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

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MPPA
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Systematic Reviews on Prevalence
(Zaza, 1998; Wu, 2007; Silva et al., 2015)

• 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.

Measurement in PAM

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

Notes:
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).

ICF Model – 3 levels

(Adapted from WHO, 2002)

- Body functions & structures
- Activity limitations
- Participation restrictions
- Environmental factors
- Personal factors

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.

COSMIN Checklist

(Tersce 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>Open-ended</td>
<td>Ackermann &amp; Driscoll (2010)</td>
</tr>
<tr>
<td>Prevalence</td>
<td>Binary</td>
<td>NMQ-E</td>
<td>Dawson et al. (2009)</td>
</tr>
<tr>
<td>Pain location</td>
<td>Body chart</td>
<td>BPI</td>
<td>Linton &amp; Borromis (1997)</td>
</tr>
<tr>
<td>Pain frequency &amp;</td>
<td>VAS 10cm</td>
<td>OMSQ</td>
<td>Gabel et al. (2011)</td>
</tr>
<tr>
<td>duration (2)</td>
<td></td>
<td>OMSQ</td>
<td></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; Bilanger (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.

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± 1.1 (mean ± SD) years.
- PRMD prevalence rates:
  - Lifetime: 77.2%, 1-year: 45.5%,
  - Point prevalence: 36.0% (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.

### MPIIQM: 14 initial items Source Deletion

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Source</th>
<th>Deletion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition of pain</td>
<td>ÖMPSQ</td>
<td>1 (not-used)</td>
</tr>
<tr>
<td>Frequency of pain</td>
<td>ÖMPSQ</td>
<td>3 (CL)</td>
</tr>
<tr>
<td>Worst pain</td>
<td>BPI</td>
<td></td>
</tr>
<tr>
<td>Least pain</td>
<td>BPI</td>
<td></td>
</tr>
<tr>
<td>Average pain</td>
<td>BPI</td>
<td></td>
</tr>
<tr>
<td>Pain right now</td>
<td>BPI</td>
<td></td>
</tr>
<tr>
<td>Mood</td>
<td>BPI</td>
<td></td>
</tr>
<tr>
<td>Relations with other people</td>
<td>BPI</td>
<td>5 (not-used)</td>
</tr>
<tr>
<td>Sleep</td>
<td>BPI</td>
<td>4 (low CVR)</td>
</tr>
<tr>
<td>Enjoyment of life</td>
<td>BPI</td>
<td></td>
</tr>
<tr>
<td>Using your usual technique</td>
<td>DASH</td>
<td></td>
</tr>
<tr>
<td>Playing because of symptoms</td>
<td>DASH</td>
<td></td>
</tr>
<tr>
<td>Playing as well as you would like</td>
<td>DASH</td>
<td></td>
</tr>
<tr>
<td>Spending your usual amount of time playing</td>
<td>DASH</td>
<td>2 (not-used)</td>
</tr>
</tbody>
</table>

### MPIIQM: factor loadings for 9-item solution explaining 71.32% of the variance

<table>
<thead>
<tr>
<th>Item Description</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>0.848</td>
<td></td>
</tr>
<tr>
<td>Enjoyment of life</td>
<td>0.818</td>
<td></td>
</tr>
<tr>
<td>Using usual technique</td>
<td>0.797</td>
<td></td>
</tr>
<tr>
<td>Playing because of symptoms</td>
<td>0.695</td>
<td></td>
</tr>
<tr>
<td>Playing as well as you would like</td>
<td>0.895</td>
<td></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.

- 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</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>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 - 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.
Prevalence Rates?

Pain-related musculoskeletal problems are defined as “pain, weakness, numbness, tingling, or other symptoms that interfere with your ability to play your instrument at the level to which you are accustomed.” This definition does not include mild transient aches and pains.

9. Have you ever had pain problems that have interfered with your ability to play your instrument at the level to which you are accustomed? Yes No

10. Have you had pain problems that have interfered with your ability to play your instrument at the level to which you are accustomed during the last 12 months? Yes No

11. Have you had pain problems that have interfered with your ability to play your instrument at the level to which you are accustomed during the last month (4 weeks)? Yes No

12. Currently (in the past 7 days), do you have pain problems that interfere with your ability to play your instrument at the level to which you are accustomed? Yes No