Measuring the Quality of Service Production Using Goal Programming: a Case Study from a Specialised Centre for the Treatment of Cancerous Tumours/Al-Diwaniyah

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Health institutions, including specialised centres for the treatment of cancerous tumours, provide a case study of a health service of high quality beyond the expectations of the patient and achieve satisfaction. The current research aims to apply the objective programming model using the program Win-QSB version2 to measure the quality of health service production and to identify the reality of the status of this service in our health institutions. This may help them in developing appropriate solutions to overcome the problems that they may face in the performance of their work which may prevent the provision of service at the required level.

Key words: *Health Service, Quality of Health Service, Goal Programming, Cancerous tumours.*

Introduction

Service is one concept that is difficult to define accurately. It is the result of the non-physical processes of performance and intangible effort that the beneficiary uses directly and depends on the production of his participation and direct contact with him (Roy , 2005 : 5). It is defined as an intangible product that is based on the function it provides and is suited to the customer's wishes and provides added value through the exchange of information. It is one of the main pillars supporting the system by providing information and assistance in providing the design and evaluation of the new product (Loader , 2006 : 179). Figure (1) shows the concept of service from the point of view (Hollins & Sadie).

Figure 1. Service Concept
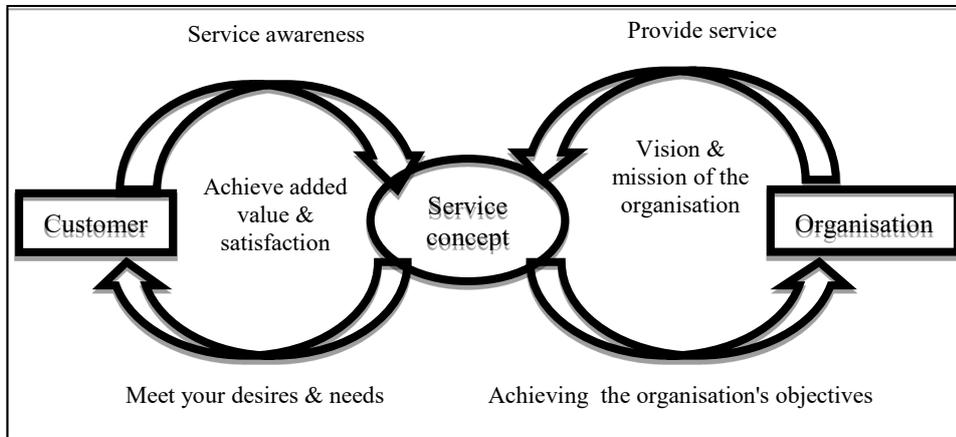
Source: Hollins, Bill & Shinkis, Sadie "Managing service operations design and implementation" 1ˢᵗ Copyright Sage Publications 2009 . PP : 8 www.sage.com .

The health service is defined as the activities and efforts of a variety of subsystems that affect the provision of health services, such as diagnosis, care, patient care, clinical care, health maintenance teams (radiation, laboratories, physiotherapy) and the teams responsible for providing the patient with appropriate treatment The whole system is to provide health service (Mclaughlin & Hays, 2008 :10). Other researchers, such as (Denton , 2013 : 2) defined the amount of health services produced by hospitals, health centres and related agencies to achieve customer satisfaction (patients) through safety and security, as well as continuous work on coordinating the resources and procedures by which requests are met. Which will contribute to reducing waiting times and raising services to create an ideal health environment. (Carrier & Kendall , 2016 : 83) pointed out that it means contact between service providers of doctors and health workers with patients, through which the detection of diseases, diagnosis, treatment, surgery, health and the use of modern medical equipment, which helps to diagnose and identify diseases and describe the treatment needed for each case. There are a number of basic characteristics of the health service that they share with the characteristics of other services.

Research Methodology
Research problem: The problem arises from the apparent decline in the provision of health services, which adversely affects the patients arriving at the specialised centre for the treatment of cancerous tumours, which is the delay in providing the appropriate health service and the long waiting period, which leads to the deterioration of the patient's health condition and the occurrence of complications as a result of failure to provide timely service. Accordingly, the research problem can be formulated with the following questions:

1. Can a high-quality health service be provided to patients arriving at a specialised centre for the treatment of cancerous tumours?

2. Does the Goal Programming Model contribute to determining the optimal number of service delivery channels and other resources in the health service production system in order to ensure the quality level that the centre administration aspires to reach?

Research Significance

1. Demonstrate the significant role of the objective programming model in determining the optimal number of human and material resources needed to provide a health service with a high level of quality and as planned, being the best mathematical methods that achieve the desired goals optimally.

2. It is an attempt to draw the attention of officials in health institutions to the importance of the objective programming model in pointing out weaknesses in the health system in order to develop appropriate remedies and at the lowest possible cost.

Research objectives

1. Reduce waiting times for patients arriving at the specialised centre for cancer treatment.

2. Raise the efficiency of the system, which leads to raise the level of quality of service provided and the lowest possible costs.

3. Highlight the importance of the objective programming model in determining the material and human resources needed to provide a high-quality health service to ensure satisfaction for patients arriving at the centre.

Procedural chart and research hypotheses

The present research has a basic hypothesis that "The Goal Programming Model has great importance and role in determining the level of quality of health service that the organisation seeks to reach by providing the administration with the status it reaches". Figure (2) shows the chart of the research.

