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Outcomes Assessment After Hand Burns

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Introduction

Hand burn injuries can result in devastating functional impairments with biological, social, and psychological consequences that limit community and professional re-integration and can hamper quality of life (1–7). Improving the quality of hand burn injury management requires accurate measurement of functional disabilities and treatment outcomes. This is accomplished through outcome assessments that provide information on the effectiveness of clinical interventions, rehabilitation, and treatments (8–11). Furthermore, as United States health care policies transition to value-based insurance models, outcomes assessments are increasingly being applied to evaluate quality and cost-effectiveness of healthcare (4, 8–11).

Hand burn outcomes measures focus on both the systemic impact of injuries, with health-related quality of life (HRQL) assessments, as well as disease-specific disabilities such as appearance, movement, and symptomology (e.g., pain) (4, 6, 12). Although no universal outcomes instruments exist to comprehensively evaluate hand burn injuries, the availability and quality of assessments are improving. Formally, descriptive outcomes and objective mechanical measures were employed to evaluate the success of a surgical approach or rehabilitation program (8, 12). Through an appreciation of environmental, personal, and psychosocial health influences on health outcomes, health care professionals now emphasize

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the clinical relevance of assessments that evaluate subjective measures through patient-reported outcomes (PRO) (8, 13–18).

The biopsychosocial approach to evaluating functional disabilities has been promoted by the World Health Organization (WHO), and their efforts to standardize outcomes assessments through the International Classification of Functioning Disability and Health (ICF) framework (19). Although numerous outcomes assessment instruments are available to investigate burn or hand injuries, few have been validated in the sub-population of hand burns. Current literature efforts in hand burn injury outcomes are dedicated to understanding how comprehensively and accurately instruments assess the outcomes outlined in the WHO-ICF (19–22). This article provides an overview on the purpose, availability, and application of outcomes assessments in hand burns.

International Classification of Functioning Disability and Health

The International Classification of Functioning Disability and Health (ICF) is a comprehensive classification of health and health-related domains and is the WHO framework for measuring health and disability at the individual and population levels (19). This framework helps conceptualize a patient's quality of life by relating the function and disability of an individual in the context of environment, personal, and disease-related factors (Figure 1) (19–21). The specific domains evaluated by the WHO-ICF include body structure, body function, activity, and participation. The ICF provides a “foundation and a common framework allowing all conditions to be compared using a common metric - the impact on the functioning of the individual,” and should be used clinically for “functional status assessment, goal setting and treatment planning and monitoring, as well as outcome measurement” (19).

Using the WHO-ICF framework is an important step towards standardizing health outcomes measures. To facilitate this process, current and future outcomes instruments should be defined by what WHO-ICF domains/subdomains they evaluate. This will allow clinicians to effectively monitor specific WHO-ICF domains and identify outcomes that are deficient within the biopsychosocial model. In 2011, Rudolf et al. published a paper outlining the formal consensus process of developing the ICF Core Sets for Hand Conditions that “provides the basic international standard of what should be measured and reported to describe functioning and disability of patients with hand conditions ” (20). Included in this document is the brief WHO-ICF Core Set for Hand Conditions (Table 1) that provides a minimal standard of outcomes to describe functioning and is a valuable tool to improve hand burn outcomes measures.

Patient-reported outcomes

Patient reported outcomes have become an important adjunct in the assessment of the WHO-ICF domains. PROs are a recognized and standardized method of reporting a patients' perspective on treatment benefits, and may be the outcome most important to patients. PROs are reports coming directly from patients about how they function or feel in relation to a health condition and its treatment (8, 13, 15–17). They are now widely used as clinician-

based outcomes to gain further knowledge on domains such as “symptoms, functioning, health perception, satisfaction, and [HRQL]” (23). This is in contrast to traditional objective outcomes measures such as functional metrics (e.g., range of motion, grip strength, degree of contracture), morbidity, and other physiological markers, that fail to accurately assess HRQL and psychosocial domains (7, 12, 24).

PROs facilitate a more complete understanding of the functioning and disability caused by health conditions as described by the WHO-ICF. For example, the Patient and Observer Scar Assessment Scale (POSAS) is an outcome instrument that includes PROs, such as pain, itching, appearance and overall opinion on burn scars (25). This provides subjective insight that is unattainable by traditional objective measures. Although PROs are beneficial to the evaluation of hand burns, available literature suggests that current PRO instruments incompletely evaluate all the WHO-ICF domains (3, 7, 17, 21).

