Journal of Hand Therapy xxx (2017) 1–9

Contents lists available at ScienceDirect

Journal of Hand Therapy

journal homepage: www.jhandtherapy.org

Scientific/Clinical Article

# Cross cultural adaptation and refinement of an English version of a Dutch patient-reported questionnaire for hand sensitivity: The Radboud Evaluation of Sensitivity

Tara L. Packham PhD (c), OTReg(Ont)[a,b,*], Joy C. MacDermid PhD, PT[b,c], Susan Michlovitz PhD, PT[b,d], Edith Cup PhD, OT[e], Lucelle Van de Ven-Stevens PhD, OT/CHT NL[f]

[a] Hand Therapy Clinic, Regional Rehabilitation Program, Hamilton Health Sciences, Hamilton, Ontario, Canada
[b] School of Rehabilitation Sciences, McMaster University, Hamilton, Ontario, Canada
[c] Roth|McFarlane, Hand and Upper Limb Centre, and Department of Physical Therapy, Western University, London, Ontario, Canada
[d] Department of Rehabilitation and Regenerative Medicine, Program in Physical Therapy, Columbia University, New York, NY, USA
[e] Department of Rehabilitation, Donders Centre for Neuroscience, Radboud University Medical Center, Nijmegen, The Netherlands
[f] Dutch Association of Occupational Therapists (Ergotherapie Nederland), Utrecht, The Netherlands

ARTICLE INFO

*Article history:*
Received 1 July 2016
Received in revised form
17 January 2017
Accepted 22 March 2017
Available online xxx

*Keywords:*
Allodynia
Patient-reported outcomes
Translation
Cultural validation
Psychometrics

ABSTRACT

*Study Design:* Longitudinal clinical measurement.
*Introduction:* Sensory alterations in the hand can present as both decreased sensation or numbness, and hyperesthesia, including mechanical allodynia and cold intolerance. However, few patient-reported outcomes have been developed and validated for evaluation, particularly for increased sensitivity. The Radboud Evaluation of Sensitivity was developed in the Netherlands for patient-reported evaluation of hand sensitivity in complex regional pain syndrome.
*Purpose of the Study:* The purpose of this study was to translate into English and culturally validate the Radboud Evaluation of Sensitivity for the North American context.
*Methods:* Forward and backward translation, followed by a psychometric evaluation of the synthesized version of the translated tool, was undertaken in a heterogeneous group of persons after hand injury, including nerve injuries, hand trauma, and complex regional pain syndrome.
*Results:* Thirty-six persons completed test-retest reliability testing, yielding an intraclass correlation coefficient of 0.92 (95% CI 0.85 to 0.96) for single measures. Internal consistency was also high at $\alpha = 0.96$ in a larger sample ($n = 56$). Although some support for construct validity was generated, several validity hypotheses were not confirmed. Of interest, there appeared to be significant differences in the scores between persons with hypoesthesia as compared with those with hyperesthesia.
*Conclusions:* The Radboud Evaluation of Sensitivity, English version appears to be a reliable tool for the self-reported evaluation of sensory alterations in the hand, including both hypoesthesia and hyperesthesia. More research is needed to add to the extent of and confidence in the validity and responsiveness of this assessment.
*Level of Evidence:* Level II.



## Introduction

Painful tactile sensitivity and sensory alterations in the hand can occur after physical damage (ie, trauma)[1] or chemical insult (ie, diabetes and inflammation) to the peripheral nerve and/or nervous system.[2] These may present associated with burns, lacerations, nerve compression syndromes, complex regional pain syndrome (CRPS), crush injuries, severe postoperative or posttraumatic swelling, and/or the sequelae of infection or metabolic conditions.[3] Hand therapists often use the term “hypersensitivity” as an umbrella term to describe the clinical presentation of abnormal

Dr Packham is funded by a doctoral scholarship from the Canadian Institutes of Health Research. Joy MacDermid was supported by a Canadian Institutes of Health Research Chair in Gender, Work and Health and the Dr James Roth Chair in Musculoskeletal Measurement and Knowledge Translation. This study was funded by the New Investigators Fund at Hamilton Health Sciences.

* Corresponding author. Hand Therapy Clinic, Regional Rehabilitation Centre, 300 Wellington Street North, Hamilton, Ontario, Canada L8L 0A4. Tel.: 1-905-527-4322x40578; fax: 1-905-527-0338.
*E-mail address:* packhamt@hhsc.ca (T.L. Packham).

0894-1130/$ – see front matter © 2017 Hanley & Belfus, an imprint of Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.jht.2017.03.003

**Table 1**
Definitions, descriptors, and evaluations for pain and sensitivity

| Terms | Definitions from IASP[3] | Other clinical descriptors | Standardized sensory evaluations | |
|---|---|---|---|---|
| | | | Lab based[7] | Clinical |
| Allodynia | Painful response to a nonpainful or nonnoxious stimulus, such as light touch (mechanical allodynia: may be static or dynamic) or heat/cold (thermal allodynia) | Hypersensitivity, tactile defensiveness, cold sensitivity | Algometer<br>Pressure pain threshold | Brush-evoked allodynia[8]<br>Cold allodynia[7]<br>TenTest[9] |
| Hyperesthesia | Increased sensation | Hypersensitivity to touch and temperature, cold intolerance, heat sensitivity | Thermal evoked pain threshold (hot and cold) | ICE test[10]<br>Cold Intolerance Severity Scale[11] |
| Hyperpathia | Increasing pain with repeated stimuli, “Wind-Up” or temporal summation | Hypersensitivity to pain | Pressure pain threshold | Pinprick test[12] |
| Dysesthesia | Odd, crude, or unexpected sensation; may include paraesthesias such as pins and needles or tingling | Hypersensitivity, pins and needles, tingling, funny feelings, difficulty with discrimination | — | BCTQ symptom severity scale[13]<br>PRUNE[14]<br>STT gnosis test[15] |
| Hypoesthesia | Decreased response to any tactile stimulus | Lack of feeling, numbness, crude sensation | Pressure and vibration perception threshold | 2-point discrimination[16]<br>Sensory mapping (monofilaments)[16]<br>10 test[9] |