Figure 2. The procedural chart of the research
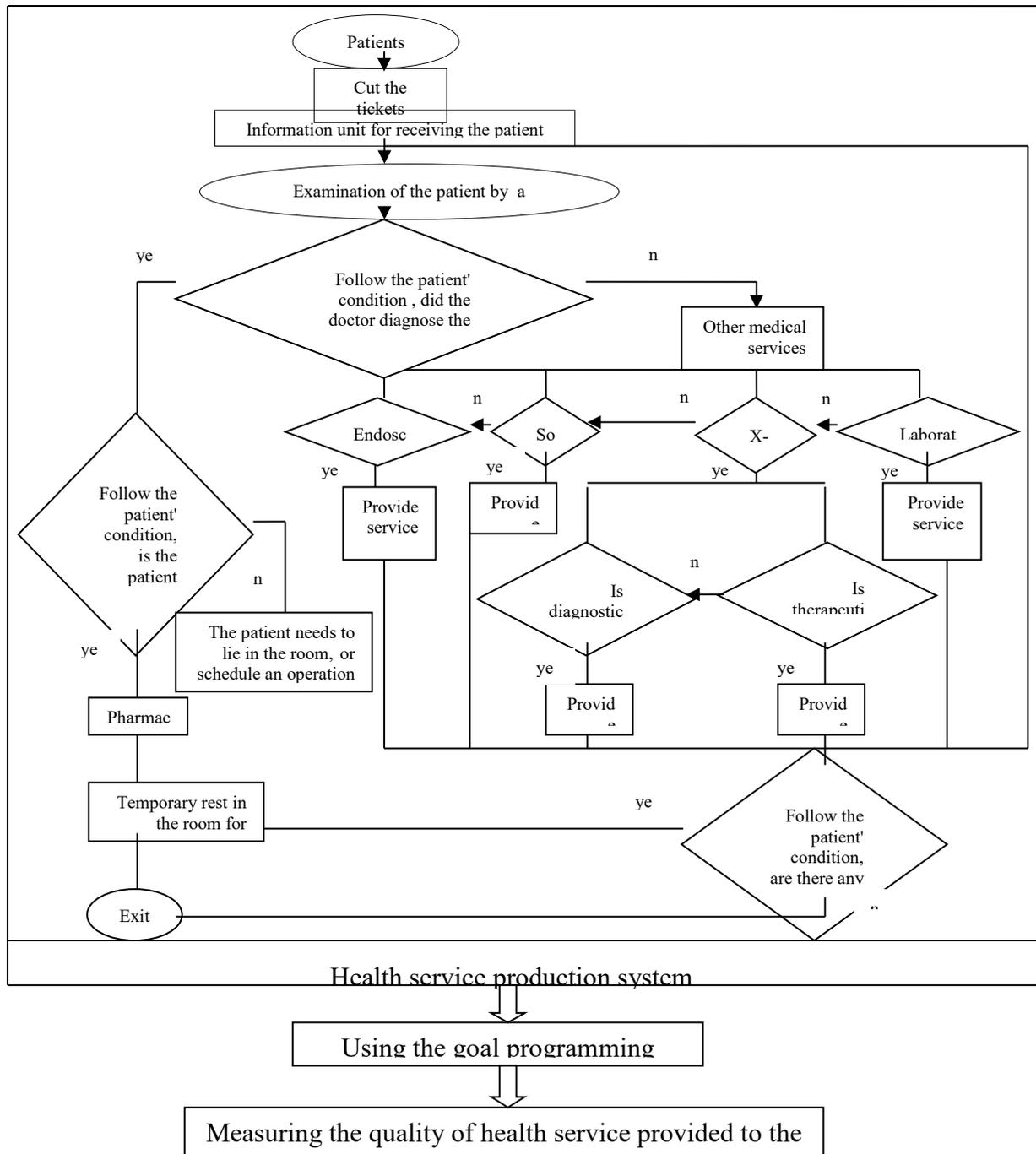
Research sample and society

The Specialised Centre for Treatment of Cancerous Tumours in Diwaniyah represents the current research community. The research sample focused on medical cadres, devices and equipment that are all working to provide service to patients arriving to the centre. This is

where data were collected on the application of the objective programming model in terms of the number of patients arriving at the centre and the human resources and material qualified to provide the service for them for a period of seven months from 1 January 2019 to 13 July 2019.

Theoretical Framework

Health Service Concept

The health service is one of the most important services because of its connection with human life, in particular, and society in general. Health services can be therapeutic services, hospitalisation or diagnostic. (Black & Gruen ,2005: 8 ; Teshnizi et al., 2018 :82) defines the health service as the work performed by a group of health professionals, primarily concerned with the health of patients' lives, long-term health care and recovery, as well as social rehabilitation of people with mental illness and treatment of addiction. It also includes quarantine and is seen in the human body as a biological system and attention to its therapeutic inputs and implications for its health. It is also a set of humanitarian work that is provided to patients that reflects the degree of interest in them and avoid complications and aims to save them from risks and provide health insurance and the level of service provided exceeds the financial costs provided by the patient (Funtleyder , 2009 : 19; Anders, 2011:175). (Thomas, 2010: 155). (Dias , 2012: 10) also stressed that it is the interactive activities provided by the group of systems that work integrally in the health field and cannot distinguish between the limits of these systems they start from patient contact with health care and primary diagnosis and refer to more specialised secondary care that positively affects the patient's life and public health. Thus, the basic characteristics of health services can be defined as follows:

1. Intangibility: Services are distinguished from intangible goods and other features of the service arise from the intangible property. Therefore, the customer cannot use the senses to view the service, but the service can be perceived by the beneficiary (Reid & Sanders ,2011 :87).

2. Simultaneity: It means the degree of interdependence between the service and the provider, and this feature has two dimensions. First, services are produced and consumed at the same time and second, is that the beneficiary cannot be separated in most cases during the service (Schwientek & Schmidit, 2008 : 37).

3. Heterogeneity: It means that the service provided varies according to the ways it is provided to the beneficiary, or the services vary depending on the skill of the provider and the time and place of delivery. (Fitzsmmons & Fitzsmmons, 2011:21; Rostami et al., 2018: 60).

