

Improving Medicine Supply and Availability Using Simulation - A Case Study of Uganda

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Abstract

Medicine availability is a concern in low and middle-income countries hospitals, contributing to delayed treatment, out-of-pocket purchases, and deaths. Supply chains moving medicines are deemed weak, preventing on-time and continuous supply and availability in hospitals. There is a lack of studies using simulation to capture the complex nature of medicine supply chains, dealing with uncertainties and dynamisms, having separate agents with individual rules governing their operations; a decision made by one agent affects the entire system's performance. Using a case study of Uganda's public health care sector, our study evaluates the medicine supply chain using Discrete Event Simulation and Agent-based modelling to improve service delivery. Also, the model examines the effectiveness of various interventions in ensuring continuous supply and availability of medicines to all public hospitals in Uganda. Observation and unstructured interviews with supply chain personnel inform model conceptualisation using process mapping and Overview Design Development protocol. The two conceptual models are a basis for building a hybrid model. Model verification and validation using expert opinions, debugging, facility records, and sensitivity analysis will be done in later stages of research to ensure usefulness and increase user confidence. Our research develops an understanding of how to organise a supply chain and allows for generalisation across low-middle-income countries. Based on the model output derived from different interventions, healthcare policymakers can make data-driven decisions as a step forward to achieving UN SDG 3 of good health and well-being, specifically 3.3 to achieve Universal Health Coverage and access to essential medicines.

Keywords

Medicine supply chain, Availability, Discrete event simulation, Agent-based modelling, Service delivery

Biographies

Mouhamad Shaker Ali Agha is an Associate Professor (teaching) in the Department of Management Science where he also received his PhD and MSc. His research interest lies in the area of supply chain management and Industry 4.0 in general. In particular, He is interested in the supply chain risk and resilience analysis, digital supply chains, operations innovation. Dr Ali Agha is leading a research group that specialised in these areas. Dr Ali Agha is also the director of MSc Business Analysis and Consulting and MSc International Master Project Management in Strathclyde Business School.

Hellen Nabayiga is a PhD student in the Department of Management Science at the University of Strathclyde. Her research interest facilitates decision-making, focusing on applying operation tools like simulation tools to solve complex issues within the supply chains across sectors to improve performance and service delivery. Hellen's current research combines discrete event simulation, agent-based modelling tools and supply chain concepts to address the availability of medicine in Uganda's public healthcare sector.