Patient-Reported Outcome Measures (PROMs) Relevant to Musculoskeletal Conditions Translated and Validated in the Greek Language: A COSMIN-Based Systematic Review of Measurement Properties

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ABSTRACT

Background: The use of patient-reported outcome measures (PROMs) constitutes a valuable tool in evaluating the quality of care offered in orthopaedic surgery. The aim of this review is to identify the PROMs that have been translated into and validated in the Greek language, summarise their measurement properties, and evaluate their methodological quality according to the COSMIN Risk of Bias Checklist.

Methods: A structured literature search was conducted using the databases PubMed/MEDLINE, Embase, Scopus, and the Cochrane Library in order to identify PROMs relevant to musculoskeletal conditions translated and validated in the Greek language. The methodological quality of the studies was assessed according to the COSMIN Risk of Bias Checklist, and the quality of measurement properties according to the COSMIN criteria.

Results: Literature search yielded 6743 articles. After removal of duplicates and screening of the articles, 32 studies including PROMs related to musculoskeletal conditions were identified. The studies included 31 PROMs and reported 171 measurement properties. Methodological quality was adequate for 81 of them (47.3%). The most commonly reported measurement properties were internal consistency, reliability, construct validity and responsiveness.

Conclusion: The majority of PROMs translated into Greek involves the lower extremity and especially knee pathologies. The search revealed that there are areas of Musculoskeletal Medicine such as skeletal trauma, musculoskeletal oncology, and paediatric orthopaedics in which patient-reported-outcome measures have not been translated into Greek. Translation and validation of new outcome measures is encouraged, using studies designed in compliance with the COSMIN guidelines, and further validation of the translated instruments.

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INTRODUCTION

Traumatic, degenerative, and inflammatory musculoskeletal conditions, are extremely common causes of pain and disability, that affect all patients’ age groups. They are responsible for a large number of health-care visits and days of hospitalisation, and many days of work loss.¹ Proper clinical assessment and interpretation of imaging studies are crucial in order to achieve accurate diagnosis. However, during the treatment of musculoskeletal conditions, an important factor of decision-making is the impact of the disorder on the patient’s functional status and everyday
PATIENT-REPORTED OUTCOME MEASURES (PROMs) RELEVANT TO MUSCULOSKELETAL CONDITIONS TRANSLATED AND VALIDATED IN THE GREEK LANGUAGE: A COSMIN-BASED SYSTEMATIC REVIEW OF MEASUREMENT PROPERTIES

activity. Therefore, it is necessary to evaluate the patient’s perspectives about their condition. The use of valid and reliable patient-reported outcome measures (PROMs) can offer better and more detailed assessment of the patient’s experience and provide critical information about prognosis and further management. Furthermore, more detailed and in-depth evaluation of patients’ experience is of paramount importance in order to achieve improvement of the provided care by the health-care facilities.

PROMs can be classified in three broad categories: generic, disease-specific, and condition-specific. Generic PROMs can be used for a broad spectrum of clinical conditions and measure single aspects of health or cover multiple dimensions of health status. Disease-specific PROMs are used to assess the outcome regarding a particular condition. Condition-specific PROMs are not used to assess a particular disease, but a broader health condition or state. They include a range of functional status or disability measures used to assess the health of a particular population group such as the elderly or those with mental health conditions.

The selection of a PROM depends on the construct of interest and the measurement properties of the PROM. PROM measurement properties include reliability, validity and responsiveness. However, the quality of the studies providing evidence about the instruments’ measurement properties is often overlooked. The COSMIN (COnsensus-based Standards for the selection of health status Measurement INstruments) initiative developed a consensus-based standard for assessing the quality of studies on measurement properties.

The purpose of PROM utilisation in clinical practice and research is to achieve an accurate representation of the patients’ perspectives. For that reason, it is important that the patient carries out the completion of the questionnaire unassisted. The inability of the patient to comprehend the questionnaire because of language difficulties can have a detrimental effect on the reliability of the data. As a result, translation of PROMs into other languages and cross-cultural adaptation using well-accepted methodological standards are necessary for the development of appropriate questionnaires. The aim of this review is to systematically identify the Greek-language validated PROMs reported in the published literature, which are used to assess musculoskeletal conditions and to evaluate the psychometric properties of the identified instruments using the COSMIN risk of bias checklist.

METHODS

Literature search

Structured search of Pubmed/MEDLINE, Embase, Scopus, and the Cochrane library was performed without time restriction, in order to identify studies translating and validating a PROM into the Greek language. Studies only in the English language were included. The electronic search was tailored to the individual database being searched and was based on the protocol suggested by the COSMIN group. The search strategy involved the combination of index terms and free-text words (including patient-reported outcome measures, quality of life, questionnaire, assessment tool, outcome tool, outcome measures, instrument, score, scale, cross cultural, Greek) and the Boolean operators ‘OR’ and ‘AND’. The final search was performed on 6 February 2021. Reference lists were hand-searched to identify potential additional relevant studies.

Selection Criteria for Eligible Studies

After removal of duplicate studies, two reviewers (ID and IS) independently assessed all titles and abstracts. We included all studies that reported a translation and validation of at least one PROM, designed for the assessment of musculoskeletal conditions, into the Greek language. Clinical studies were eligible regardless of the presence or type of study intervention. Studies for de novo development of PROMs in Greek were also included. Any disagreement regarding eligibility of a study was resolved by consensus between the two reviewers, and if required, the senior author (T.T.) was consulted.

Data Extraction

Data were extracted by ID and IS. The following data were extracted from each publication: the PROM, the intended construct for measurement, measurement properties, study population and diagnosis, number of patients, patient demographics, country and language.

Assessment of the quality of studies and assessment of measurement properties

Two authors independently rated the methodological quality of the eligible studies using the COSMIN Risk of Bias checklist. Furthermore, the quality of measurement properties was assessed according to the COSMIN criteria for good measurement properties.

The COSMIN Risk of Bias checklist consists of 3 sections. The first section involves content validity, which is the degree to which the content of a PROM is an adequate reflection of the construct to be measured. Content validity evaluation includes: the relevance (all items in a PROM should be relevant for the construct of interest within a specific population and context of use), comprehensiveness (no key aspects of the construct should be missing), and comprehensibility (the items should be understood by patients as intended). In this systematic review, only the comprehensibility of the translated versions of PROMs was assessed, as relevance and comprehensiveness are considered more applicable to the initial development of the instrument. For the tools developed de novo in Greek, the development checklist was utilised and all compo-
ments of content validity were evaluated. The second section of the checklist evaluates internal structure, and it consists of structural validity, internal consistency, and cross-cultural validity/measurement invariance. The third section involves the remaining measurement properties, which are: measurement error, criterion validity, hypotheses testing for construct validity and responsiveness. Each measurement property is awarded a score of “Very good”, “Adequate”, “Doubtful”, “Inadequate”, or not applicable. The methodological quality of each measurement property is assessed by a box containing questions scored on this scale according to defined COSMIN criteria. A system of ‘worst score counts’ applies for each box. The methodological quality of a measurement property could only be rated “Very good” if all the boxes of the checklist are rated “Very good”.

RESULTS
Search results
A total of 6743 studies were initially identified in the literature search. Removal of duplicates yielded 6612 studies. After screening, 43 full-text articles were retrieved, of which 32 met the inclusion criteria for this review. The study selection flow chart is shown in Figure 1.
The identified studies included 31 PROMs. Two of them were developed de novo in the Greek language, and 29 were translated versions. The characteristics of the identified studies are shown in Table 1 and the characteristics of the identified PROMs are shown in Table 2.

All the instruments that were identified regarding the musculoskeletal system were disease-specific. The majority of the questionnaires (16) involved the lower limb.8-23 Nine of them involved knee conditions,10-18 while three questionnaires involved foot and ankle pathologies.19-21 Five instruments were retrieved about upper limb conditions tools translated and validated in Greek.24-29 Regarding spine conditions, six instruments were retrieved,30-35 with two of them being health-related quality of life measures.30,32,33 Two questionnaires involved other conditions: fibromyalgia37 and juvenile arthritis.38 Two questionnaires that were constructed de novo in Greek were also retrieved, the Functional Assessment Scale for Acute Hamstring Injuries score (FASH score)22 and the Brace questionnaire (BrQ).36

Quality of the included studies
In 32 identified studies, 31 PROMs were validated. The total number of reported measurement properties was 171. The methodological quality for 37 of them (21%) was inadequate and doubtful for 43 (25%) of them. Many measurement properties were not reported. The methodological quality of the studies is summarized at Tables 3 and 4. The measurement properties of each PROM were rated according to the COSMIN criteria for good measurement properties (Table 5).

