OPTIMIZATION MODEL IN PUBLIC HEALTH SERVICES TO SUPPORT SMART CITIES

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ABSTRACT

The provision of health services for sufferers of Covid 19 needs to be improved because the availability of resources in public health services cannot guarantee that it will always be sufficient to meet maximum service needs, but if the availability of excess resources can also cause waste. If resources in the service center are minimal, it can result in service requests not being fulfilled, this problem needs to be handled better so as not to harm service providers and those requesting services. When a patient needs health services, the patient will provide information on the priority level or the emergency of the patient's condition, the location of the patient, and the type of service he wants based on his needs, this information will be received by the service provider so that information on requests for health services can be scheduled by the hospital as the owner of the server resource. health service providers, medical personnel, doctors, health experts, operational support personnel, and other supporting equipment. Synchronizing data between available resources on the server allocates time for each health service which maximizes the use of limited resources to provide maximum health services to patients. The purpose of this study is to obtain a public health service optimization model that can be used to support the achievement of smart cities by using linear integer programs so that the model produced in this study can solve the problem of limited resources owned by service centers in providing services. All requests for services by patients can be done optimally but minimize all costs incurred, and can reduce the risk that can endanger the patient or the risk of patient death. This new model succeeded in maximizing health services according to patient demand and minimizing the arrival time of medical personnel according to patient requests. This model obtains the information that the maximum value of the objective function is 94.00 at the 30th iteration stage.

Keywords: *Model, Health Service, Smart City, Smart Service.*

1. INTRODUCTION

The service queue model using first come first serve (FCFS) is a conventional service provider model that can be applied if the required resources are still sufficient and ignore the waiting time for service recipients, but if the service request increase it will certainly result in a long queue pile, this will be a new problem, because the demand for resources exceeds the number of available resources. Inadequate resource access in the service center can also be a problem, this is a challenge that must be resolved properly by carrying out real-time communication between the available resources at the service center (server) so that it can provide the maximum possible service.

By using a scheduling algorithm that was developed to allocate the length of time for providing health services, data synchronization is carried out between the resources owned by the server, so that the service delivery time depends on the resources available at the service center. Service requests that enter the server data can come from various data sources provided by prospective patients or from various devices owned by patients that are connected to internet services which are then used by health service providers to provide health services and obtain health service schedules [1]. To reduce operational costs, it is necessary to optimize the use of limited resources.

Smart cities include built-in tools and the use of intelligent support system techniques that can help make intelligent decisions [2]. However, to design a design that is satisfactory and more efficient in its use requires more fundamental techniques in modeling design and evaluating the effect of modeling design that has been generated. The initial evaluation aims to predict the impact of the system before use [2].

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Exchanging information on health services can be done through the use of information technology to provide health care services and patient monitoring. Smart HealthCare is growing rapidly in solving health care problems, due to an increase in service demand to improve the accessibility of care outside hospitals, as well as the Coronavirus disease (COVID-19) pandemic incident at the end of 2019 which led to an increase in demand for health services and the need for increased resource efficiency available [3].

If the population growth in the elderly continues to increase or there is a pandemic event, there will be a shortage of clinical personnel in providing health services. The handling of problems that may occur needs to be resolved quickly and as best as possible in order to provide better and optimal services to people who need health services, this reflects that humans want to always be in a healthy state and have a longer life [4].

Health services to patients must be carried out optimally, so that health services become smart, namely by providing quality services and reducing the cost of health services and overcoming the problem of limited nursing personnel [5].In general, the need for health services is increasing from time to time, because population growth is also increasing throughout the country [6], and relations between countries also seem to be closer and faster, because they can be attached by plane, so there are possibilities that patients can just come from another country. [7]. Improving service to patients by building or adding medical facilities that are not as needed can result in suboptimal service provision for patients, and result in the waste of money for investors. The resource management department often argues that they have to add less equipment, even though this is a waste as a result of mismatching needs that should be met [8].

