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Clinical relevance of current patient-reported outcome measures for ankle fracture: surgeons' perspective

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Abstract

Objectives: Determine the relevance of the most frequently used patient-reported outcome measures (PROMs) for monitoring patient recovery after ankle fracture, from the clinical perspective of orthopaedic trauma surgeons, given lack of validated PROMs.

Design: Prospective cohort.

Setting: Orthopaedic Trauma Association committee meetings, electronic correspondence.

Patients/Participants: Orthopaedic trauma surgeons.

Intervention: Delphi method for consensus activities.

Level of Evidence: IV.

Main Outcome Measurements: Most clinically relevant PROMs for ankle fracture recovery.

Results: Several English-language PROMs were identified based on use in literature and relevance to ankle fractures. 7 were selected by expert consensus. These are the Ankle Fracture Outcome of Rehabilitation Measure (A-FORM), Foot and Ankle Ability Measure (FAAM), American Academy of Orthopaedic Surgeons (AAOS), Foot and Ankle Disability Index (FADI) Score, Lower Extremity Functional Scale (LEFS), Olerud–Molander Ankle Score (OMAS), and Patient-Reported Outcome Measurement Information System Physical Function (PROMIS PF). The most clinically relevant PROM is the A-FORM, followed by the AAOS, LEFS, PROMIS PF, FADI, and OMAS, and the least clinically relevant overall, the FAAM.

Conclusions: Understanding which PROM best matches physician expectations for tracking recovery is an important step toward a robust, evidence-based approach to patient care. The A-FORM was identified as the most clinically relevant among the most used PROMs. These results will aid surgeons, clinicians, and scientists to identify a uniformly, clinically relevant PROM for the treatment and study of outcomes and recovery after isolated ankle fracture.

Keywords: ankle fracture, patient-reported outcome measures, surgeon opinion, Delphi

1. Introduction

Ankle fractures are a prevalent type of injury managed by orthopaedic surgeons, with an incidence rate of 187 per 100,000 adults annually.[1,2] Postsurgical monitoring of these patients is crucial to accurately assess the meaningful outcomes after surgery and their readiness to resume activities such as walking, work, and sports. Patient-reported outcome measures (PROMs) offer a more complete understanding of recovery after ankle fracture treatment, from the patient's perspective.[3]

Interest and utilization of PROMs, as part of clinical care in orthopaedics, have increased in the past 2 decades, as more research and clinical treatments focus on PROMs to track recovery.[4–8] After ankle fracture treatment, some PROMs focus on pain and light activities of daily living while others place more focus on sports and higher levels of function.

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Several other PROMs have been created for ankle fractures specifically[9–11] while other measures have been adapted.[11–13] Unless the physician interpreting the scores of a PROM has an understanding of what type of activity or function is being examined (ie, the score reflects the activities included/measured in the PROM and nothing else), PROM scores are not able to be appropriately compared.

In the past decade, most of the literature published on ankle fractures included the use of the American Orthopaedic Foot and Ankle Society (AOFAS) questionnaire, regardless of the fact that it was not validated for ankle fractures.[8,12–16] Originally disseminated in 2011 and published in 2022, the American Orthopaedic Foot and Ankle Society (creators of the AOFAS questionnaire) issued a position letter stating that orthopaedic surgeons should *not* use it for ankle fracture recovery.[12] Despite this dissuasion and strong recommendation, improving AOFAS scores are still used to demonstrate recovery after an ankle fracture.[13,15,17]

There remains no uniform PROM used to monitor recovery after ankle fracture nor any recommendation for such PROMs from any major society, including the American Academy of Orthopaedic Surgeons, the American Orthopaedic Foot and Ankle Society, and the Orthopaedic Trauma Association.[12,13] This lack of uniformity poses a significant obstacle to understanding recovery patterns and establishing treatment and postoperative protocols for ankle fractures. Furthermore, monitoring patient recovery through PROMs is critical, and a lack of a strong, uniform recommendation for PROMs is a major hurdle in ankle fracture clinical care and research and beyond. Therefore, the goal of this study was to determine the relevance and comprehensiveness of the most frequently used PROMs for monitoring patient recovery after ankle fracture, from the clinical perspective of orthopaedic trauma surgeons.

2. Methods

2.1. Patient-Reported Outcome Measures

Initially, the Orthopaedic Trauma Association (OTA) Classification and Outcomes Committee (consisting of fellowship-trained orthopaedic trauma surgeons who are members of the OTA) worked to identify the most frequently used PROMs after isolated ankle fracture, eliminating the AOFAS questionnaire secondary to recommendations against its use.[12] Recent meta-analyses performed on ankle fracture PROMs were used to select the most prevalent PROMs into a list.[13,18–20] This process was developed to limit personal bias with focus placed mostly on prevalence of use within the literature; however, position statements from the AOFAS and American Academy of Orthopaedic Surgeons were also taken into account.