Summary of translated PROMs
PROMs about hip disorders
The modified Harris Hip Score was developed in 2000,39 as a modification of the original Harris Hip Score.40 It includes only assessments about pain and function, therefore it can be used as a patient-reported outcome measure. Reliability of The Greek version of mHHS8 received sufficient rating. The rest of the measurement properties were indeterminate or were not reported.
The 12-item International Hip Outcome Tool (iHOT-12)41 was developed as a shorter version of the 33-item International Hip Outcome Tool questionnaire,42 and it is used for the assessment of the quality of life of patients with hip disorders. In the Greek version of iHOT-12, reliability was rated sufficient. The rest of the measurement properties were indeterminate or were not reported.

PROMs about knee disorders
Literature search yielded nine instruments for the evaluation of knee conditions translated in Greek. The Western Ontario and McMaster Osteoarthritis Index (WOMAC) is a 24-item questionnaire,43 designed for the assessment of patients with hip or knee osteoarthritis. It has been translated and validated in Greek in two studies.10,11 In the study of Konstantinidis et al.,11 comparative validation
Table 1. Characteristics of the translated PROMs validation studies.

| Study (year) | Instrument | Country (language) | Population (inclusion and exclusion criteria) | N     | Mean age (SD, range) | Female: Male |
|--------------|------------|--------------------|-----------------------------------------------|-------|----------------------|--------------|
| Stasi et al. (2020) | mHHS | Greece (Greek) | Inclusion: existence of hip OA according to the Kellgren-Lawrence classification system. Exclusion: any kind of surgical intervention to the affected hip, other hip disorders or medical conditions, chronic inflammatory diseases or lower limb muscle weakness due to neurological aetiology, medication that adversely affected their postural or dynamic balance. | 90    | 66.28 (8.27, 55-87) | 23:67        |
| Stasi et al. (2020) | iHOT-12 | Greece (Greek) | Inclusion: existence of hip OA, according to the Kellgren–Lawrence classification system. Exclusion: other types of arthritis, lower limb muscle weakness due to a central or peripheral neurological aetiology, insufficient knowledge of the Greek language. | 124   | 65.80 (8.25, 50-85) | 95:29        |
| Papathanasiou et al. (2013) | WOMAC | Greece (Greek) | Inclusion: existence of knee OA. Exclusion: any kind of surgical intervention to the affected knee, medical conditions such as rheumatoid arthritis, psoriatic arthritis, systemic lupus erythematosus, lower limb muscle weakness due to a central or peripheral neurological aetiology, unstable angina, or uncontrolled hypertension or hypotension medication that adversely affected their postural or dynamic balance. | 123   | 69.5(6.2) | 67:56        |
| Konstantinidis et al. (2013) | WOMAC Lequesne Index | Greece (Greek) | Inclusion: primary hip or knee OA, age greater than 40 years, ability to complete the questionnaires. Exclusion: secondary OA due to rheumatologic diseases, any other kinds of disabling lower limb arthro- or myopathy, physiotherapies of intra-articular perfusion or treatment with cortisone, diacerein or glucosamine in the last 6 months; symptoms of acute synovitis, of the affected joint, recent wound of injury of the lower leg, heavy respiratory or heart failure, peripheral vascular disease, severe psychiatric diseases, inability to speak Greek fluently. | 97    | Hip OA group: 67.66 ± 9.70 Knee OA group 69.46 ± 9.52 | 69:18        |
Table 1. Characteristics of the translated PROMs validation studies. *Continued from previous page*

| Study (year) | Instrument | Country (language) | Population (inclusion and exclusion criteria) | N     | Mean age (SD, range) | Female: Male |
|--------------|------------|-------------------|-----------------------------------------------|-------|----------------------|--------------|
| Kapreli et al. (2010)\(^{12}\) | KOS-ADLS | Greece (Greek) | Inclusion: native Greek speakers
Exclusion: pathological disorder or impairment involving both knees, other conditions that could affect lower extremity function | 94    | (24-61) | 37:57 |
| Moutzouri et al. (2014)\(^{13}\) | KOOS | Greece (Greek) | Inclusion: over 40 years of age, fulfillment of criteria for primary TKR, ability to understand and complete the self-reported questionnaires. Exclusion: TKR for other reason than knee OA, significant disease in the lower limb or low back pain | 60    | 72.1 | 44:16 |
| Koumantakis et al. (2015)\(^{14}\) | IKDC | Greece (Greek) | Inclusion: patients with knee disorders | 80    | 35.3(11.9) | 16:64 |
| Moutzouri et al. (2020)\(^{15}\) | KOOS-Child | Greece (Greek) | Inclusion: age 8-14 years, ability to understand and complete self-reported questionnaires, knee pathology symptoms confirmed by the orthopaedic surgeon’s clinical examination and medical history. Exclusion: cognitive impairments, congenital diseases, chronic illnesses, limited lower limb joints range of motion | 59    | 11 (1.8) | 30:29 |
| Panagopoulos et al. (2020)\(^{16}\) | LKSS TAS | Greece (Greek) | Inclusion: patients with various knee pathologies
Exclusion: inflammatory or posttraumatic knee arthritis, infectious disease, age of <16 years, poor knowledge of Greek language, and the inability to understand and read Greek texts | 55    | 24(7,17-54) |
| Papadopoulos et al. (2016)\(^{17}\) | AKPS | Greece (Greek) | Inclusion: age 18-45, anterior knee pain for at least 4 weeks
Exclusion: age older than 45 | 130   | 20.1 (6.2, 18-45) | 62:68 |
| Korakakis et al. (2015)\(^{18}\) | VISA-P | Greece (Greek) | Inclusion: age greater than 18, willing to participate in research, ability to give informed consent participation in sports. Exclusion: pregnancy and referred spinal symptoms. | 187   | 26.3 |
| Touzopoulou et al. (2017)\(^{19}\) | ATRS | Greece (Greek) | Inclusion: patients with acute Achilles’ tendon total rupture, treated surgically
Exclusion: chronic ruptures, under 18 years old patients and traumatic bisections of Achilles tendon | 46    | 41(10, 24-39) | 4:42 |
### Table 1. Characteristics of the translated PROMs validation studies. *Continued from previous page*

| Study (year) | Instrument | Country (language) | Population (inclusion and exclusion criteria)                                                                                                                                                                                                 | N       | Mean age (SD, range) | Female: Male |
|--------------|------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------------------|--------------|
| Tsekoura et al. (2019)<sup>20</sup> | CAIT       | Greece (Greek)    | Inclusion: age greater than 18 years, ability to complete the self-reported questionnaires unassisted Exclusion: ankle sprain episode and/or lower extremity injury within the last 2 months                                                                 | 123     | 23.46(6.5, 20-29)   | 56:67         |
| Kaoulla et al. (2008)<sup>21</sup>  | MFPDI      | Australia (Greek) | Inclusion: ability to walk household distances unaided                                                                                                                                                                                                                                                | 104     | 73.00, (5.26, 64 -90) | 64:40        |
| Maliaropoulos et al. (2014)<sup>22</sup> | FASH       | Greece (Greek, English, German) | Inclusion: activity in sport, age greater than 18 years Exclusion: pregnancy and referred spinal symptoms                                                                                                                                | 140     | 22.8(3.6)          | 51:89        |
| Korakakis et al. (2015)<sup>23</sup> | EILP       | Greece (Greek)    | Inclusion: age greater than 18 years, participation in sports Exclusion: pregnancy, previous lower extremity or spine surgery, referred pain from the lumbar region.                                                                                                                                   | 160     | 23.8 (4.4)         | 78:82        |
| Vrouva et al. (2016)<sup>24</sup>  | SPADI      | Greece (Greek)    | Inclusion: rotator cuff tear confirmed with US or MRI, conservative treatment Exclusion: neurological and Psychiatric conditions, surgery on the affected or the ipsilateral shoulder                                                                 | 102     | 47.4 (20-80)       | 60:42        |
| Spanou et al. (2019)<sup>25</sup>  | SPADI      | Greece (Greek)    | Inclusion: age greater than 18 years any kind of shoulder pain for at least four weeks Exclusion: cognitive, communication or psychological problems                                                                                                                                | 130     | 44.5 (7.4)         | 68:62        |
| Themistocleous et al. (2006)<sup>26</sup> | DASH       | Greece (Greek)    | Inclusion: Greek native language, unilateral disorder of the upper limb, healthy medical condition, informed consent, age above 18 years, ability to complete questionnaires independently, symptom duration of more than two months | 106     | 46(20-68)          | 55:51        |
| Bougea et al. (2018)<sup>27</sup>  | BCTQ       | Greece (Greek)    | Inclusion: age equal to or greater than 18 years, first-time diagnosis of CTS, absence of severe intellectual disability or cognitive impairment Exclusion: symptoms, or signs of polyneuropathy, systemic diseases potentially associated with polyneuropathy, other diseases that cause hand symptoms, pregnancy | 90      | 57.3(13.8, 23-88)  | 15:75        |
Table 1. Characteristics of the translated PROMs validation studies.  
Continued from previous page