In a recent systematic review, Coenen et al. evaluated the ability of PRO measures used in the field of hand injuries to capture the WHO-ICF domains of function and environment (17). They assessed 8 available outcomes instruments, such as the Michigan Hand Outcomes Questionnaire (MHQ) and The Disabilities of the Arm, Shoulder, and Hand Score (DASH), and provided comprehensive tables to summarize the second-level WHO-ICF outcomes that are adequately measured by each instrument (17, 26–28). For example, the authors found that both the MHQ and DASH are suitable instruments to evaluate ‘Activities and participations: b134 Sleep functions.’ Coenen et al. concluded that although the functioning aspects stated by the patients are partially captured by questionnaires, the WHO-ICF environment and body structure domains are often disregarded in current PRO measures (17).

Clinometric properties

Before using an outcomes questionnaire, the appropriateness of the instrument must be demonstrated through a statistical analysis of its clinometric properties (8, 29–31). These properties, as well as the practicality (e.g., user-friendliness of questionnaires), should be considered before selecting an instrument for clinical or research purposes. Furthermore, clinometric properties vary by study population and setting, and therefore, the appropriateness of an instrument may not be applicable across all cultures or age groups (29–33). As a result of the paucity of information on clinometric properties of outcome instruments used in hand burn patients, selecting an instrument can be difficult. A basic understanding of the metrics that determine the quality of outcomes assessments is required to select the correct instrument for a given system, disease, patient-population, or study question (Table 2) (8, 13, 29–31).

In response to the lack of standardization of outcomes instruments in medical literature, Mokkink et al. published the COnsensus-based Standards or the selection of health Measurement INstruments (COSMIN) study, which provides guidelines on evaluating the methodological quality of studies on health status measurement instruments (32–33). Likewise, in the pursuit of transparency on the quality of instruments, the Patient Reported Outcomes Measurement Information System (PROMIS) was created to provide a bank of

tested questionnaires and their ability to measure specific outcome domains (34). Although substantial efforts remain to identify validated, comprehensive outcome assessment instruments, we provide an overview of common approaches to assessing outcomes in hand burns.

Assessing outcomes

To standardize hand burn outcomes research, outcomes should be categorized within the WHO-ICF Core Sets for Hand Conditions (Figure 2). The researcher can then identify the most appropriate instruments available to assess these outcomes. The WHO emphasizes the importance of measuring all WHO-ICF domains to accurately report disabilities related to a disease, and therefore both global and hand-specific instruments are often indicated. Lastly, given the absence of a perfect outcome measure instrument, the limitations of instruments used and the WHO-ICF components not assessed within a study, should be disclosed.

Hand burn outcomes

Falder et al. originally proposed seven core domains to comprehensively assess outcomes after burn injuries, including skin, neuromuscular function, sensory and pain, psychological function, physical role function, community participation and perceived quality of life (2). With the introduction of the WHO-ICF Core Sets for Hand Conditions, a more robust, structured list of outcomes exists (19–20). Both proposals strive for a holistic assessment of burn outcomes, but this is currently not attainable with a single outcomes measuring tool. Furthermore, clinicians may prefer to investigate a specific outcome of interest, such as functionality, aesthetics, or scarring characteristics, when evaluating a burn injury patient. In this regard, having unique outcome measuring instruments can be both necessary and complimentary.

Global outcomes measures

Measuring HRQL is the leading outcome in burn care research (21, 24). To fully understand the impairments of burn injuries, isolated or multiple, the systemic impact of the injury should be considered (21, 35–38). This concept is supported by the WHO, which defines quality of life as “an individual’s perception of their position in life in the context of the culture and value systems.... It is a broad ranging concept affected in a complex way by the person’s physical health, psychological state, personal beliefs, social relationships, and their relationships to salient features of their environment” (39).

The Short Form (SF)-36, Sickness Impact Profile (SIP), European Quality of Life 5 Dimensions (EQ-5D), and the brief Burn Specific Health Scale (BSHS-B) are frequently used generic HRQL questionnaires in burn research (40–44). The BSHS-B is disease-specific, self-rated questionnaire developed to assess the quality of recovery after a burn injury (43–44). This instrument is likely more relatable to patients with hand burns, because the measurement includes the outcomes of heat sensitivity and hand function (to measure fine motor skills) (21, 44). Although generic HRQL questionnaires provide a global assessment of function and disability, two systematic reviews by Meirte et al. and Cieza and Stucki have found that contextual factors (e.g., environmental, personal, and social factors),

body function, and mental function are poorly evaluated. For examples, social support, a well-recognized adjunct to coping with and recovering from burn injuries, is often incompletely assessed (21, 45). Similarly, personal factors that influence function and quality of life (e.g. age, gender, and educational level) are often overlooked or under-appreciated.

