

Developing Credible Practice Guidelines for Modeling and Simulation in Healthcare: A Multifaceted Approach

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Abstract— There is a growing demand to use computational modeling and simulation (M&S) in healthcare. For broader use and acceptance, a unified M&S practice standards and guidelines are necessary. This abstract presents a multifaceted initiative dedicated to meet this challenge.

I. INTRODUCTION

The role of computational modeling and simulation (M&S) in healthcare research and practice continues to grow at a rapid pace [1-2]. However, there is a lack of broadly accepted standards and guidelines to establish the adaptation of M&S to clinical practitioners, regulators, and patients [3-5]. To help fill this critical gap, the “Committee on Credible Practice of Modeling & Simulation in Healthcare” (hereafter, referred to as the Committee) was established under the Interagency Modeling and Analysis Group (IMAG) and the Multiscale Modeling (MSM) Consortium [6]. This paper presents this interdisciplinary Committee’s initial synthesis of: (1) Ten Simple Rules of Credible Practice based on the Committee’s internal efforts and its survey of the global bio-medical and M&S community; (2) important elements of M&S certification guidelines; and (3) the limitations and uncertainties in this developing effort.

II. METHODS

Committee members conducted an initial internal analysis to establish the Committee’s perspective on the top ten considerations for credible practice of M&S in healthcare [7]. The Committee then surveyed the broader M&S stakeholder community to draw out globally well-balanced guidelines across the range of disciplines and application interests.

Survey participants were instructed to rank 32 “simple rules” of credible practice on a scale of zero (Not Important) to five (Extremely Important). To avoid ranking bias, each participant received the rules in random order. Additionally, three of the 32 rules were repeated in the survey to assess the consistency of each participant’s responses. Upon completion of the survey, the data were reduced to only include responses from participants who were consistent and did not miss more than two questions. Finally, the 32 rules were ranked based on the total number of Extremely Important (5) or Very Important (4) responses for each rule received.

III. RESULTS

Of the 185 survey participants, 148 provided consistent and complete responses. They represented four continents and ten disciplines with varying degrees of education and M&S experience. While comparative analysis between the

Committee’s perspective and the survey results showed noticeable differences in the final ranking of the 32 rules, both groups agreed that the four rules listed in Table 1 are necessary for the credible practice of M&S in healthcare.

TABLE I. FOUR HIGH PRIORITY CREDIBILITY CONSIDERATIONS IDENTIFIED BY THE COMMITTEE AND BROADER M&S COMMUNITY

Simple Rule [7]	Description
<i>Define context clearly</i>	Develop and document the subject, purpose, and intended use(s) of the model or simulation
<i>Use appropriate data</i>	Employ relevant and traceable information in the development or operation of a model or simulation.
<i>Evaluate within context</i>	Verification, validation, uncertainty quantification, and sensitivity analysis of the model or simulation are accomplished with respect to the reality of interest and intended use(s) of the model or simulation.
<i>List limitations explicitly</i>	Restrictions, constraints, or qualifications for or on the use of the model or simulation are available for consideration by the users or customers of a model or simulation.

IV. FUTURE WORK

The perspectives of the two groups will be synthesized as the foundation for the development of “Guidelines for Credible Practice of Modeling and Simulation in Healthcare,” as well as a Model Certification Guideline. Moreover, a glossary of terms is under development on the Committee’s website in an attempt to unify the use of M&S terminology across a variety of disciplines and stakeholders in the field. These end-products will be published as peer-reviewed journal articles, as well as Committee approved white papers.

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