

# Linking of the American Academy of Orthopaedic Surgeons Distal Radius Fracture Clinical Practice Guidelines to the International Classification of Functioning, Disability, and Health; International Classification of Diseases; and ICF Core Sets for Hand Conditions

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## Abstract

**Background:** American Academy of Orthopaedic Surgeons (AAOS) distal radius fracture (DRF) clinical practice guidelines (CPG) are readily available to clinicians, patients, and policymakers. International Classification of Functioning, Disability, and Health (ICF) provides a framework for describing the impact of health conditions. The International Classification of Diseases–10th Revision (ICD-10) is a classification system to classify health conditions as specific disease or disorders. The aim of this study is to analyze and describe the scope and focus of the AAOS DRF CPG using the ICF and ICD-10 as a basis for content analysis, and to compare the content of the CPG with the ICF hand core sets as the reference standard. **Methods:** Established linking rules were used by 2 independent raters to analyze the 29 recommendations of the AAOS DRF CPG. ICD-10 codes were assigned in the same process. Summary linkage statistics were used to describe the results for ICF and the hand core sets. **Results:** Among the 29 recommendations of the AAOS DRF CPG, 5 meaningful concepts were linked to the ICF codes. Of these, 5 codes appeared on the comprehensive ICF core set and only 3 codes appeared in the brief ICF core set, and 7 conditions were covered in ICD-10 codes. **Conclusions:** The AAOS DRF CPG focuses on surgical interventions and has minimal linkage to the constructs of the ICD-10 and ICF. It does not address activity or participation (disability), and is not well linked to key concepts relevant to hand conditions.

**Keywords:** American Association of Orthopaedic Surgeons (AAOS) guidelines; distal radius fracture (DRF); International Classification of Functioning, Disability, and Health (ICF); International Classification of Diseases–10th Revision (ICD-10); clinical practice guidelines (CPG)

## Introduction

Distal radius fracture (DRF) is one of the most common types of fracture<sup>7,25,31</sup> that can cause substantial pain, disability,<sup>6,14,24,29,30,37</sup> and health care burden.<sup>6</sup> Study shows that more than 640 000 cases of DRF were reported during 2001 in North America,<sup>14</sup> and nearly 372 000 individuals of age 65 years and older sustain DRF every year in the United States.<sup>35</sup> Many studies describe the extent of impairments and disabilities experienced by the patients with DRF. Appropriate and effective treatment is essential to manage the DRF and to minimize the

disability experienced by the patients with DRF.<sup>30</sup> Evidence-based practice guidelines help the health care professionals in clinical decision making on the effective treatment.<sup>4</sup>

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Clinical practice guidelines (CPG) are defined as “Systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances.”<sup>25</sup> Evidence-based CPG are developed by identifying high-quality evidence to facilitate more rational and efficient clinical practice and better health care outcomes.<sup>21,25</sup> Many professional organizations have developed evidence-based CPG that play a significant role in initiating quality of health care.<sup>16</sup>

The American Academy of Orthopaedic Surgeons (AAOS) is the largest professional group that provides professional support to orthopedic surgeons and other allied health care professionals who work in orthopedics.<sup>2</sup> The AAOS has invested substantial effort in developing clinical practice guidelines, for a variety of common orthopedic conditions including DRF.<sup>1</sup> The CPG was developed using a process where orthopedic surgeons develop priority clinical questions and the best evidence was identified to locate the best available evidences to address the issues raised,<sup>1</sup> a process thoroughly described on the Web site (<http://www.aaos.org/research/guidelines/DRFguideline.asp>).

