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EMPLOYING THE VALUE STREAM MAPPING BY USING THE PROCESS ACTIVITY MAPPING TO IMPROVE THE EFFICIENCY OF THE MEDICAL SERVICE

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A B S T R A C T

This study sought to employ the value Stream mapping by using the process activity mapping as one of its tools in redesigning the medical service in order to increase its efficiency. By getting rid of the waste that makes the waiting time for the patient longer at a time when he is in dire need of the necessary health care, with the shortest possible waiting period. The problem of the study is represented in the large number and length of the approved procedures for treating the patients, which led to an increase in waiting times, which negatively affected the value of the service provided to the customer. The study derived its importance as it deals with one of the most vital sectors, and an attempt to arouse the interest of health organizations.

The study followed the method of a case study, in its applied side, it relied on analyzing current value Stream mapping through the use of one of its tools (process activity mapping) in order to identify waste, eliminate it or reduce it, and identify potential improvement areas, thus contributing to achieving the requirements of agility in work to improve the efficiency of service provided to customers. The study reached a set of conclusions, the most important of which are: "Long waiting times and low service efficiency indicators for the case of the research sample, the lack of effective maintenance and repair systems to qualify important and expensive devices, in addition to their great importance in facilitating tasks and reducing waiting time".

K E Y W O R D S

Value Stream Mapping, Operation activity mapping, service efficiency.

Introduction

The health sector is one of the most important service sectors, as it provides the solid ground for building a healthy person who is free of diseases in a manner commensurate with divine honor. Organizations in this sector must find an effective tool in order to remove all activities that do not add value to customers and improve the efficiency of the service provided to them in the manner that It leads to success, and development in this field is among the most important basic indicators for measuring the level of civilization and economic progress of any country. The problem of the study is represented in the large number and length of procedures adopted in the treatment of patients, which led to an increase in waiting times, as well as the distance between the necessary health services centers, which negatively affected the value of the service provided to the customer in terms of cost, service quality expectations, actual benefits, effort, time, and rest. In order to stand on the reality of the provided health service, the problem of the study is launched through the following question:

- To what extent does the use of the value stream mapping affect improving the efficiency of health service?
- Does its use contribute to reducing waiting times or improving the efficiency of the service provided in the organization?
- What are the results achieved as a result of its application to streamline and design the health service in a distinct way?

The study aims to identify the reality of operations activities in the organization, the available capabilities and the extent to which this tool can be applied, and to determine the impact of its use in order to direct attention towards activities that do not add value from the customer's point of view, and work to identify and remove or reduce them whenever possible. Thus, the current study is of great importance when selecting one of the organizations of this vital sector that provides one of the noblest humanitarian services, which is Tikrit Teaching Hospital. Where the study dealt with how to use one of the most important tools of the value flow map to identify waste and reduce or remove it whenever possible and potential areas for improvement in a way that contributes to providing a service commensurate with the interest desired by the service applicant and bringing this organization to the level of competition with private medical clinics in light of the endless care of this sector by the state. as the study adopted the process activity mapping (one of the value stream mapping tools) for this purpose and its adoption in drawing a map of the current value flow to depict operations Accurately identifying activities that add value and activities that do not add value in order to take appropriate measures to reduce waiting times and improve the efficiency of the provided service. The study proved the possibility of using this tool in this consultancy and that it has a high ability to solve its problems and achieve a rapid response to the customer's requirements and needs.

LITERATURE REVIEW

1.Value Stream Mapping

1.1. Value Stream Mapping Concept

It is a lean manufacturing technique used in continuous improvement programs to help understand and improve the flow of material and information within organizations. It was originally developed within the Toyota Production System. matters, identifying waste, reducing process cycle times, and applying process improvement, and in some organizations it has become a function of their agile application, and in some areas it can be a critical technique for documenting process and eliminating waste, since every improvement initiative must start from a clear understanding of current performance and the idea of achieving Minimal waste. (Pitcher, 2009:2). (Kadam, et al., 2012: 26) indicates that it is a set of methods that visually display the flow of materials and information throughout the production process, and focus on activities that add value and remove those that add cost and not value, in order to achieve a long-term goal at the time of performance. (Reducing set-up

