Original Article

Psychometric Properties of a Modified version of the Roland-Morris Disability Questionnaire (M-RMDQ)

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Abstract

Background: Chronic pain can be associated with limitations in patient function. Assessment of pain-related limitations is one of the important outcome domains that should be considered when designing chronic pain clinical trials. Although a validated instrument for the assessment of pain-related disability in Iranian chronic low back pain (CLBP) patients exists, to date there is no psychometrically sound instrument to measure pain-related physical disability amongst Iranian chronic pain patients suffering from pain in other parts of their bodies.

Methods: Six hundred chronic pain patients completed the Modified version of the Roland-Morris disability questionnaire (M-RMDQ) in addition to questionnaires on demographic variables, pain intensity and depression.

Results: Internal consistency, test-retest reliability, and concurrent and predictive validity were calculated for the M-RMDQ. Internal consistency of the M-RMDQ items was acceptable (Cronbach's alpha=0.88). Test-retest reliability with a mean 36-day interval between assessments in 76 chronic pain patients was high (ICC=0.90). Concurrent validity was confirmed via significant correlations between the scores of M-RMDQ, depression and pain intensity. Predictive validity of the M-RMDQ was confirmed as it successfully differentiated pain clinic chronic pain patients from the non-pain clinic chronic pain population.

Conclusion: The M-RMDQ has adequate reliability and validity and can be used as a sound measure of physical disability associated with chronic pain among the Iranian population.

Key words: chronic pain, physical disability, reliability, validity

Introduction

Chronic pain is a significant problem for a substantial proportion of the population in western societies[1] as well as developing countries.[2] Chronic pain can be associated with varying degrees of limitations in patient function.[3–5] For example, Blyth el al.[4] in a large-scale survey in Australia have found that 11% of males and 13.5% of females had chronic pain that caused interference in daily activities. Therefore, one of the aims of pain treatment is to improve or restore patients' participations in normal daily activities. The assessment of physical functioning of chronic pain patients has been an important issue for several years[6] and recently emphasized as one of the six core outcome domains that should be considered when designing chronic pain clinical trials.[7–8] In order to assess the patient's physical functioning; clinicians and researchers require valid and reliable measures. One of the most widely used measures of physical functioning among chronic pain patients is the Roland-Morris disability questionnaire (RMDQ).[6] With 24 items, the RMDQ covers a range of aspects of daily living and asks patients to answer each item with reference to their back pain. The validity, reliability and sensitivity of the RMDQ have been established with chronic low back pain (CLBP) patients[6] as well as with heterogeneous chronic pain patients.[9] To date, only one study examined the reliability and validity of a Persian (Iranian) translated version of the RMDQ.[10] The results of that study supported the psychometric properties of the RMDQ in 100 Iranian CLBP patients. More specifically, in that study the internal reliability (Cronbach alpha) was 0.83 and the test-retest coefficient (with one day interval between assessment amongst 31 patients) was 0.83, $P<0.01$. Furthermore, the construct and concurrent validity of the RMDQ were confirmed through significant correlations between RMDQ scores and the physical functioning subscale scores of the SF-36[11] ($r=-0.62$, $P<0.001$), as well as pain intensity scores measured by the visual analogue scale ($r=0.36$, $P<0.001$).

Although the above findings are important, the nature of the study sample (i.e., CLBP) and the wording of the items of the questionnaire used limit the generalizability of the Mousavi et al.[10] findings to other chronic pain patient populations (i.e., people who suffer from pain in body parts other than the lower back). More specifically, each of the 24 items of the questionnaire that was used in the Mousavi et al.[10] study asks patients to answer questions taking their back pain into account (i.e., I stay at home most of the time because of my back pain). Thus, some modifications in the wording of the items are necessary before this instrument can be used with Iranian chronic pain patients who suffer from pain in other parts of their bodies. Furthermore, Mousavi et al.[10] have examined the reliability of their questionnaire with a one day interval between two assessments. As has been discussed by Anastasi, "if the interval between two assessments is fairly short, the test takers may recall many of their former responses. In other words, the same pattern of yes and no responses is likely to recur through sheer memory".[12] Therefore, the test-retest reliability of the RMDQ should be examined across a more extended time interval.

We designed the present study to replicate and expand the psychometric properties of a slightly modified version of the RMDQ in a larger heterogeneous sample of chronic pain patients in Iran.

Materials and Methods

Participants

A total of 600 people with chronic pain participated in this study. Of these, 431 were chronic pain patients who referred to four medical centers in Tehran for possible treatments. Participants were accepted into the study if they met the inclusion criteria for the study (i.e., having experienced pain for more than 6 months

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at the time of the study, able to read and speak Persian, aged 18 years and over, and willing to participate in a research study). The remaining 169 participants were identified by a survey of 1175 full time employees of a company that participated in a survey aimed at identifying people with chronic persistent or recurrent pain. All 169 of this group were working.