The Delphi method is an iterative, structured communication process and elicitation technique to help a group of experts or stakeholders provide anonymous feedback/responses and then reconfirm or revise responses based on summaries of these responses.[21] This process of iterative feedback continues until an a priori number of rounds are met or consensus is achieved. In this study, the Delphi method was used to reach consensus for a complete list of candidate PROMs.[22] At the 37th annual OTA meeting in 2021, the OTA Classification and Outcomes Committee (COC) met, a quorum was reached, and voting to approve the aggregated list of PROMs for ankle fracture was done in person. However, those who could not attend in person were given the opportunity of electronic voting.

2.2. Identifying Domains (Comprehensiveness)

At the same meeting, the OTA-COC determined relevant domains to ankle fracture recovery to adequately address and monitor recovery and healing after surgical treatment of isolated ankle fracture, from the orthopaedic surgeon perspective. In addition to the OTA-COC, the OTA's Evidence Based Quality, Value, and Safety Committee (EBQVS) was also enlisted for their expertise. Each member of these committees was allowed time, during a combined meeting of the 2 committees, to bring forward potential domains. Follow-up surveys for domains were conducted through email for a period of 10 months (December 2021 to September 2022). Each candidate domain was added to this comprehensive list, and both committees voted on each domain, only further considering domains that reached a majority vote through an anonymous online survey. Consensus was reached using the Delphi method.

Questions from each PROM were aligned with each subdomain. 1 author (K.S.) took each of the 207 questions from the 7 identified PROMs and aligned them into a respective domain, based on relevance. Any questions that could fit multiple domains, or did not clearly fit any domain, were placed on a separate list for the OTA-COC and OTA-EBQVS to vote on domain placement. Each domain was broken into subdomains to allow for easier grouping of questions and ease of ranking (ie, ranking 10 questions is easier than 35). All subdomains were voted on and approved by the OTA-COC and OTA-EBQVS by email votes and in-person meetings. Once all questions were assigned to their respective domains, the committee chairs for the OTA-COC and OTA-EBQVS were allowed to review each domain and approve final question placement. Afterward, the OTA-COC was allowed to review and approve/disapprove domain assignment. This process was conducted through in-person meetings at the 38th annual OTA meeting in 2022 and the 2023 American Academy of Orthopaedic Surgeons annual meeting. In addition, chairs of the OTA-COC and OTA-EBQVS met during 4 1-hour online meetings throughout 2022 and 2023 during their tenure as chair.

2.3. Surgeon Perspective (Relevance)

The study was deemed exempt from Institutional Review Board and Animal Use Committee Review. To allow for each surgeon to rank questions in each subdomain from least to most clinically relevant for tracking recovery after ankle fracture, a REDCap survey was developed such that each identified subdomain was coded as a separate "section" within the REDCap project. Surgeons were blinded from knowing which PROM the questions originated. Instructions given to the surgeons stated to review and rank the questions in order of clinical relevance, as it applies to their own specific practice. In addition, the surgeons were reminded that questions and answers can appear very similar/identical as some PROM questionnaires/questions are very similar. They were also informed that any perceived repeated questions were from different PROMs and, in fact, were not repeated. 1 surgeon beta-tested the REDCap survey and reported a total completion time of 35 minutes for these activities. After

beta-testing, the REDCap survey was enhanced, directions were clarified, and the ability to save results and return to the survey was added.

The OTA's email listserv for the OTA-COC and OTA-EBQVS was used for wide, initial dissemination of the survey to orthopaedic trauma surgeons with invitations for snowball recruitment (ie, surgeons from these listservs were recruited and then encouraged to forward links to other orthopaedic trauma surgeons that they may know). Anonymous links to complete the REDCap survey and summary emails describing the purpose of the survey were sent. Reminder emails were sent out every few months. In total, survey invitations were sent 6 times.

Each ranking was inverse weighted by the number of questions in each PROM included in the REDCap database, as is standard, to adjust for the different numbers of questions from PROM to PROM. An inverse weight is calculated as the inverse of the total number of questions from each PROM divided by the total number of questions included across all PROMs. These inverse weights were then multiplied by the number of questions ranked most relevant for each PROM, to obtain the relevance score for each PROM. Then, the relevance scores were ordered to rank the 7 PROMs from most clinically relevant to least clinically relevant. Excel was used for all analyses.

