

## INTISARI

Saat ini riset terkait penjadwalan ruang operasi yang sudah mempertimbangkan faktor ketidakpastian durasi proses operasi, belum mengintegrasikan aspek *pre* dan *post-operative*. Di sisi lain, riset terkait penjadwalan ruang operasi yang sudah mengintegrasikan aspek *pre* dan *post-operative* masih bersifat deterministik, belum mempertimbangkan faktor ketidakpastian durasi operasi. Oleh karena itu, penelitian ini bertujuan untuk mengembangkan model matematis untuk penjadwalan ruang operasi bagi pasien elektif yang mempertimbangkan faktor ketidakpastian durasi dan mengintegrasikan aspek *pre* dan *post-operative* dengan batasan berupa dokter bedah, ruang operasi, tim perawat, serta ruang pemulihan.

Penjadwalan ruang operasi termasuk permasalahan *NP-Hard*, adanya penambahan faktor ketidakpastian durasi menyebabkan kompleksitas komputasi meningkat, sehingga penelitian ini mengusulkan suatu prosedur *pre-processing* data untuk meningkatkan efisiensi perhitungan. *Clustering* digunakan untuk mengelompokkan tindakan operasi berdasarkan jenis dan durasi operasi. Prioritas untuk tiap *cluster* yang terbentuk ditentukan berdasarkan metode *Shortest Processing Time*, *Longest Processing Time*, dan *random*. Fungsi tujuan dari model yang dikembangkan dalam penelitian ini adalah meminimalkan *waiting time* pasien dan *overtime* perawat. Algoritma Genetik digunakan dalam penyelesaian model agar jadwal operasi dapat diperoleh dalam waktu komputasi yang relatif pendek. Pengaruh faktor ketidakpastian durasi proses operasi terhadap jadwal yang dihasilkan di tiap metode dianalisis dengan menggunakan simulasi *Montecarlo*.

Hasil penelitian menunjukkan bahwa adanya pertimbangan faktor ketidakpastian durasi operasi membuat jadwal operasi yang dihasilkan lebih mendekati kondisi real. Pada penjadwalan yang menggunakan durasi estimasi berdasar *clustering* jenis bedah, metode *Cluster-SPT* menghasilkan penurunan *waiting time* pasien dan *overtime* perawat paling besar, dengan penurunan sebesar 68,71% dan 51,07% apabila dibandingkan dengan kondisi aktual. Pada penjadwalan yang menggunakan durasi estimasi berdasar *subclustering* jenis bedah, metode *Subcluster-SPT* menghasilkan penurunan *waiting time* pasien dan *overtime* perawat paling besar, dengan penurunan sebesar 69,55% dan 51,31% apabila dibandingkan dengan kondisi aktual. Prosedur *pre-processing* data yang dikembangkan juga mampu menurunkan waktu komputasi sebesar 15,33%. Sehingga dapat disimpulkan bahwa prosedur dan model yang dikembangkan mampu menurunkan *waiting time* pasien dan *overtime* perawat sekaligus mempercepat waktu komputasi.

**Kata kunci:** penjadwalan ruang operasi, analisis *clustering*, algoritma genetik, *waiting time* pasien, *overtime* perawat

## ABSTRACT

*Currently, researches on operating room scheduling, which have taken the factor of uncertainty in surgical duration into account, have not yet integrated pre- and post-operative aspects. On the other side, researches related to operating room scheduling, which have integrated pre- and post-operative aspects, are still deterministic; they have not yet considered the factor of uncertainty in surgical duration. This research, therefore, seeks to develop a mathematical model for operating room scheduling for elective patients, which considers surgical duration uncertainty and integrates pre- and post-operative aspects with such limitations as surgeons, operating rooms, nurse team, and recovery rooms.*

*Operating room scheduling is included as NP-hard problem. The addition of the factor of uncertainty in surgical duration leads to an increase in computational complexity, and therefore this research proposed data pre-processing procedure to improve computational efficiency. Clustering was used to categorize surgical procedures based on the types and the duration of surgery. The priority of each formed cluster was determined in accordance with such methods as Shortest Processing Time, Longest Processing Time, and random. The development of the model in the research aims at minimizing patient waiting time and nurse overtime. Genetic Algorithm was applied in completion of model so that the operating room schedule could be obtain within a relatively shorter computation time. The influence of the factor of surgical duration uncertainty on the schedule resulted in each method was analyzed using Montecarlo simulation.*

*The results of the research reveal that the consideration of the factor of uncertainty in surgical duration causes the resulted operating room schedule to approximate the real condition. In the scheduling using duration estimation based on clustering of the types of surgery, Cluster-SPT method results in the biggest reduction of patient waiting time and nurse overtime by 68.71% and 51.07% if compared to the real condition. Meanwhile, in the scheduling using duration estimation based on subclustering of the types of surgery, Subcluster-SPT method results in the biggest reduction of patient waiting time and nurse overtime by 69.55% and 51.31% if compared to the real condition. The developed data pre-processing procedure also enables to reduce computation time by 15.33%. In conclusion, the developed procedure and model can reduce patient waiting time and nurse overtime, and shorten the computation time.*

**Keywords:** *operating room scheduling, clustering analysis, genetic algorithm, patient waiting time, nurse overtime.*