



## Editorial

# Gait and clinical movement analysis research priorities: 2007 Update from the research committee of the gait and clinical movement analysis society

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## 1. Introduction

In 1995, the National Center for Medical Rehabilitation Research (NCMRR) within the National Institutes of Health (NIH) sponsored a workshop entitled “Gait Analysis in Rehabilitation Medicine” [1]. The purpose of the workshop was to develop and prioritize a set of recommendations pertaining to the role of gait analysis in enhancing the function of people with locomotor disabilities. The results of the workshop were 37 prioritized recommendations. Professional organizations and societies were charged with the responsibility of further synthesizing the workshop products. Government agencies, industry, and professional organizations were challenged to work cooperatively towards achieving advancements for the future use of gait analysis in rehabilitation medicine.

It has been over a decade since the NCMRR workshop. Since that time there have not been any reports of systematic attempts to assess or redefine research priorities in the gait analysis community. Since the workshop, the field of gait and motion analysis has continued to mature. The Research Committee of the Gait and Clinical Movement Analysis Society (GCMAS) decided that a reassessment of priorities was necessary. The purpose of their

project was to reassess and redefine a priority list for investigations of gait and clinical movement analysis.

## 2. Study methods and results

A three-step process was used. In April of 2004, the Gait and Clinical Movement Analysis Society (GCMAS) Research Committee ( $n = 5$ ) met in Lexington, KY and reviewed the 37 recommendations of the NCMRR Gait Analysis Workshop (Table 1 lists the Top eight recommendations). The committee selected, by consensus the four recommendations considered to be most relevant to the mission of the GCMAS. In April of 2007, a discussion session open to all members of the GCMAS and other conference attendees was held at the annual meeting of the GCMAS in Springfield, MA to discuss these recommendations. Forty members attended the meeting. Four focus groups were formed to discuss the recommendations. From the meeting, four additional recommendations were developed for a total of eight recommendations (Table 2). The recommendations were framed in a similar format to those of the NCMRR workshop.

From November 15 to December 15 of 2007, the entire GCMAS membership had the opportunity to prioritize the eight recommendations via an electronic voting process through the GCMAS website.

Members ranked each of the eight recommendations from one to ten with ten being the most important and one being the least important to their profession and to the society. Members could use the same score response more than once, but were encouraged to differentiate between recommendations as the key objective of this stage was to establish a hierarchy of importance that distinguished between recommendations. The results from this final step are based upon the scoring of 73 GCMAS members (out of 250, 29%) who prioritized the recommendations (Table 2). The recommendation with the highest score ( $9.1 \pm 1.2$ ) was “Gait analysis is an effective tool in the clinical decision making process for improving treatment outcomes in individuals”. It not only had the highest ranking, but it also had the smallest standard deviation, indicating the consistency of its ranking amongst respondents. The second and third ranked recommendations were tied with a rank of 7.8, although there was a slight difference in standard deviations (2.0 compared with 2.3).

## 3. Discussion

The GCMAS has re-evaluated the priorities for research in gait and human movement analysis initiated by NIH over a decade ago. The GCMAS is an association of professionals (e.g., engineers,

**Table 1**

NCMRR gait analysis priority rankings from 1995. Lower scores indicate greater importance of the recommendation.

Priority ranking	Mean priority score	Recommendation title
1	200.6	Is gait analysis efficacious in improving treatment outcomes?
2	207.8	Effectiveness of gait analysis.
3	222.2	Role of three-dimensional computerized gait analysis in treatment decision making and as an outcome measure and its cost effectiveness.
4	226.8	Development of models to study the relationship between the observed abnormal gait, lower extremity structure, and underlying etiology.
5	233.3	Gait assessment and functional outcome.
6	233.7	Gait assessment and clinical decision making.
7	235.2	Identify relationships between impairment, functional gait limitations, and disability.
8	236.5	Expand the clinical application of gait analysis.

**Table 2**  
Ranking, score (mean  $\pm$  SD), recommendation and description of research objectives from GCMAS in 2007. Higher scores indicate greater importance of the recommendation.

