alternative	Value (K <sub>i</sub> )	Rank
A <sub>3</sub>	0,1855	1
A <sub>1</sub>	0,1583	2
A <sub>5</sub>	0,1568	3
A <sub>4</sub>	0,1564	4
A <sub>2</sub>	0,1465	5

Based on calculations by applying the ARAS method to 5 alternative general practitioners at Bhakti General Hospital which can be seen in Table 8, alternative A3 is with a value of 0.1855 on behalf of Dr. Lenny Tampubolon as the best general practitioner at Bhakti General Hospital.

## 4. CONCLUSION

From the results of this study, it can be concluded that the ARAS method can be used to determine decisions in choosing the best general practitioner. This research shows that alternative A3, namely Dr. Lenny Tampubolon with a score of 0.1855 is considered the best general practitioner at Bhakti General Hospital. Applying the ARAS Method, users can get recommendations based on the assessment of the weight of predetermined criteria. This method can help in solving problems in determining the best general practitioner.

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