HealthCare Clinic Simulation

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Abstract—As the number of interactions between patients, doctors, nurses, and technical and support staff increases, researchers and analysts are starting to see the potential of using simulation in the healthcare industry. To find the best configuration, inefficiencies might be removed, or resource allocation adjusted. In the healthcare industry, simulation has primarily been employed in comparison studies of various systems for resource or scheduling needs. The following performance metrics are frequently supplied when analyzing such alternatives: throughput, time in system, queue times and lengths. This study analyzes a clinic's operational systems using the existing performance metrics as well as the additional recommended performance metric of total working capital.

1. INTRODUCTION

Researchers propose that including stakeholders and patients during conceptual modeling could result in a more effective simulation study with better chances of being put into practice. Our work is mostly used in health care studies, which are distinguished by a large number of stakeholders and patients, varied goals, and frequently a politically heated context. We create a framework for participatory conceptual modeling using techniques from the problem-structuring methodology for soft systems. This method has the advantage of supporting conceptual modeling by involving stakeholders and patients in an organized and participatory manner. Through improved modeling and visualization, software has become more and more fitted to the healthcare industry. Simulators have been used to study virtually every type of healthcare setting, including hospitals and public health, among others. Patient flow, staffing, work schedules, facility capacity, admissions/scheduling, appointments, logistics, and planning are common issues. The fact that "people service people," or that people are both the client and the supply, makes health care issues particularly challenging.

I.II Related Work

According to F. Salvetti et. Al (2021) In a mixed reality environment for hybrid simulation, where physical and digital items co-exist and interact in real time, outside of a headset, enhanced reality for immersive simulation (e-REAL®) combines the real and virtual worlds. The enhanced reality lab, or e-REAL, is a completely immersive and multitasking environment created to help participants experience difficult circumstances in a group setting while concurrently interacting with peers, topic experts, and learning facilitators both locally and remotely. The e-REAL lab uses tools for enhanced reality to support visual thinking and knowledge visualization. It is a lab that encourages proactive data and information study that is extremely interactive and face-to-face.

Systems for simulating everything from patient flow in emergency rooms to populations with particular chronic conditions are reviewed. In terms of the platform utilized to construct the model, the data sources, and the computing power required to conduct the simulation, a pattern of variability and scalability was observed and analyzed. The synthesis of simulation models revealed clusters of programming languages and products. With an emphasis on requirements discovery, models, and simulation scenarios, design models and the development processes of systems engineering are addressed. The information visualization approaches employed for the simulations are described, along with interaction modes and trends. Particularly agent-based simulation models were examined, and the results show that agent characteristics vary in the literature research in areas like socio-

demographic design considerations.

I.III Objective and Scientific Contribution

This research will focus on achieving the following objectives:

- We will collect the data of the Healthcare Clinic for a complete week. By using the data, we gathered, we can then understand the arrival and departure patterns for each patient.
- Validating the hypothetical curves that will be acquired from the ARENA simulation model with the curves that will be generated from the collected data.
- Running the average patient arrival to show the flow of the Healthcare Clinic.

II. MODELING APPROACH

II.I Modeling Hypothesis

The main objective of this paper consists in providing a simulation-based healthcare clinic. This tool will help decide on server location. The following hypothesis is considered:

1. Hospitals entity: The attributes of hospitals are hospital-id, name, city, address, and phone.
2. Patient entity: The attributes of patients are patient-id, name, address, dob and phone.
3. Doctor entity: the attributes of doctor are doctor id, name, address, qualification, dob and salary.
4. Medical report entity: the attributes of medical report are report-id, problems, and date of examination.
5. Staff entity: the attributes of staff are staff-id, name, address ,salary and dob.

III. EXPERIMENTS AND RESULTS

The staff estimated that the process time would be somewhere between 0.5-1 minutes if everything went well. Because it was just an estimation, several different scenarios were taken under examination. It was also very important to find out how long the operation could take before it would have a negative effect on the operation of the ED. All developed scenarios were tested, and the results were compared to the existing operation, concentrating on the average throughput time of all patients. The results showed that if the operation is as effective as the staff has estimated, there will be a 26 % reduction of the average throughput time.