Improving the patient care process is one way to improve health services. The efficient service process can be improved by providing quality services by utilizing the available resources. A smart hospital environment can facilitate all patient requests by improving patient care processes through efficient scheduling policies and utilization of health resources through optimal capacity planning. Discussion of dynamic scheduling policies to improve patient care processes is carried out with an efficient capacity scheme based on patient flow variables or patient care processing time. Optimized scheduling policies and capacity schemes can be built in a smart hospital environment via a wireless sensor network and a smart health care system [2].

The increasing demand for healthcare in hospitals is a formidable challenge for managers dealing with the field of resources, especially in terms of decision making. The challenge is due to services that cause high costs, limited budgets, and limited resources. Most of the hospitals are experiencing pressure in the provision of resources, such as a lack of qualified nursing professionals (doctors and medical personnel), limited hospital equipment and facilities, which can result in increased operating costs. Capacity planning, especially for hospitals, is concerned with ensuring a balance between the quality of health care provided and the costs of providing health care [7], the assignment model is held to minimize reassignment costs, fees due to service delays and overtime costs for service providers, additional services are added as limits set at certain operational limits. When a new patient is assigned to be treated in the service department, several other patients will queue and be delayed to get service because the workload in each health service is still providing services. [9].

Smart health care is a hospital service system to meet the demands of patients who need health services that can be served by the hospital (resource provider server) quickly by providing services to patients who need health services, providing services to medical personnel based on the type of illness the patient is suffering from, providing the necessary equipment according to the patient's disease, providing services by minimizing all costs incurred for health care and maximizing the use of all limited resources.

The widespread application of electronic health records (EHRs) to record data routinely generated as part of standards of care provides new opportunities for leveraging this information for quality improvement and evidence-based treatment. However, a continuing challenge is how to effectively implement this high dimensional and unstructured data set [10].

To optimize the workflow or clinical care process by considering the fit of a new patient case with appropriate diagnostic expertise to a Clinical Decision Support System (CDSS), expert expertise may be recommended to treat similar types of cases. In current clinical practice, patients are referred to experts based on one or more of the following factors: patient preference signs and symptoms, primary care patient or doctor, insurance plan, and availability of physicians and available medical equipment. The research framework is developed with associated methods and algorithms that use the patient's semantic knowledge to assess and recommend expertise with the aim of optimizing the process for diagnosing patients [10].

A context-adaptive medical diagnosis system selected from a pool of human experts and the CDSS to make diagnostic recommendations. The system can be performed online, and experts are relied on when making diagnostic recommendations, with the best context-adaptive expert accuracy, meaning the best diagnosis mechanism (whether a human expert or CDSS) for each context is perfectly literate. In addition, the diagnostic recommendations made by the system will be checked by a clinician before final predictions are made [10].

In hospitals, capacity planning is concerned with ensuring a balance between the quality of health care provided and the costs paid by patients, but high costs do not necessarily mean optimal service. Planning involves predicting the quantity and specific attributes of resources required to provide health care services at a given level of cost and quality. The most basic measurement of hospital capacity planning is the number of inpatient beds available, the number of doctors according to their expertise and the number of nurses or medical personnel. In general, the capacity model is intended to calculate the number of nurses needed, while the ideal capacity model also provides insight into opportunities for increased capacity utilization [11].

Modeling and simulation are important tools in resolving epidemic disease outbreaks (disease outbreaks in certain communities / areas that exceed normal or normal numbers) that occur suddenly, such as an example of the current case, namely how to handle the COVID 19 pandemic so that it can be informed and it is understood how the epidemic is spread in the community, several models are proposed and studied. To solve the problem of epidemic spread in social networks by building and analyzing the nature of small world networks or micro-scale social networks [12]. Social networks, family groups, neighbors, the circle of friends, and health care systems are classic examples of key roles in human activities and lives, modeling palliative care networks as a special type of health care system using an agent-based approach, this smart service model provides a framework for studying various aspects of the system from both perspectives that focus on improving the quality of life of patients with life-threatening diseases or those that can lead to death, handling this problem is done by providing various support services to patients so that patients are more active and comfortable in living everyday life [13].

