

# Intrarater and Inter-rater Reliability of Active Cervical Range of Motion in Patients With Nonspecific Neck Pain Measured With Technological and Common Use Devices: A Systematic Review With Meta-regression

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## ABSTRACT

**Objectives:** The purpose of this systematic review was to compare intrarater and inter-rater reliability of active cervical range of motion (ACROM) measures obtained with technological devices to those assessed with low-cost devices in patients with nonspecific neck pain. As a secondary outcome, we investigated if ACROM reliability is influenced by the plane of the assessed movement.

**Methods:** Medline, Scopus, Embase, the Cochrane Library, CINAHL, PEDro, and gray literature were searched until August 2016. Inclusion criteria were reliability design, population of adults with nonspecific neck pain, examiners of any level of experience, measures repeated at least twice, and statistical indexes on reliability. A device was considered inexpensive if it cost less than €500. The risk of bias of included studies was assessed by Quality Appraisal of Reliability Studies.

**Results:** The search yielded 35 151 records. Nine studies met all eligibility criteria. Their Quality Appraisal of Reliability Studies mean score was 3.7 of 11. No significant effect of the type of device (inexpensive vs expensive) on intraclass correlation coefficient (ICC) was identified for intrarater (ICC = 0.93 vs 0.91;  $P > .99$ ) and inter-rater reliability (ICC = 0.80 vs 0.87;  $P > .99$ ). The plane of movement did not affect inter-rater reliability ( $P = .11$ ). Significant influences were identified with intrarater reliability ( $P = .0001$ ) of inexpensive devices, where intrarater reliability decreased ( $P = .01$ ) in side bending, compared with flexion-extension.

**Conclusions:** The use of expensive devices to measure ACROM in adults with nonspecific neck pain does not seem to improve the reliability of the assessment. Side bending had a lower level of intrarater reliability. (J Manipulative Physiol Ther 2017;40:597-608)

**Key Indexing Terms:** Neck Pain; Range of Motion, Articular; Validation Study as Topic; Cost Control

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## INTRODUCTION

Neck pain (ie, pain in the neck with or without pain referred into 1 or both upper limbs that lasts at least 1 day) is a common complaint in the global population.<sup>1</sup> It was estimated that about the 5% of population at any time suffers from neck pain.<sup>1</sup> Objective evaluation of active range of motion, for neck pain as much as for other condition, is a cornerstone of clinical assessment,<sup>2,3</sup> just like history taking, visual inspection, and passive motion examination.<sup>4</sup>

Changes in active cervical range of motion (ACROM) are considered adequate indicators for treatment effect<sup>3</sup> and

prognosis for nonspecific neck pain<sup>3</sup> but not useful for diagnosing the condition. However, results from previous systematic reviews on reliability of ACROM measurement indicate conflicting conclusions because of potential selection biases. In former studies, an asymptomatic sample was sometimes used to test ACROM, and reviews pooled data from this population with a symptomatic one.<sup>3,5-7</sup> Moreover, data were pooled from patients with multiple diagnoses, mixing results of measures in specific neck pain (ie, neck pain originating from systemic conditions like rheumatic diseases or identified causes like radiculopathy) with nonspecific ones.<sup>3,5-7</sup> In the end, previous reviews did not perform an adequate assessment of methodological quality of identified studies: In some cases there was a complete lack of assessment<sup>5,6</sup>; in others the assessment was performed by tools that were not validated.<sup>2,7</sup> To avoid such biases, it was decided to create this systematic review with stricter criteria in the selection procedure.

Neck pain is highly disabling and demands direct and indirect costs (eg, public or private health costs, insurance refunds, working days lost). Some studies have estimated that a patient with nonspecific back and neck pain will spend about \$5500 per year,<sup>8,9</sup> with a trend of increasing costs,<sup>8,9</sup> mainly because of medical specialty costs, possibly related to innovative contents and collaborative markets with producers of supplies.<sup>10</sup>

To contain costs for spine pain management, it is important to evaluate if devices are reliable and cost-worthy. Therefore, the purpose of this systematic review was to compare intrarater and inter-rater reliability of ACROM measures from technological devices to those assessed with low-cost devices in patients with nonspecific neck pain. As a secondary outcome, we investigated if ACROM reliability is influenced by the plane of the assessed movement.

## METHODS

### Search Strategy

This systematic review was written in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement for reporting systematic reviews and meta-analyses of studies,<sup>10</sup> without registering a protocol review. A systematic search was performed in 6 electronic databases (Medline, Scopus, Embase, the Cochrane Library, CINHALL, and PEDro) from each databases' inception until August 2016; in addition, a gray literature search was performed on articular mobility textbooks, with no limits about year of publication.

A search strategy was built using keywords combined with Boolean operators. Relevant hand-searched articles, found in textbooks, were also included to obtain as complete information as possible. The search strategies are reported in Appendix 1.

A hand search of the reference lists of the articles screened for inclusion was also performed to locate any publications not identified through the electronic database searches.

### Eligibility Criteria

Two authors (M.S., F.Gi.) independently reviewed the articles obtained by the systematic search for eligibility and possible inclusion. Titles and abstracts of all articles were screened for eligibility, based on the criteria listed next. In case of uncertain eligibility, all reviewers screened the full text of the manuscript for inclusion into the systematic review.

**Inclusion Criteria.** Studies were included only if intrarater or inter-rater reliability design was adopted. Publications in any language as full-text articles and peer review were included. Studies based on participants with nonspecific neck pain<sup>11</sup> were included for the review. Examiners with various levels of experience and education were included for review, and no restrictions were made based on their demographics. Studies were included if the measurement of ACROM was performed at least twice (by the same rater or different raters). The studies were included if they provided statistics about reliability of measurements such as intraclass correlation (ICC), standard error of measurement, and limits of agreement.

**Exclusion Criteria.** Types of studies excluded were letters, editorials, comments, case studies, protocols, guidelines, conference proceedings, review articles, and those whose full text was not available. Also excluded were studies with asymptomatic participants or with mixed populations (healthy and symptomatic) where data were pooled together without any distinction and those involving participants with other pathologic conditions different from nonspecific neck pain. Students were not included as raters. Studies where the measurement of ACROM was performed only once by a single rater or was not performed were not included. Studies were excluded if they did not provide statistics about reliability of measurements.

### Quality Assessment

The Quality Appraisal of Reliability Studies (QAREL) checklist evaluated the risk of bias.<sup>12</sup> It has been reported to have acceptable levels of content validity (good) and inter-rater reliability ( $\kappa > 0.60$ ).<sup>13</sup> It has been used in systematic reviews aimed at reliability of clinical tests in rehabilitation.<sup>14-16</sup> In this systematic review, a QAREL checklist was adopted to assess methodological quality both across studies and within studies.

A QAREL is composed of 11 items and assesses the external validity, internal validity, and statistical methods of reliability studies. Based on guidelines provided, each item is equally weighted and scored as *Yes*, *No*, *Unclear*, or *Not Applicable*. Former systematic reviews of inter-rater and intrarater reliability based on QAREL scores have used

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