4. Perishability: This characteristic indicates that the service cannot be stored or retained for a long period of time because the production of the service is directly related to its consumption. One of the problems facing the provision of the service is the inability to store or use it and benefit from it (Wisner , 2012 : 404) .

5. Lack of owner ship: Another feature of the service is the lack of ownership and transfer of ownership from the service provider to the beneficiary. This means that nothing intangible can be acquired and consumed directly (Bazarth & Handfield , 2011: 154).

Components and elements of a health service production system

The system of health service production consists of all services that have a role in the restoration, preservation and treatment of people's health, and thus the main objective of this system is to preserve the health and life of people and provide health services to them. With Input, Operations, and Output (Slack et al., 2016:13). It is composed of three important elements: the customer (patient) and health service provider (doctors and health staff) and experience of the service provided, these components are the core part of the system of production of the health service and is affected by other health systems that are involved in the service (Donald &Warren :2010, 5).. (Omachonu & Eispruch, 2010:10) pointed out the elements of the production of the service as follows:

1. Health Service Production Processes System: The system of production of health service operations is in the senior management of the health institution, which is the source of decisions related to the presentation and delivery of services. It attracts and manages human resources and identifies forms of communication within these institutions. Customers have a significant and prominent role in the production of health services (Meyler *et al*.,2012:31).

2. Physical Support: this is reflected in the interior design of the health institution represented by the medical equipment and equipment necessary to save critical illnesses and provide health service in these institutions which in turn affects the production of the service (Min , 2014 : 63).

3. Workers or employees: These are workers or direct employees of doctors, pharmacists, analysts, administrators and other specialties who are in direct contact with the client (patient) to provide diagnostic and medical treatment and analytical treatment for the treatment of medical conditions in order to provide protection for patients (Mosadeghrad,2013:210; Owens, 2016:4).

4. Customer (patient): is the person who deals with the health institution and receives health service from them. They can be divided into:

    a. Internal customers: The employees in all sections of the health institution are called internal customers who deal with each other and are in constant contact in order to provide service to customers (patients) (Heizer & Render , 2017: 157).

    b. External customers: Anyone who deals with the health institution from outside its system and receives the final service from it and leads to achieve patient satisfaction, which is defined as the general trend of the patient towards the health care experience.

Quality of health service: concept, dimensions, importance and objectives
***Concept**

The health service is defined as enhancing the patient's experience of service by changing their perceptions, providing respect for them, preserving their dignity, treating them with goodness and success of the service experience, as well as providing doctors with information, knowledge and modern medical devices and achieving satisfaction and healing for them. (Muntlin & Carlsson, 2006:255 ; Ozcan ,2008 : 95) stresses that it is the ideal commitment to the principles and guidelines of health and take the necessary measures that will achieve patient satisfaction and provide a health service that exceeds his expectations of the extent of the commitment of the doctor to provide health services in a timely manner and appropriate treatment and reduce waiting times for patients (Naveh & Stem, 2005:259 ; Pheng & Rui ,2016:33). It can be summarised by saying that the quality of health service focuses on three aspects:

1. Ability to achieve desired goals using available medical means and methods.
2. The procedures followed are expected to be the best comprehensive measure of patient care and take into account the balance between the service provided and the profits and losses that result from the delivery of the service.
3. The degree of service provided, which increases the achievement of the desired results and reduces the occurrence of undesirable results that are consistent with the current professional knowledge.

*Dimensions

(Zeithmal, Parasarman & Berry, 1986) developed a five-dimensional scale based on the measurement of the quality of the health service, called the SERVQUAL scale based on the requirements of the market. These dimensions are reliability, responsiveness, affirmation, empathy and tangibility (Kandampully, 2012: 99). This scale with five categories is divided into two parts, the first measures perception and the other measures patient expectations. Ahmed points out that there are three dimensions to the quality of health service: the art of care, technical care and the environmental dimension. The art of care demonstrates the effectiveness of the methods used to diagnose and treat patients (Abro & Jalbani ,2012 :786). Technical care means the extent of humanitarian treatment and respect provided to patients, while the environmental dimension emphasises the suitability of the service environment and the procedures for the provision of service (Pheng & Rui ,2016 :27; Singh & Prasher , 2017: 293) . Figure (3) shows the quality of perceived customer service from the point of view (Fitzsmmons & Fitzsmmons) .

Figure 3. Quality of perceived customer service
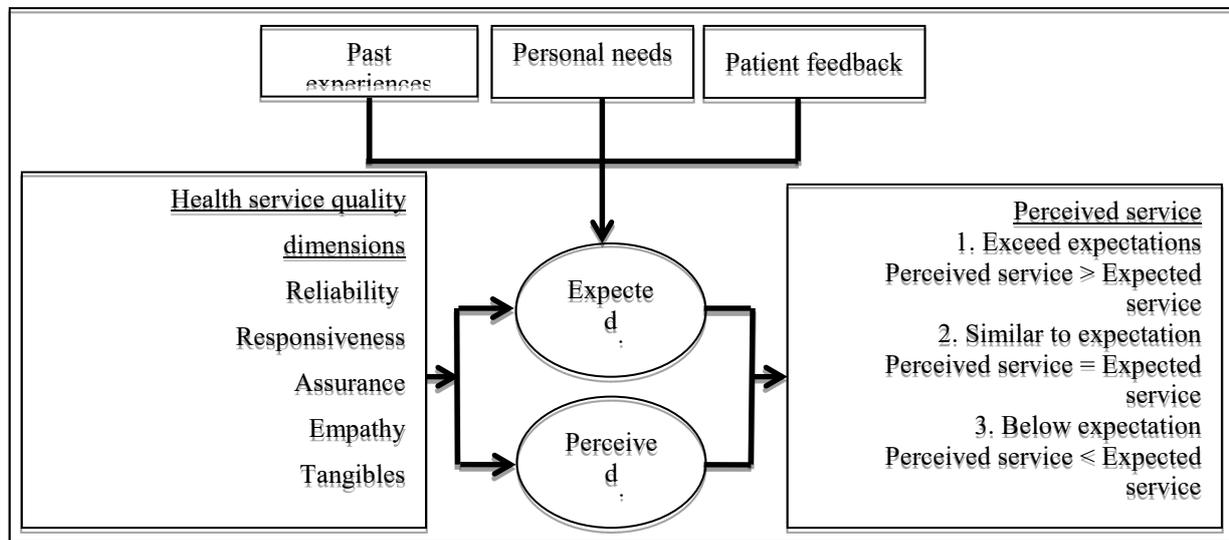
Sorece : Fitzsmmons , Jams A. & Fitzsmmons , Mona J. , (2011) " Service Management Operation , Strategy , Information & Technology ", 7th Edition Copyright McGraw- Hill Irwin. PP.117 www.gbv.de .