Repairing network connections is the first step towards smarter healthcare, and can be done with a faster and more detailed analysis. This means giving individuals the opportunity to have more patient information so that every professional has access to all relevant information and can make the right diagnosis and treatment decisions as quickly as possible. This is a shift in activity over the years from notes to the paper, reducing medical errors, and increasing efficiency, and that means applying advanced analysis to large amounts of health data, to support better outcomes for smart health care for people. The problem with this decision is to coordinate the use of multiple resources within the hospital [14]. In this case, the most appropriate model to build is a linear integer programming problem.

The purpose of this study is to obtain a Smart Health model in public health services by using linear integer programming so that the resulting model can solve problems to provide services as early as possible by minimizing travel costs, minimum service fees, minimum doctor's fees, minimum priority fees. service and minimize costs due to inaccurate service delivery time, and maximize service to patient requests.

2. MATERIAL AND METHOD

The ratio of the health worker to patient population is imbalanced, due to a lack of health care providers and inadequate infrastructure [15], this problem will be more frequent in rural areas. Various parameters received from sensors installed in patients are collected and evaluated through smart devices [16]. Furthermore, the android application of the system displays data about the patient's vital statistics without the patient's physical presence [17]. Every time there is an abnormal data change, a notification will automatically appear in the doctor's android mobile application [18]. Therefore, the IoT-based smart health care monitoring system allows remote monitoring of patients who support smart hospital services [18].

Smart cities rely heavily on real-time information, namely sensors to view parameters such as temperature, humidity, allergens, pollution, traffic conditions, and grid status. The values of these parameters provide context that helps the system to understand the state of citizens at a given time [19]. Responding to sensory data strategically helps health care become smarter [20].

The results of the design of this model will provide a better decision support system in handling medical problems in patients, so that patients can

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quickly get first aid and what actions to take. Smart health care starts with the input of patient data or data received from a device that is installed by the patient or what is called a smart device attached to the patient, the data will be received by the server that handles the distribution of patient services, if the patient is the first priority, the patient must be served immediately. and prioritized at the nearest connected hospital. to the server system, and in this condition it is also recommended to immediately pick up the patient, and maybe the patient can be escorted by the patient's family or closest person is also possible because in this case, the first priority is to take first aid to the patient. Furthermore, the distribution of patient care which is priority 2 will be provided by hospital services depending on the decisions that will be given by the system, where the considerations in the assessment are the availability of resources at the hospital, the availability of specialist doctors who handle diseases or the availability of polyclinics, the availability of supporting equipment. required and the availability of inpatient rooms which provide information about the type/class of room. The following provides a framework for the design of a decision support system model for smart health care [21].

Policies in providing health services will be very beneficial if used wisely and can help many people. As health facilities develop, they will provide services in an emergency, which if it occurs will alert the nearest resource or facilities to the location of the victim. [22].

3. DATA COLLECTION

The data source for benchmarking (a process commonly used in management or generally strategic management) in this study is medical data in the health sector in hospitals and health offices. The numerical data obtained is entered into a matrix form which is used as a support in the development and modeling process by providing clarity on each objective function of the model mathematically.

The limitation in this study only discusses the cost of priority level of service, travel costs for types of medical services, travel costs for medical personnel, costs for medical personnel, fees for doctors, fees for types of services, time required for medical staff. This data is taken from the minimum function matrix set, and is presented in detail in the table below:

Table 1: The function states the cost of h medical staff travel from place i to the j place to provide health services to patients

Description: Costs for *h* medical staff travel in units of 10,000 rupiah. The table above explains the travel costs of medical staff *h* from α_{ij} ($i = 1, j = 1$) worth = 40.000, travel costs of *h* medical staff from α_{ij} ($i = 1, j = 2$) worth = 10.000, travel costs of *h* medical staff from α_{ij} ($i = 1, j = 3$) worth = 50.000, travel costs of *h* medical staff from α_{ij} ($i = 1, j = 4$) worth = 80.000, travel costs of *h* medical staff from α_{ij} ($i = 1, j = 5$) worth = 20.000, travel costs of *h* medical staff from α_{ij} ($i = 2, j = 1$) worth = 40.000, travel costs of *h* medical staff from α_{ij} ($i = 2, j = 2$) worth = 30.000, travel costs of *h* medical staff from α_{ij} ($i = 2, j = 3$) worth = 20.000, travel costs of *h* medical staff from α_{ij} ($i = 2, j = 4$) worth = 100.000, travel costs of *h* medical staff from α_{ij} ($i = 2, j = 5$) worth = 20.000, and so on.