Considering the epidemiology of the DRF and the extent of disability experienced as the result of DRF around the world,<sup>6,13,19,30,32,37,39,40</sup> it is important for the clinicians, policy-makers, researchers, and public, including people with disability, to have a uniform language/terminology to describe the disability. The International Classification of Functioning, Disability, and Health (ICF) is World Health Organization's (WHO) initiative that provides a unified framework for the description of health constructs.<sup>45</sup> It was approved by World Health Assembly in 2001.<sup>8</sup> The International Classification of Diseases–10th Revision (ICD-10) is the standard diagnostic tool for epidemiology, health management, and clinical purposes, including analyzing the general health of the population group.<sup>44</sup> It is used universally in linking the mortality and morbidity statistics and indexing of hospital records.<sup>44</sup>

As described by ICF, disability is a universal human experience that occurs through the complex interaction between a person's health condition and personal factors and environmental contextual factors, resulting in functioning at various levels: body structures and functions, activities, and participation.<sup>15,43</sup> ICF and ICD-10 are the international language for describing health and disability and can be used for content analysis in evaluating outcome measures<sup>3,9,38,43</sup> or disability experiences<sup>2</sup> to understand the content of the outcome measures, treatment program, and disability experiences.<sup>15</sup> ICF can enhance patient centeredness and goal setting.<sup>11,12,20,33</sup> For these reasons, the International Guidelines Network recommended ICF and ICD-10 to be incorporated into guideline development,<sup>42</sup> and the American Physical Therapy Association<sup>17</sup> has adopted ICF as a framework for recent and future guidelines.

The ICF core set for hand conditions was developed in 2009 to comprehensively describe functioning and disability

of individuals with hand conditions.<sup>23,36</sup> A total of 117 ICF codes were included in the comprehensive ICF core set for hand conditions. These codes can be taken into account when conducting a comprehensive, multidisciplinary assessment.<sup>36</sup> The brief ICF core set has 23 ICF codes and it can be used in assessing any patient with hand conditions irrespective of the health care setting and can be used by the individual health care professionals even when not a multidisciplinary team is involved.<sup>23,36</sup>

The process for developing CPG and the available pool of evidence determine the nature and scope of the resulting recommendations. Understanding the quality and content of the CPG is needed for potential users to consider their usefulness in practice. Although there has been much development of methodology to determine the quality of CPG<sup>1,29</sup> and the quality of guidelines in the hand therapy has been evaluated,<sup>27</sup> there has been less focus on understanding the content or comprehensiveness of the CPG recommendations. For guidelines to be useful, they should do the following: provide recommendations that are evidence-based providing clear direction on the strength of the supporting evidence, recommend clear and specific actions to be taken under specific circumstances, provide clear indication of the expected outcomes and potential complications with different treatment options, and provide a sufficient range of options so that users can provide comprehensive care. As ICF is recommended as a framework for CPG, the purpose of this study is to examine the linkage of the AAOS DRF CPG for the ICF and ICD-10.

The purpose of this study is to

1. classify the content addressed in the recommendations of the AAOS CPG for distal radius fracture using ICF and ICD-10 codes, and
2. determine the extent to which the recommendations represent important areas of function and disability by comparing content with the ICF hand core sets.

## Methods

The AAOS DRF clinical practice guidelines consist of 29 recommendations (<http://www.aaos.org/research/guidelines/DRFguideline.asp>); each recommendation was directly linked to the ICF separately by 2 health professionals (physiotherapists). The linking process was based on the 10 linking rules for ICF developed by Cieza et al.<sup>8</sup> All 29 recommendations were linked to the most precise ICF and ICD-10 category; items that were not codable in ICF were assigned as not covered (nc).

To get the most appropriate linkage, after some calibration of codes, raters evaluated the set of recommendations independently and met to review and discuss codes until consensus between the 2 reviewers was reached. In the case of disagreement, a third rater who was well trained in ICF

arbitrated. As a final stage, the linked ICF categories were compared and analyzed with the comprehensive ICF core set for the hand conditions.

