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

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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)

Instrument	Reliability Thoroughness	Reliability Results	Validity Thoroughness	Validity Results
MSK Load Quest. for Musicians	0	0	0	0
MPQM	*	**	*	*
CPGQ	*	**	*	**
NMQ	*	*	*	*
NMQ-E	*	**	0	0
LF-MPQ & SF-MPQ	**	**	**	**
BPI	**	**	**	**

0	No reported evidence of reliability or validity	
	Thoroughness of reliability & validity	*Results of reliability & validity*
*	Basic information only	Weak
**	Several types of tests, several studies and authors	Adequate
***	All major forms of tests, numerous studies	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
(WHO, 2002)
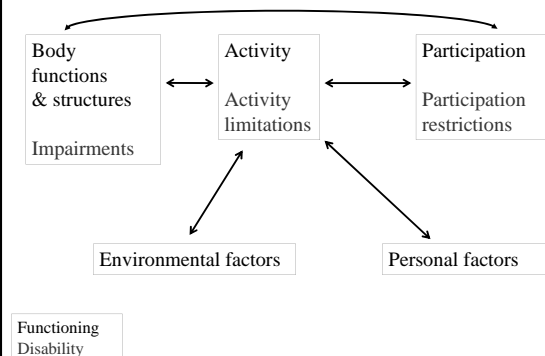
Operational Definition of PRMDs
(Zaza et al., 1998)

- *"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
(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

Structure / items	Question type	Source	Reference
Demographics	Binary Open-ended	MLPHQM	Ackermann & Driscoll (2010) Berque & Gray (2002)
Prevalence	Binary	NMQ-E	Dawson et al. (2009) Zaza & Farewell (1997)
Pain location	Body chart	BPI	Cleeland & Ryan (1994)
Pain frequency & duration (2)	VAS 10cm	ÖMPSQ ÖMSQ	Linton & Boersma (2003) Gabel et al. (2011)
Pain intensity (4)	NRS: 0-10	BPI	Cleeland & Ryan (1994)
Affective interference (4)	NRS: 0-10	BPI	Cleeland & Ryan (1994)
Activity interference (4)	NRS: 0-10	DASH	Hudak et al. (1996) Lamontagne & Bélanger (2012)

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%, 1-year: 45.5%,
  – 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)
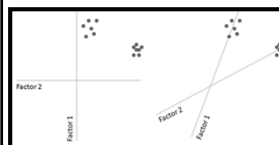
Steps involved:

1. Inter-item correlation matrix.
2. Factor extraction: number of factors retained.
3. Factor rotation: enhance interpretation of factors.
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

MPIIQM: 14 initial items	Source	Deletion
Duration of pain	ÖMPSQ / ÖMSQ	1 (<0.4)
Frequency of pain	ÖMPSQ / ÖMSQ	3 (CL)
Worst pain	BPI	
Least pain	BPI	
Average pain	BPI	
Pain right now	BPI	
Mood	BPI	
Relations with other people	BPI	5 (test-retest)
Sleep	BPI	4 (low CVR)
Enjoyment of life	BPI	
Using your usual technique	DASH	
Playing because of symptoms	DASH	
Playing as well as you would like	DASH	
Spending your usual amount of time playing	DASH	2 (<0.4)

MPIIQM: factor loadings for 9-item solution explaining 71.32% of the variance	Factor 1 Pain intensity	Factor 2 Pain interference
Worst pain	0.830	
Least pain	0.814	
Average pain	0.979	
Pain right now	0.783	
Mood		0.848
Enjoyment of life		0.818
Using usual technique		0.797
Playing because of symptoms		0.695
Playing as well as you would like		0.895

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

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

Guideline sample size: 50

Measurement property tested	MPIIQM	MPQM
Target population	Permanent	Freelance
Sample for psychometric testing	N=37	N=31
Reference to WHO - ICF	Yes	No
Reference to instrument purpose, i.e. evaluative	Yes	No
Prevalence items	Yes	No
Face validity	Yes	Assumed
Content validity	Yes	No
Pilot testing	Yes	No
Missing scores	Yes	No
Construct validity	Yes – EFA 2-factor structure 9 items	Yes – PCA 3-componenet structure – 10 items
Criterion validity	No	Yes – but with CPGQ
Internal consistency	Yes	Yes
Test-retest reliability	Yes	No

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.

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Prevalence Rates?

Playing-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