Table 2:Tthe function states the travel cost of the type of medical service k from place i to place j for the provision of health services to patients

Description: The cost of travel for the type of medical service *k* in units of 10,000 rupiah. The table above explains the cost of travel based on the type of medical service *k* from α_{ij} ($i = 1, j = 1$) worth = 30.000, travel costs based on the type of medical service *k* from α_{ij} ($i = 1, j = 2$) worth = 60.000, travel costs based on the type of medical service *k* from α_{ij} ($i = 1, j = 3$) worth = 60.000, travel costs based on the type of medical service *k* from α_{ij} ($i = 1, j = 4$) worth = 60.000, travel costs based on the type of medical service *k* from α_{ij} ($i = 1, j = 5$) worth = 100.000, travel costs based on the type of medical service *k* from α_{ij} ($i = 2, j = 1$) worth = 100.000, travel costs based on the type of medical service *k* from α_{ij} ($i = 2, j = 2$) worth = 70.000, travel costs based on the type of medical service k from α_{ij} (i = 2, j = 3) worth = 60.000, travel costs based on the type of medical service k from α_{ij} (i = 2, j = 4) worth = 100.000, travel costs based on the type of medical service k from α_{ij} (i = 2, j = 5) worth = 60.000, and so on.

Table 3: The function states the honorarium of medical staff h from place i to place j for providing health services to patients

Description: The cost of paying medical staff h in units of 10,000 rupiah. The table above explains the h medical staff honorarium fees from β_{ij} (i = 1, j = 1) worth = 80.000, medical staff honorarium h from β_{ij} (i = 1, j = 2) worth = 100.000, medical staff honorarium h from β_{ij} (i = 1, j = 3) worth = 50.000, medical staff honorarium h from β_{ij} (i = 1, j = 4) worth = 40.000, medical staff honorarium h from β_{ij} (i = 1, j = 5) worth = 80.000, medical staff honorarium h from β_{ij} (i = 2, j = 1) worth = 10.000, medical staff honorarium h from β_{ij} (i = 2, j = 2) worth = 70.000, medical staff honorarium h from β_{ij} (i = 2, j = 3) worth = 80.000, medical staff honorarium h from β_{ij} (i = 2, j = 4) worth = 50.000, medical staff honorarium h from β_{ij} (i = 2, j = 5) worth = 40.000, and so on.

Table 4: The function states the honorarium of doctor d from place i to place j for providing health services to patients

Description: The cost of paying doctor d in units of 10,000 rupiah. The table above explains the d doctor honorarium fees from δ_{ij} (i = 1, j = 1) worth = 70.000, doctor honorarium d from δ_{ij} (i = 1, j = 2) worth = 80.000, doctor honorarium d from δ_{ij} (i = 1, j = 3) worth = 10.000, doctor honorarium d from δ_{ij} (i = 1, j = 4) worth = 10.000, doctor honorarium d from δ_{ij} (i = 1, j = 5) worth = 90.000, doctor honorarium d from δ_{ij} (i = 2, j = 1) worth = 100.000, doctor honorarium d from δ_{ij} (i = 2, j = 2) worth = 60.000, doctor honorarium d from δ_{ij} (i = 2, j = 3) worth = 40.000, doctor honorarium d from δ_{ij} (i = 2, j = 4) worth = 60.000, doctor honorarium d from δ_{ij} (i = 2, j = 5) worth = 40.000, and so on.

