



Priority Statement Title: Establishing Validation Standards for Biomechanical Modeling

Priority Statement Code: CJ4B

Domain: ALL

Priority Statement

Background and Relevance

In order to understand functional performance, disease etiology and musculoskeletal design it is critical to accurately quantify the loads placed on individual muscles, tendons, ligaments, cartilage surfaces and bones. Direct measurement of these loads *in vivo* has been quite limited, due to the highly invasive nature of such experiments. Computational modeling can resolve the indeterminate nature of the muscle force-joint torque problem through optimization. However, this approach is hindered by an inability to accurately determine model parameters, limited access to such parameters over large populations (both healthy and pathological), and the proper validation of model calculations and assumptions.

Unfortunately, too many published studies assume that models are valid without applying appropriate validation procedures and apply them to conditions beyond which they were intended. This may result in erroneous or misleading conclusion, provides inappropriate support for surgical decision making, which ultimately reflects poorly on biomechanics community and makes cross-fertilization between biomechanics and clinical fields problematic. Thus, one of the pressing needs is to establish procedures to identify uniform sets of criteria for model validation, informed by the question in hand. This procedures can become the standard practice by which all funding and publishing decisions are made from. This has the potential to improve the quality of modeling research as well as increase the reputation of the field.

Objectives

1. Improve the current quality of modeling work and bring a new status to it.
2. Develop a set of validation standards to which all publications and proposals can be held.
3. Create a set of required information for determining model utility and scope, and allowing model reproducibility. For example;
 - a. define and justify the application space of model (e.g., static vs. dynamic; *in vivo*, *ex vivo*, vs *in vitro*; muscle vs joint vs whole body)
 - b. develop a clear, but concise, list of model input parameters and the assumptions associated with them.

Recommended Actions

1. Convene a standards committee, possibly a joint effort between ASB, ISB, and ASME to determine task specific validation standards.
2. Communicate the recommendations of the committee to editors of journals and program chairs.