### Linking to ICF

The ICF is a bio-psycho-social model and hierarchically organized linking system divided into conceptual units such as functioning and disability and contextual factors.<sup>22,43,45</sup> Functioning and disability concepts have been subdivided into body structure (s), body function (b), and activity and participation (d). The contextual factor consists of environmental factor (e) and personal factors (pf).<sup>22,45</sup> The linking is an alphanumeric hierarchical linking system, starting with broad concepts at the chapter or first level and progressing to more detail across the second to fourth levels. A letter signifies whether the code relates to impairments in body structure (s) or body function (b) or activity/participation (d) or environmental factors (e), and number added to the right indicates an increasing precision of description.<sup>45</sup> Concepts that were not defined by the ICF were marked not defined (nd), and concepts that represent the personal factors were marked as (pf) as they are not linkable in ICF.<sup>45</sup>

### Analysis

**ICF linkage indicators.** Raters established the content of the CPG using the instructions/training and established linking rules<sup>8</sup> and any further updates established by the ICF branch to select the ICF codes that best represent the content of the CPG. Individual codes were compared with the ICF core sets for the hand conditions (<https://www.icf-research-branch.org/icf-core-sets-projects2/other-health-conditions/development-of-icf-core-sets-for-hand-conditions>) and summarized using summary statistics that describe ICF linkage.<sup>26</sup>

We described the number of codes and the distribution, for example, by chapters or domains. Summary statistics that describe how the linkage to ICF in a broad sense more specially to hand core and even more specifically to the disability codes within the core sets were obtained using previously proposed summary statistics as listed below ([http://srs-mcmaster.ca/wp-content/uploads/2015/04/ICF-linkage-indicators\\_Final-to-Post.pdf](http://srs-mcmaster.ca/wp-content/uploads/2015/04/ICF-linkage-indicators_Final-to-Post.pdf)).

**CPG to ICF linkage.** This is the percentage of items from the CPG that can be linked to ICF codes. This represents the extent to which content of the CPG can be expressed in ICF codes:

$$\text{CPG to ICF linkage} = \frac{\text{No. of recommendations linked to at least 1 ICF code}}{\text{Total No. of recommendations on the CPG}} \times 100\%$$

$$\text{AAOS DRF CPG to ICF linkage} = \frac{11}{29} \times 100\% = 38\%$$

**CPG to (comprehensive or brief) core set absolute linkage.** This is the percentage of items from the CPG that could be linked to ICF codes that appear on a relevant brief or comprehensive core set:

$$\text{No. of recommendations linked to a code appearing in the core set} \\ = \frac{\text{Total No. of recommendations on the CPG}}{\text{Total No. of recommendations on the CPG}} \times 100\%$$

$$\text{Comprehensive core set absolute linkage} = \frac{11}{29} \times 100\% \\ = 38\%$$

$$\text{Brief core set absolute linkage} = \frac{8}{29} \times 100\% \\ = 28\%$$

**CPG to (brief or comprehensive) core set unique linkage.** It is the percentage of the CPG's items that could be linked to unique ICF codes and represents the extent to which the items of the CPG represent different content indicated by the core set. Once an item is linked to a core set item, additional items that code to that same code are not counted again:

$$\text{No. of recommendations that are linked to unique codes in the core set} \\ = \frac{\text{Total No. of recommendations on the CPG}}{\text{Total No. of recommendations on the CPG}} \times 100\%$$

$$\text{Comprehensive core set unique linkage} = \frac{5}{29} \times 100\% \\ = 17\%$$

$$\text{Brief core set unique linkage} = \frac{4}{29} \times 100\% = 14\%$$

**Core set unique disability representation.** It is the percentage of unique core set disability codes that are covered when the CPG's items are linked to ICF codes. It represents the extent to which the disability codes defined by the core sets are represented on the CPG. Once an item is linked to a core set disability code, additional items that code to the same code are not counted again:

$$\text{No. of unique (d) codes from the recommendation that appear in the core set} \\ = \frac{\text{Total no. of disability codes in the core set (brief or comprehensive)}}{\text{Total no. of disability codes in the core set (brief or comprehensive)}} \times 100\%$$