III.I Case Study

III.I.I Parameters of the Emergency Treatment In a Public Healthcare

Healthcare systems models and simulations will be used by healthcare organization managers, emergency planners, first responders, doctors and nurses, support, and training personnel to:

1. Analyze the resource requirements, behavior, and performance of healthcare systems.
2. Conduct training exercises, drills, emergencies, tests, alerts, and support real world

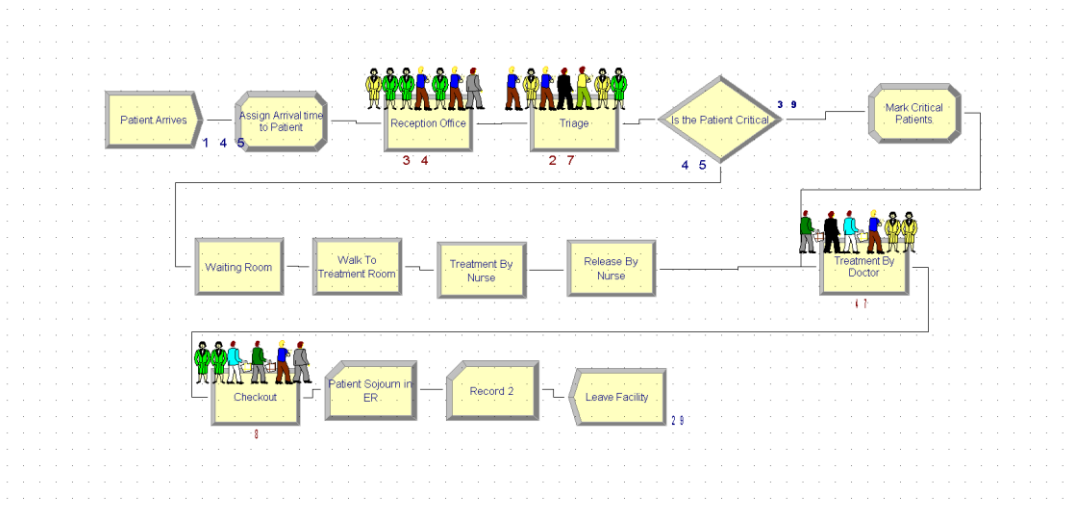
incidents (natural disasters, terrorist attacks, and epidemics).

3. Determine the readiness of healthcare systems to respond to various types of emergencies.
4. Model past incidents for education, training, and analysis purposes.

III.II Data Requirements

a. This section identifies input and output data types that may be supported for healthcare models and simulations.
b. Structure of healthcare organizations and inventory of resources.
c. Standard healthcare processes and procedures (e.g., triage and treatments).
d. Message logs and incident timelines.
e. Specification of the incident area including event types and parameters, timing of events, schedule of responder and healthcare personnel activities, population, terrain, and buildings in affected areas.
f. Demographics data: population location, density, and attributes by time of day.

III.III Design of Experiments



IV. DISCUSSION

This section is intended to capture practices and issues relevant to program sponsors, project managers, researchers, developers, and implementers of M&S of healthcare systems for homeland security applications. Development and implementation experiences are used to identify the best practices to be followed for future efforts and to provide uncertainties, cautions and warnings for use of such applications. These unmet needs and requirements are used to identify and prioritize the research, development, standards, and implementation issues that should be addressed going forward. This section hence provides a summary of discussion topics and recommendations that are divided into three major areas:

- Identification of best practices
- Uncertainties, cautions and warnings regarding expectations of these models and simulations
- Research, development, standards, and implementation issues that may need to be addressed by the research community, program sponsors, and stakeholders to improve the quality and utility of incident management models and simulations

V. CONCLUSIONS

This initial version of the document is the starting point of an effort to capture the current knowledge relevant to M&S of Emergency Treatment in Public Healthcare. It identifies the needs, translates them into requirements and provides summary information on resources available to meet the needs and requirements. The information on needs, requirements, and resources is used together with research, development, and implementation experiences to distill practices and issues for future efforts.

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