| Study (year) | Instrument | Country (language) | Population (inclusion and exclusion criteria) | N    | Mean age (SD, range) | Female: Male |
|-------------|------------|--------------------|-----------------------------------------------|------|----------------------|--------------|
| Goula et al. (2014) | Hand20 | Greece (Greek) | Inclusion: Greek native language, unilateral disorder of the upper limb, age above 18 years, ability to complete questionnaires independently, moderate to excellent general health condition | 134  | 51.72 (18-77) | 92:42 |
| Stasinopoulos et al. (2014) | PRTEE | Greece (Greek) | Inclusion: clinical diagnosis of LET for at least 4 weeks Exclusion: dysfunction in the shoulder, neck and/or thoracic region, local or generalized arthritis, neurological deficit, radial nerve entrapment, limitations in arm functions, operative or conservative treatment for LET in the 4 weeks before entering the study | 82   | 46.7 (18-60) | 61:21 |
| Graham et al. (2015) | ASqOL | Greece (Greek) | Inclusion: confirmed AS diagnosis, aged 18 years and above, ability to understand and complete questionnaires independently, ability to provide written informed consent Exclusion: Presence of major co-morbidity with significant influence on subject’s QoL, inability to participate in the study due to cognitive disorders | 92   | 49.6 (11.5, 27-75) | 29:63 |
| Trouli et al. (2008) | NDI | Greece (Greek) | Inclusion: age over 18, written consent of the patient, absence of symptoms below the elbows related to specific neck disorders. Exclusion: patients with symptoms below the elbow and one positive finding in the neurological testing and/or a positive Upper Limb Tension Test | 65   | 62.3 (14.6) | 29:36 |
| Antonarakos et al. (2009) | SRS-22 | Greece (Greek) | Inclusion: patients with scoliosis, treated surgically | 51   | 21.2 (16-27) | - |
| Potoupinis et al. (2012) | SRS-22 | Greece (Greek) | Inclusion: patients with idiopathic scoliosis, conservatively treated | 87   | (12-18) | 80:7 |
| Christakou et al. (2011) | QBPS | Greece (Greek) | Inclusion: low back pain lasting for at least 8 months age greater than 18 years old, adequate verbal ability and communication. Exclusion: significant anatomical abnormalities, the presence of inflammatory or neoplastic lesion, serious psychiatric disorders | 130  | 41.5 (11.6) | 70:60 |
with the Lequesne Index was performed. The majority of the participants (68 of 97) were patients with knee osteoarthritis, with the rest being patients with hip osteoarthritis. The study of Papathanasiou et al. included only patients with knee osteoarthritis. In both studies, internal consistency and reliability received sufficient ratings. The rest of the measurement properties received adequate ratings.

Six instruments were retrieved that can be used for various knee pathologies, the Knee Outcome Survey-Activities of Daily Living Scale (KOS-ADLS), the Knee Injury and Osteoarthritis Outcome Score (KOOS) and KOOS-Child, the International Knee Documentation Committee Subjective Knee Form (IKDC), the Lysholm Knee Scoring Scale (LKSS), and the Tegner Activity Scale (TAS). The KOS-ADLS is a 14-item questionnaire assessing the symptoms and function during daily activities of patients with knee pathologies. The Greek version of KOS-ADLS received sufficient ratings for internal consistency, reliability, construct validity and responsiveness. The rest of the measurement properties were not reported or were indeterminate. Due to difficulty of understanding some of the items by the paediatric population, another version of KOOS was developed, modified for children. Reliability, construct validity and responsiveness of the Greek version were rated sufficient. All other measurement properties were indeterminate or were not reported.

The IKDC is a 10-item instrument and evaluates symptoms and functional status of both daily life and sports activities. The Greek version of IKDC received sufficient ratings for internal consistency, reliability, construct validity, and responsiveness. The rest of the measurement properties were not reported or were indeterminate. The internal consistency and reliability of the Greek versions were rated sufficient. All other measurement properties were indeterminate or not reported. The internal consistency and reliability of the Greek versions were rated sufficient. All other measurement properties were indeterminate or not reported.

Two instruments were retrieved that were specifically designed for the assessment of anterior knee pain, the Kujala Anterior Knee Pain Scale (KAKPS) and the Victorian Institute of Sport Assessment scale-Patella (VISA-P) questionnaire. All measurement properties of the KAKPS Greek version were indeterminate or not reported, except for internal consistency and reliability. Regarding the measurement properties of the VISA-P Greek version, they were indeterminate or not reported, besides construct validity and responsiveness.

**PROMs about ankle disorders**

The Achilles Tendon Rupture Score (ATRS) is the only outcome measure validated for Achilles' tendon ruptures. Its purpose is the evaluation of symptoms and function after Achilles tendon rupture. Internal consisten-

| Study (year) | Instrument | Country (language) | Population (inclusion and exclusion criteria) | N | Mean age (SD, range) | Female: Male |
|--------------|------------|--------------------|-----------------------------------------------|---|---------------------|-------------|
| Boscainos et al. (2003) | ODI, RMDQ | Greece (Greek) | Inclusion: patients with low back pain | 697 | 45.9 (14.2, 15-80) | 235:462 |
| Vasilidis et al. (2006) | BrQ | Greece (Greek) | Inclusion: patients with idiopathic scoliosis, conservatively treated with brace | 28 | 13.3 | 21.7 |
| Zis et al. (2016) | FIRST | Greece (Greek) | Inclusion: age greater than 18 years, duration of pain of more than 3 months, a native Greek speaker, willingness to provide written informed consent Exclusion: suffering from painful syndromes of other origins, gross cognitive deficits or intellectual disability, severe psychiatric comorbidity | 101 | Fibromyalgia group: 53.6 (11.9) Osteoarthritis group: 66.1 (14.1) |
| Pratsidou et al. (2017) | JAMAR | Greece (Greek) | Inclusion: patients with juvenile arthritis | 375 | 269:106 |
Table 2. Characteristics of the identified original PROMs that were translated and validated in Greek.

| PROM                                      | Abbreviation | Year of Development | Original language | Intended construct and domains                                                                 | Number of questions | Target of development population                                      |
|-------------------------------------------|--------------|---------------------|-------------------|------------------------------------------------------------------------------------------------|--------------------|------------------------------------------------------------------------|
| Modified Harris Hip Score                 | mHHS         | 2000\(^{39}\)       | English           | Pain, function                                                                                   | 8                  | Patients that underwent hip arthroscopy                                |
| International Hip Outcome Tool-12        | iHOT-12      | 2012\(^{42}\)       | English           | Symptoms and Functional Limitations, Sports and Recreational Activities                          | 12                 | Patients with hip disorders                                           |
| Western Ontario and McMaster Index       | WOMAC        | 1988\(^{43}\)       | English           | Pain, stiffness and physical functional disability                                               | 24                 | Patients with hip or knee osteoarthritis                               |
| Lequesne Algofunctional Index            | -            | 1980\(^{44}\)       | English           | Pain or discomfort, maximum walking distance with or without walking aids and physical/functional disability | 11                 | Patients with hip osteoarthritis, on NSAIDs                            |
| Knee Outcome Survey-activities of Daily Living scale | KOS-ADLS  | 1998\(^{45}\)       | English           | Symptoms/functional status in daily activities                                                   | 17                 | Patients with knee disorders                                          |
| Knee injury and Osteoarthritis Outcome score | KOOS       | 1998\(^{46}\)       | English           | Pain, symptoms, activities of daily living, sport and recreation function, and knee-related quality of life | 32                 | Patients that underwent ACL reconstruction                            |
| International Knee Documentation Committee Subjective Knee Form | IKDC       | 2001\(^{47}\)       | English           | Symptoms, sports activities, function                                                               | 10                 | Patients with knee disorders                                          |
| Knee Injury and Osteoarthritis Outcome for Children | KOOS-Child | 2012\(^{48}\)       | English, Swedish   | Pain, symptoms, activities of daily living, sport and recreation function, and knee-related quality of life | 32                 | Children with knee injuries                                           |
| Lysholm Knee Scoring Scale               | LKSS         | 1985\(^{49}\)       | English           | Symptoms during daily activities                                                                 | 8                  | Patients with ACL injury                                               |
| Tegner Activity Scale                    | TAS          | 1985\(^{50}\)       | English           | Activity level in daily life and sports                                                            | 10                 | Patients with ACL injury                                               |
| Anterior knee pain scale (Kujala scale)   | KAKPS        | 1993\(^{51}\)       | English           | General symptoms/symptoms in sports activities                                                    | 13                 | Patients with anterior knee pain and patellofemoral joint disorders   |
| Victorian Institute of Sport Assessment scale-Patella | VISA-P   | 1998\(^{52}\)       | English           | Symptoms, ability to participate in sports                                                        | 10                 | Patients with patellar tendinopathy, asymptomatic controls            |
| Achilles tendon rupture score            | ATRS         | 2007\(^{53}\)       | English           | Limitations of activity due to Achilles’ tendon rupture                                            | 10                 | Patients with Achilles tendon rupture                                  |
Table 2. Characteristics of the identified original PROMs that were translated and validated in Greek.