times, improving quality, shaping the cell, improving the supplier relationship and trying to reduce inventory). Whereas, Abdul samad, et al., (2013:23) indicated that it can be a communication tool, an action planning tool, and a tool for managing the change process in the organization. It allows documenting the current production waiting time, inventory levels, and cycle times in order to determine the value-added percentage of the total waiting time for the product family currently, and to create a vision of an ideal value stream. By representing the flow of materials and information, and providing a common language to explain the process, which helps in making decisions to get rid of waste, and based on the foregoing, it represents an agile visual technique used in redesigning productive systems by displaying material and information flows with reference to all activities (that add value). And those that add cost and not value) required to provide a good or service to the customer, provide a common language for talking about the manufacturing process, evaluating the current process with the aim of identifying the sources of waste and its sources, and a tool that contributes to formulating the process of change in the organization, as well as it shows the future improvement approach through Creating a better flow vision towards the value that the customer expects.

1.2. value stream mapping tools

Researchers and practitioners have found focusing on the value stream mapping a major issue, as there are many tools for this map used to improve and redesign manufacturing systems with the aim of making them more efficient, flexible and competitive to meet the challenges of the economic market in their classification environment. These tools were initially developed by (Hines & Rich) in 1995 in their article (The Seven Tools of Value Stream Mapping) in response to the widespread recognition of the seven types of waste that were defined by (Ohno). These tools were created to help lean practitioners identify waste. The appropriate methods for improvement (Wan, etal., 2007: 2), and these tools are: (process activity mapping, supply chain response matrix, Production variety funnel, Quality filter mapping, Demand amplification mapping, Decision point analysis, Physical Structure mapping, (Hines & Rich, 2013:50).

1.3. Value Stream Mapping Steps

The steps of the value stream map are embodied in the following:

(Abuthakeer et al, 2010:54); (Apel et al., 2007:11) ;(Ritsch, 2006:2-4)

Define the product or product family

Draw a map of the current state. .

. Analyze the present value flow map and identify problem areas.

. Draw a map of the future state.

. Preparing and implementing an action plan.

Where the first step involves choosing a specific product (a specific case) on which the value stream map will focus. After using the chosen product, a value stream mapping is created for the current process. After completing the current value stream map, the team evaluates the process and the steps that it includes. All this information was collected on a map. performance analysis. Each step in the process is mapped to an initial value flow that includes metrics such as (Cycle Time, Takt Time, Work –in-process (wip), Setup Time, Down Time, Number of Workers Number, and Waste Ratio).

The Value Stream Mapping (VSM) identifies the added value in the process, and also displays all the other steps that do not add value. After analyzing and evaluating the current process of the product, the problem areas can be identified with the aim of reducing them completely, so that the final value flow map can be created. The last step is to implement the ideas new technologies that will in turn create a more efficient agile manufacturing process. (Apel et al., 2007: 11)

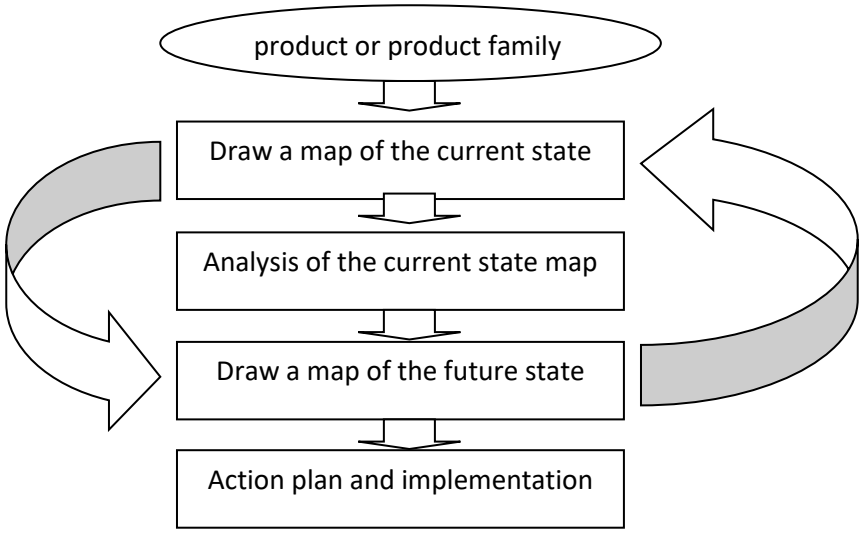


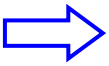
Figure (1) The steps of the ideal value stream mapping