Meirte et al. found that generic HRQL questionnaires fail to sufficiently evaluate all WHO-ICF domains, and therefore, recommend adjunct outcome assessments to appreciate the impact of burns (21). Additionally, Van Baar et al. concluded that available outcome assessments do not provide sufficient information to estimate the functional consequences of burns (3). Functional outcomes often assessed include mental health, self-care, domestic life, education, and work status. Less attention is afforded to the consequences of burns on body structure, movement, and skin; domains that can be dramatically affected by hand burns (3, 21).

Hand specific outcomes measures

The ICF Core Sets for Hand Conditions serves as the standard of what should be measured and reported to describe disabilities in hand burn patients (19–20). This framework provides a unified language to identify, monitor, and communicate outcomes in patients. Although the WHO-ICF Core Sets for Hand Conditions was recently introduced, there are an abundance of hand-specific outcome instruments that predate this standardization. Currently, there is no agreed upon best method for assessing hand function after burn injuries, because there is little information on how accurately WHO-ICF domains are assessed with available instruments (12, 17).

Hand outcome assessments may include descriptive, component measures (e.g., range of motion), performance measure (e.g., objective dexterity tests), or patient-reported outcomes (e.g., questionnaires) (7). Unfortunately, few outcomes instruments are validated in hand burns. Lin et al. found in their systematic review that no burn-specific hand function outcomes measures exists, and that the applicability, reliability, validity and responsiveness of hand function measures in patients with hand burns needs further investigations (7).

Descriptive outcomes measures

Clinicians have used descriptive outcomes to define burn injuries and evaluate therapeutic interventions. One approach is to use deformity descriptions, such as webspace contracture, dorsal skin contracture, boutonniere deformity, etc., to categorize and describe disabilities from hand burns (12). Likewise, the number of contractures, severity of contractures, and total body surface area of burn requiring grafting have all been used to quantify the severity of burn injuries (46). This descriptive approach lacks standardization and is hampered by subjectively, and has limited utility compared to more current, robust instruments.

Scar scales are an alternative descriptive option that has garnered substantial attention in the burn literature (47–48). Because burn injuries often lead to soft-tissue disfigurements, describing the appearance of burns are frequently used to assess burn severity, rehabilitation, and effectiveness of therapeutic interventions. Burn scar scales provide an objective assessment of descriptive parameters including appearance (e.g., vascularization and

pigmentation) and physical characteristics (e.g., height, texture, and pliability). Additionally, some burn scar scales have added PRO to assess patient symptoms (e.g., pain, pruritus) and opinions of appearance (24, 25, 47–49).

The Vancouver Scar Scale and the POSAS are two commonly used instruments applied in burn and scar literature (25, 49). Although both scales have been used to assess hand burn outcomes, they have not been validated in this population (50, 51). Tyack et al. reviewed the clinometric properties of 18 commonly used burn scar scales and found that the POSAS had high reliability but indeterminate validity, whereas the VSS was investigated rigorously but had indeterminate quality clinometric properties (47). In a separate systematic review, Van der Wal et al. found that the POSAS was the highest quality scale, because it includes a comprehensive list of scar features, incorporates patient's opinion, and has superior internal consistency and reliability when compared to the VSS (30). Despite these findings, both instruments are routinely used in burn injury research. For example, Hultman used the VSS to demonstrate improvement in the signs of symptoms of hypertrophic burn scars with use of laser therapies (52).

Component outcomes measures

Range of motion (ROM) deficits are common in hand burn injuries secondary to joint contractures, hence the intrigue in using this as a surrogate outcome for hand function (12, 53). Unfortunately, the measurement of ROM is not standardized and studies have not shown a clear correlation between ROM and functional performance improvement (12). Similarly, objective physical measures (e.g., hand strength and endurance) have been used as hand burn outcomes. Clifford et al. evaluated grip strength dynamometry and found that it is a reliable and valid outcomes measure for burn-affected upper limb strength (54). The authors concluded that grip strength allows clinicians to quantify impairments that contribute to loss of hand function. Unfortunately, it is difficult to interpret how component measures translate to disability and daily activity impairment. Therefore, these assessment instruments should be used in conjunction with more dynamic outcome measure such as the BSHS-B.