Continued from previous page

| PROM                                      | Abbreviation | Year of Development | Original language               | Intended construct and domains                                      | Number of questions | Target of development population                                      |
|--------------------------------------------|--------------|---------------------|---------------------------------|---------------------------------------------------------------------|---------------------|---------------------------------------------------------------------|
| Cumberland Ankle Instability Tool          | CAIT         | 2006\(^{53}\)      | English                         | Severity of functional ankle instability                           | 9                   | Patients with ankle sprains                                         |
| Manchester Foot Pain and Disability Index  | MFPDI        | 2000\(^{54}\)      | English                         | Functional limitation, pain intensity, concern with personal appearance, difficulty in performing work or leisure activities | 19                  | Patients with foot disorders, rheumatology patients                |
| Functional Assessment Scale for Acute Hamstring Injuries | FASH        | 2014\(^{22}\)      | Greek, English, German           | Pain during sports activities                                      | 10                  | Patients with hamstring injuries                                   |
| Exercise Induced Leg Pain questionnaire    | EILP         | 2012\(^{25}\)      | German                          | Symptoms/Difficulty in sports activities                           | 10                  | Patients with exercise induced leg pain                            |
| Shoulder Pain and Disability Index         | SPADI        | 1991\(^{56}\)      | English                         | Pain, disability                                                  | 20                  | Patients with shoulder pain                                       |
| Disabilities of the Arm, Shoulder and Head | DASH         | 1996\(^{57}\)      | English                         | Symptoms, physical function, social function                      | 30                  | Patients with upper extremity conditions                           |
| Hand20                                     | Hand20       | 2010\(^{38}\)      | English                         | Symptoms severity                                                | 20                  | Patients with upper extremity conditions                           |
| Boston carpal tunnel questionnaire         | BCTQ         | 2018\(^{39}\)      | English                         | Symptoms severity, functional status                              | 19                  | Patients with carpal tunnel syndrome                               |
| Patient-rated Tennis Elbow Evaluation      | PRTEE        | 2005\(^{60}\)      | English                         | Pain, functional disability, difficulty in usual activities       | 15                  | Patients with lateral elbow tendinopathy                          |
| Ankylosing spondylitis Quality of Life     | ASqOL        | 2003\(^{61}\)      | English, Dutch                   | Impact of ankylosing spondylitis on the quality of life           | 18                  | Patients with ankylosing spondylitis                              |
| Neck Disability Index                      | NDI          | 1991\(^{62}\)      | English                         | Symptoms in various activities                                    | 10                  | Patients with neck injuries                                       |
| Scoliosis research society-22 questionnaire | SRS-22      | 2003\(^{63}\)      | English                         | Function/activity, Physical functioning Pain, Role physical, Mental health, Bodily pain, Self-image/ appearance, General health, Satisfaction with management | 22                  | Patients with scoliosis                                           |
| Quebec Back Pain Disability Scale          | QBPDS        | 1996\(^{64}\)      | English, French                  | Functional disability during: rest/bed, sit/stand, ambulation, handling of large/heavy objects, movement and bending/stooping | 20                  | Patients with back pain                                           |
| Oswestry Disability Index                  | ODI          | 1980\(^{65}\)      | English                         | Pain Intensity, personal care, lifting                            | 10                  | Patients with back pain                                           |
| Roland-Morris Disability Questionnaire     | RMDQ         | 1983\(^{66}\)      | English                         | Function                                                        | 24                  | Patients with back pain                                           |
Table 2. Characteristics of the identified original PROMs that were translated and validated in Greek. Continued from previous page

| PROM                                                      | Abbreviation | Year of Development | Original language | Intended construct and domains                                                                 | Number of questions | Target of development population                                                                 |
|-----------------------------------------------------------|--------------|---------------------|-------------------|-------------------------------------------------------------------------------------------------|---------------------|-------------------------------------------------------------------------------------------------|
| BRACE questionnaire                                       | BrQ          | 2006               | Greek             | General health perception, physical functioning, emotional functioning, self-esteem and aesthetics, vitality, school activity, bodily pain and social functioning | 34                  | Patients with idiopathic scoliosis treated conservatively                                       |
| Fibromyalgia Rapid Screening Tool                         | FIRST        | 2010               | English, French   | Pain                                                                                           | 6                   | Patients with chronic pain due to fibromyalgia                                                   |
| Juvenile Arthritis Multidimensional Assessment Report     | JAMAR        | 2011               | English           | Overall well-being, functional status, health-related quality of life (HRQoL), pain, morning stiffness, disease activity/status/course, articular and extra-articular involvement, drug-related side effects/compliance, and satisfaction with illness outcome. | 38                  | Patients with juvenile arthritis                                                               |

Table 3. Comprehensibility assessment of the translated versions of PROMs.

| PROM  | Methodological quality | Rating | Methodological quality | Rating |
|-------|------------------------|--------|------------------------|--------|
| mHHS  | Doubtful               | -      | EILP                   | Doubtful                       | -      |
| iHOT-12 | Doubtful           | -      | SPADI                  | Doubtful                       | -      |
| WOMAC  | Doubtful               | -      | SPADI                  | Doubtful                       | -      |
| Lequesne Index | Doubtful         | -      | DASH                   | Doubtful                       | -      |
| WOMAC  | Doubtful               | -      | BCTQ                   | Doubtful                       | -      |
| KOS-ADLS | Doubtful            | -      | Hand                   | Doubtful                       | -      |
| KOOS   | Doubtful               | -      | PRTEE                  | Doubtful                       | -      |
| IKDC   | Doubtful               | -      | ASqOL                  | Adequate                       | +      |
| KOOS-Child | Doubtful         | -      | NDI                    | Doubtful                       | -      |
| LKSS   | Adequate               | +      | SRS-22                 | Doubtful                       | -      |
| TASM   | Adequate               | +      | SRS-22                 | Doubtful                       | -      |
| AKPS   | Doubtful               | -      | QBPDS                  | Adequate                       | +      |
| VISA-P | Doubtful               | -      | ODI                    | Doubtful                       | -      |
| ATRS   | Doubtful               | -      | RMDQ                   | Doubtful                       | -      |
| CAIT   | Doubtful               | -      | FIRST                  | Doubtful                       | -      |
| MFPI   | Doubtful               | -      | JAMAR                  | Doubtful                       | -      |
| FASH   | Inadequate             | -      |                        |                                  |        |
The Cumberland Ankle Instability Tool (CAIT) is a questionnaire of nine independently-scored items, for the assessment of symptoms of ankle instability. The Greek version received sufficient ratings. The rest were not reported.

