HEALTHCARE RESOURCE PLANNING:

A SIMULATION APPROACH

A THESIS

SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE

FELLOW PROGRAMME IN MANAGEMENT

INDIAN INSTITUTE OF MANAGEMENT

INDORE

BY

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[2013FPM013]

MARCH 2018

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ABSTRACT

Healthcare system is complex due to its dynamic and critical operating environment with multiple layers of service providers. Simulation as a technique is often used to model and study such complex systems in the literature. The popularity of simulation in healthcare domain has resulted into a large number of articles intended to solve myriad of healthcare problems. This study has been divided into three parts. In the first part, the healthcare simulation literature is analyzed and categorized based on the healthcare service delivery levels. The following major research gaps are identified: (i) process design and resource planning for disaster preparedness in an emergency department of the multi-specialty hospitals to check operational vulnerability, (ii) there exists a research gap in terms of capturing dynamic human behavior in modeling emergency department in hospitals along with resource planning for effective healthcare service delivery. Multi-method simulation modeling including discrete event simulation and agent-based simulation may help in this (iii) it is also observed that the tertiary and quaternary healthcare service delivery needs the attention of the researchers for reducing service delay and improving patient throughput. This study primarily focuses on the third research gap.

Timely delivery of quality care is an essential competitive dimension of the healthcare industry. During the preliminary visits to various Indian multi-specialty hospitals, it is observed that patients availing cashless medical insurance often face a significant delay during the discharge process. The second part of the study seeks to address the issue of service lag between medical discharge and administrative discharge for the patients in an accredited hospital using the discrete event simulation modeling technique. The simulation results depicted that hospital can reduce up to 38% of the time spent in

discharge process by removing the inefficiency and increasing resources. Such reduction would help all the three stakeholders, i.e. patients, hospitals and insurance companies.

Chemotherapy, also referred as medical oncology, is a primary line of treatment for cancer. Due to multiple chemotherapy regimens (combination of medicines) for the different ailments, therapy duration varies from two hours to more than 12 days. It is observed that patients requiring a shorter duration therapy often face a longer waiting in the system resulting into an extended length of stay (LOS) in the hospital. In the third part of the study, a simulation model is developed for the chemotherapy process of a super specialty oncology hospital. Upon analyzing several scenarios, key interventions are proposed that resulted in reduction up to 93.5% in an average wait time of patients. It also improved LOS and patient throughput leading to efficient chemotherapy procedure. We also analyzed the impact of patient mix and growth in patient volume to test the response of the model post-interventions.

This study can be beneficial to the academicians and practitioners for using simulation modeling technique to improve the healthcare delivery system. Additionally, process improvement together with simulation modeling may realize more benefits to the healthcare delivery system. Simulation models developed in this study are face validated in consultation with the stakeholders.

Keywords*:* Healthcare; Resource Planning; Simulation; Health Insurance; Third Party Administrators; Cancer Care; Chemotherapy Patient Flow; Health Service Delivery.

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