The dimensions of health service quality can be explained below:

1. Reliability: is the performance provided by a reliable and reliable health service system, the patient's confidence in the service provided by the health institution and the timely delivery of a high degree of accuracy, efficiency, speed and processing of service requests in a timely and long term under normal working conditions (Zuckerman, 2006:101 ; Gupta & Martin , 2014 :280).

2. Responsiveness: means the self-readiness of the service provider and its readiness to provide assistance to the patient and provide the service with a high degree of efficiency taking into account that the service provided is free of medical errors, taking into account the physical condition of patients with special needs and the provision of the service in line with their condition (Bauer & Adams , 2014: 25). (Mehsin , 2016:16) adds that it is the speed of providing health care as soon as possible.

3. Assurance: this dimension indicates that the service performs the purpose and returns the positive results to the beneficiary, and how comfortable it is when dealing with the service institution. It also includes the need to provide the health institution with equipment that has modern design in order to achieve safety and maintain patients and in line with their sense of satisfaction and safety for them when reviewing the health institution (Khanna *et al*., 2010 : 104).

4. Empathy: is the relationship and interaction between health institution auditors and members of the health and technical team. It includes listening and communication between health care providers and patients. A good relationship contributes to high

levels of success in providing the required service as required, as well as raising the level of humane dealing and justice (Hollins & Shinkins, 2009: 146).

5. Tangibles: refers to all the medical equipment, facilities, performance and equipment available in the health institution. Further to this, it includes personnel, their health expertise and the ability to provide high quality services and a positive impact on the production of health service (Pheng & Rui , 2016 : 30).

* The importance and objectives of health service quality

The quality of health service is of great importance to the lives of individuals and can be summarised as follows (Quigley *et al*., 2008: 5; Thomas , 2010 : 293; Davis ,2014 :44; Owens , 2016 : 12):

a. Encouraging workers in health institutions at all levels to increase their productivity and urge them to do the best.

b. Increased predictability of health institution needs by providing statistical system information and accuracy of work .

c. Patient protection in the application of quality requirements, as the adoption of specific standards that contribute to the protection of the client from commercial fraud and enhance confidence in organisations.

d. Focus on ethical work in achieving the need of patients and provide health service away from falsehood, cheating and lying in the work and reliability of the service provided.

e. Achieving Legal Liability. When health institutions provide the service and are legally responsible for any harm that occurs as a result of the use of the health service, the health service must be produced and avoid defects in its delivery to patients.

f. Reducing patient waiting times and taking into account the increase in service channels if necessary, to provide timely health service, reduce costs and enable the organisation to perform its functions effectively, thus gaining a competitive advantage.

g. Quality in the health service is subject to continuous improvement through a specialised department within the organisational structure of the health institution aiming to achieve inclusiveness and complementarity in performance. The objectives of the quality of health service can be defined as follows (Goodowin *et al* ., 2006 :23; Morrow , 2012 : 54; Oakland , 2014 : 18; Melo , 2014 :25):

a. Achieving better productivity levels by developing technical, human and cognitive skills for senior management levels , reaching the required level of health care provided to patients is the primary objective of quality implementation.

b. Improving the morale of employees, working in a team spirit and achieving cooperation among the employees in the health institution in order to achieve the best health service.

c. Ensure the physical and mental health of patients.

d. Adequacy of treatment and care provided for various conditions.

e. Increased competition among health organisations through achieving the best quality of health service.

f. Knowing the reactions of patients (feedback), analysing their expectations and trying to provide a service that exceeds their expectations.

g. Providing a renewed health service by adapting the operations of health institutions with advanced technology and increasing the levels of education for service providers and establishing rehabilitation and development courses for its staff.

h. Design the health service to ensure that it is readily available to patients and achieve safety for the community in line with achieving the development of service standards and performance standards.

Goal programming concept

The Goal Programming Model is a quantitative method used in the light of multiplicity and conflict goals when choosing between decision alternatives in resource allocation situations. It is a mathematical model that seeks to find the closest and best payload to the specific values of the goals.

* *Goal Programming Model*

It is a mathematical model that aims to find the closest and best solutions to a number of predetermined goals, in other words, the Goal Programming Model aims to reduce the total deviations from the targets set advance to a minimum. (Romero , 1991:35 ; Mohamed et al., 2004 :7):

Minimise $Z = \sum_{i}^{m} = 1(k_i^+ + k_i^-) \dots \dots \dots (1)$

Subject to:

$Bx - Ak^+ + Ak^- = C \dots \dots \dots (2)$

$x_j, k_i^-, k_i^+ \geq 0 \dots \dots \dots (3)$

Whereas:

C: represents the target values, here we have (m) the goals expressed by a vertical vector consisting of (m) elements.