2. Process activity mapping

*2.1.**Process activity mapping Concept***

It is a technique for analyzing the flow in the visual work site (De Bucort, et al., 2012:3) and it is a gradual introduction of the process that works as an aid in lean manufacturing to identify and remove process steps that do not add any value to the customer, through which the current state of the process can be understood (Gopalakrishnan, 2010:87), And its origins in industrial engineering, which includes a set of techniques that can be used to remove waste from the work site, inconsistencies, and absurdities, and provide high-quality products quickly and easily, and it is a technique known by several names as the most common process analysis, and there are five stages to this approach It is "the study of the flow of processes, the identification of waste, the consideration that a process can be rearranged into a more efficient chain, the consideration of whether everything there is working at each stage is absolutely necessary" (Hines & Rich, 2013:51). (Daniel & Julie, 2008:144) believes that it is a graphic representation or illustration of the process that shows the inputs, outputs, and steps of the process depending on the purpose of the map and it can be at a high level or detailed. As for (Slack, et al, 2010:97), they see it as a simple and easy way to record the details of the process and for future analysis, usually. Described (Hizer & Render, 2011:293) as a tool that uses symbols, time, and distance to provide a structured and complex means of analyzing and recording events. Krajewski, et al, (2013:149) defined it as an organized method of recording all the activities performed by people, machines at workstations, with clients or materials. Based on the foregoing, it is considered a visual tool that shows the activities that take place on a specific product from start to finish, step by step, smoothly, to identify weaknesses and activities that add or do not add value, and then identify potential development and improvement opportunities. The process activity mapping is defined by a number of symbols (icons) that provide a common language that describes in detail how to create value for the organization, whether it is industrial or service, shown in Table (1). (Slack et al, 2010:97); (Krajewski et al, 2013:150).

Table (1) symbols of the process activity mapping

Symbols	
Inventory	
Transport	
Process	
Delay	
Examination	

Source: Prepared by researchers based on the aforementioned sources.

The process activity mapping is an effective tool that enables us to know what is happening now, how to predict it and why. It also helps us collect information to understand where waste and inefficiency lie and its impact on stakeholders. It also helps to develop new and improved processes that contribute to reducing or eliminating inefficiency.

*2.2.**Benefits of the process activity mapping:***

The process activity mapping contributes to achieving a number of benefits: (Gopalakrishnan, 2010:89)

a. Helps the lean manufacturing team understand the current process as well as identify opportunities for improvement.
b. Determine the actual methods that show the locations of dangerous problems and possible solutions by linking ideas, information and data related to the process in a visual and effective manner.
c. The team was able to examine each step of the process while clearly defining the waste in the process and its report on the future (developed) process map.
d. The agile team can use the current and future process activity mapping to clearly quantify the improvement.
e. The process activity mapping can be used as a visual training tool for people in the developed process.

3. Service Efficiency

3.1.service efficiency Conceptualization

The concept of service design refers to everything that makes service delivery desirable, effective, efficient, usable and useful to the customer. As for service redesign, it is defined according to what was stated in it (Al-Taie, 2006: 26) that it means rethinking the foundations of work, and radically changing the design and paths of operations in order to radically improve performance levels in terms of cost, quality of services, and speed. (Heizer & Render, 2011: 303) indicated that service redesign is a rethinking of the business foundations to bring significant improvements in performance. Effective process design relies on re-evaluating the process purpose and basic assumptions, and focuses on activities across cross functional lines and on dramatic improvements in cost, time. , and customer value. Service quality is defined as the difference between the level or nature of service that the customer expects and the level or nature of service that the customer perceives (Robert & Lindsay,

2007: 2). He explained (Chalabi, 2011: 53) that the quality of service is "the ability or ability of the organization to meet or exceed the customer's expectations and perceptions." The medical service was defined as "all events and activities carried out by health organizations with all their members, and at all levels of society with all its members, to reach their physical, psychological and social safety and thus reach a relatively healthy society". According to (Kotler & Clarke, 1997: 332), the quality of medical service represents the level of awareness achieved from the performance results of the medical service, compared to what it was earlier (Zaidan, 20: 2012).

