

## USC RESEARCH BANK

<http://research.usc.edu.au>

This is the author accepted version of the following publication:

Gabel, C P, Osborne, J W, Melloh, M (2013) Clinimetric re: Badalamente et al. Parts 1 and 2. J Hand Surg Am. 2013;38(2):401–406 and 407–412, Journal of Hand Surgery, 38 (8) 1661-1662, DOI: <http://dx.doi.org/10.1016/j.jhsa.2013.05.034>

### PERMISSIONS

Permission has been granted by the copyright holder to deposit this author accepted version as Open Access in the USC Research Bank. Open Access research is digital, online and free of charge, and is made possible by the consent of the author or copyright holder.

This is the author's version of a work that was accepted for publication in Journal of Hand Surgery. Changes resulting from the publishing process, such as peer review, editing, corrections, structural formatting, and other quality control mechanisms may not be reflected in this document. Changes may have been made to this work since it was submitted for publication. A definitive version was subsequently published in Journal of Hand Surgery, 38 (8) 1661-1662, 2013, DOI: <http://dx.doi.org/10.1016/j.jhsa.2013.05.034>

To Dr Ghazi Rayan  
Editor, Journal of Hand Surgery

21<sup>st</sup> April 2013

From:

Philip Gabel, PT, PhD  
Jason Osborne, PhD, Statistician  
Markus Melloh, MD, MPH, PhD, MBA

Dear Editor;

**Re: Badalamente et al. Measurement scales in clinical research of the upper extremity, part 1: general principles, measures of general health, pain, and patient satisfaction. J Hand Surg Am. 2013 Feb;38(2):401-6 and Badalamente et al. Measurement scales in clinical research of the upper extremity, part 2: outcome measures in studies of the hand/wrist and shoulder/elbow. J Hand Surg Am. 2013 Feb;38(2):407-12.**

We wish to commend the authors on these articles as they are important in educating clinicians and researchers on the value of patient reported outcome (PRO) measures and the clinimetric properties supporting them. Though focusing on reliability, validity and responsiveness, discussion of other essential properties would broaden the understanding of the complex clinimetric interrelations that ensure overall validity.

**Internal Consistency (IC)** is briefly defined and discussed in Part 2; however, the acceptable range of  $\alpha=0.70-0.95^1$  is not mentioned. Outside this 'window', low-IC makes item analysis unjustified while high-IC causes 'item redundancy' with too many similar items. Achieving this 'window' requires a balance between items reflecting the domain of interest and the statistical processes of psychometric analysis<sup>2</sup>. For the DASH, a consistently demonstrated  $\alpha>0.95$  raises questions on potential redundancy within its items.

**Factor Analysis (FA)** is an exploratory technique that can help researchers infer whether items reflect a single domain (e.g. upper extremity function) or multiple constructs (e.g. pain, psychological...). A single factor is generally required to defend using single summated scores. It is generally not acceptable to sum items from different factors (constructs) as a single measure<sup>3,4</sup>. Principal Component Analysis (PCA) is generally not considered a best practice<sup>3</sup>, as other methods (maximum likelihood, principal axis factoring), with subject-to-item ratios exceeding  $n=20$  can produce better results. Subsequently, confirmatory methodology are preferred to test hypotheses about instrument structure for classical psychometric designed tools wherein IC is maximised<sup>2</sup>.

**Practicality** ensures a PRO's purpose and satisfaction when used by patients. It guarantees readability (Flesch levels at  $\leq$ Grade 7), limited missing responses ( $\leq 5\%$ ), and realistic times for completion (3-5 minutes) and scoring (30-60 seconds) with minimal to no errors<sup>5</sup>.

The implications of PROs with clinimetric properties beyond accepted boundaries should be critically analysed. Lack of conformity to these standards might raise questions on their validity and confidence in their use.

Yours sincerely

Charles Philip Gabel  
Jason W. Osborne and  
Markus Melloh

Charles Philip Gabel, PT, PhD  
Faculty of Health Science  
University of the Sunshine Coast  
Queensland, Australia

---

Jason W Osborne, PhD, Statistician  
Educational and Counselling Psychology  
University of Louisville  
Louisville, KY, USA

---

Markus Melloh, MD, MPH, PhD, MBA  
Western Australian Institute for Medical Research (WAIMR)  
University of Western Australia  
Nedlands, Western Australia, Australia

### **List of References**

1. Terwee CB, Bot SD, de Boer MR, et al. Quality criteria were proposed for measurement properties of health status questionnaires. *J Clin Epidemiol* 2007;60:34-42.
2. Boyle GJ. Does item homogeneity indicate internal consistency or item redundancy in psychometric scales? *Personality and Individual Differences* 1991;12:291 -4.
3. Costello AB, Osborne J. Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis. *Practical Assessment, Research & Evaluation* 2005;10:1-9.
4. Doward LC, McKenna SP. Defining Patient-Reported Outcomes. *Value Health* 2004;7:S4-S8.
5. Gabel CP, Michener LA, Melloh M, Burkett B. Modification of the Upper Limb Functional Index to a Three-point Response Improves Clinimetric Properties. *J Hand Ther* 2010;23:41-52