### Table 4. Methodological quality of the translated versions’ validation studies per measurement property.

| Instrument      | Structural validity | Internal consistency | Cross-cultural validity | Reliability | Measurement error | Criterion validity | Hypotheses testing for construct validity | Responsiveness |
|-----------------|---------------------|----------------------|-------------------------|-------------|-------------------|-------------------|------------------------------------------|-----------------|
| mHHS            | Very good           | Adequate             | Inadequate              | Inadequate  | Adequate          | Adequate          | Doubtful                                 | Adequate        |
| iHOT-12         | Very good           | Adequate             | Adequate                | Very good   | Very good         | Very good         | Adequate                                 | Adequate        |
| WOMAC           | Adequate            | Very good            | Inadequate              | Adequate    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| Lequesne Index  | Inadequate          | Very good            | Inadequate              | Inadequate  | Doubtful          | Doubtful          | Doubtful                                 | Doubtful        |
| WOMAC           | Inadequate          | Very good            | Inadequate              | Inadequate  | Doubtful          | Doubtful          | Doubtful                                 | Doubtful        |
| KOS-ADLS        | Adequate            | Adequate             | Inadequate              | Adequate    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| KOOS            | Very good           | Adequate             | Adequate                | Adequate    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| IKDC            | Doubtful            | Adequate             | Adequate                | Adequate    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| KOOS-Child      | Inadequate          | Adequate             | Adequate                | Adequate    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| LKSS            | Very good           | Inadequate           | Inadequate              | Adequate    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| TAS             | Very good           | Adequate             | Adequate                | Adequate    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| AKPS            | Adequate            | Very good            | Adequate                | Adequate    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| VISA-P          | Adequate            | Adequate             | Adequate                | Adequate    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| ATRS            | Very good           | Adequate             | Adequate                | Adequate    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| CAIT            | Inadequate          | Adequate             | Adequate                | Inadequate  | Doubtful          | Adequate          | Adequate                                 | Adequate        |
| MFPDI           | Very good           | Adequate             | Adequate                | Adequate    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| FASH            | Adequate            | Very good            | Inadequate              | Adequate    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| EILP            | Adequate            | Inadequate           | Inadequate              | Very good   | Very good         | Very good         | Very good                                | Very good       |
| SPADI            | Adequate            | Very good            | Inadequate              | Adequate    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| SPADI            | Very good           | Inadequate           | Inadequate              | Adequate    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| DASH            | Inadequate          | Doubtful             | Inadequate              | Adequate    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| BCTQ            | Very good           | Inadequate           | Inadequate              | Very good   | Adequate          | Adequate          | Adequate                                 | Adequate        |
| Hand20          | Very good           | Inadequate           | Adequate                | Adequate    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| PRTECE           | Doubtful            | Doubtful             | Doubtful                | Adequate    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| ASqOL           | Doubtful            | Very good            | Doubtful                | Doubtful    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| NDI             | Adequate            | Doubtful             | Doubtful                | Very good   | Very good         | Very good         | Very good                                | Very good       |
| SRS-22           | Inadequate          | Very good            | Doubtful                | Adequate    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| SRS-22           | Very good           | Doubtful             | Adequate                | Adequate    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| QBPDS           | Very good           | Adequate             | Adequate                | Adequate    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| OD              | Very good           | Adequate             | Adequate                | Adequate    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| RMDQ            | Adequate            | Very good            | Adequate                | Adequate    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| BrQ             | Very good           | Adequate             | Adequate                | Adequate    | Adequate          | Adequate          | Adequate                                 | Adequate        |
| FIRST           | Adequate            | Very good            | Inadequate              | Very good   | Adequate          | Adequate          | Very good                                | Very good       |
| JAMAR           | Adequate            | Very good            | Doubtful                | Very good   | Adequate          | Adequate          | Adequate                                 | Adequate        |
Table 5. Quality of the translated versions’ measurement properties.

| Instrument      | Structural validity | Internal consistency | Cross-cultural validity | Reliability | Measurement error | Criterion validity | Hypotheses testing for construct validity | Responsive-ness |
|-----------------|---------------------|----------------------|-------------------------|-------------|-------------------|-------------------|------------------------------------------|-----------------|
| mHHS            | N/R                 | -                    | N/R                     | +           | ?                 | N/R               | ?                                        | ?               |
| iHOT-12         | ?                   | +                    | N/R                     | +           | ?                 | ?                 | ?                                        | ?               |
| WOMAC 10        | N/R                 | +                    | N/R                     | +           | N/R               | ?                 | ?                                        | ?               |
| Lequesne Index  | N/R                 | +                    | N/R                     | +           | ?                 | ?                 | ?                                        | ?               |
| WOMAC 11        | N/R                 | +                    | N/R                     | +           | ?                 | ?                 | ?                                        | ?               |
| KOS-ADLS 12     | N/R                 | +                    | N/R                     | +           | ?                 | N/R               | +                                        | +               |
| KOOS 13         | N/R                 | +                    | N/R                     | +           | ?                 | N/R               | +                                        | +               |
| IKDC 14         | N/R                 | +                    | N/R                     | +           | ?                 | N/R               | +                                        | +               |
| KOOS-Child 15   | ?                   | +                    | N/R                     | +           | ?                 | N/R               | +                                        | +               |
| LKSS 16         | N/R                 | +                    | N/R                     | +           | ?                 | N/R               | ?                                        | ?               |
| TAS 16          | N/R                 | +                    | N/R                     | +           | ?                 | N/R               | ?                                        | ?               |
| AKPS 17         | N/R                 | +                    | N/R                     | +           | ?                 | N/R               | ?                                        | ?               |
| VISA-P 18       | ?                   | +                    | N/R                     | +           | ?                 | N/R               | +                                        | +               |
| ATRS 19         | N/R                 | +                    | N/R                     | +           | ?                 | N/R               | +                                        | +               |
| CAIT 20         | N/R                 | +                    | ?                       | +           | N/R               | N/R               | ?                                        | ?               |
| MFPDI 21        | N/R                 | +                    | N/R                     | N/R         | N/R               | N/R               | ?                                        | ?               |
| FASH 22         | ?                   | ?                    | N/R                     | +           | N/R               | ?                 | ?                                        | ?               |
| EILP 23         | ?                   | ?                    | N/R                     | +           | +                 | N/R               | ?                                        | ?               |
| SPADI 24        | +                   | +                    | N/R                     | N/R         | +                 | N/R               | +                                        | +               |
| SPADI 25        | N/R                 | +                    | N/R                     | +           | ?                 | N/R               | +                                        | +               |
| DASH 26         | ?                   | +                    | N/R                     | -           | N/R               | N/R               | ?                                        | ?               |
| BC72 27         | N/R                 | +                    | N/R                     | N/R         | +                 | +                 | +                                        | +               |
| Hand 20 28      | N/R                 | +                    | N/R                     | N/R         | +                 | N/R               | ?                                        | ?               |
| PRTEE 29        | N/R                 | ?                    | N/R                     | +           | -                 | N/R               | ?                                        | ?               |
| ASqO 30         | N/R                 | +                    | N/R                     | ?           | N/R               | N/R               | ?                                        | ?               |
| ND 31           | -                   | ?                    | N/R                     | +           | +                 | N/R               | ?                                        | ?               |
| SRS-22 32       | N/R                 | +                    | N/R                     | N/R         | NA                | ?                 | ?                                        | ?               |
| SRS-22 33       | ?                   | +                    | N/R                     | N/R         | N/R               | ?                 | ?                                        | ?               |
| QBPS 34         | N/R                 | +                    | N/R                     | N/R         | N/R               | ?                 | ?                                        | ?               |
| OD 35           | N/R                 | +                    | N/R                     | N/R         | N/R               | N/R               | ?                                        | ?               |
| RMDQ 36         | ?                   | +                    | N/R                     | N/R         | N/R               | ?                 | ?                                        | ?               |
| BrQ 37          | N/R                 | ?                    | N/R                     | N/R         | N/R               | N/R               | ?                                        | ?               |
| FIRST 38        | N/R                 | +                    | N/R                     | +           | +                 | +                 | +                                        | +               |
| JAMAR 39        | N/R                 | +                    | N/R                     | -           | N/R               | N/R               | ?                                        | ?               |

Greek version of the CAIT 20 received sufficient ratings for internal consistency and reliability. All other measurement properties were indeterminate or were not reported. The (Manchester Foot and Pain Disability Index) MFPDI was the only retrieved tool translated and validated in Greek 21 that is designed for the assessment of disability.
caused by foot disorders. It consists of 19 items, that starting with the statement “Because of pain in my feet”, divided in three subscales: functional limitation, pain intensity, concern with personal appearance. Only internal consistency of the Greek version was rated sufficient. Reliability and responsiveness were indeterminate. All other measurement properties were not reported.

PROMs about upper limb disorders
The Shoulder Pain and Disability Index has been translated and validated in Greek in two studies.61 In the study of Vrouva et al.,24 the participants were patients with rotator cuff tear, treated conservatively. All measurement properties were rated sufficient except for measurement error and criterion validity that were not reported. In the study of Spanou et al.,25 the participants were patients that suffered of shoulder pain for at least four weeks. Internal consistency, construct validity and responsiveness were rated sufficient. All other measurement properties were indeterminate or not reported. The Disabilities of the Arm, Shoulder, and Hand (DASH) Questionnaire is utilized for the assessment of a variety of symptoms associated with upper limb disorders. Only internal consistency of the Greek version26 received sufficient rating. Reliability was rated insufficiently, and the rest of the measurement properties were indeterminate or not reported. The Hand20 questionnaire was also designed for the assessment of a variety of symptoms of upper limb disorders.58 Evaluation of the measurement properties’ quality showed sufficient internal consistency and reliability, with all other measurement properties being indeterminate or not reported. One instrument was retrieved for the evaluation of hand conditions, the Boston Carpal Tunnel Questionnaire (BCTQ).59 All measurement properties of the Greek version59 received sufficient ratings, except for structural validity, cross-cultural validity and measurement error that were not reported. One questionnaire was retrieved for elbow disorders, the Patient-rated Tennis Elbow Evaluation (PRTEE) which is an updated version of the Patient-Rated Forearm Evaluation Questionnaire (PRFAQ).60 The Greek version of PRTEE60 received sufficient rating for reliability. All other measurement properties were indeterminate or not reported.