Comprehensive core set unique

$$\text{disability representation} = \frac{0}{37} \times 100\% = 0\%,$$

Brief core set unique

$$\text{disability representation} = \frac{0}{37} \times 100\% = 0\%.$$

## Results and Discussion

The AAOS guidelines on the treatment of DRF covered 7 different conditions that were codable in ICD-10 (Table 1). Only 11 recommendations were linkable in ICF giving it a percentage score of 38%. Two concepts were linked to the component of body structure (s), 2 concepts were linked to the components of body function (b), one concept was linked to the components of environmental factors (e), and no concept was linked to the component of activity and participation (d; Table 2). Among the 29 recommendations, 18 recommendations (62%; Table 3) did not have a meaningful concept that could be linked to ICF.

### CPG to the (Comprehensive or Brief) Core Set Absolute Linkage and Unique Linkage

Of the 29 recommendations of AAOS DRF treatment guidelines, 11 recommendations with meaningful concept were linked to the comprehensive core set for hand conditions resulting in the absolute linkage score of 38%, and 5 recommendations were linked to the brief core set for the hand conditions (28%). The unique linkage of the AAOS DRF treatment guideline recommendation to the unique codes (5 codes) in the comprehensive core set was 17% (Table 4) and in the brief core set (4 codes) was 14% (Table 4).

### Unique Core Set Disability Representation

Surprisingly, by means of the linking procedure, none of the AAOS DRF guideline recommendations represented the activity and participation (d) ICF category and we were unable to link any of the meaningful concepts of the AAOS DRF guidelines to the disability codes on either comprehensive or brief core set for the hand conditions. It has 0% representation scores when linked to unique core set disability content.

### Discussion

This study indicates that the AAOS DRF recommendations have minimal linkage to ICF and ICD-10; also, they address little of the content of the hand core set. Only a few of the meaningful concepts from the CPG were directly linked to the ICF categories, for example, pain (b280, sensation of pain), casts and splints (e115, products

**Table 1.** ICD-10 Conditions Used in the AAOS Guidelines.

| ICD-10 codes | Health conditions                                 |
|--------------|---------------------------------------------------|
| S52.5        | Fracture of the lower end of radius               |
| S63.0        | Dislocation of the radioulnar joint               |
| S52.7        | Fracture and dislocation of radius and ulna       |
| S63.3        | Traumatic rupture of the ligament of wrist        |
| Z46.7        | Fitting and adjustment of orthopedic devices      |
| Z45          | Adjustment and management of the implanted device |
| Z47.8        | Other orthopedic follow-up care                   |

Note. ICD-10, International Classification of Diseases–10th Revision; AAOS, American Academy of Orthopaedic Surgeons.

and technology for personal use in daily living), and ligaments of the forearm (s73013, ligaments of the forearm). Concepts like wrist motion and finger motion exercises were linked to the ICF by codes that were relatively imprecise. For example, “active finger motion exercise” and “early wrist motion” were linked to b7100 (b7100, mobility of single joint).

The AAOS recommendations mainly focused on surgical interventions that are not represented by the ICF categories and have been coded as not codable “nc.” This focus aligns well with the target audience being orthopedic surgeons. Health policymakers, funders, and clinicians should be aware that as the guidelines do not address function,<sup>14</sup> they are not appropriate for rehabilitation professionals or other groups who are focused on functional outcomes. CPG may be developed by multidisciplinary teams and should address comprehensive management or be very focused on a specific intervention or target user. As long as the scope and target audience are specified as recommended by Appraisal of Guidelines for Research and Evaluation (AGREE),<sup>10,28</sup> this is acceptable. AAOS CPG recommendations use a development strategy where the evidence search is driven by the questions of an expert clinician team who were predominantly surgeons. The lack of focus on function in the recommendations might reflect deficiencies in the evidentiary pool with respect to rehabilitation. This concern was raised in previous systematic reviews of exercise for upper limb fractures<sup>5</sup> and a 2007 Cochrane review of rehabilitation in DRF.<sup>19</sup>

