



CONTRIBUTION OF COMPUTATIONAL SYSTEMS, MODELING AND SIMULATION IN MEDICAL ADVANCEMENT

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Abstract

Computational systems, modeling and simulations have become an integral part of the medical field, especially in Emergency Medicine (EM). This research paper is a study of the application, uses and limitations of computational systems and their contribution to medical advancements. This paper includes a review of the data analysis based on conducted studies and interpretation for the accurate diagnosis and treatment of diseases. This paper also includes the background and analysis of the foundations of computational tools used in medicine today.

Keywords

Contribution: the part played by a person or thing in bringing about a result or helping something to advance

Computational: using or relating to computers

Systems: a group of related hardware units or programs or both, especially when dedicated to a single application.

Modelling: devise a representation, especially a mathematical one, of (a phenomenon or system)

Simulation: the production of a computer model of something, especially for the purpose of the study.

INTRODUCTION

Computational systems are programs of hardware/software that portray mathematical representations or models of a unit based on a specific data set.

Computational systems in medicine require collaborative inputs from analysts, mathematicians, physicians, bioengineers, and researchers for an effective output. They involve the use of mathematical modelling and are applied for the treatment of cancer, providing precision dosages of drugs, cardiovascular medicine, prototyping, etc. These systems address the need for the interpretation of quantitative data and predict cellular capacities. These systems facilitate the simplification and increase the accuracy of several medical procedures.

Application:

Training: Computer simulations provide physicians training in healthcare a learning opportunity by mimicking clinical scenarios and planned exposures which help training in emergency communication skills and team training without any patient risk.



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Medical imaging and informatics: using computational systems for X-rays, MRIs, CT scans, ultrasounds, etc.; computers play a significant role in the organization of data using information networking. They are also used to develop and design other medical devices.

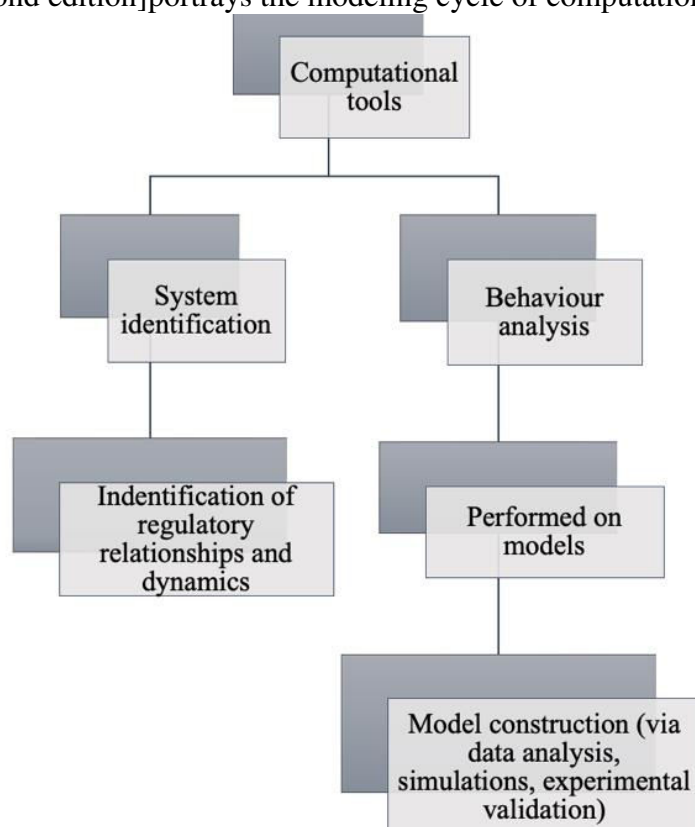
Data analysis: software statistical packages such as the biomedical computer package (BMD), Statistical package for the social sciences (SPSS), GenStat and Epi-Info are commonly used for medical research.

Laboratory computing: running tests and providing accurate and valid results in a short time frame. They also help in predicting the possible effects of drugs.

Computer-assisted decision making: they assist doctors with clinical decision making and regulating the dosage of treatment for patients.

Limitations: Prevents a deeper understanding due to complexities and non-linearities; can be misused (unintendedly) if not user-interface friendly.

A chart [formed and adapted from Roland Eils' and Andres Kriete's "Computational Systems Biology", second edition] portrays the modeling cycle of computation tools.

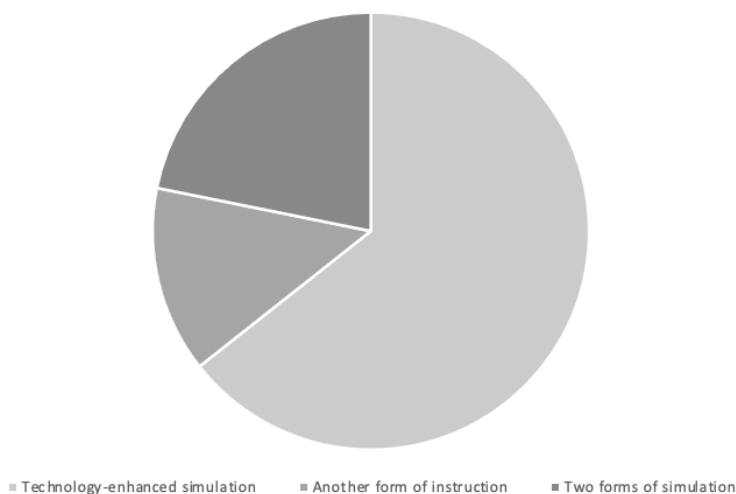


Statistical Analysis:

As per a study conducted by the Progressive Clinical Practice, it was concluded that Emergency Medicine (EM) learners associate technology-enhanced simulation with gaining more favourable effects compared to other instruction. The study was conducted with the identification of 85 EM learners. The study shows that most students find technology-enhanced simulation to be the most

favourable instruction method, resulting in long-term advancements as simulations are a more accurate form of instruction with minimal/no sources of human error.

Comparison of different forms of instruction based on favorability of EM students



RESULT

Computational systems, modelling and simulations have notably contributed in the advancement of healthcare with the introduction of technology which results in wholistically improved patient treatment.

CONCLUSION

Computational systems are developing over the past decade with respect to visualization, interpretation, analysis, and storage of aggregate quality data. They are essential in the field of medicine for effective and accurate treatment of patients. They have contributed significantly to medical advancements with the interpretation of biomedical data which consequently contributes to the appropriate diagnosis, treatment, and prevention of diseases.

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