PROMs about spine disorders
Six instruments were retrieved for the evaluation of spine conditions. The Neck Disability Index is a short, condition-specific questionnaire used for patients with neck pain.61 It consists of 10 items concerning various activities. The Greek version of NDI61 received sufficient ratings for reliability and measurement error. All other measurement properties were indeterminate or not reported.

Regarding the assessment of patients with low back pain, three condition-specific tools were identified: the Quebec Back Pain Disability Scale (OBPDS),34 the Oswestry Disability Index (ODI) and the Roland-Morris Disability Questionnaire (RMDQ).35 Internal consistency of all three translated versions was rated sufficient. All other measurement properties were indeterminate or not reported. Finally, two patient reported Health-Related quality of Life measures (HRQoL) were identified: the Ankylosing Spondylitis Quality of Life (ASQoL) questionnaire30 and the scoliosis research society – 22 (SRS-22) questionnaires.32,33 The internal consistency of the ASQoL Greek version30 was rated sufficient. All other measurement properties were indeterminate or not reported. The SRS-22 has been translated and validated in Greek in two studies. The study of Antonarakos et al.32 included surgically treated patients, while the study of Potoupnis et al.33 included conservatively treated patients. The ratings were similar: sufficient internal consistency and reliability, with the rest of the measurement properties being indeterminate or not reported.

PROMs constructed de novo in Greek
Two instruments were retrieved that were constructed de novo in Greek, the Brace questionnaire (BrQ) and the Functional Assessment Scale for Acute Hamstring Injuries (FASH). The BrQ was constructed by Vasiliadis et al. in 200636 and it is a HRQoL measure for adolescents with idiopathic scoliosis treated conservatively. It consists of 34 items divided in 8 subdomains. The methodology for total PROM design received “inadequate” rating, due to the fact that the construct of interest was not clearly described according to the COSMIN criteria.7 Pilot test of the questionnaire was not performed, therefore the content validity of the questionnaire was not assessed. The FASH questionnaire was constructed in 2014 by Malliaropoulos et al.22 It is a condition-specific, 10-item questionnaire designed to evaluate the functional status of athletes with hamstring injuries. Total PROM design was rated “inadequate”, as the description of the construct was not clear. Pilot test was performed, and the sample was an accurate representation of the target population. However, the items were not tested in their final form; thus, the methodological quality of comprehensibility assessment was rated “inadequate”. Comprehensiveness was not assessed. Summary of PROM development checklist is presented in Table 6.

DISCUSSION
The purpose of this review was to summarise the PROMs involving musculoskeletal conditions that have been translated and validated in Greek, and to also evaluate the methodological quality of the validation studies according to the COSMIN Risk of Bias Checklist.7 Thirty-
one translated versions of PROMs were identified. The methodological quality for 47.3% (n=81) of the measurement properties was adequate and 45% (n=77) of the measurement properties received the “sufficient” rating. The remaining measurement properties were indeterminate or not reported.

Content validity is the degree to which the content of an instrument is an adequate reflection of the construct to be measured\(^5\) and is the most important measurement property of a PROM. Comprehensibility is a significant component of content validity, and it was rated “insufficient” in the majority of the studies, as cognitive debriefing was not performed during pre-testing or the process that was used was not clearly described. Other components of content validity (comprehensiveness and relevance) were not evaluated in this systematic review, as they are considered more applicable to the initial development of a PROM.

Structural validity refers to the degree to which the scores of a PROM are an adequate reflection of the dimensionality of the construct to be measured.\(^3\) It is usually assessed with factor analysis. In the majority of the studies, factor analysis was not performed,\(^5,11,14,15,16,19,20,24,26-28,31-33,36\) and the authors assumed models from other studies that evaluated the structural validity of the construct of interest.

Internal consistency is an important component of internal structure of a PROM. It represents the degree of interrelatedness among the items and is often assessed by Cronbach’s alpha.\(^5\) For the appropriate interpretation of internal consistency, the items should form a unidimensional scale or subscale. Unidimensionality means that the items in a scale or a subscale measure a single construct. Internal consistency was one of the most frequently reported measurement properties across the studies. The methodological quality was sound in the vast majority of them, with the calculation of Cronbach’s alpha.

Cross cultural adaptation is the cornerstone of the comprehensibility of a PROM, and it is absolutely necessary for the accurate reflection of a PROM in another language. The translation process in most of the studies was in compliance with the international guidelines (such as those of Beaton et al.\(^6\)). For further confirmation of cross-cultural validity, it is suggested by COSMIN guidelines to perform comparisons between at least two different groups, with differences such as gender, literacy or language. However, such comparisons were performed only in two studies, the validation of CAIT\(^20\) and the validation of SPADI by Vrouva et al.\(^24\) Reliability refers to the total variance in the measurements which is due to “true” differences between patients. “True” is the average score that would be obtained if the scale was administered an infinite number of times to the same person.\(^5\) It does not concern the accuracy of an instrument, but only its consistency.\(^70\) Reliability also

| Table 6. Quality of development of PROMs that were constructed de novo in Greek. |
|---|
| PROM | PROM design | Pilot test | Total PROM development |
|---|---|---|---|
| Clear construct | Clear origin of construct | Clear target population for which the PROM was developed | Clear context of use | PROM developed in sample representing the target population | Concept elicitation | Total PROM design | Pilot test performed in sample representing the target population | Comprehensibility | Comprehensiveness |
| FASH\(^22\) | Inadequate | Doubtful | Very good | Very good | Adequate | Inadequate | Very good | Inadequate | Inadequate |
| BrQ\(^36\) | Inadequate | Doubtful | Very good | Very good | Doubtful | Inadequate | NA | NA | Inadequate |
The BrQ36 has been translated and validated in Polish, 71 instruments are utilized in everyday clinical practice. However, it cannot be excluded that the initial ones. Literature search did not yield any further validation studies due to the lack of an a priori hypotheses statement. The results were deemed indeterminate methodological quality was adequate. However, in most of the studies, the results were deemed indeterminate due to the lack of an a priori hypotheses statement. Literature search did not yield any further validation studies for any of the translated versions of PROMs, besides the initial ones. However, it cannot be excluded that the instruments are utilized in everyday clinical practice. The BrQ36 has been translated and validated in Polish, 71 Italian, 72 French, 73 Korean, 74 and Persian. 75 The results of the validation studies were satisfactory regarding reliability. The FASH scale has been validated in German 76 and French. 77 The validation studies reported satisfactory internal consistency and reliability results. To the best of our knowledge, this is the first systematic review that summarises the PROMs related to the musculoskeletal system that have been translated in the Greek language and evaluates their measurement properties according to the COSMIN criteria. This review can be used as an everyday clinical practice reference guide for clinicians, in relation to the available instruments translated in the Greek language. It also highlights the strengths and limitations of the studies conducted with the aim of PROM validation in the Greek language. Therefore, it offers information for future researchers in relation to the quality of the existing studies and how to avoid shortcomings in the future. The limitation of this study is that it only includes studies with PROMs constructed in the English language. Instruments constructed in other languages were not included. Literature search for this review revealed that there is a lack of translated and validated instruments in Greek in several areas of musculoskeletal medicine, such as traumatology, paediatric orthopaedics, and orthopaedic oncology. Further research is encouraged with studies in compliance with the COSMIN criteria in order to translate and validate new outcome measures in Greek regarding those areas. In addition, further research is encouraged regarding the PROMs that have already been translated in Greek, in order to achieve further validation of their measurement properties and report the measurement properties that have not been previously reported.

CONCLUSION
A number of PROMs has been translated into the Greek language related to musculoskeletal conditions. The majority of them involves the lower limb and especially knee conditions. Further validation of these instruments is encouraged, with studies of good quality according to the COSMIN checklist. In addition, there are quite a few fields of musculoskeletal medicine where outcome measures have not been translated yet. Therefore, it is indicated that new tools need to be translated into Greek, in compliance with the COSMIN criteria that will involve those areas of clinical practice.

CONFLICT OF INTEREST
The authors declare no conflict of interest.

