Optimization of surgery allocation to operating rooms in a post-pandemic context

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***Abstract*—The return to normal after a general close down of services such as surgeries is characterized by a large number of surgeries that were put on-hold and that need to be scheduled. It is critical to optimize the allocation of surgeries to operating rooms, reducing the average waiting time and possible casualties. In this study, different policies of allocation of operating rooms to surgeries in a hospital will be discussed.**

Keywords—Surgery, Allocation, Waiting Time, Operating Rooms

I. INTRODUCTION

This section will expose the context of the simulation system, the problem statement, the motivation to tackle the problem, the expected contributions, the main goals of the project and the structure of the paper.

II. LITERATURE REVIEW

The allocation of surgeries to operating rooms, with the goals of minimizing waiting time, as well as of maximizing operating room usage, has been approached in many articles. However, most of them do not consider extreme situations, where surgeries need to be done in mass, such as the one we are living in right now. In a situation with mass surgeries, we can contemplate the possibility of reallocating operating rooms to a given medical specialty, according to the existing needs. If a hospital is overwhelmed, reallocation of surgeries to another hospital can also be considered. These are some situations that have not been considered in many articles that approach this subject.

Article [1] studies a method for scheduling surgeries where first the operating rooms are divided in two time blocks per day which are assigned to surgeons and then the surgeons assign the respective surgeries to the existing time blocks. The simulation system in this article calculates the scheduling for one week, having all the surgeries that cannot be done in that week removed from the system. It also assumes that the operating rooms always have the equipment necessary for the surgeries, independently of the type of surgery. It does not consider, this way, costs of adapting the operating rooms according to the surgery or even the possible reallocation of an operating room adapted to one medical specialty to another for a certain time period.

Article [2] studies the allocation of resources to surgeries, including not only operating rooms but also medical staff. It does not consider a high number of surgeries known *a priori*, resulting from an event such as a pandemic, nor does it consider that surgeries can move from one hospital.

Article [3] also studies the method used in article [1], where operating rooms are allocated first to surgeons and then the surgeons' time blocks are allocated to surgeries. However, it also considers another method, called "Open scheduling strategy" where surgeries from different medical specialties can occur in the same operating room.

Article [4] studies the allocation of surgeries to operating rooms specialties in two stages. The first one, surgery priorities are evaluated based on patient age, surgery types, estimated surgery durations, and delayed days using regression technique without considering specialties. In the second scenario, the proposed priority-based surgery scheduling optimization model considering operating rooms specialties is solved using the discrete harmony search (DHS) algorithm. Also as the article [1], It assumes that the operating rooms always have the equipment necessary for the surgeries, independently of the type of surgery, so, it does not consider, this way, costs of adapting the operating rooms according to the surgery or even the possible reallocation of an operating room adapted to one medical specialty to another for a certain time period.

In general, all the methods simulated in these articles are applicable to normal situations, to optimize the process of scheduling surgeries allocating them to operating rooms. However, they do not consider scenarios of rupture, like in a post-pandemic context, where the flow of surgeries that need to be done is much bigger.

TABLE I

GAP ANALYSIS

	Surgeries known a priori	*Surgery urgency*	*Allocation across different medical specialties*	*Allocation across different hospitals*
[1]	X	X		
[2]		X		
[3]		X	X	
[4]	X	X	X	
Our Approach	X	X	X	X

III. METHODOLOGICAL APPROACH

This section will contain the methodological approach, with a description of the variables and performance metrics used, the operating policies and the entities of the system. It will also include the data requirements and simulation scenarios used.

IV. IMPLEMENTATION

This section will explain the implementation of the system.

V. RESULTS

This section will display the results obtained during the simulation process and the respective analysis.

VI. RELATED WORK

This section will contain an explanation of other related works and place our method's contributions to the field in this context. It will also include a comparison between this project and the other related works.

VII. CONCLUSIONS

This section will summarize the project objectives and results.

VIII. FUTURE WORK

This section will contain possible improvements and new analysis hypotheses to the field in this context.

REFERENCES

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