Table 5: The function states the fee for the type of service to k from place i to place j for the provision of health services to patients

Description: Service type honorarium fee k in units of 10,000 rupiah. In the table above, it explains the honorarium fee based on the type of service k from β_{ij} (i = 1, j = 1) worth = 40.000, honorarium fee based on type of service k from β_{ij} (i = 1, j = 2) worth = 100.000, honorarium fee based on type of service k from β_{ij} (i = 1, j = 3) worth = 100.000, honorarium fee based on type of service k from β_{ij} (i = 1, j = 4) worth = 10.000, honorarium fee based on type of service k from β_{ij} (i = 1, j = 5) worth = 90.000, honorarium fee based on type of service k from β_{ij} (i = 2, j = 1) worth = 100.000, honorarium fee based on type of service k from β_{ij} (i = 2, j = 2) worth = 60.000, honorarium fee based on type of service k from β_{ij} (i = 2, j = 3) worth = 60.000, honorarium fee based on type of service k from β_{ij} (i = 2, j = 4) worth = 40.000, honorarium fee based on type of service k from β_{ij} (i = 2, j = 5) worth = 30.000, and so on.

Table 6: The function states the cost for the priority type of service to k from place i to place j for the provision of health services to patients

Description: Service type honorarium fee k in units of 10,000 rupiah. In the table above, it explains the cost based on the priority type of service k from r_{ij} (i = 1, j = 1) worth = 0.000, cost based on the priority type of service k from r_{ij} (i = 1, j = 2) worth = 100.000, cost based on the priority type of service k from r_{ij} (i = 1, j = 3) worth = 100.000, cost based on the priority type of service k from r_{ij} (i = 1, j = 4) worth = 100.000, cost based on the priority type of service k from r_{ij} ($i = 1, j = 5$) worth = 90.000, cost based on the priority type of service k from r_{ij} ($i = 2, j = 1$) worth = 100.000, cost based on the priority type of service k from r_{ij} ($i = 2, j = 2$) worth = 0.000, cost based on the priority type of service k from r_{ij} ($i = 2, j = 3$) worth = 0.000, cost based on the priority type of service k from r_{ij} ($i = 2, j = 4$) worth = 100.000, cost based on the priority type of service k from r_{ij} ($i = 2, j = 5$) worth = 0.000, and so on.

Table 7: The function states the cost of the time needed by medical staff h to arrive at the place of the i patient who needs service

Description: conversion of 1 minute of time needed by medical staff h in units of minutes to units costing 10,000 rupiah (time span 10 minutes to 100 minutes to costs 10,000 to 100,000). The table above explains the costs of the time needed by h staff from t_{ij} ($i = 1, j = 1$) worth = 60.000, costs for the time needed by staff h from t_{ij} ($i = 1, j = 2$) worth = 40.000, costs for the time needed by staff h from t_{ij} ($i = 1, j = 3$) worth = 70.000, costs for the time needed by staff h from t_{ij} ($i = 1, j = 4$) worth = 80.000, costs for the time needed by staff h from t_{ij} ($i = 1, j = 5$) worth = 80.000, costs for the time needed by staff h from t_{ij} ($i = 2, j = 1$) worth = 80.000, costs for the time needed by staff h from t_{ij} ($i = 2, j = 2$) worth = 70.000, costs for the time needed by staff h from t_{ij} ($i = 2, j = 3$) worth = 90.000, costs for the time needed by staff h from t_{ij} ($i = 2, j = 4$) worth = 100.000, costs for the time needed by staff h from t_{ij} ($i = 2, j = 5$) worth = 60.000, and so on.

4. PROBLEM DESCRIPTION

The results of this study are discussed in three parts, namely the modeling results, discussing the resulting models, and conducting simulations on the resulting model design queue system. The results of modeling as the main objective in this study aim to provide services as early as possible by utilizing the available resources.