B: it expresses the relationship between the main goals and the sub-goals, which are the parameters of the decision variables and represent the matrix of dimensions $(m \times n)$.

$$B = \begin{bmatrix} b11 & b12 \dots \dots \dots & b1n \\ b21 & b22 \dots \dots \dots & b2n \\ bm1 & bm2 \dots \dots \dots & bmn \end{bmatrix} \qquad C = \begin{bmatrix} c1 \\ c2 \\ : \\ . \\ cm \end{bmatrix}$$

x: is the decision variables and represent a value consisting of $(n \times 1)$.

$$x = \begin{bmatrix} x1 \\ x2 \\ : \\ . \\ xn \end{bmatrix}$$

k_i^+, k_i^- : are the positive and negative deviation variables respectively and represent a vertical vector consisting of (m) elements of the variable representing deviations from the goals.

Whereas :

$k_i^+, k_i^- \geq 0$

k_i^+ : refers to excess in achieving goals.

k_i^-: refers to deficiencies in achieving goals.

It represents a vector consisting of $(m \times 1)$.

$$k^+ = \begin{bmatrix} k_1^+ \\ k_2^+ \\ : \\ k_m^+ \end{bmatrix} \qquad\qquad k^- = \begin{bmatrix} k_1^- \\ k_2^- \\ : \\ k_m^- \end{bmatrix}$$

A : represents the unit matrix which consists of $(m \times m)$ dimensions

$$A = \begin{bmatrix} 1 & 0 \dots \dots & 0 \\ 0 & 1 \dots \dots & 0 \\ 0 & 0 \dots \dots & 1 \end{bmatrix}$$

The Goal Programming Model consists of three basic elements(Tamiz et al., 1998:579):

1. Objective Function: The goal function in the Goal Programming Model is that it includes criteria related to the desired goals achieve them, which is to reduce unwanted deviations from the desired goals to a minimum, rather from objective function constrained by one criterion as in a linear programming model, it is either maximising profit or reducing its cost.

2. Constraints: The goals Programming Model has two types of constraints (lee & Olson , 1999:8):

   a. Structural constraints: the basic constraints imposed by the nature of the problem reflect the state of the study.

   b. Goals constraints: goals constraints in the goals programming model include all objectives that the organisation seeks to achieve and the level to be achieved for each. In addition, to clarify the contribution of each decision variable in achieving the levels specific goals for different, positive and negative deviations for different goals. The form of goals constraints shall be as follows:

   $fi(x) + k_i^- - k_i^+ = ci$

Whereas

$$fi(x): The\ linear\ function\ representing\ the\ goals\ function$$
$$i = 1,2 \dots \dots \dots, m$$

1. Non-negative Condition: This condition requires that the problem variables under study do not appear in the optimal solution with negative values. They are either equal to zero or greater than zero. These variables include all variables of the objectives Goal Programming Model, whether the decision variables or variables deviation from the specific values of the goals or slack variables. As well as meant that the variables that reflect the quantity and quality of production or the number of workers etc. cannot be negative because it is contrary to the logic of life (Jahanshahloo, 2008:34).

$$xj, k_i^-, k_i^+ \geq 0$$

Whereas

$$i = 1,2 \dots \dots \dots, m$$
$$j = 1,2 \dots \dots \dots, n$$

Practical Framework

The specialised centre for the treatment of cancerous tumours

The specialised centre for the treatment of cancerous tumours was established in Diwaniyah in 2018 after it was one of the therapeutic departments of Diwaniyah Education Hospital to become a specialised centre for the diagnosis and treatment of cancerous tumours after the number of patients with these diseases has increased in recent years. The centre received 345 new cases of cancer from 1/1/2019 to 31/7/2019 in addition to other cases previously registered in the centre that received treatment and follow-up. The number of patients per day to the centre is about (66) and the centre provides services over (5) days a week, an average of (330) monthly and (3960) annually. It has been observed that the largest percentage of people with cancer are women (Breast cancer), followed by men whose cancer has been distributed among (Lymphoma, Testicular cancer, Bone cancer, Pulmonary cancer, Pancreatic cancer, Multiple Myeloma), while among children, the lowest rate was (Brain cancer). Table (1) shows the number of medical staff in the centre, while table (2) shows the number of medical devices and equipment (resources) in the centre.

Table 1: The number of medical staff in the centre

No.	Medical staff	The actual number	Patient for each job title (current situation)	Patient for each job title (Planned situation)
1	Specialist doctor	2	32	15
2	Practiced doctor	3	32	15
3	Pharmacist	2	35	20
4	Nurse	35	32	20
5	Medical investigations workers	3	38	18
6	Diagnostic radiology workers	2	38	18
7	Therapeutic radiology workers	2	38	18
Total		49		

Table 2: the number of medical devices and equipment (resources) in the centre

No.	Devices and equipment (resources)	The actual number	Patient for each device (current situation)	Patient for each device (Planned situation)
1	X-ray	1	32	18
2	Tomography	1	32	18
3	Endoscopy	1	32	7
4	Ultrasound	1	32	18
5	Therapeutic radiology	1	32	18
6	Operating theatres	1	32	32
7	Patient bed	41	32	41
Total		47		

Building a mathematical model

To build the mathematical model of Goal Programming, we need to apply four basic steps:

1. Define decision variables (x_j).
2. Express the objective function.
3. Identify constraints.
4. Non-negative condition.
5. Define decision variables (x_j).

