Development and psychometric evaluation of the Musculoskeletal Pain Intensity and Interference Questionnaire for professional orchestra Musicians (MPIIQM)

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Operational Definition of PRMDs
(Zaza et al., 1998)

• “Pain, weakness, numbness, tingling, or other symptoms that interfere with (their) ability to play (their) instrument at the level (they) are accustomed to.”

• Qualitative study: semi-structured interviews.

• Musicians could clearly distinguish between “normal aches and pains” and a PRMD.
Heterogeneity of prevalence studies:
- Meta-analysis difficult,
- Methodological weaknesses of studies,
- Lack of operational definition,
- Low response rates,
- Errors and omissions,
- Measurement bias,
- Instruments not validated and inconsistent,
- Poorly described,
- Deficient in collecting psychosocial factors.
Literature Review – Inclusion Criteria

- Measurement of pain intensity,
- Prevalence,
- Frequency and duration of pain,
- Pain interference – function,
- Pain interference – psychosocial / affective variables,
- Suitable for acute and chronic MSK pain,
- Evaluative rather than discriminative or predictive,
- Minimal respondent burden: <20 minutes to complete.
- English language.
Search Results

• Musculoskeletal Load and Physical Health Questionnaire for Musicians (Ackermann & Driscoll, 2010).

• Musculoskeletal Pain Questionnaire of Musicians (MPQM) (Lamontagne & Bélanger, 2012).

• Chronic Pain Grade Questionnaire (CPGQ) (Von Korff et al., 1992).

• Nordic Musculoskeletal Questionnaire (NMQ) and extended version (NMQ-E) (Kuorinka et al., 1987; Dawson et al., 2009).

• McGill Pain Questionnaire (LF-MPQ and SF-MPQ) (Melzack, 1975; Melzack, 1987).

• Brief Pain Inventory (BPI) (Cleeland et al., 1982).
# Summary Ratings for Selected Instruments

**(McDowell, 2006)**

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Reliability Thoroughness</th>
<th>Reliability Results</th>
<th>Validity Thoroughness</th>
<th>Validity Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSK Load Quest. for Musicians</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>MPQM</td>
<td>*</td>
<td>**</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>CPGQ</td>
<td>*</td>
<td>**</td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td>NMQ</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>NMQ-E</td>
<td>*</td>
<td>**</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>LF-M PQ &amp; SF-M PQ</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>BPI</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
</tbody>
</table>

0  No reported evidence of reliability or validity

* Basic information only

** Several types of tests, several studies and authors

*** All major forms of tests, numerous studies

**Results of reliability & validity**

Weak

Adequate

Excellent
Study Aims

- Develop and Validate for a population of professional orchestra musicians a new biopsychosocial self-report instrument:

  - Musculoskeletal (MSK) pain,
  - Pain interference – function,
  - Pain interference – psychosocial or affective constructs.
Stages

- **Phase 1** – Development of the new instrument – adaptation and modification of selected instruments.

- **Phase 2** – Psychometric evaluation of the new instrument.
Criteria for the New Instrument

• Short: <15 minutes to complete.

• Specific to population of orchestra musicians.

• Evaluative qualities, i.e. ability to measure change over time, and changes in health status following interventions (Kirshner & Guyatt, 1985).

• Follow the biopsychosocial principles set out by WHO in the International Classification of Functioning, Disability and Health (ICF) (WHO, 2002).
COSMIN Checklist
(Terwee et al., 2007; Mokkink et al., 2010; de Vet et al., 2011)

Guidelines from the “COnsensus-based Standards for the selection of health Measurement INstruments” checklist were followed at every stage of instrument development and psychometric testing.
Phase 1 – Instrument Development

• Participants.

• Draft instrument.

• Content validity.

• Pilot testing.

• Face validity.
## Structure of the MPIIQM

<table>
<thead>
<tr>
<th>Structure / items</th>
<th>Question type</th>
<th>Source</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographics</td>
<td>Binary</td>
<td>MLPHQM</td>
<td>Ackermann &amp; Driscoll (2010)</td>
</tr>
<tr>
<td></td>
<td>Open-ended</td>
<td></td>
<td>Berque &amp; Gray (2002)</td>
</tr>
<tr>
<td>Prevalence</td>
<td>Binary</td>
<td>NMQ-E</td>
<td>Dawson et al. (2009)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Zaza &amp; Farewell (1997)</td>
</tr>
<tr>
<td>Pain location</td>
<td>Body chart</td>
<td>BPI</td>
<td>Cleeland &amp; Ryan (1994)</td>
</tr>
<tr>
<td>Pain frequency &amp; duration (2)</td>
<td>VAS 10cm</td>
<td>ÖMPSQ</td>
<td>Linton &amp; Boersma (2003)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ÖMSQ</td>
<td>Gabel et al. (2011)</td>
</tr>
<tr>
<td>Pain intensity (4)</td>
<td>NRS: 0-10</td>
<td>BPI</td>
<td>Cleeland &amp; Ryan (1994)</td>
</tr>
<tr>
<td>Affective interference (4)</td>
<td>NRS: 0-10</td>
<td>BPI</td>
<td>Cleeland &amp; Ryan (1994)</td>
</tr>
<tr>
<td>Activity interference (4)</td>
<td>NRS: 0-10</td>
<td>DASH</td>
<td>Hudak et al. (1996)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lamontagne &amp; Bélanger (2012)</td>
</tr>
</tbody>
</table>
Face & Content Validity – 26 items
(de Vet et al., 2011; De Vellis, 2012)

- Evaluate **relevance** of each item – rating them as “essential”, “useful but not essential”, or “not necessary”.