The problem that becomes the main description of the provision of optimal health services based on the concept of "Smart Health" is how to provide services as early as possible with the use of limited health resources, were when going to provide health care services, medical staff h go from the place i to place j for providing health care services so that the results of the modeling can solve these problems, while the results of the smart health service modeling are as follows:

1. Minimizing the cost of the priority level of service to k from the place i to place j for providing health services to patients
2. Minimizing the cost of traveling for the type of medical service k from the place i to place j at the time of providing health services to patients.
3. Minimizing medical staff travel costs h from the place i to place j at the time of providing health services to patients.
4. Minimizing the cost of medical staff h from the place i to place j to provide health services to patients.
5. Minimizing doctor fee-fees d from the place i to place j for providing health services to patients.
6. Minimizing the cost of the type of service to k from the place i to place j at the time of providing health services to patients.
7. Minimize the time it takes t for medical staff to arrive at a patient who requires service.
8. Maximizing service to patient requests.

5. MODEL PROPOSED

The results of the model testing, namely the model proposed in solving the problem of this study are to minimize all costs incurred during service to patients so that all patient requests are served maximally with minimal costs, while the optimal model proposed in this study is presented below :

$$\begin{aligned} \textit{Minimum } A = & \sum_{i\in N}\sum_{j\in N}\alpha_{ij}\sum_{h\in H}x_{ij}^{h} + \sum_{i\in N}\sum_{j\in N}\alpha_{ij}\sum_{k\in K}x_{ij}^{k} + \sum_{i\in N}\sum_{j\in N}\beta_{ij}\sum_{h\in H}x_{ij}^{h} \\ & + \sum_{i\in N}\sum_{j\in N}\beta_{ij}\sum_{k\in K}x_{ij}^{k} + \sum_{i\in N}\sum_{j\in N}\delta_{ij}\sum_{h\in H}x_{ij}^{d} + \sum_{i\in N}\sum_{j\in N}r_{ij}\sum_{k\in K}x_{ij}^{k} \\ & + \sum_{i\in N}\sum_{j\in N}t_{ij}\sum S_{ij}^{h} \end{aligned} \quad (1)$$

The meaning of the above equation is the set of minimum function matrices, namely: the function of stating the travel costs of medical staff h from the place i to place j for providing health services to patients, plus the function of stating the cost of traveling for medical service type k from the place i to place j health services to patients, plus the function of stating the medical staff honorarium h from the place i to place j for providing health services to patients, plus the function of stating the doctor's fee from the place i to place j for providing health services to patients, plus the function of stating costs

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priority level of service to *k* from place *i* to place *j* for the provision of health services to patients, plus the function of stating the fee for the type of service to *k* from place *i* to place *j* for providing health services to patients, plus the function of stating the cost to the time required by medical staff h to arrive at the patient's place *i* who need service.

From the model described above, it aims to maximize health services and minimize costs, where when a patient requests treatment to the health care department of the hospital, he will be given health care according to the patient's request, namely medical / nursing/doctor staff must be in accordance with the type the patient's illness (a type of service *k*). What should be drunk in this new model are: minimizing the travel of medical staff h from the place *i* to place *j* at the time of providing health services to patients, minimizing the cost of traveling for medical services type k from the place *i* to place *j* at the time of providing health services to patients, Minimizing doctor honorarium d from the place *i* to place *j* for providing health services to patients, minimizing the cost of the priority level of service to k from the place *i* to place *j* for providing health services to patients minimizing costs of medical staff *h* from the place *i* to place *j* for delivering health services for patients, minimizing the cost of the type of service to *k* from the place *i* to place *j* at the time of providing health services to patients, minimizing the time required for medical staff *h* to arrive at the place of patient *i* who requires service.

6. MATHEMATICAL MODELING CALCULATIONS

To perform mathematical modeling calculations in this study, the Linear Interactive and Discrete Optimizer (LINDO) modeling application is used. The following is a model to minimize the travel costs of medical personnel h from the place i to place j when providing health services to patients, minimizing travel costs for medical services type k from the place i to place j at the time of providing health services to patients, minimizing medical personnel costs. h from the place i to place j for providing health services to patients, minimizing the cost of the type of service to k from the place i to place j at that time in providing health services to patients, minimizing the time required for medical personnel h to arrive at the patient i need services are as follows:

Min 4 A11 + 1 A12 + 5 A13 + 8 A14 + 2 A15
+ 4 A21 + 3 A22 + 2 A23 + 10 A24 + 2 A25
+ 8 A31 + 7 A32 + 9 A33 + 8 A34 + 9 A35
+ 2 A41 + 4 A42 + 7 A43 + 3 A44 + 5 A45
+ 2 A51 + 9 A52 + 3 A53 + 10 A54 + 4 A55

+ 3 A11 + 6 A12 + 6 A13 + 6 A14 + 10 A15
+ 10 A21 + 7 A22 + 6 A23 + 10 A24 + 6 A25
+ 5 A31 + 10 A32 + 2 A33 + 8 A34 + 1 A35
+ 9 A41 + 9 A42 + 9 A43 + 10 A44 + 4 A45
+ 3 A51 + 6 A52 + 3 A53 + 1 A54 + 2 A55

+ 8 B11 + 10 B12 + 5 B13 + 4 B14 + 8 B15
+ 1 B21 + 7 B22 + 8 B23 + 5 B24 + 4 B25
+ 1 B31 + 3 B32 + 6 B33 + 7 B34 + 6 B35
+ 5 B41 + 6 B42 + 8 B43 + 2 B44 + 10 B45

+ 10 B51 + 4 B52 + 1 B53 + 5 B54 + 7 B55

+ 7 D11 + 8 D12 + 1 D13 + 1 D14 + 9 D15
+ 10 D21 + 6 D22 + 4 D23 + 6 D24 + 4 D25
+ 9 D31 + 6 D32 + 8 D33 + 2 D34 + 7 D35
+ 6 D41 + 7 D42 + 4 D43 + 8 D44 + 4 D45

+ 2 D51 + 3 D52 + 8 D53 + 1 D54 + 7 D55

+ 4 B11 + 10 B12 + 10 B13 + 1 B14 + 9 B15
+ 10 B21 + 6 B22 + 6 B23 + 4 B24 + 3 B25
+ 2 B31 + 9 B32 + 8 B33 + 1 B34 + 6 B35
+ 4 B41 + 7 B42 + 1 B43 + 8 B44 + 7 B45
+ 2 B51 + 10 B52 + 3 B53 + 2 B54 + 8 B55

+ 0 R11 + 10 R12 + 10 R13 + 10 R14 + 10 R15
+ 10 R21 + 0 R22 + 0 R23 + 10 R24 + 0 R25
+ 0 R31 + 0 R32 + 0 R33 + 0 R34 + 10 R35
+ 10 R41 + 0 R42 + 10 R43 + 10 R44 + 10 R45
+ 0 R51 + 10 R52 + 10 R53 + 0 R54 + 10 R55

+ 6 T11 + 4 T12 + 7 T13 + 8 T14 + 8 T15
+ 8 T21 + 7 T22 + 9 T23 + 10 T24 + 6 T25
+ 1 T31 + 4 T32 + 9 T33 + 8 T34 + 7 T35
+ 7 T41 + 4 T42 + 3 T43 + 3 T44 + 5 T45
+ 10 T51 + 5 T52 + 9 T53 + 1 T54 + 3 T55

Information is obtained that the maximum value of the objective function is 94 and the value of the optimal decision variable, which is presented in table 8 and Figure 1 as a graphic image of the optimal decision variable value is:

Table 8: Value of optimal decision variable

VARIABLE	VALUE	REDUCED COST
A11	1.00	0.00
A12	0.00	0.00
A13	0.00	4.00

A14	0.00	7.00
A15	0.00	5.00
A21	0.00	6.00
A22	0.00	2.00
A23	1.00	0.00
A24	0.00	12.00
A25	0.00	0.00
A31	0.00	3.00
A32	0.00	7.00
A33	0.00	1.00
A34	0.00	6.00
A35	1.00	0.00
A41	0.00	2.00
A42	0.00	4.00
A43	0.00	7.00
A44	0.00	4.00
A45	1.00	0.00
A51	1.00	0.00
A52	0.00	10.00
A53	0.00	1.00
A54	0.00	6.00
A55	0.00	1.00
B11	0.00	7.00
B12	0.00	15.00
B13	0.00	10.00
B14	1.00	0.00
B15	0.00	12.00
B21	0.00	4.00
B22	0.00	6.00
B23	0.00	7.00
B24	0.00	2.00
B25	1.00	0.00
B31	1.00	0.00
B32	0.00	9.00
B33	0.00	11.00
B34	0.00	5.00