Table (3) shows the decision variables :

Table 3: The decision variables

x_1	Specialist doctor	x_8	X-ray
x_2	Practiced doctor	x_9	Tomography
x_3	Pharmacist	x_{10}	Endoscopy
x_4	Nurse	x_{11}	Ultrasound
x_5	Medical investigations workers	x_{12}	Therapeutic radiology
x_6	Diagnostic radiology workers	x_{13}	Operating theatres
x_7	Therapeutic radiology workers	x_{14}	Patient bed

Express the objective function: The specialised centre for the treatment of cancerous tumours aims to provide medical services with the highest level of quality possible for cancer patients who are reviewing us, as the average daily access to (66) patients, which is included in the calculations of the objective function and constraints. The objective function can be divided into several sub-targets as shown in table (4):

Table 4: Sub-targets of the objective function

Min: $z = x_1/66$	Reducing the ratio of the number of specialist doctors to the number of patients arriving at the centre	Min: $z = x_8/66$	Reducing the ratio of the number of X-ray devices to the number of patients arriving at the centre
Min: $z = x_2/66$	Reducing the ratio of the number of Practiced doctors to the number of patients arriving at the centre	Min: $z = x_9/66$	Reducing the ratio of the number of Tomography devices to the number of patients arriving at the centre
Min: $z = x_3/66$	Reducing the ratio of the number of Pharmacists to the number of patients arriving at the centre	Min: $z = x_{10}/66$	Reducing the ratio of the number of Endoscopy devices to the number of patients arriving at the centre
Min: $z = x_4/66$	Reducing the ratio of the number of Nurses to the number of patients arriving at the centre	Min: $z = x_{11}/66$	Reducing the ratio of the number of Ultrasound devices to the number of patients arriving at the centre
Min: $z =$	Reducing the ratio of	Min: $z =$	Reducing the ratio of

$x_5/66$	the number of Medical investigation workers to the number of patients arriving at the centre	$x_{12}/66$	the number of Therapeutic radiology devices to the number of patients arriving at the centre
Min: $z=$ $x_6/66$	Reducing the ratio of the number of Diagnostic radiology workers to the number of patients arriving at the centre	Min: $z=$ $x_{13}/66$	Reducing the ratio of the number of Operating theatress to the number of patients arriving at the centre
Min: $z=$ $x_7/66$	Reducing the ratio of the number of Therapeutic radiology workers to the number of patients arriving at the centre	Min: $z=$ $x_{14}/66$	Reducing the ratio of the number of Patient bed to the number of patients arriving at the centre

Identify constraints: It is divided into resource constraints and goal constraints. Resource constraints include two main constraints, the number of medical staff and the number of medical devices and equipment. Table (5) main and sub-resource constraints:

Table 5: Main and sub-resource constraints

The number of medical staff $x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7$ ≤ 49		The number of medical devices and equipment $x_8 + x_9 + x_{10} + x_{11} + x_{12} + x_{13} + x_{14}$ ≤ 47	
$x_1 \leq 2$	Specialist doctor	$x_8 \leq 1$	X-ray
$x_2 \leq 3$	Practiced doctor	$x_9 \leq 1$	Tomography
$x_3 \leq 2$	Pharmacist	$x_{10} \leq 1$	Endoscopy
$x_4 \leq 35$	Nurse	$x_{11} \leq 1$	Ultrasound
$x_5 \leq 3$	Medical investigations workers	$x_{12} \leq 1$	Therapeutic radiology
$x_6 \leq 2$	Diagnostic radiology workers	$x_{13} \leq 1$	Operating theatres
$x_7 \leq 2$	Therapeutic radiology workers	$x_{14} \leq 41$	Patient bed

Goal constraints can be presented in table (6) :

Table 6: Goal constraints

|			
$15x_1 \geq 66$	the ratio of the number of specialist doctors to the number of patients arriving at the centre	$18x_8 \geq 66$	the ratio of the number of X-ray devices to the number of patients arriving at the centre
$15x_2 \geq 66$	the ratio of the number of Practiced doctors to the number of patients arriving at the centre	$18x_9 \geq 66$	the ratio of the number of Tomography devices to the number of patients arriving at the centre
$20x_3 \geq 66$	the ratio of the number of Pharmacists to the number of patients arriving at the centre	$7x_{10} \geq 66$	the ratio of the number of Endoscopy devices to the number of patients arriving at the centre
$20x_4 \geq 66$	the ratio of the number of Nurses to the number of patients arriving at the centre	$18x_{11} \geq 66$	the ratio of the number of Ultrasound devices to the number of patients arriving at the centre
$18x_5 \geq 66$	the ratio of the number of Medical investigation workers to the number of patients arriving at the centre	$18x_{12} \geq 66$	the ratio of the number of Therapeutic radiology devices to the number of patients arriving at the centre
$18x_6 \geq 66$	the ratio of the number of Diagnostic radiology workers to the number of patients arriving at the centre	$32x_1 \geq 66$	the ratio of the number of Operating theatres to the number of patients arriving at the centre
$18x_7 \geq 66$	the ratio of the number of Therapeutic radiology workers to the number of patients arriving at the centre	$41x_1 \geq 66$	the ratio of the number of Patient bed to the number of patients arriving at the centre

1- Non-negative condition :

$$x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7 + x_8 + x_9 + x_{10} + x_{11} + x_{12} + x_{13} + x_{14} \geq 0$$

Solve the mathematical model

Table (7) displays writing the Goal Programming Model in Win-QSB program based on the previous tables. Table (8) shows results of the Goal Programming Model in Win-QSB:

Table 7: Writing the Goal Programming Model in Win-QSB program

File Edit Format Solve and Analyze Results Utilities Window WinQSB Help

as3

C15 : X3   0
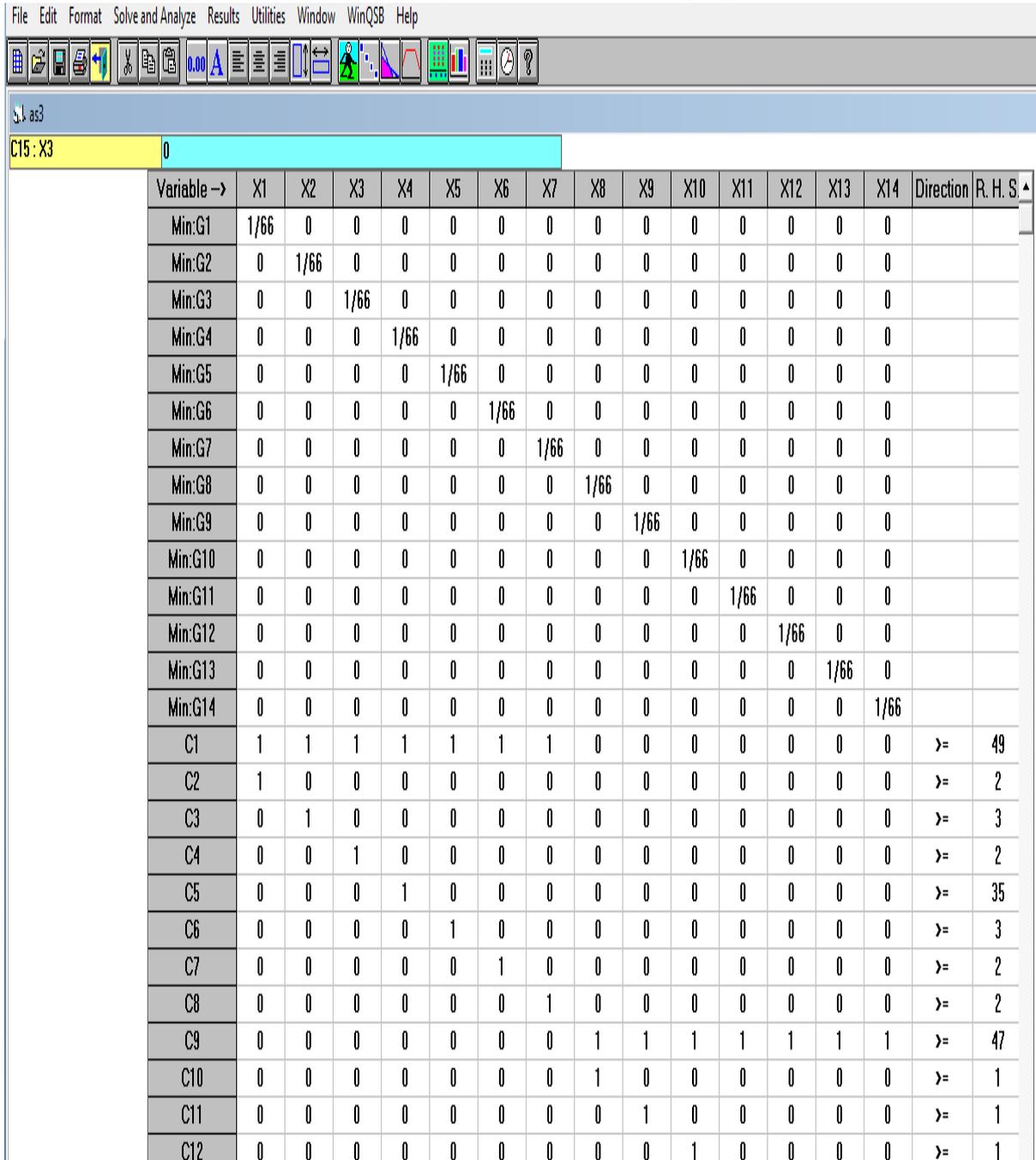
Variable →	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	Direction	R. H. S.
Min:G1	1/66	0	0	0	0	0	0	0	0	0	0	0	0	0		
Min:G2	0	1/66	0	0	0	0	0	0	0	0	0	0	0	0		
Min:G3	0	0	1/66	0	0	0	0	0	0	0	0	0	0	0		
Min:G4	0	0	0	1/66	0	0	0	0	0	0	0	0	0	0		
Min:G5	0	0	0	0	1/66	0	0	0	0	0	0	0	0	0		
Min:G6	0	0	0	0	0	1/66	0	0	0	0	0	0	0	0		
Min:G7	0	0	0	0	0	0	1/66	0	0	0	0	0	0	0		
Min:G8	0	0	0	0	0	0	0	1/66	0	0	0	0	0	0		
Min:G9	0	0	0	0	0	0	0	0	1/66	0	0	0	0	0		
Min:G10	0	0	0	0	0	0	0	0	0	1/66	0	0	0	0		
Min:G11	0	0	0	0	0	0	0	0	0	0	1/66	0	0	0		
Min:G12	0	0	0	0	0	0	0	0	0	0	0	1/66	0	0		
Min:G13	0	0	0	0	0	0	0	0	0	0	0	0	1/66	0		
Min:G14	0	0	0	0	0	0	0	0	0	0	0	0	0	1/66		
C1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	>=	49
C2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	>=	2
C3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	>=	3
C4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	>=	2
C5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	>=	35
C6	0	0	0	0	1	0	0	0	0	0	0	0	0	0	>=	3
C7	0	0	0	0	0	1	0	0	0	0	0	0	0	0	>=	2
C8	0	0	0	0	0	0	1	0	0	0	0	0	0	0	>=	2
C9	0	0	0	0	0	0	0	1	1	1	1	1	1	1	>=	47
C10	0	0	0	0	0	0	0	1	0	0	0	0	0	0	>=	1
C11	0	0	0	0	0	0	0	0	1	0	0	0	0	0	>=	1
C12	0	0	0	0	0	0	0	0	0	1	0	0	0	0	>=	1