Modified version of the RMDQ (M-RMDQ)

Current guidelines[13,14] for cross-cultural adaptation of measures generally recommend a multi-step process, including forward and back translation and steps to ensure the conceptual equivalence of the measures. In our translation and preparation of the RMDQ[6] we took the following steps: 1) independent translation of the original version of the RMDQ from English into Persian by two bilingual mental health practitioners. Any differences were resolved by agreement between both translators. 2) Back translation from Persian into English by two separate mental health practitioners fluent in Persian and English. Again, differences were resolved by agreement between both translators. 3) Revision of the final translation by the author. 4) Pilot study on a sample of 30 Persian chronic pain patients to examine if the revised version from step 3 was acceptable and understandable.

As the present study included a heterogeneous group of chronic pain patients the phrase of "because of my back" was replaced by the phrase "because of my pain" for all items except item 13. For item 13, "My back is painful almost all the time" was replaced by "I am in pain almost all the time". Thus, subjects were asked to relate the items to their pain, regardless of its location. A precedent for this was noted in previously published papers in Western cultures.[9,15,16]

As with the original version of the RMDQ,[6] the Modified RMDQ (M-RMDQ) consists of 24 items. The items are related to the day the instrument is completed and each item is answered as either 'yes' or 'no'. The scoring system of the measure is simple; each endorsed item receives one score and the total scores can range from 0 (no disability) to 24 (severe disability). In general, the questionnaire can be completed in about five minutes, without any assistance.

Procedure

In this study, reliability of the P-RMDQ was determined by calculating the Cronbach alpha and test-retest reliability.[12,17] The Cronbach alpha measures the internal consistency of a scale and may range from 0 to 1. Cronbach alphas that are 0.70 or greater are viewed as acceptable.[17] Test-retest reliability assesses the stability of a measure over time, by administering the same scale to the same participants at two time points.[12,17]

In order to establish the concurrent validity of the M-RMDQ, in addition to the M-RMDQ, patients were asked to complete two other psychometric measures [i.e., the Beck Depression Inventory[18] (BDI) and a pain Numerical Rating Scale[19] (NRS)]. Concurrent validity is a measure of how well a particular test correlates with a previously validated measure.[12] In the present study, significant and positive correlations were hypothesised between scores of the M-RMDQ with scores of the BDI and NRS. Furthermore, in the present study the predictive validity of the M-RMDQ was established by having compared two groups of patients (431 chronic pain patients who attended the four pain clinics and 169 identified chronic pain patients who were working at the time of the study) on disability, distress and pain. A number of earlier studies[20–22] have demonstrated that pain clinic patients differ significantly from people with chronic pain but who do not attend pain clinics in relation to functional impairment, pain intensity, and emotional and psychological distress. For example, in the Turk study,[22] pain clinic patients were found to complain of more constant pain, report higher levels of functional impairment, and greater emotional and psychosocial distress than people living with chronic pain in the community. Based on the present literature, it was hypothesized that the pain clinic sample would be more physically disabled, more distressed and suffer from more severe pain than a non-clinic sample. Using a series of independent sample *t*-tests, the sample of 431 pain clinic patients was compared on some study variables to the sample of 169 people with chronic pain who were working (and not attending a pain clinic).

Finally, the relationships between physical disability with pain sites, gender, age and educational attainment were investigated, using a series of analysis of variance (ANOVA) for pain sites and analysis of covariance (ANCOVA) for age, gender and educational attainments.

Data on demographic (i.e., age, gender, education, and marital status) and pain-related medical history (i.e., pain duration, pain site and health care utilization due to pain) were also collected from the patients.

BDI and NRS psychometric measures

Usual pain intensity over the past week. This was measured, using a Numerical Rating Scale (NRS). The NRS required patients to rate their usual pain intensity on a 0 to 10 (11-point) scale where 0 indicates "no pain" and 10 means, "pain as bad as it could be". The validity of the NRS and its sensitivity to treatment effects have been well documented.[19]

The revised version of the BDI[18] was used to measure mood. The inventory consists of 21 categories of symptoms. Obtained by summing scores on each category, the total score may range from 0 to 63 with higher scores indicating higher levels of depression. The BDI is a widely used self-report measure of depressive symptoms in clinical situations. The validity and reliability of the BDI have been confirmed among an Iranian sample.[23]

Results

Sample characteristics and descriptive findings

The participants were predominantly male (57%), married (88.8%), and most (61%) had at least a high school diploma (i.e., 12 years formal education). The mean age of the sample was 41.9 (*SD*=12.7) years and the mean time since pain onset was 52.60 (*SD*=63.40) months. Almost 41% (247) of the participants reported that pain affected their limbs. The other pain sites were, in order of frequency: back (32%); abdomen and/or pelvic (8.2%); head, face and mouth (5.7%); shoulder (5.2%); neck (4.4); and chest (3.2%). Participants rated their usual pain intensity over the past week on an 11-point scale (0 – 10) as 5.19 (*SD*=2.1). Of the total sample, 455 (76%) reported taking medication for pain relief at the time of the study. The mean duration of medication usage was 33.1 (*SD*=53.2) months (median=12 months). Of the total sample, 148 (25%) reported at least one hospitalization due to pain and 88 (14.7%) reported at least one pain-related surgery (mean number of pain related surgeries was 1.9 (*SD*=2.12).