3.2.Quantitative indicators used in the study

The study relied on a set of quantitative indicators appropriate to the nature of the study data, as shown in Table (2).

Table (2) The quantitative indicators used in the study

	Quantitative indicators	Calculation method	approved sources
1	cycle time	The maximum time allowed to complete one unit at each workstation	*(Jacobs et al.,2009:175)*
2	available time	6 hours * 60 minutes	Depending on the actual working hours per day in the organization.
3	total time to add the value	Operations time + examination time + primitives preservation time	*(Heizer&Render,2009:228)*
4	total time to non-add the value	Transfer time + time delays	*(Heizer&Render,2009:228)*
5	Waiting time	Total time to add value + total time not to add value	*(Al-Daffi,2011:9)*
6	Takt time	available time per day / average number of reviewers per day	*Bonaccorsi et al.,2011:432)(*
7	Service efficiency	Total Value Adding Time / Total Waiting Time	

Source: Prepared by the researcher based on the sources mentioned in the table

4. Scheme of the study

In light of the problem of the study and its objectives and within its theoretical and applied context, the procedural scheme for the study was prepared according to the principles of agile, represented by the procedures used to transform from the current work reality to a future map of the value stream that proposes the necessary improvements to advance the current service reality, as in Figure (2).

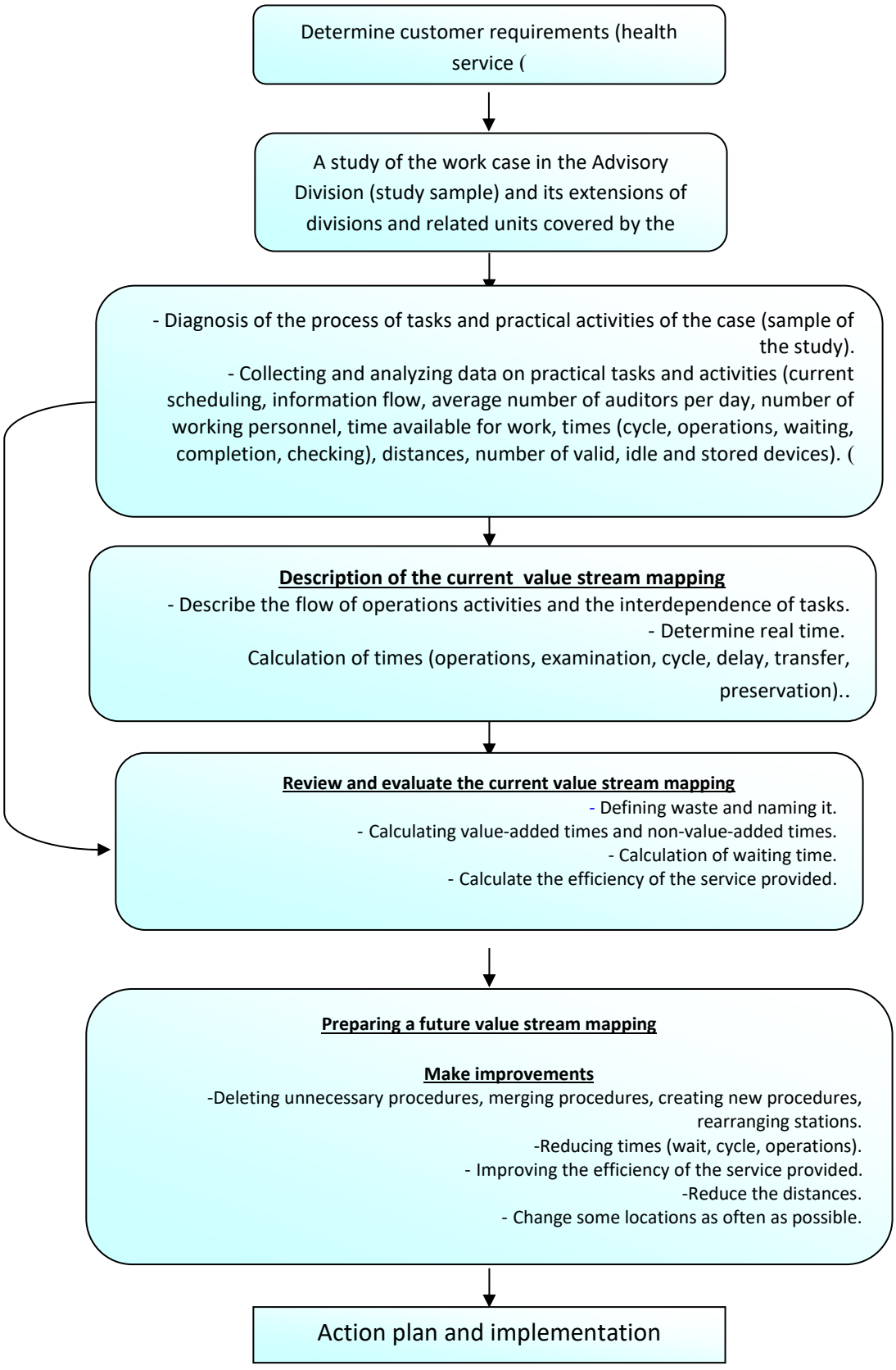


Figure (2) the procedural chart of the study

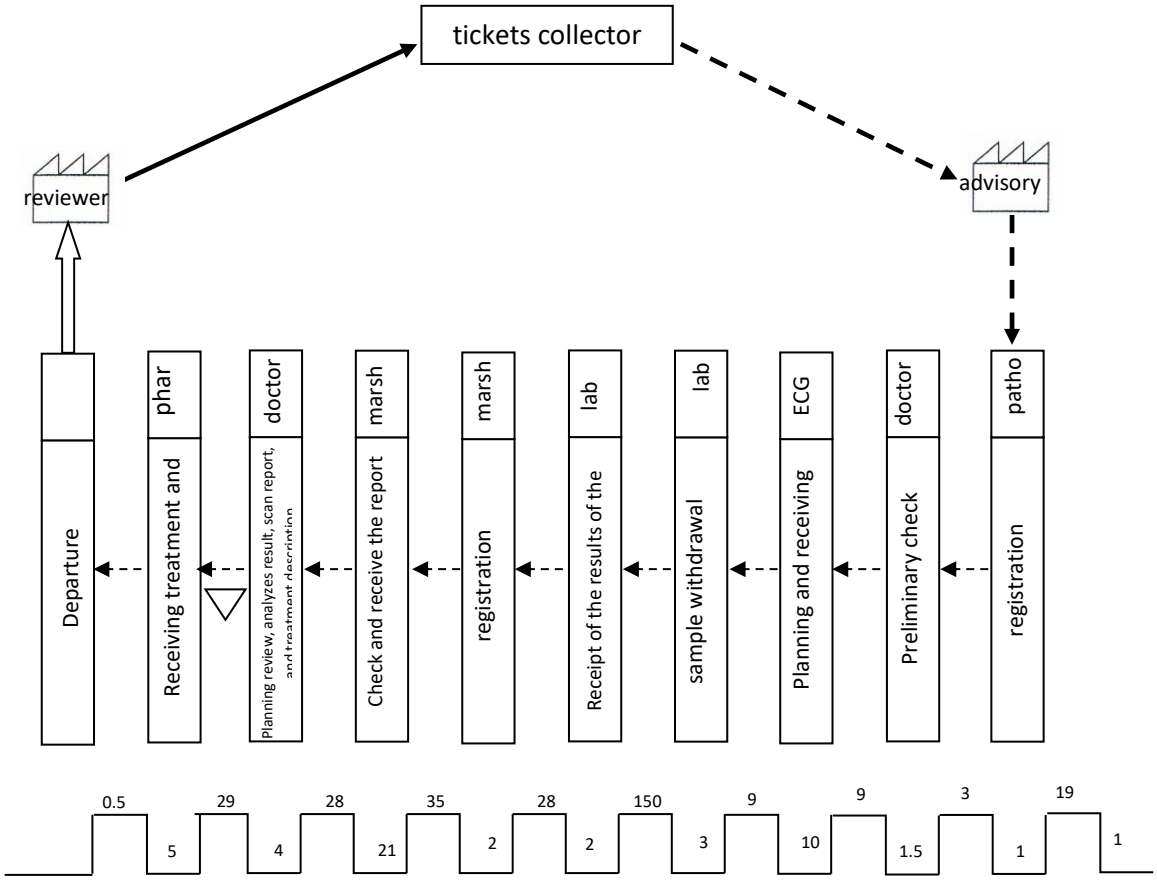
THE APPLIED SIDE OF THE STUDY

A case (cerebral thrombus) will be selected, which is one of the cases received by the Consultant Brain and Neurological Medicine at Tikrit Teaching Hospital, as it is among the longest consultations in terms of waiting times and low service efficiency.

• ***Current Value stream mapping of the case*** **(**cerebral thrombus**)**
It is one of the cases that come to this consultant, whether from the Emergency Division or according to the referral system from the health centers, which requires taking the necessary medical measures without worsening the patient's health condition through a set of measures collected in the scheme (process activity mapping) and as in Appendix (1). The table shows (3) A summary of the process activity based on the process activity map for the case in question, as shown in Figure (3) the current value flow map related to the case referred to above.

Table (3) a summary of the activity of the current process for a reviewer with a cerebral thrombus in the Brain and Neurological Medicine Consultation

Procedures	Symbols	number of symbols	total time (min)	distance (meter)
Processes		9	44.5	
Moving		7	62.5	1120
Delay		9	248	
Examination		2	5	
Preservation		1	1	



min Total value adding time=50.5

Total time not adding value =310.5 min

Figure (3) Current value stream mapping for the case of (brain thrombus)

be registered with the nurse in a time of (1.5) minutes to be examined by the specialist doctor in a time of (2) minutes and a report Referring it to the ECG to perform the planning and receiving it in a time of (10) minutes, then transferring it to the laboratory to perform some analyzes, where the sample is withdrawn in a time of (3) minutes and the result is received in a time of (2) minutes, then it is transferred to the scan to record in (1) minutes and the scan is performed in (20) minutes and receives the report in (1) minutes, then returns to the specialist doctor to view the results of the analyzes, planning and examination report in (3) minutes and describes the necessary treatment to be received from the Istihariyat Pharmacy in a time of (4) minutes and keeps his priorities there in (1) minutes and then leaves consultancy; The total time for adding the value was (50.5) minutes and the total time for not adding the value was (310.5) minutes. Thus, the total waiting time was (361) minutes, which was calculated by:

Total value adding time = operations time + checking time + primitives saving time