C13	0	0	0	0	0	0	0	0	0	0	1	0	0	0	>=	1
C14	0	0	0	0	0	0	0	0	0	0	0	1	0	0	>=	1
C15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	>=	1
C16	0	0	0	0	0	0	0	0	0	0	0	0	0	1	>=	41
C17	15	0	0	0	0	0	0	0	0	0	0	0	0	0	>=	66
C18	0	15	0	0	0	0	0	0	0	0	0	0	0	0	>=	66
C19	0	0	20	0	0	0	0	0	0	0	0	0	0	0	>=	66
C20	0	0	0	20	0	0	0	0	0	0	0	0	0	0	>=	66
C21	0	0	0	0	18	0	0	0	0	0	0	0	0	0	>=	66
C22	0	0	0	0	0	18	0	0	0	0	0	0	0	0	>=	66
C23	0	0	0	0	0	0	18	0	0	0	0	0	0	0	>=	66
C24	0	0	0	0	0	0	0	18	0	0	0	0	0	0	>=	66
C25	0	0	0	0	0	0	0	0	18	0	0	0	0	0	>=	66
C26	0	0	0	0	0	0	0	0	0	7	0	0	0	0	>=	66
C27	0	0	0	0	0	0	0	0	0	0	18	0	0	0	>=	66
C28	0	0	0	0	0	0	0	0	0	0	0	18	0	0	>=	66
C29	0	0	0	0	0	0	0	0	0	0	0	0	32	0	>=	66
C30	0	0	0	0	0	0	0	0	0	0	0	0	0	1	>=	66
LowerBound	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
UpperBound	M	M	M	M	M	M	M	M	M	M	M	M	M	M		
VariableType	Integer	Integer	Integer	Integer	Integer	Integer	Integer	Integer	Integer	Integer	Integer	Integer	Integer	Integer		

Table 8: Results of the Goal Programming Model in Win-QSB

Goal 1:	Minimize	G1 =	5.00
Goal 2:	Minimize	G2 =	5.00
Goal 3:	Minimize	G3 =	4.00
Goal 4:	Minimize	G4 =	35.00
Goal 5:	Minimize	G5 =	4.00
Goal 6:	Minimize	G6 =	4.00
Goal 7:	Minimize	G7 =	4.00
Goal 8:	Minimize	G8 =	4.00
Goal 9:	Minimize	G9 =	4.00
Goal 10:	Minimize	G10 =	10.00
Goal 11:	Minimize	G11 =	4.00
Goal 12:	Minimize	G12 =	4.00
Goal 13:	Minimize	G13 =	3.00
Goal 14:	Minimize	G14 =	66.00

The application of the mathematical model of the objective programming proved a significant shortage of medical and service cadres between what already exists and what is planned by the centre's management. We can see from Table (8) that the number of specialist doctors that achieve the quality of service at the level that the management of the Centre aspires to reach (5) doctors, while the actual number is (2). Similarly, for practiced doctors (5) must be provided, whereas the actual number is (3), and in terms of the number of pharmacists that achieve the optimal solution was (4), which means that the shortage in this specialisation is (2). As for the number of nurses that achieve the optimal solution was equal to the actual

presence in the centre, which amounted to (35) nurse. With regard to the workers in medical investigations as well as diagnostic and therapeutic radiology has also recorded a shortage of the actual asset as the number of staff needed to provide this type of services, which achieves the optimal solution (4) for each. The results obtained from the application of the objective Programming Model recorded a significant shortage between the actual asset and what the centre management plans to reach with regard to medical devices and equipment. It was found from the table of the optimal solution that the number of X-ray devices should be available (4) while the actual present is (1) and this applies to Tomography devices. Endoscopy devices that achieve the best solution were (10), while currently available in the centre is only one device. As for Ultrasound and Threapeutic Radiology devices, the results of the optimal solution table showed that the centre's management should provide (4) devices for each type in order to raise the level of quality to the level that it seeks to reach. As for the number of operating theatres, it is necessary to provide (3) instead of just one, as for the patient beds, the results showed the need to provide (66) beds instead of the actual one that was recorded (41).

From the above can be said that the current research has been able to prove the validity of the hypothesis "The Goal Programming Model has a great importance and role in determining the level of quality of health service that the organisation seeks to reach by providing the administration with the status it reaches".

Conclusions and Recommendations
Conclusions

1. Increase the patient's waiting times in the waiting queues inside the centre due to lack of medical staff which negatively affects the patient's health status. Relatives may be forced to move to another centre outside the city, putting the patient's life at risk.
2. The large shortage of necessary medical devices and equipment hinders the proper and timely delivery of services to patients arriving at the centre.
3. The great shortage of medical treatments is what forces the patient to wait for long periods until arrival to the pharmacy of the centre or buy it from private pharmacies, which carries the patient very high costs.
4. The efficiency of the Goal Programming Model in determining the level of quality of health service produced by the health system, which helps managers in making appropriate decisions that will raise the level of quality of health service provided to patients.

Recommendations

1. Work to provide the necessary medical and service cadres as well as the necessary medical equipment and equipment in the production of health service in sufficient numbers because of its significant contribution to reduce the momentum of work on

service providers as well as ensuring the provision of health service free of defects and a high level of quality.

2. The need to provide the necessary treatments by the officials of the Ministry of Health, especially since the cancer cases do not bear the delay and urgently need to provide medicines at the specified time, as any delay may put the patient's life at risk.

3. The necessity of sensitising decision makers in the health service institutions, including the specialised centre for the treatment of cancerous tumours, on the importance of applying the objective programming model because of its significant and effective role in restructuring and designing the system of production of health service in the centre and raise the level of quality in it to the level planned by the centre management.

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