Performance outcomes measures

Performance tests assess hand function with specific and standardized tasks. Unlike descriptive outcomes, performance tests are designed to assess activity limitations and participation restrictions in patients with hand function problems by simulating activities of daily life (4–8). For example, the Jebsen-Taylor Hand Function Test (JTHF) evaluates hand movements such as writing and picking up objects and has been used to evaluate outcomes in burn patients (7, 55, 56). These outcomes measures aid in the evaluation of hand dexterity, functional sensibility, daily tasks, and strength, but are limited by the absence of the patient's perspective on disabilities.

In 2009, Van de Ven-Stevens et al. published a systematic review of the clinometric properties of available performance outcomes hand instruments to assess limitations in activities (as defined by the WHO-ICF as “the execution of a task or action by an individual”) (4). This study was not limited to burn patients, but provided insight into the shortcomings of performance assessments. Twenty-three instruments were reviewed,

including performance outcomes measures such as pegboard tests, manipulating objects, and single task objectives. Although some outcomes measures performed well, none of the instruments had a uniformly positive rating in all clinometric properties.

Patient-reported outcomes measures

The addition of PRO measure instruments has made the biopsychosocial approach to outcomes assessment attainable, by providing insight on how functional limitation are influenced by psychological and social factors (17–20). The MHQ and DASH are two of the most common self-reported outcome measures used in upper extremity disorders. They are questionnaires that provide comprehensive feedback on a patients' perception of their overall hand function, ADL, symptoms (e.g. pain), social activities, work, sleep, aesthetics, and patient satisfaction (26, 27). Currently, as with the performance outcomes measures, the clinometric properties of most instruments are largely inconclusive to support their validity in hand burn outcomes. Wu et al. did evaluate the QuickDASH (an abbreviated version of the DASH) in upper limb burn injury patients and found positive conclusions on the validity, repeatability and responsiveness of the instrument to assess change in functional levels in this patient population (5).

Outcomes databases

Equally important to identifying and measuring outcomes related to hand burns, is the organized collection of population data. Aggregating large volumes of patient outcome information into databases facilitates research endeavors aimed at improving the care of patients and comparing the effectiveness of interventions (57). Electronic databases (e.g., administrative claims databases) are powerful resources that allow for observational studies that are large, low cost, fast, and provide insight into how current health care practices affect outcomes (57). Identifying the most pertinent hand outcomes to measure and include in large databases is an important component to the future of outcomes assessments in hand burn injuries.

The Burn Model System (BMS) National Database, established by The National Institute on Disability, Independent Living, and Rehabilitation Research, is the largest multicenter, longitudinal database on burn outcomes (58). This database describes the functional and psychosocial recovery of burn patients, and was created with the purpose of improving the care of burn survivors (58). Several outcomes instruments are collected by the BMS, predominantly global assessment measures, including the SF-36 and BSHS. Although the JTHF test was previously included in the BMS National Database, there is currently no hand-specific outcomes instrument. This database has been used to investigate a wide range of burn-related outcomes including; contractures related to burns, risk factors for heterotopic ossification in seriously burned adults, and satisfaction with life after burns (59–61). Studies focused on hand burns are feasible with the BMS, but the addition of hand-specific outcomes instruments, such as the MHQ, would enable more informative investigations.

Conclusions

The WHO has provided a foundation for the field of hand surgery to effectively evaluate outcomes in hand disorders with the introduction of the ICF Core Sets for Hand Conditions. This paves the way for clinicians and researchers to establish standardized approaches to measuring outcomes in specific hand disorders, including burn injuries. There exists an abundance of outcomes instruments within burn and hand literature, respectively, but identifying the most appropriately instruments to evaluate the biopsychosocial disabilities after hand burns remains unclear. Several systematic reviews indicate that a comprehensive assessment of hand burns requires a global assessment of HRQOL, via generic outcomes measures instruments, complemented by hand-specific outcome instruments. For example, Byrne et al. studied fat grafting for burn reconstruction of the hand, and the authors used multiple instruments, including grip strength, ROM, DASH, MHQ, and the POSAS to describe function and disability outcomes (51). Further information is needed to conclude on the validity (and other clinometric properties) of instruments to assess the outcomes outlined within WHO-ICF framework in hand burn patients.

