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CHALLENGES OF USING SIMULATION FOR HEALTHCARE OPERATIONS MANAGEMENT IN DEVELOPING COUNTRIES: THE CASE OF ETHIOPIA

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ABSTRACT

Computer simulation has been employed in developed countries to address healthcare service operations management problems. However, leveraging simulation in developing countries, where the burden of diseases is high, health systems are weak and resources are scarce, is limited. This study, hence, aims to investigate the usage and adoption of simulation for healthcare operations management in developing countries and the challenges of using simulation in this context by studying the case of Ethiopia through a systematic literature review and survey.

1 INTRODUCTION

Healthcare operation management aims to improve the quality and the efficiency of healthcare services by addressing a range of issues such as long waiting times, overcrowding, stressed medical staff, and medical accidents (Jha, Sahay, and Charan, 2016; Dai and Tayur, 2020). Simulation methods, such as system dynamics, discrete event simulation, and agent-based modelling, have been used for modelling and analyzing different healthcare operation management problems (Barnes, Golden, and Price, 2013) because they are suitable for modelling and analyzing dynamic and complex healthcare systems from different operational perspectives in a low-risk and cost-effective manner (Parks et al., 2011). Considering their benefit, simulation models have been widely employed in developed countries for healthcare service operations management (Parks et al., 2011). However, leveraging simulation in developing countries, where healthcare management challenges are quite different due to scarcity of resources, high burden of diseases, high population numbers, and poor health system planning, implementation, monitoring and evaluation, is limited (Jha, Sahay, and Charan, 2016). This is evident with the low number of publications produced by researchers and/or practitioners from developing countries. To the best of our knowledge, there is no research which studies the challenges and opportunities of using simulation for healthcare operations management in developing countries. Besides, there is no systematic literature review on the usage and adoption of simulation for healthcare operations management in developing countries. This study, hence, aims to investigate the usage and adoption of simulation for healthcare operations management in

developing countries and the opportunities and challenges of using simulation in this context by studying the case of Ethiopia through a systematic literature review and survey.

2 METHODS

The systematic literature review was used to understand the state-of-the-art, adoption and usage of simulation and the opportunities and challenges of using simulation in healthcare operations management in developing countries compared to developed countries. We have systematically searched papers from PubMed, Web of Science, Scopus, and IEEE Xplore databases using different keywords (e.g., simulation, agent-based, system-dynamic, discrete-event, healthcare operation management, challenges, opportunities, developing countries, and names of African countries). The survey was used to assess the awareness level of simulation and identify the challenges that hinder the adoption of simulation to study healthcare operations management problems in developing countries. The survey participants were 253 researchers (the population size is 3810) who work at Ethiopian universities in health informatics, informatics, computing, public health policy, engineering and operations management/research fields.

3 RESULTS

The systematic literature review shows that simulation has been used to model and analyze healthcare operations management from different perspectives aiming at reducing the probability of failure, achieving specifications, eradicating unpredicted bottlenecks, preventing under or over-utilization of resources, decreasing overcrowding, and improving clinical pathways and healthcare system performance. The survey participants constitute female (32%) and male (68%) researchers with BSc (6%), MSc (84%) and Ph.D. (10%) and with 1-5 years of experience (18%), 5-10 years of experience (70%) and more than 10 years of experience (12%). Sixty-two percent of the participants never witnessed any computer simulation-based healthcare operations management systems, whereas 38% of the participants witnessed a computer simulation-based healthcare operations management system for patient flow and bed management in public and private hospitals abroad. The study participants believe that computer simulation helps to improve effectiveness (94%), improve planning and resource utilization (91%), minimize crowdedness (91%) and the waiting time of patients (91%), improve the productivity and efficiency of healthcare professionals (93%), and helps healthcare professionals make more informed decisions (91%). However, 58% of the participants do not utilize their awareness of computer simulation for health care operation management. The participants responded that the lack of ICT infrastructure in their institute (71%), lack of organized data (72%), and health professionals' willingness/attitude (63%) are the challenges to implementing computer simulation in healthcare operations management. Besides, participants mentioned in the open-ended questions that the lack of data sharing policy, awareness among healthcare management and patients, and top management support are the challenges of using computer simulation for healthcare operations management.

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