Rank	Score	Recommendation	Description
1	9.1 $\pm$ 1.2	Gait analysis is an effective tool in the clinical decision making process for improving treatment outcome in individuals.	The primary reason for the inconsistent utilization of clinical gait analysis is the lack of efficacy data demonstrating that functional outcomes are improved as a direct result of gait analysis. The consequence of this uncertainty is that individuals with disabilities are either deprived of a useful assessment tool or are subjected to a time consuming and unnecessary evaluation. The purpose of this recommendation is to demonstrate that clinical gait analysis alters treatment decisions so as to improve functional outcomes.
2	7.8 $\pm$ 2.0	Gait/motion analysis has applications beyond gait in individuals with cerebral palsy.	Gait analysis is frequently used in guiding the selection and assessing outcome of orthopaedic surgical procedures for individuals with cerebral palsy. However, other medical pathologies may benefit in a similar manner. The purpose of this line of research is to demonstrate the effectiveness of gait/motion analysis in guiding selection and assessing outcome in other medical conditions besides cerebral palsy and to explore the assessment of movement other than gait (e.g., upper extremity).
3	7.8 $\pm$ 2.3	Gait/motion analysis is an effective functional outcome measure.	There is a paucity of quantitative research documenting the advantage of computerized gait analysis over traditional clinical evaluations or questionnaires as a functional outcome assessment tool. Historically, most orthopaedic surgeons and rehabilitation specialists have relied primarily on static examination and observational gait analysis to assess outcomes. Recently, questionnaires have been developed that may overlap with gait analysis assessments. The purpose of this line of research is to demonstrate that gait analysis is an effective functional outcome measure.
4	7.2 $\pm$ 2.1	Gait/motion analysis is an accurate, precise, and valid method of quantifying movement.	Advances in instrumentation and computer technology have substantially increased the accuracy and precision of the data collected in gait/motion analysis process. Nevertheless, there are relatively few studies that have comprehensively identified the real and potential artifacts inherently involved in transforming the basic collected data set (e.g., spatial location of body markers) into assessment variables (e.g., joint angles). The purpose of this line of research is to document the inherent limitations and uncertainties associated with motion analysis techniques, investigate their effects on the information made available for clinical interpretation, and develop new approaches that improve quality relative to accuracy, precision, sensitivity, reproducibility, and validity.
5	6.6 $\pm$ 2.0	Gait/motion analysis is underutilized due to the lack of understanding by clinicians of its benefits and limitations.	A major barrier to a wider use of gait/motion analysis for directing interventions or in outcome assessment is the lack of a basic understanding by physicians, therapists, orthotists/prosthetists, and other medical professionals regarding its capabilities, benefits, and limitations. The purposes of this line of research are to develop and implement educational methods that can assist medical professionals in understanding the concepts involved in gait/motion analysis.
6	6.4 $\pm$ 2.1	Gait/motion analysis is a cost effective patient management tool.	The cost effectiveness of gait analysis as a clinically useful tool has yet to be demonstrated as it relates to an individual's participation, functional limitations, and disability. The lack of information has impeded the ability to justify the benefits of gait analysis to the consumer, medical community, and insurance providers. The purpose of this line of research is to demonstrate the cost effectiveness of gait/motion analysis as a patient management tool.
7	5.0 $\pm$ 2.3	Gait/motion analysis data are difficult to share.	Sharing data among motion analysis laboratories is typically difficult due to differences in methods. Not enough work has been done to develop procedures for sharing. This can limit understanding, interpretation, and presentation of results. The purposes of this line of research are to develop and implement systematic methods of sharing data among motion analysis laboratories to expand the body of knowledge and to support advances within the field.
8	4.6 $\pm$ 2.3	Gait/motion analysis laboratories lack systematic business practices and organization to promote and sustain the field of gait/motion analysis.	The field of gait/motion analysis is comprised of individual researchers, individual laboratories and networked systems within clinical and academic sites. Such diverse individualization makes it difficult to advance the standing of the field within business markets and political arenas. The purpose of this line of research is to develop better systematic business practices and organization to promote and sustain the field of gait/motion analysis.

kinesiologists, physicians, therapists) involved in the stimulation and advancement of scientific knowledge in the field of gait and human movement analysis in both clinical and research settings. The society's purpose is to promote education, professional interaction and the exchange of ideas among Society members [2].

It is noteworthy that the highest priorities identified by the two processes have not substantially changed over the past decade (Tables 1 and 2). The issues of efficacy of gait analysis as a clinical decision making tool and as a functional outcome measure remain, as does expansion of the applications of gait/motion analysis. However, recommendations related to education and data sharing are also included in the top priorities of the most recent ranking. These recommendations were also included in the 1995 NCMRR report, but at a lower priority.

The purpose of this study was to develop a priority list for investigations of gait and clinical movement analysis. Eight recommendations were identified and ranked. The recommendations were similar to those previously identified over 10 years ago. Continued work is needed in these areas to advance the field of gait and movement analysis. In addition, these priority areas should be periodically assessed to monitor progress and to adjust priorities as the field moves forward.

## Introductory comments

The Research Committee of the Gait and Clinical Movement Analysis Society (GCMAS), one of the Societies affiliated with Gait and Posture, undertook a reassessment of research priorities in the field of gait and clinical movement analysis. It was interesting to observe that the main priorities have not changed over the past ten years and still focus around the efficacy and efficiency of gait analysis in improving clinical outcomes.

I considered the findings of this workshop relevant to the majority of the Readers of Gait and Posture. I, therefore, invited the authors to publish their findings in a Guest Editorial.

Tim Theologis  
Editor in Chief  
Gait and Posture

## References

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