REFERENCES
1. Smith E, Hoy DG, Cross M, Vos T, Naghavi M, Buchbinder R, et al. The global burden of other musculoskeletal disorders: estimates from the Global Burden of Disease 2010 study. Ann Rheum Dis 2014;73:1462-9.
2. Weldring TSS. Patient-reported outcomes (PROs) and patient-reported outcome measures (PROMs). Health Serv Insights 2013;6:61-8.
3. Sansoni J Health Outcomes: An Overview from an Australian Perspective. Available at: https://ahsri.uow.edu.au/content/groups/public/@web/@chsd/documents/doc/uow217836.pdf
4. Kyte DG, Calvert M, van der Wees PJ, ten Hove R, Tolan S, Hill JC. An introduction to patient-reported outcome measures (PROMs) in physiotherapy. Physiotherapy 2015;101:119-25
5. Mokkink LB, Terwee CB, Patrick DL, Alonso J, Stratford PW, Knol DL, et al. The COSMIN study reached international consensus on taxonomy, terminology, and definitions of measurement properties for health-related patient reported outcomes. J Clin Epidemiol 2010;63:737-45.
6. Pirinsen CAC, Mokkink LB, Bouter LM, Alonso J, Patrick DL, de Vet HCW, et al. COSMIN guideline for systematic reviews of patient-reported outcome measures. Qual Life Res 2018;27:1147-57.
7. Mokkink LB, de Vet HCW, Pirinsen CAC, Patrick DL, Alonso J, Bouter LM, et al. COSMIN Risk of Bias checklist for systematic reviews of Patient-Reported Outcome Measures. Qual Life Res 2018 May;27:1171-9.
8. Stasi S, Papathanasiou G, Dicochnou A, Polikreti B, Chalimourdas A, Macheras GA. Modified Harris Hip Score as patient-reported outcome measure in osteoarthritic patients: psychometric properties of the Greek version. Hip Int 2021 Jul;31(4):516-25.
9. Stasi S, Starmou M, Papathanasiou G, Frantziskaki P, Kanavas E, Evaggaia-Sossidis G, et al. International Hip Outcome Tool (12-items) as health-related quality-of-life measure in osteoarthritis: validation of Greek version. J Patient Rep Outcomes 2020 May 27;4:41.

10. Konstantinidis GA, Aetras VH, Kanakari KA, Natsis K, Bellamy N, Niakas D. Comparative validation of the WOMAC osteoarthritis and Lequesne algofunctional indices in Greek patients with hip or knee osteoarthritis. J Rheumatol 2019;46:216-21.

11. Papathanasiou G, Stasi S, Okonmoulo M, Roussou I, Papageorgiou E, Chronopoulou E, et al. Clinimetric properties of WOMAC Index in Greek knee osteoarthritis patients: comparisons with both self-reported and physical performance measures. Rheumatol Int 2015;35:115-23.

12. Kapreli E, Panelli G, Strimpakos N, Bills E, Zacharopoulou A, Athanasopoulou S. Cross-cultural adaptation of the Greek version of the Knee Outcome Survey--activities of Daily Living Scale (KOS-ADLS). Knee 2011;18:424-7.

13. Moutzouri M, Tsoumpos P, Bills E, Papoutsidakis A, Giatis J. Cross-cultural translation and validation of the Greek version of the Knee Injury and Osteoarthritis Outcome Score (KOOS) in patients with total knee replacement. Disabil Rehabil 2015;37:1477-83.

14. Koumantakis GA, Tsiolikas GA, Papoutsidakis A, Ververidis A, Drosos GS. Cross-cultural adaptation and validation of the International Knee Documentation Committee Subjective Knee Form in Greek. J Orthop Traumaol 2016;17:123-9.

15. Moutzouri M, Tsoumpos P, Bania T, Bills E, Giatis J. “Greek KOOS-Child: a valid, disease specific, diagnostically accurate and responsive PROM in children with knee-related pathology”. Knee Surg Sports Traumatol Arthrosc 2021 Jun;29(6):1841-9.

16. Parap CCTV. Bills E, Floros GR, Stavropoulos T, Kaparounaki E, Mouchou M, et al. Cross-Cultural Adaptation of the Greek Versions of the Lysholm Knee Scoring Scale and Tegner Activity Scale. Cuneus 2020; 24:9372.

17. Papadopoulou C, Constantinou A, Chameleon A, Stasinopoulou D. Greek cultural adaption and validation of the Kujala anterior knee pain scale in patients with patellofemoral pain syndrome. Disabil Rehabil 2017;39:704-8.

18. Korakakis V, Patsiaouras A, Malliaropoulou N. Cross-cultural adaptation of the VISA-P questionnaire for Greek-speaking patients with patellar tendinopathy. Br J Sports Med 2014;48:1647-52.

19. Tsoumpos P, Ververidis A, Giatas G, Drosos GL. Validation and cross-cultural adaptation of Greek version of Achilles tendon Total Rupture Score. Foot Ankle Surg 2019;25:8-12.

20. Tsikoura M, Bills E, Foulekis K, Christakou A, Tsepis E. Cross-cultural adaptation, reliability, and validity of the Greek version of the Cumberland Ankly Instability Tool. Physiother Theory Pract 2019;7:1-9.

21. Kacoula P, Fresco N, Menz HB. Development and validation of a Greek language version of the Manchester Foot Pain and Disability Index. Health Qual Life Outcomes 2008;6:39.

22. Malliaropoulou N, Korakakis V, Christodoulou D, Pahdiar N, Pyne D, Giakas G, et al. Development and validation of a questionnaire (FASH--Functional Assessment Scale for Acute Hamstring Injuries) to measure the severity and impact of symptoms on function and sports ability in patients with acute hamstring injuries. Br J Sports Med 2014;48:1607-12.

23. Korakakis V, Malliaropoulou N, Malliros N, Malliros P, Lappis K, Papadopoulou S, Pahdiar N, Nauks T, et al. Cross-cultural Adaptation and Validation of the Exercise-Induced Leg Pain Questionnaire for English- and Greek-Speaking Individuals. J Orthop Sports Phys Ther 2015;45:485-96.

24. Vrousa S, Batistaki C, Koutsioumpa E, Kostopoulos D, Stamos KN, Efstathopagiatou G. The Greek version of Shoulder Pain and Disability Index (SPADI): translation, cultural adaptation, and validation in patients with rotator cuff tear. J Orthop Traumatol 2016;17:3-15.

25. Spanou A, Maroulis I, Lamnisos D, Stasinopoulos D. Reliability and validity of the Greek shoulder pain and disability index in patients with shoulder pain. Disabil Rehabil 2020;42:1299-04.

26. Themistocleous GS, Goudelis G, Kyrou I, Chloros GD, Krokos A, Galanos A, et al. Translation into Greek, cross-cultural adaptation and validation of the Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH). J Hand Ther 2006; 19:350-7.

27. Bougea A, Zambelis T, Vokou P, Katsika PZ, Tzavara C, Kokotis P, et al. Reliability and Validation of the Greek Version of the Boston Carpal Tunnel Questionnaire. Hand (N Y) 2016;13:593-9.

28. Goulis T, Ververidis A, Tripanias G, Tikeridis K, Drosos GL. The Greek version of the Hand20 questionnaire: cross-cultural translation, reliability and construct validity. Hand Surg 2015;20:33-8.

29. Stasinopoulos D, Papadopoulos C, Antoniadou M, Nardi L. Greek adaptation and validation of the Patient-Rated Tennis Elbow Evaluation (PRTEE). J Hand Ther 2015;28:286-90.

30. Graham JE, Rouse M, Twiss J, McKenna SP, Vidalis AA. Greek adaptation and validation of the Arkylosing Spondylitis Quality of Life (ASQoL) measure. Hippokratia 2015;19:119-24.

31. Trouil MN, Vernon HT, Kakavelakis KN, Antonopoulou MD, Paganas AN, Lionis CD. Translation of the Neck Disability Index and validation of the Greek version in a sample of neck pain patients. BMC Musculoskelet Disord 2008;22:9106.

32. Antonarakos PD, Katranitsa L, Angelis L, Paganas A, Koen EM, Christodoulou EA, et al. Reliability and validity of the adapted Greek version of scoliosis research society - 22 (SRS-22) questionnaire. Scoliosis 2009 16;4:14.

33. Potoupnis M, Papavasiiliou K, Kaneridis E, Pellios S, Kapetanou A, Sayegh F, et al. Reliability and concurrent validity of the adapted Greek version of the Scoliosis Research Society-22 Questionnaire. A cross-sectional study performed on conservatively treated patients. Hippokratia 2012;16:225-9.

34. Christakou A, Andrriopoulou M, Asimakopoulou P. Validity and reliability of the Greek version of the Quebec Back Pain Disability Scale. J Back Musculoskelet Rehabil 2011;24:145-54.

35. Boscanos PJ, Sajkic G, Stilianessi E, Proukakis K, Papadakis SA. Greek versions of the Oswestry and Roland-Morris Disability Questionnaires. Clin Orthop Relat Res 2003;411:40-50.