- **Relevance to:**
  - Construct measured,
  - Target population (orchestra musicians),
  - Type of instrument used (evaluative),
  - Comprehensiveness of the items.

- **Content Validity Ratios (CVR)** calculated to assess agreement among experts, value between -1 and +1 (Lawshe, 1975).
Face & Content Validity Results

- **Respondent burden:** 10 minutes to complete.

- **Content Validity Ratios (CVR):** The items “relations with people”, “sleep”, and “playing your instrument as well as you would like” did not reach the minimum agreement of at least half of the experts.

- **Changes made:** to the instrument to improve wording and clarity.
Phase 2 – Psychometric Evaluation – 14 items

• Recruitment and data collection.

• Construct validity.

• Internal consistency.

• Test-retest reliability.

• Statistical analysis.
Participants’ Characteristics

• **N=183** professional orchestra musicians.
  - Royal Scottish National Orchestra (RSNO).
  - BBC Scottish Symphony Orchestra (BBC SSO).
  - Scottish Chamber Orchestra (SCO).

• **Response rate = 55%**, i.e. 101 questionnaires.

• **Orchestra playing**: 23.5± 11.1 (mean ± SD) years.

• **PRMD prevalence rates**:
  - Lifetime: 77.2%,
  - Point prevalence: 36.6% (n=37).

• **Missing scores**: <3%, very low.
Construct Validity
(de Vet et al., 2011; Field, 2011; De Vellis, 2012)

• Determine **dimensionality** and internal structure of an instrument (set of items), i.e. how many constructs/dimensions underlie a set of items.

• Reduce the size of the instrument by deleting items that do not contribute to a construct.

• **Terminology:** constructs, dimensions, clusters of variables, components, factors.
Exploratory Factor Analysis (EFA) – 14 items
(de Vet et al., 2011; Field, 2011; De Vellis, 2012)

Steps involved:
1. Inter-item correlation matrix.
2. Factor extraction: number of factors retained.
4. Item reduction: optimising the dimensionality.
5. Iterative process: EFA re-run after each item deletion.
EFA = Principal Axis Factoring

- N=37 subjects who reported point prevalence.
- Principal Axis Factoring (PAF), SPSS.
- 14 items measured by VAS and NRS.
- Cut-off for significance of factor loading: 0.4.
- Iterative process.

Guideline sample size:
Subject-to-item ratio of 5:1 = 70
<table>
<thead>
<tr>
<th><strong>MPIIQM: 14 initial items</strong></th>
<th><strong>Source</strong></th>
<th><strong>Deletion</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Duration of pain</strong></td>
<td>ÖMPSQ / ÖMSQ</td>
<td>1 (&lt;0.4)</td>
</tr>
<tr>
<td><strong>Frequency of pain</strong></td>
<td>ÖMPSQ / ÖMSQ</td>
<td>3 (CL)</td>
</tr>
<tr>
<td><strong>Worst pain</strong></td>
<td>BPI</td>
<td></td>
</tr>
<tr>
<td><strong>Least pain</strong></td>
<td>BPI</td>
<td></td>
</tr>
<tr>
<td><strong>Average pain</strong></td>
<td>BPI</td>
<td></td>
</tr>
<tr>
<td><strong>Pain right now</strong></td>
<td>BPI</td>
<td></td>
</tr>
<tr>
<td><strong>Mood</strong></td>
<td>BPI</td>
<td></td>
</tr>
<tr>
<td><strong>Relations with other people</strong></td>
<td>BPI</td>
<td>5 (test-retest)</td>
</tr>
<tr>
<td><strong>Sleep</strong></td>
<td>BPI</td>
<td>4 (low CVR)</td>
</tr>
<tr>
<td><strong>Enjoyment of life</strong></td>
<td>BPI</td>
<td></td>
</tr>
<tr>
<td><strong>Using your usual technique</strong></td>
<td>DASH</td>
<td></td>
</tr>
<tr>
<td><strong>Playing because of symptoms</strong></td>
<td>DASH</td>
<td></td>
</tr>
<tr>
<td><strong>Playing as well as you would like</strong></td>
<td>DASH</td>
<td></td>
</tr>
<tr>
<td><strong>Spending your usual amount of time playing</strong></td>
<td>DASH</td>
<td>2 (&lt;0.4)</td>
</tr>
</tbody>
</table>
**MPIIQM:** factor loadings for 9-item solution explaining 71.32% of the variance