A 2011 systematic review focused on fractures of the upper extremity finding that most studies addressed proximal humerus fractures or distal radius fractures and found conflicting studies about the relative benefits of home versus supervised exercise or combinations of these.<sup>5</sup> The most comprehensive Cochrane review was performed by Handoll et al and published in 2006.<sup>19</sup> They found weak evidence of improved hand function for hand therapy in the days after plaster cast removal, with some beneficial effects continuing 1 month later (one trial). They also found a lack of differences in the outcome between supervised and unsupervised

**Table 2.** ICF Codes Used in the AAOS Guidelines.

| Description                                                    | ICF codes | Comprehensive core set for hand conditions | Brief core set for hand conditions |
|----------------------------------------------------------------|-----------|--------------------------------------------|------------------------------------|
| Spinal cord and related structures                             | s120 •    | s120 •                                     | s120 •                             |
| Ligaments and fasciae of the forearm/structures of the forearm | s73013 ▪  | s7301 ⊖                                    | X                                  |
| Sensation of pain                                              | b280 •    | b280 •                                     | b280 •                             |
| Mobility of a single joint                                     | b7100 •   | b7100 •                                    | b710 ⊖                             |
| Products and technology for personal use in daily living       | e115 •    | e115 •                                     | e1 *                               |

Note. • represents the same level, ▪ represents the fourth level, ⊖ represents the third level, \* represents the chapter level, and X is an absent code. ICF, International Classification of Functioning, Disability, and Health; AAOS, American Academy of Orthopaedic Surgeons.

**Table 3.** AAOS DRF Recommendations That Are Not Codable in ICF.

## AAOS recommendations

We suggest operative fixation for fractures with postreduction radial shortening of >3 mm, dorsal tilt >10°, or intraarticular displacement or step-off >2 mm as opposed to cast fixation.

We are unable to recommend for or against any one specific operative method for fixation of distal radius fractures.

We are unable to recommend for or against operative treatment for patients older than 55 years with distal radius fractures.

We are unable to recommend for or against locking plates in patients older than 55 years who are treated operatively.

Arthroscopic evaluation of the articular surface is an option during operative treatment of intraarticular distal radius fractures.

We are unable to recommend for or against the use of supplemental bone grafts or substitutes when using locking plates

We are unable to recommend for or against the use of bone graft (autograft or allograft) or bone graft substitutes for the filling of a bone void as an adjunct to other operative treatments.

In the absence of reliable evidence, it is the opinion of the work group that distal radius fractures that are treated nonoperatively be followed by ongoing radiographic evaluation for 3 weeks and at cessation of immobilization.

We are unable to recommend whether 2 or 3 Kirschner wires should be used for distal radius fracture fixation.

We are unable to recommend for or against using the occurrence of distal radius fractures to predict future fragility fractures.

We are unable to recommend for or against concurrent surgical treatment of distal radioulnar joint instability in patients with operatively treated distal radius fractures.

We suggest that all patients with distal radius fractures undergo a postreduction true lateral X-ray examination of the carpus to assess DRUJ alignment.

To limit complications when using external fixation, it is an option to limit the duration of fixation.

We are unable to recommend for or against overdistracted of the wrist when using an external fixator.

Ultrasound and/or ice are options for adjuvant treatment of distal radius fractures.

We are unable to recommend for or against fixation of ulnar styloid fractures associated with distal radius fractures.

We are unable to recommend for or against using external fixation alone for the management of distal radius fractures where there is depressed lunate fossa or 4-part fracture (sagittal split).

Note. AAOS, American Academy of Orthopaedic Surgeons; DRF, distal radius fracture; DRUJ, Distal Radio Ulnar Joint; ICF, International Classification of Functioning, Disability, and Health.