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Key points

1. Improving the quality of care of hand burns requires accurate assessments of functional disabilities and clinical outcomes.
2. Despite the availability of several hand and burn outcomes measures instruments, few have been validated in hand burn patients.
3. The International Classification of Functioning Disability and Health Core Sets for Hand Conditions should be the standard guide for assessing hand burn outcomes.
4. Currently, a comprehensive assessment of hand burn outcomes requires a generic-HRQOL questionnaire complemented by hand- or burn-specific instruments.
5. Further research is needed to validate outcomes instruments in hand burn populations.

Synopsis

Accurately assessing function and disability after hand burns is imperative to improving the management of patients. Importantly, the biological, social, and psychological impact of these injuries should be considered. The International Classification of Functioning Disability (ICF) and Health Core Sets for Hand Conditions provides a comprehensive guide to what should be measured and reported in patients with hand burns. Although many outcomes measures instruments are available to assess patients with hand or burn injuries, few are validated in the sub-population of hand burns. Further efforts are required to investigate the ability of current assessment instruments to evaluate hand burn outcomes within the ICF framework.

Figure 1.

The International Classification of Functioning Disability and Health (ICF) is a classification of health and health-related domains, and is the World Health Organization (WHO) framework for measuring health and disability at the individual and population levels. *From* Meirte J, van Loey NE, Maertens K, et al. Classification of quality of life subscales within the ICF framework in burn research: Identifying overlaps and gaps. *Burns* 2014; 40(7): 1354; with permission.

Assessing outcomes in hand surgery research

Figure 2.

Assessing outcomes in hand burn research involves: (1) identifying outcomes of interest and categorizing these within the WHO-ICF Core Sets for Hand Conditions, (2) selecting appropriate global and/or hand-specific outcome measure instruments, (3) identifying the limitations of the instruments chosen, and (4) identifying deficiencies in assessing the WHO-ICF domains to accurately report disabilities related to a disease.

BSHS-B, Burn Specific Health Scale-Brief; JTHF, Jebsen-Taylor Hand Function Test; MHQ, Michigan Hand Outcomes Questionnaire; SF-36, Short Form-36; VSS, Vancouver Scar Scale; WHO-ICF, World Health Organization-The International Classification of Functioning Disability and Health.

Table 1

Brief International Classification of Functioning, Disability and Health - Core Set for Hand Conditions by the World Health Organization

ICF category	Title
Body Functions	
b152	Emotional functions
b265	Touch function
b270	Sensory functions related to temperature and other stimuli
b280	Sensation of pain
b710	Mobility of joint functions
b715	Stability of joint functions
b730	Muscle power functions
b760	Control of voluntary movement functions
b810	Protective functions of the skin
Body structures	
s120	Spinal cord and related structures
s720	Structure of shoulder region
s730	Structure of upper extremity
Activities and participation	
d230	Carrying out daily routine
d430	Lifting and carrying objects
d440	Fine hand use
d445	Hand and arm use
d5	Self-care
d6	Domestic life
d7	Interpersonal interactions and relationships
d840–d859	Work and employment
Environmental factors	
e1	Products and technology
e3	Support and relationships
e5	Services, systems and policies

Data from Rudolf KD, Kus S, Chung KC, et al. Development of the International Classification of Functioning, Disability and Health Core Sets for Hand Conditions – results of the World Health Organization international Consensus Process. *Disabil Rehabil.* 2012; 34(8): 681–693.

Table 2

Clinometric properties help determine the quality of outcomes assessment instrument

Clinometric	Description
Validity	Descriptive term used to mean that an instrument accurately reflects the concept that it is intended to measure.
Content validity	Subjective assessment of the comprehensiveness of an instrument and how adequately items cover an area that needs to be assessed.
Criterion validity	Demonstrates how a new scale correlates with a <i>gold standard</i> . This validity is not applied in outcomes research because no reference standard can be defined to compare to each patient's individual assessment of outcomes.
Reproducibility	Measures reliability and it refers to the extent to which repeated administration of an instrument to a stable population yields the same results.
Responsiveness	Reflects the ability to detect change, and is frequently defined as the minimally-important change (or minimal clinically important difference) from the perspective of the patient or their provider. The level of change in an instrument score must reflect a true change in the condition (not test-retest errors).
Interpretability	The degree to which one can assign qualitative meaning to an instrument's quantitative scores.
Feasibility	The ease to which an outcome assessment instrument can be applied in the clinical setting.

Data from Refs^{8, 13, 29–31}