B35	0.00	9.00
B41	1.00	0.00
B42	0.00	4.00
B43	0.00	0.00
B44	0.00	1.00
B45	0.00	8.00
B51	0.00	8.00
B52	0.00	10.00
B53	1.00	0.00
B54	0.00	3.00
B55	0.00	11.00
D11	0.00	6.00
D12	0.00	7.00
D13	0.00	0.00
D14	1.00	0.00
D15	0.00	8.00
D21	0.00	6.00
D22	0.00	2.00
D23	1.00	0.00
D24	0.00	2.00
D25	0.00	0.00
D31	0.00	7.00
D32	0.00	4.00
D33	0.00	6.00
D34	1.00	0.00
D35	0.00	5.00
D41	0.00	2.00
D42	0.00	3.00
D43	1.00	0.00
D44	0.00	4.00
D45	0.00	0.00
D51	0.00	1.00
D52	0.00	2.00
D53	0.00	7.00
D54	1.00	0.00
D55	0.00	6.00

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R11	1.00	0.00
R12	0.00	10.00
R13	0.00	10.00
R14	0.00	10.00
R15	0.00	10.00
R21	0.00	10.00
R22	1.00	0.00
R23	0.00	0.00
R24	0.00	10.00
R25	0.00	0.00
R31	1.00	0.00
R32	0.00	0.00
R33	0.00	0.00
R34	0.00	0.00
R35	0.00	10.00
R41	0.00	10.00
R42	1.00	0.00
R43	0.00	10.00
R44	0.00	10.00
R45	0.00	10.00
R51	1.00	0.00
R52	0.00	10.00
R53	0.00	10.00
R54	0.00	0.00
R55	0.00	10.00
T11	0.00	2.00
T12	1.00	0.00
T13	0.00	3.00
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T24	0.00	4.00
T25	1.00	0.00
T31	1.00	0.00
T32	0.00	3.00
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T34	0.00	7.00
T35	0.00	6.00
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T42	0.00	1.00
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T44	0.00	0.00
T45	0.00	4.00
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T52	0.00	4.00
T53	0.00	8.00
T54	1.00	0.00
T55	0.00	2.00

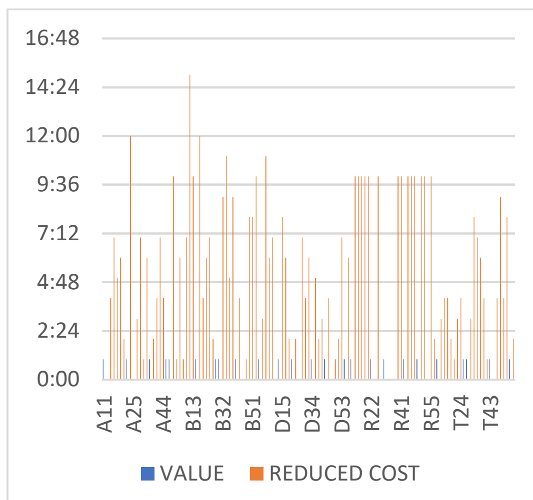

Figure 1. Optimal Decision Variable Value

7. CONCLUSIONS

From the results of this study, conclusions can be drawn which are described as follows:

1. The smart health service optimization model is an optimization of health service delivery based on the Smart Health concept, by providing quality care services as quickly as possible to patients by reducing health care costs and, overcoming the problem of lack of limited nursing staff resources by maximizing the use of resources.

2. This model is a model that minimizes travel costs, service fees, and other costs that arise in providing services to patients.
3. Active constraints with negative dual prices indicate that the addition of each unit value to the right side of the constraint will cause the value of the objective function to decrease.
4. Information is obtained that the maximum value of the objective function is 94.00000 in the 30th iteration step.

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