**Table 4.** ICF Linkage Indicators to Define the Linkage Between AAOS DRF CPG Recommendations and the ICF Core Sets.

| Linkage indicator                            | Comprehensive core set (%) | Brief core set (%) |
|----------------------------------------------|----------------------------|--------------------|
| 1. Measure to core set absolute linkage      | 38                         | 28                 |
| 2. Measure to core set unique linkage        | 17                         | 14                 |
| 3. Unique core set disability representation | 0                          | 0                  |

Note. ICF, International Classification of Functioning, Disability, and Health; AAOS, American Academy of Orthopaedic Surgeons; DRF, distal radius fracture; CPG, clinical practice guidelines.

exercises during mobilization based on one small trial. For interventions started postimmobilization, there was weak evidence of a lack of clinically significant differences in outcome in patients receiving formal hand therapy (4 trials), passive

mobilization (2 trials), ice or pulsed electromagnetic field (1 trial), or whirlpool immersion (1 trial) compared with no intervention. There was weak evidence supporting the short-term benefit of continuous passive motion (postexternal

fixation; 1 trial), intermittent pneumatic compression (1 trial), and ultrasound (1 trial). This review suggested weak evidence of better short-term hand function in participants given physiotherapy than in those given instructions for home exercises by a surgeon based on 1 trial. A recent systematic review addressed therapist supervised versus home program exercise following DRF and found a small pool of evidence to recommend between these 2 approaches, but suggested both were beneficial.<sup>41</sup> More recent systematic reviews on other aspects of DRF have not concurred and would benefit future CPG efforts. Although the available evidence is weak, it does not directly align with the recommendations of the AAOS, which suggests that the method of posing questions to drive the literature search may miss relevant evidence. A search strategy that looks for all evidence on rehabilitation is advisable for future guidelines that wish to address rehabilitation of distal radius fractures.

We found that the wording of the AAOS guidelines rarely specified a specific outcome of treatment. This is a notable departure from the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) approach for guideline recommendations that suggest that it should be clear what the strength of the evidence is for different outcomes, as the risk of bias in the evidentiary pool may be different for different outcomes.<sup>18</sup> Furthermore, as treatments can have different effects on different outcomes, and different risk parts of the informed consent process involve providing a clear summary of this information to patients, CPG ideally should provide a clear indication of the nature and strength of the evidence and the balances of costs, risks, and benefit across different outcomes if they are to assist patients and clinicians in choosing among treatment options. None of the guideline recommendations addressed how to optimize activities and participation outcomes following DRF or referred to this outcome. This is an important gap because activity and participation is a primary focus in rehabilitation and has been shown to be more related to health status recovery<sup>38</sup> and patient satisfaction.<sup>40</sup> The potential limitation of our study can be the use of 2 raters that has affected the selection of the codes and agreement in linking. However, we have limited the potential linking error by consulting with the third rater (MacDermid) who was the part of the expert group that approved the core set for hand conditions the international ICF consensus conference.

## Conclusion

The biomedical approach evident in the AAOS guidelines may anticipate that improvements in surgical approach and radiographic outcomes may translate to better functional outcomes, although this is not explicitly stated. Conversely, a rehabilitation guideline should consider multiple aspects of the ICF that affect patient outcomes, as rehabilitation tends to take on a broader focus. In fact, rehabilitation

guidelines may need to incorporate theoretical frameworks<sup>34</sup> and empirical evidence<sup>41</sup> to provide algorithms by which patients are allocated less or more intensive therapy, or different therapeutic paradigms depending on different injury, psychological, social, or physical factors.

The comprehensive and brief ICF core set for the hand conditions was developed to describe the functioning and disability of the hand conditions.<sup>22</sup> The core sets were established through evidence-informed multidisciplinary international consensus. Participants of the consensus panel included surgeons. As the hand core set forms a reference standard for the core issues in hand conditions,<sup>22</sup> a gap between a CPG and these concepts reflects a lack of attention to important domains of hand function. Future guidelines that focus on rehabilitation are needed and should consider using the ICF hand core sets when developing search strategies and recommendations.

## Ethical Approval

This study was approved by our institutional review board.

## Statement of Human and Animal Rights

This article does not contain any studies with human or animal subjects.

## Statement of Informed Consent

This article does not contain any participants to obtain consent.

## Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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