= 44.5 + 5 + 1 = 50.5 minutes

Total time not adding value = time for transitions + time for delays

= 62.5 + 248 = 310.5 minutes

Total Waiting Time = Total Value Adding Time + Total No Value Adding Time

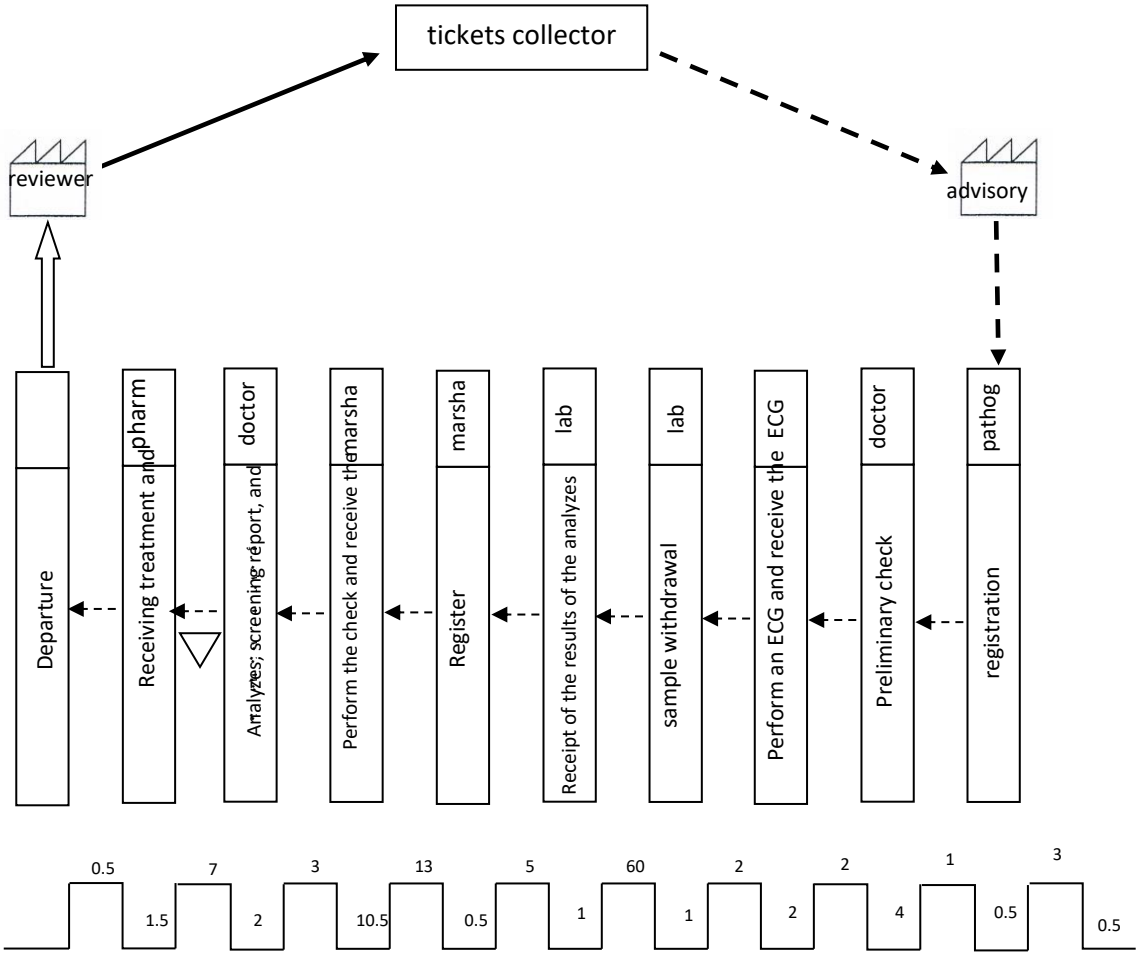
= 50.5 + 310.5 = 361 minutes

That is, the value-adding time percentage of the total waiting time is (approximately 14%), while the non-value-adding time constitutes (86%) of the total waiting time, which necessitates the necessity of addressing the waste resulting from movements and delays in order to expedite the treatment of the patient and alleviate his pain and thus then:

Service Efficiency =Total value addition time 50.5 / The total waiting time 361= (0.1398) = 14% approximately

- proposed (future) value stream mapping

Figure (4) shows the proposed (future) value flow map for a reviewer with a cerebral thrombosis who came to this consultancy.



min Total value adding time=23.5

Total time not adding value=96.5 min

Figure (4) Suggested(Future) value stream mapping for the case of (brain thrombus) in the Brain

Table (4) summary of the proposed operation activity for a patient with a stroke in the brain and neurological medicine consultant

Procedures	Symbols	number of symbols	total time (min)	distance (meter)
Processes		9	17	
Moving		7	15.5	310
Delay		7	81	
Examination		2	6	
Preservation		1	0.5	

Total value adding time = operations time + checking time + primitives saving time

= 17 + 6 + 0.5 = 23.5 minutes

Total time not adding value = time for transitions + time for delays

= 15.5 + 81 = 96.5 minutes

Total Waiting Time = Total Value Adding Time + Total No Value Adding Time

= 23.5 + 96.5 = 120 minutes

That is, the percentage of the value adding time out of the total waiting time (approximately 20%), while the time not adding the value constitutes (80%) of the total waiting time, thus:

Service Efficiency =Total value addition time 23.5 / The total waiting time 120= (0.1958) = 20% approximately

CONCLUSION

By comparing the results reached in the present value flow map with the results above, the following is evident:

The total time to add value in the current value flow map is (50.5) minutes, the total time to add value in the proposed value flow map is (23.5) minutes, and the total time not to add value in the current value flow map is (310.5) minutes, and the total time not to add value in the flow map The proposed value is (96.5) minutes, which indicates a reduction of waste by (53.5 %) from the time of adding the value, and by (69%) from the time of not adding the value. Service efficiency reached (14%) in the current value flow map, while in the proposed value flow map it reached (20%).