36. Vasiliadis E, Grivas TB, Gkoltsiou K. Development and preliminary validation of Brace Questionnaire (BrQ): a new instrument for measuring quality of life of brace treated scoliotics. Scoliosis 2006 May 20;1:7.

37. Zis P, Brozou V, Stavropoulos T, Argyra E, Siakata I, Karanouzou E, et al. Validation of the Greek Version of the Fibromyalgia Rapid Screening Tool. Pain Pract 2017;17:320-9.

38. Pratsidou-Gertsi P, Trachana M, Karanouda-Tsakalidou F, Tsitsiari A, Tantii M, Vougouka O, et al. Paediatric Rheumatology International Trials Organisation (PRINTO). The Greek version of the Juvenile Arthritis Multidimensional Assessment Report (JAMAR). Rheumatol Int 2018;38:219-8.

39. Byrd TJ and Jones KS Prospective analysis of hip arthroscopy with 2-year follow-up. Arthroscopy 2000;16:578-87.

40. Harris WH Traumatic arthritis of the hip after dislocation and acetabular fractures: treatment by mold arthroplasty. An end-result study using a new method of result evaluation. J Bone Joint Surg Am 1969;51:737-55.

41. Griffin D, Parsons, N, Mohtadi N, Pedersen M, Chan D, Safran M A short version of the international hip outcome tool (HOT-12) for use in routine clinical practice. Arthroscopy 2012;28:611-8.

42. Mohtadi N, Griffin D, Pedersen M, Chan D, Safran M, Parsons N, et al. The development and validation of a self-administered quality-of-life outcome measure for young, active patients with symptomatic hip disease. The international hip outcome tool (HOT-33). Arthroscopy 2012;28:585-10.

43. Bellamy N, Buchanan WW, Goldsmith CH, Campbell J, Stitt LW. Validation study of WOMAC: a health status instrument for measuring clinically important patient relevant outcomes to antirheumatic drug therapy in patients with osteoarthritis of the hip or knee. J Rheumatol 1988;15:1833-40.

44. Lequesne MG, Merry C, Pratson M, Gerard P. Indexes of severity for osteoarthritis of the hip and knee. Validation--value in comparison with other assessment tests. Scand J Rheumatol Suppl 1987;65:85-9.
45. Imgang JJ, Snyder-Mackler L, Wanner RS, Fu FH, Harner CD. Development of a patient reported measure of function of the knee. J Bone Joint Surg Am 1998;80:1132-45.

46. Roos EM, Roos HP, Lohmander LS, Ekdahl C, Beynon BD. Knee Injury and Osteoarthritis Outcome Score (KOOS)-development of a self administered outcome measure. J Orthop Sports Phys Ther 1998;28:98-96.

47. Ebrahimzadeh MH, Makmalbalad H, Golhasani-Keshatan F, Rababi S, Birjandinejad A. The International Knee Documentation Committee (IKDC) Subjective Short Form: a validity and reliability study. Knee Surg Sports Traumatol Arthrosc 2015;23:3163-7.

48. Ortvist M, Iversen MD, Janarv PM, Broström EW, Roos EM. Psychometric properties of the Knee injury and Osteoarthritis Outcome Score for Children (KOOS-Child) in children with knee disorders. Br J Sports Med 2014;48:1437-46.

49. Tegner Y, Lysholm J. Rating systems in the evaluation of knee ligament injuries. Clin Orthop Relat Res 1985;198:43-9.

50. Kujala UM, Jaakkola LH, Koskinen SK, Taimela S, Hurme M, et al. Scoring of patello-femoral disorders. Arthroscopy 1993;9:159-63.

51. Visentini PJ, Khan KM, Cook JL, Kiss ZS, Harner CD. The VISA score: an index of severity of symptoms in patients with jumper's knee (Patellar Tendinosis). J Sci Med Sport 1998;1:22-8.

52. Nilsson-Heland K, Thomee R, Silbernagel KG, Thomée P, Saxén E, Eriksson BI, et al. The Achilles tendon Total Rupture Score (ATRS): development and validation. Am J Sports Med 2007;35:421-6.

53. Hiller CE, J National Medical Centre for Sports and Exercise Medicine. J Bone Joint Surg Am 2009;91:1439.

54. Hudak PL, Amadio PC, Bombardier C. Development of an upper extremity outcome measure: the DASH (disabilities of the arm, shoulder and hand) [corrected]. The Upper Extremity Collaborative Group (UECG). Am J Ind Med 1996;29:602-8.

55. Suzuki M, Kurimoto S, Shinohara T, Tatebe M, Imaeda T, Hirata H. Development and validation of an illustrated questionnaire to evaluate disabilities of the upper limb, J Bone Joint Surg Br 2010;92:2639-9.

56. Levine DW, Simmons BP, Koris MJ, Daltrey LH, HoIt GG, Fossel AH, et al. A self-administered questionnaire for the assessment of severity of symptoms and functional status in carpal tunnel syndrome. J Bone Joint Surg Am 1993;75:1585-92.

57. MacDermid J. Update: the patient-rated forearm evaluation questionnaire is now the patient-rated tennis elbow evaluation. J Hand Ther 2005;18:407-10.

58. Doherty LC, Spoornewegen MA, Cook SA, Whalley D, Hallwell PS, Kay LJ, et al. Development of the ASQol: a quality of life instrument specific to Ankylosing Spondylitis. Ann Rheum Dis 2003;62:20-6.

59. Varnon H, Mior S: The Neck Disability Index: A study of reliability and validity. J Manipulative Physiol Ther 1991;14:409-15.

60. Harner TR, Group JM, Shin TM, Hornal P, Merola AA, Grogan DP, Pugh L, et al. Results of the Scoliosis Research Society instrument for evaluation of surgical outcome in adolescent idiopathic scoliosis: a multicenter study of 244 patients. Spine 1999;24:1435-40.

61. Kopec J, Esdaile J, Abrahamowicz M, Abenhaim L, Wool-Dauphine S, Lamping D, et al. The Quebec Back Pain Disability Scale. Measurement properties. Spine 1995;20:341-52.

62. Fairbank JC, Couper J, Davies JB, O'Brien JP. The Oswestry low back pain questionnaire. Physiotherapy 1980;66:271-3.

63. Roland M, Morris R: A study of the natural history of back pain: Part I. Development of a reliable and sensitive measure of disability in low-back pain. Spine 1983;8:141-4.

64. Perrot S, Bouhassira D, Ferriani J. Development and validation of the Fibromyalgia Rapid Screening Tool (FIRST). Pain 2010;150:250-6.

65. Filicamo G, Consolaro A, Schiappapietra B, Dalprà S, Lattanzi B, Magri-Manzoni S et al. A new approach to clinical care of juvenile idiopathic arthritis: the Juvenile Arthritis Multidimensional Assessment Report. J Rheumatol 2011;38:938-53.

66. Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. Spine 2000;25:3186-9.

67. Streiner DL, Norman G. Health Measurement Scales. A practical guide to their development and use. New York: Oxford University Press; 2003.

68. Strauss ME, Smith GT. Construct Validity: Advances in Theory and Methodology. Ann Rev Clin Psychol 2009;5:1-25.

69. Kinel E, Kotwicki T, Podolska A, Bialek M, Strywka W. Polish validation of the Brace Questionnaire. Eur Spine J 2012;21:1603-8.

70. Aulisa AG, Guzzanti V, Galli M, Erra C, Scuderi G, Pauda L. Validation of Italian version of Brace Questionnaire (BrQ) Scoliosis 2013;8:13.

71. Decemunick J, Tirat-Herbert A, Rodriguez Martinez N, Bernard JC. French validation of the Brace Questionnaire (BrQ) Scoliosis Spinal Discord 2017;12:12-8.

72. Lim JM, Goh TS, Shin JK, Kim DS, Lee CS, et al. Validation of the Korean version of the Brace Questionnaire. Br J Neurosurg 2018;32:678-81.

73. Rezaee S, Jalali M, Babaei T, Kamali M. Reliability and concurrent validity of a culturally adapted persian version of the Brace Questionnaire in adolescents with idiopathic scoliosis. Spine 2019;7:553-8.

74. Loehrer , Nauck T, Korakakis V, Mallaropoulos V. Validation of the FASH (Functional Assessment Scale for Acute Hamstring Injuries) questionnaire for German-speaking football players. J Orthop Surg Res 2016;11:130.

75. Locquet M, Willem W, Specque C, Beaudert C, Bruyère O, Van Beveren J, et al. Cross-cultural adaptation, translation, and validation of the functional assessment scale for acute hamstring injuries (FASH) questionnaire for French-speaking patients. Disabil Rehabil 2020;42:2076-82.

patient-reported outcome measures (proms) relevant to musculoskeletal conditions translated and validated in the greek language: a cosmin-based systematic review of measurement properties