3. Results

3.1. Comprehensiveness

The OTA-COC identified 7 self-report PROMs to consider (Table 1); all PROMs were English-language versions developed for adults:

- Ankle Fracture Outcome of Rehabilitation Measure (A-FORM)[9]
- Foot and Ankle Ability Measure (FAAM)[23,24]: Owing to the confusion for one question regarding difficulty "landing," this question was omitted from consideration
- American Academy of Orthopaedic Surgeons Foot and Ankle Outcomes Questionnaire (AAOS)[25]
- Foot and Ankle Disability Index (FADI) Score[26]
- Lower Extremity Functional Scale (LEFS)[27]
- Olerud–Molander Ankle Score (OMAS)[10,11]
- Patient-Reported Outcome Measurement Information System Physical Function (PROMIS PF)[5,24,28–31]: For purposes of this study, 84-item bank questions were considered relevant for lower extremity injuries

In total, 207 questions from these 7 PROMs (A-FORM, AAOS, FAAM, FADI, LEFS, OMAS, and PROMIS PF) were identified and assigned to 5 domains (Pain, Physical Function,

TABLE 1.

Description of Patient-Reported Outcome Measure (PROM) Used

Patient-Reported Outcome Measure (PROM)	Number of Questions	Brief Description of PROM
Ankle Fracture Outcome of Rehabilitation Measure (A-FORM) v1.0	15	Foot and ankle pain, swelling, stiffness, physical function, activities of daily living, mental health symptoms, recreational activities, footwear, and social relationships. Uses 2 primary outcome scores on a scale of 0–80 and 0–1, with greater scores indicating a higher level of function and improved quality of life, respectively
Foot and Ankle Ability Measure (FAAM) v1.0	31	Activities of daily living (22 items) and recreation (9 items) as separate subscales with only subscale scores reported. The subscores range from 0 to 100 with greater scores indicating a higher level of function
American Academy of Orthopaedic Surgeons Foot and Ankle Outcomes Questionnaire (AAOS) v1.0	25	Foot and ankle swelling, stiffness, activities of daily living (putting on socks/shoes), physical activity (including standing and balance), and type of shoe, ie, comfortable to wear. Following completion of the survey, responses are standardized to range from 0 to 100, with higher scores indicating better foot function
Foot and Ankle Disability Index (FADI) Score v1.0	26	Describes, separately as subscales, activities and sports. Subscale scores are reported separately from a range of 0–100, with greater scores indicating a greater level of disability
Lower Extremity Functional Scale (LEFS) v1.0	20	Describes activities of daily living. The final score ranges from 0% to 100% with greater values indicating a greater level of function
Olerud–Molander Ankle Score (OMAS) v1.0	9	Describes symptoms and function after ankle fracture including pain, stiffness, swelling, recreational activities, and activities of daily living. Scores range from 0 to 100 with greater scores indicating fewer symptoms
Patient-Reported Outcome Measurement Information System Physical Function (PROMIS PF) v2.0	165-CAT[32,33]	The computer adaptive test (CAT) version administers a minimum of 4 items, and the stopping rule is when either 12 items have been administered or the standard error is less than 3.0 using the T-score distribution. The PROMIS PF has a range of 0–100 points with a mean of 50 and SD of 10. Greater scores indicate greater function

TABLE 2.

Identified Domains and Subdomains for Patient-Reported Outcome Measures After Surgical Treatment of Isolated Ankle Fracture

Domain	Subdomain
Pain	General pain
	Pain interference
Physical function	Assistive devices
	Coordination and balance
	Endurance
	Uneven terrain
	Low-demand, in-home activity
	Low-demand standing
	Low-demand walking
	Moderate difficulty
	Motion
	Stairs
Psychosocial	Psychological
	Sleep
	Social
Return to activity	Heavy activity chores
	Jumping
	Light activity chores
	Moderate activity chores
	Personal care
	Recreational exercise
	Running long distance
	Running short distances/sprints
	Self-care
	Squatting
	Strenuous recreation
	Strenuous sports
	Work
Other	Shoe wear
	Swelling

Psychosocial, Return to Activity, and Other) and 30 subdomains (Table 2). 2 questions were unintentionally omitted from the LEFS ("running on uneven ground" and "usual hobbies, recreational, or sporting activities").

3.2. Relevance

From approximately 26 invited surgeons, snowball recruitment resulted in 46 respondents. Of these, 34 partially completed the REDCap survey (74%) while 12 respondents provided complete responses (26%). Rankings of "most clinically relevant" within the 30 identified subdomains ranged from 12, from the full list of PROMIS PF questions, to 1, from the OMAS (Table 3). Accounting for the number of questions included in the REDCap database for each PROM, the most clinically relevant PROM is the A-FORM, followed by the AAOS, PROMIS PF, FADI, LEFS, and OMAs (tied), and the least clinically relevant overall, the FAAM (Table 3).