Figure (4), which represents the proposed value flow map, was based on the following:

1. Opening three ticket outlets instead of one, which reduces waiting time in front of the box office.
2. Priority is given to the patient in this case, given that his condition is special.
3. Exerting more effort than the (administrative) nurse to reduce registration and scheduling time.
4. The skill of the nurse responsible for drawing the sample reduced the operation time from (2) minutes to (1) minutes
5. Repairing the defective device in the chemistry unit and qualifying it for service instead of manual work, and adding a device to the hematology unit that reduces the waiting time for receiving the results of the required analyzes.
6. Increasing the number of drug suppliers in the Consultant pharmacy to (2) suppliers, which reduced the waiting time in front of the pharmacy to receive treatment.
7. A greater effort was made by the administrator in charge of memorization to reduce the period of memorizing primitives to (0.5) minutes.
8. The cycle time in the present value flow map was (21) minutes, while in the proposed value flow map (15.5) minutes, with a decrease of (5.5) minutes, or by (26%), which means a contribution to streamlining the completion of the current operations procedures in this div.

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Appendix (1) current process activity mapping for a reviewer with a cerebral thrombus case in the Brain and Neurological Medicine Consultation

step number	Description of procedure steps	▽	□	D	⇨	○	time (min)	distance (meter)	individuals
1	ticket window			◦			17		1
2	Cut the review ticket					◦	1		
3	Switch to advisory				◦		2	25	
4	Nurse / Recording and Scheduling					◦	1.5		1
5	Queuing to enter the doctor			◦			3		
6	Doctor's examination		◦				2		1
7	Referral to ECG				◦		1	10	

8	Queue awaiting planning action			◦			8		
9	Perform planning and receive the result					◦	10		1
10	Switch to the laboratory				◦		4	60	
11	Line up for sample collection			◦			5		
12	sample withdrawal					◦	3		1
13	Waiting for the result of the analyzes			◦			150		
14	Receipt of the result					◦	2		
15	Move to the checker				◦		28	500	
16	Register					◦	2		1
17	Wait before making the check			◦			20		
18	Examination with a check					◦	20		2
19	Waiting to receive the result			◦			15		
20	Receipt of the result					◦	1		
21	Go back to the doctor				◦		25	500	
22	Waiting to enter the doctor			◦			3		
23	Analyzes, screening report, and treatment description		◦				3		
24	Go to the pharmacy				◦		2	20	
25	Wait in front of the pharmacy			◦			27		1
26	Receipt of treatment					◦	4		
27	Save the primitives	◦					1		1
28	Patient leaving consultancy				◦		0.5	5	

Appendix (2) proposed (future)process activity mapping for a reviewer with a cerebral thrombus case in the Brain and Neurological Medicine Consultation

step number	Description of procedure steps	▽	□	D	⇨	○	time (min)	distance (meter)	Individuals
1	ticket window			◦			1		3
2	Cut the review ticket					◦	0.5		
3	Switch to advisory				◦		2	25	

4	Nurse / Recording and Scheduling					◦	0.5		1
5	Queuing to enter the doctor			◦			1		
6	Doctor's examination		◦				4		1
7	Referral to ECG				◦		1	5	
8	Queue awaiting planning action			◦			1		
9	Perform planning and receive the result					◦	2		1
10	Switch to the laboratory				◦		2	35	
11	sample withdrawal					◦	1		2
12	Waiting for the result of the analyzes			◦			60		
13	Receipt of the result					◦	1		
14	Move to the checker				◦		5	200	
15	Register					◦	0.5		1
16	Wait before making the check			◦			8		
17	Examination with a check					◦	10		2
18	Waiting to receive the result			◦			5		
19	Receipt of the result					◦	0.5		
20	Go back to the doctor				◦		3	20	
21	Analyzes, screening report, and treatment description		◦				2		
22	Waiting to enter the doctor				◦		2	20	
23	Go to the pharmacy			◦			5		3
24	Receipt of treatment					◦	1		
25	Save the priorities	◦					0.5		1
26	Patient leave advisory				◦		0.5	5	