BCTQ = Boston Carpal Tunnel Questionnaire; ICE = immersion in cold water evaluation; IASP = International Association for the Study of Pain; PRUNE = Patient-Rated Ulnar Nerve Evaluation; STT = Shape Texture Test.

painful sensations.[4,5] The more precise terminology includes allodynia, hyperpathia, and dysesthesia[6] as these represent distinct phenomena (see Table 1 for definitions). However, the complexity of nerve injury and dysfunction at both the peripheral and central levels of the nervous system also can lead to the clinical coexistence of allodynia, hypoesthesia, and hyperesthesia in the same limb.[2,3,6] Persons may describe painful numbness or report both sensitivity and a loss of discriminative sensibility but can find these bidirectional changes confusing.

Self-reported evaluations or patient-reported outcomes (PROs) have become one of the preferred methods of evaluation in the field of hand rehabilitation.[17] While a systematic review exists that summarizes the measurement properties of clinician-based sensory evaluation tools,[18] no synthesis exists for those PROs addressing sensation. This group of assessments includes condition-specific PROs such as the Boston Carpal Tunnel Questionnaire[13] and Patient-Rated Ulnar Nerve Evaluation[14] and symptom-specific PROs, for example, the Cold Intolerance Severity Scale.[11] Table 1 links these tools to the specific sensory phenomenon addressed.

Although tactile “hypersensitivity” (hyperesthesia, hyperpathia, and mechanical allodynia)[19] is commonly seen, there are few self-reported tools that directly assess this impairment or address its impact on activity. Since allodynia and hyperesthesia are components of neuropathic pain (NeP),[20] self-report tools addressing NeP (including the Short Form of the McGill Pain Questionnaire,[21] Self-Reported Leeds Assessment of Neuropathic Signs and Symptoms [S-LANSS],[22] the Neuropathic Pain Questionnaire,[23] painDETECT,[24] and Douleur Neuropathic 4 [DN4][25]) may also be considered appropriate assessments. Although the DN4, S-LANSS, and Neuropathic Pain Questionnaire were primarily designed for use as screening tools to differentiate between nociceptive and NeP, it has been suggested that the DN4 also functions as an outcome measure.[26] A single study of the S-LANSS did not find support for outcome measurement on the basis of Rasch analysis[27]; however, a modified version of painDETECT demonstrated fit to the Rasch model, supporting its ability to measure change.[28] Although several studies of responsiveness endorse the SF-MPQ for prospective evaluation,[21,29] none of these tools have been evaluated in an upper extremity trauma or postsurgical population.

The Radboud Evaluation of Sensitivity (RES) was developed by hand therapists and researchers in the Netherlands to measure hand sensitivity in persons with CRPS.[30-32] It contains 8 items, scored by the client on a 100-mm visual analogue scale (VAS), comparing the affected hand to the unaffected hand; this yields a total score out of 80. Standardized instructions are given by the person administering the test. For 6 of the items, the client is presented with tactile media (rice, beans, and a towel) or is asked to touch their own skin, hair, and clothing to make a physical comparison of the sensory experience, so the evaluation is not entirely a “pen and paper” exercise. The person is asked to rate the differences between hands without specifying the direction of those differences; therefore, the assessment could equally be used to rate mechanical allodynia, hyperesthesia, hypoesthesia, and dysesthesia. No suggestions are made for the accommodation of bilateral impairments. Ratings of the subjective perception of a standardized stimulus are considered psychophysical testing, which is a common form of sensory testing.[33,34] Pilot testing of the RES was described by the developers in thesis work and a Dutch publication; however, the formal estimates of reliability and validity have not been published in a peer-reviewed journal.[30,31] Measurement properties reported included (1) substantial to excellent test-retest reliability (0.74-0.98 for individual items, $P < .01$ for all) and (2) a lack of support for construct validity based on multiple correlations to monofilament testing (with only 2/14 comparisons significant at $P < .01$).[30]

As part of a larger study on assessment and rehabilitation of allodynia (the SARA study: www.clinicaltrials.gov NCT02070367) and to address the need for simple but reliable and valid tools to address the evaluation of hyperesthesia and allodynia, we have undertaken translation and cultural validation of the RES from the original Dutch to English, to determine whether it is a reliable, valid, and responsive measure of somatosensory impairments for persons after hand trauma. Study objectives included evaluations of internal consistency, test-retest reliability, agreement, construct validity, and responsiveness.

## Methods

Participants enrolled in this study were part of a larger clinical trial on somatosensory assessment and rehabilitation of allodynia (Fig. 1). Subjects were recruited from the outpatient programs of a large regional trauma center, including a hand therapy clinic, plastics clinics, and a pain management center. The target populations were persons with CRPS of the upper limb, persons with a peripheral nerve injury in the hand or upper limb or persons with a recent hand surgery or trauma. Target sample size was calculated