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor 1 Pain intensity</th>
<th>Factor 2 Pain interference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worst pain</td>
<td>0.830</td>
<td></td>
</tr>
<tr>
<td>Least pain</td>
<td>0.814</td>
<td></td>
</tr>
<tr>
<td>Average pain</td>
<td>0.979</td>
<td></td>
</tr>
<tr>
<td>Pain right now</td>
<td>0.783</td>
<td></td>
</tr>
<tr>
<td>Mood</td>
<td></td>
<td>0.848</td>
</tr>
<tr>
<td>Enjoyment of life</td>
<td></td>
<td>0.818</td>
</tr>
<tr>
<td>Using usual technique</td>
<td></td>
<td>0.797</td>
</tr>
<tr>
<td>Playing because of symptoms</td>
<td></td>
<td>0.695</td>
</tr>
<tr>
<td>Playing as well as you would like</td>
<td></td>
<td>0.895</td>
</tr>
</tbody>
</table>
**Internal Consistency: 9-item solution**

- Homogeneity of items within a scale or subscale, i.e. items are measuring the same construct.

  **Guideline sample size:**
  Subject-to-item ratio of 5:1 = 70

- **Cronbach’s alpha:**
  - Overall scale: 0.88,
  - Factor 1 - pain intensity subscale: 0.91,
  - Factor 2 – pain interference subscale: 0.91.
## Test-retest Reliability

<table>
<thead>
<tr>
<th>MPIIQM: Test-retest reliability 10-item solution</th>
<th>ICC</th>
<th>95% CI</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worst pain</td>
<td>0.82</td>
<td>0.59-0.93</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Least pain</td>
<td>0.80</td>
<td>0.54-0.92</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Average pain</td>
<td>0.78</td>
<td>0.52-0.91</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Pain right now</td>
<td>0.82</td>
<td>0.60-0.93</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mood</td>
<td>0.69</td>
<td>0.36-0.87</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Relations with people</td>
<td>0.13</td>
<td>-0.36-0.55</td>
<td>0.294</td>
</tr>
<tr>
<td>Enjoyment of life</td>
<td>0.76</td>
<td>0.47-0.90</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Using usual technique</td>
<td>0.64</td>
<td>0.28-0.85</td>
<td>0.001</td>
</tr>
<tr>
<td>Playing because of symptoms</td>
<td>0.56</td>
<td>0.14-0.80</td>
<td>0.007</td>
</tr>
<tr>
<td>Playing as well as you would like</td>
<td>0.67</td>
<td>0.32-0.86</td>
<td>0.001</td>
</tr>
</tbody>
</table>

**Guideline sample size:** 50
Limitations

• Sample size for EFA, internal consistency, and test-retest reliability was smaller than desired.

• Other aspects of psychometrics could be tested in future studies:
  – Criterion validity, convergent validity,
  – Responsiveness, interpretability.
MPIIQM - Conclusion and Recommendations

- Guidelines from COSMIN checklist followed.
- Short completion time.
- Face and content validity.
- Good construct validity with a strong two-factor structure.
- Compliant with the WHO-ICF biopsychosocial themes.
- Reliable with potential evaluative properties.
Original article

Development and psychometric evaluation of the Musculoskeletal Pain Intensity and Interference Questionnaire for professional orchestra Musicians

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ABSTRACT

Many epidemiological surveys on playing-related musculoskeletal disorders (PRMDs) have been conducted on professional musicians, but none have evaluated or confirmed the psychometric properties of the self-report instruments that were used. The aim of the present study was to develop and validate a self-report instrument for professional orchestra musicians to measure musculoskeletal (MSK) pain and pain interference in terms of function and psychosocial constructs. 183 professional orchestra musicians in Scotland were eligible to participate in the study, of which 101 (55% response rate) took part. Development of the Musculoskeletal Pain Intensity and Interference Questionnaire for Musicians (MPIQM) involved the selection and modification of the most appropriate instruments measuring MSK pain, followed by psychometric evaluation of the new instrument. Face and content validity were ascertained by expert panels. 37 participants completed the questionnaire. The percentage of missing scores was very low (2.7%). Exploratory factor analysis revealed that the MPIQM had a strong and stable two-factor structure, with nine retained items explaining 71.3% of the variance in the data set. “Pain intensity” and “pain interference” were the two emerging factors. High internal consistency was achieved for each subscale (Cronbach’s alpha = 0.91). Substantial test–retest reliability for the pain intensity items (range 0.78–0.82), and moderate to substantial test–retest reliability for the pain interference items (range 0.56–0.76) were obtained. The MPIQM is a valid and reliable self-report instrument for the measurement and evaluation of MSK pain and pain interference in a population of professional orchestra musicians.

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