4. Discussion

The aim of this study was to work toward a robust, evidence-based first step to begin connecting what is important for physicians and patients during recovery after surgical treatment of isolated ankle fracture. PROMs analyzed were the A-FORM, FAAM, AAOS, FADI, LEFS, OMAS, and PROMIS PF. These were assigned to 5 domains (Pain, Physical Function, Psychosocial, Return to Activity, and Other) and 30 subdomains. Results identified the most clinically relevant PROM as the A-FORM, followed by the AAOS, PROMIS PF, FADI, LEFS, and OMAS, and the least clinically relevant overall, the FAAM.

Isolated ankle fractures are one of the most common fractures managed by orthopaedic surgeons and are one of the few fractures all subspecialties manage. Several ankle-specific outcome scores are available for use, outside of those included in this study [eg, American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Score, Foot and Ankle Outcome Score (FAOS), and Self-Reported Foot and Ankle Score (SEFAS)], and the literature is abundant with studies examining the recovery of ankle fractures.[34–40] Other organizations, such as the American Academy of Orthopaedic Surgeons and the American Orthopaedic Foot and Ankle Society, have recommendations or ongoing studies to validate PROMs but have had little success likely due to the high variability in what patient recovery measures are used between PROMs.[12,41]

There is already a known disconnect between physicians and patients regarding what is important during recovery and the process of recovery and rehabilitation. Determining which PROM is the most important to physicians is the beginning of the larger goal to integrate the patient perspective for an optimal PROM for those with isolated ankle fractures. A more comprehensive perspective is needed as physicians use PROMs for reasons outside of patient recovery, such as to determine the fixation method or techniques, hardware selection, and even which fractures to surgically treat.[40,42–46] Therefore, understanding which PROM best matches physician expectations for tracking recovery is an important step toward a robust, evidence-based approach to patient care.

4.1. Limitations

This study focuses on clinical relevance of existing PROMs; however, clinical friendliness of PROMs has been examined in the past. Clinical friendliness focuses on ease of integration of a

TABLE 3.

Analysis Results From Ranked Questions for Considered PROMs

PROM	Total Questions	Questions Ranked Most Relevant	Weight	Inverse Weight	Relevance Score
AAOS	25	5	0.121	8.28	41.4
A-FORM	15	4	0.072	13.8	55.2
FAAM	30	3	0.145	6.9	20.7
FADI	26	3	0.126	7.96	23.88
LEFS	18	2	0.087	11.5	23
OMAS	9	1	0.043	23	23
PROMIS PF	84	12	0.406	2.46	29.57

Question weight: calculated as the number of questions from each PROM divided by the total number of questions (207).
Relevance score: the inverse weight multiplied by the number of questions ranked as most relevant on the surgeon survey.

PROM (eg, how long does it take to train staff to administer and cost of analyzing) and ease of administration (eg, does staff administer or is it self-administered). Physicians in this study were asked to ignore all factors except those they felt were clinically relevant to monitoring recovery, and certainly, a limitation of the study is the lack of consideration on clinical friendliness. However, of the 8 scores included in this study, 5 currently encompass clinical friendliness scores. AAOS, FAAM, FADI, FAOS, and LEFS all have strong clinical friendliness scores while OMAS was limited. A-FORM and PROMIS PF lack these types of studies.[33] Taking into account A-FORM and PROMIS PF are considered the top 3 clinically relevant according to surgeons, further studies on their clinical friendliness may be warranted.

Existing literature and consensus methods were used to select the PROMs, which is intended to limit personal bias, but bias may not be completely eliminated using these methods. The importance of recovery domains from a surgeon's perspective is critical to developing a recommendation for tracking patient recovery. In certain situations, subdomains were created to better group questions, another source of potential bias. 3 questions were unintentionally omitted from the LEFS for consideration. Finally, members of the OTA-COC are composed of orthopaedic surgeons who are members of the Orthopaedic Trauma Association and primarily practice medicine in the United States in established medical facilities, which may limit generalizability for surgeons who practice medicine outside of these locations or typical medical facilities. This also limits the applicability of this survey to patients undergoing operative fixation and may not represent those who are treated nonoperatively.

5. Conclusions

The goal of this study was to determine patient-reported outcome measures (PROMs), which are most clinically relevant to surgeons who treat patients with isolated ankle fractures. From these results, the Ankle Fracture Outcome of Rehabilitation Measure (A-FORM) was identified as the most clinically relevant from among the most used PROMs, based on recent meta-analyses.[13,14,18,20] These results will aid surgeons, clinicians, and scientists to identify a uniformly, clinically relevant PROM for the treatment and study of outcomes and recovery after isolated ankle fracture.

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