

RESEARCH ARTICLE

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Application of discrete event simulation in health care: a systematic review

Xiangge Zhang^{1*}

Abstract

Background: The objective was to explore the current advances and extent of DES (Discrete Event Simulation) applied to assisting with health decision making, as well as to categorize the wide spectrum of health-related topics where DES was applied.

Methods: A systematic review was conducted of the literature published over the last two decades. Original research articles were included and reviewed if they concentrated on the topic of DES technique applied to health care management with model frameworks explicitly demonstrated. No restriction regarding the settings of DES application was applied.

Results: A total of 211 papers met the predefined inclusion criteria. The number of publications included increased significantly especially after 2010. 101 papers (48%) stated explicitly disease areas targeted, the most frequently modeled of which are related to circulatory system, nervous system and Neoplasm. The DES applications were distributed unevenly into 4 major classes: health and care systems operation (HCSO) (65%), disease progression modeling (DPM) (28%), screening modeling (SM) (5%) and health behavior modeling (HBM) (2%). More than 68% of HCSO by DES were focused on specific problems in individual units. However, more attempts at modeling highly integrated health service systems as well as some new trends were identified.

Conclusions: DES technique has been an effective tool to approach a wide variety of health care issues. Among all DES applications in health care, health system operations research occupied the most considerable proportion and increased most significantly. Health Economic Evaluation (HEE) was the second most common topic for DES in health care, but with stable rather than increasing numbers of publications.

Keywords: Systematic review, Discrete event simulation, Health care management

Background

DES is a form of computer-based modeling methodology that provides an intuitive and flexible method [1], characterized by the ability to simulate dynamic behaviors of complex systems and interactions between individuals, populations and their environments [2]. The goal of such a model is to comprehensively compare potential practices or strategy options, so as to identify the most efficient and effective ones, especially in situations where it may be infeasible to carry out required surveys or comparative experiments in practice.

In comparison with aggregate models without interaction [3] like decision trees or Markov models, DES as

an operational research technique can be more advantageous to model complex systems at the individual level instead of cohort level. The contexts simulated are usually viewed as queuing networks where individual entities pass through a series of discrete events one by one at discrete intervals, between which they have to wait in queues due to the constrained availability of resources [4]. DES is also able to allow decision makers to conduct “what if” analyses by changing the operational scenarios and rules, to predict the possible impacts resulting from a variety of policy alternatives before truly translated into practice without any alteration in present systems. However, admittedly DES models are also simplified presentations of reality, just as the portraits of other modeling techniques indicate. Typically, patients or medical care providers are referred to as entities, an essential

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Jessica J Manson



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web 1 how much of a time lag does there appear to be between a moose peak and a wolf peak the time lag between the wolf peak of 1980 and the moose peak of 1995 is about a 15 year time lag 2 during what year was there a large wolf die off hypothesize what might have been the cause of this die off there was a large wolf die off after 1980

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web to analyze the relationship of predator prey interactions between moose and wolves what is population growth changes in the size and composition of populations and the factors that cause those changes fill in the blanks the larger a population becomes the it

moose isle royale national park u s national park service - Apr 30 2022

web oct 14 2020 the moose population of isle royale has fluctuated over the years since 1980 the population has been as low as 500 animals and as high as 2 400 the fluctuation of population is directly connected to the vegetation and predators of the island

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web what animals populated isle royale after the moose how did they reach the island and what effect did this have on the moose population a small pack of wolves found and crossed a rare ice bridge that formed between the mainland and isle royale in the 1940s

wolves and moose of isle royale online lab docx wolves - Jul 02 2022

web wolves and moose of isle royale visit to answer the following introductory questions 1 what are the predators and prey involved in this activity wolf and moose wolf and moose 2 what is the purpose of this study for example how long has this study been happening why did it start what are the goals 3

solved isle royale lab report the moose arrive what is the - Jul 14 2023

web provide a biological explanation for why the moose population overshoots its carrying capacity when moose first colonize isle royale hint consulting the introduction might help at year 50 or later with the moose population at its carrying capacity what would happen if an extra 200 moose suddenly arrived on isle royale how would this

isle royale worksheet docx isle royale worksheet this lab - Feb 09 2023

web isle royale worksheet this lab simulation will take place in the simutext software by simbio use this worksheet to make sure you can answer questions about the lab that may appear on your lab quiz i e stable moose population for moose approx 200 the capacity did not change because moose are limited by plant growth which did not