Table 1 summarizes mean (*SD*), minimum and maximum, and 95% confidence intervals of age, duration of pain, depression,

Table 1. Descriptive findings of the study.

Variable	Mean (SD)	Minimum	Maximum	95%CI
Age (Year)	41.9 (12.7)	18	86	40.9–42.9
Pain duration (Month)	52.6 (63.4)	6	370	50.2–55.2
Depression (BDI)	15.4 (9.4)	0	53	14.7–16.1
Physical disability (M-RMDQ)	9.7 (5.8)	0	24	8.8–10.6
Usual pain intensity (NRS)	5.2 (2.1)	0	10	5.1–5.3

Table 2. Pearson correlation coefficient among study variables.

Variable	Physical disability	Depression	Usual pain intensity
Physical disability (M-RMDQ)	---	---	---
Depression (BDI)	0.46*	---	---
Usual pain intensity (NRS)	0.37*	0.27*	---

*P< 0.001

Table 3. Comparison between clinic and non-clinic samples.

Comparison across groups					
Variable	Clinic sample (n=431)	Community sample (n=169)	t-value	P-value	95% confidence intervals
Age (Year)	42.0 (13.9)	41.6 (8.6)	0.38	0.69	-1.80–2.69
Pain duration (Month)	40.8 (54.1)	84.6 (75.2)	-7.78	0.0001	-54.80 – -32.71
Depression (BDI)	16.9 (9.4)	11.5 (8.2)	6.51	0.0001	3.75–7.00
Physical disability (M-RMDQ)	10.7(5.7)	6.9 (4.9)	7.43	0.0001	2.76–4.75
Usual pain intensity (NRS)	5.4 (2.1)	4.6 (2.1)	3.85	0.0001	0.35–1.01

physical disability, and usual pain intensity over the past week.

Reliability

In this study the reliability of the M-RMDQ was established in two ways:

Internal consistency

Cronbach's alpha coefficient as a measure of internal consistency was calculated as 0.88. This value is high and indicates the instrument has a good internal consistency.[17]

Test-retest reliability

Test-retest reliability was assessed on a different sample of a heterogenous group (n=76) of chronic pain patients referred to three public medical centers in Tehran for treatment. The test-retest period was from the referral day (Time 1: came to the center to make an appointment) to the day of first session of treatment (Time 2: before starting any possible treatment). This period ranged from 14 to 70 days (mean 35 days, *SD*=21). During this time all patients received their usual treatments (mainly medications). The mean present pain level (0 – 10 scale) for Time 1 and Time 2 were 5.74 (*SD*=2.77) and 5.45 (*SD*=2.70), respectively. There was no significant change in pain intensity level from Time 1 to Time 2 (t =-0.32, df=75, P=0.75). The mean scores for two consecutive testing occasions of physical disability were 9.89 (*SD*=6.20) and 10.03 (*SD*=6.74), respectively (no significant changes at the level of 0.05). The intraclass correlation between Time 1 and Time 2 assessment of physical disability was 0.90 (95% CI: 0.84 – 0.94). Intraclass correlation values above 0.74 indicate good reliability.[17]

Validity

Concurrent validity

Although there is no 'gold standard' measure of physical disability against which the M-RMDQ should be compared, based on the present literature, it would be expected that physical disability scores would correlate moderately (but positively) with measures of pain intensity[24–26] and depression.[27,28] Table 2 summarizes the results of these correlations. As expected, correlational analyses showed positive correlations between M-RMDQ, depression and average pain intensity over the past week. Patients scoring higher on M-RMDQ reported higher levels of pain and depression. These findings support concurrent validity of the M-RMDQ.[12]

Predictive validity

As has been mentioned, in order to establish predictive validity of the M-RMDQ the sample of 431 pain clinic patients was compared on some study variables to the sample of 169 people with chronic pain who were working (and not attending a pain clinic), using a series of independent sample t tests. The assumption of equal variance between these two groups was examined by Levene's test for equality of variance. In order to control for the risk of type I errors, a Bonferroni adjustment was used (0.05/5=0.01). Only t values at or below the 0.01 alpha level were considered significant.

Table 3 summarizes the results of t-tests comparing the pain clinic and non-clinical (working) samples. As expected, the clinic sample reported higher levels of physical disability than the non-clinical (working) sample. Furthermore, the pain clinic sample reported higher levels of pain intensity and distress compared to the non-clinical group. These results support the predictive validity of the M-RMDQ. Interestingly, the pain clinic sample reported a shorter duration of pain compared to the non-clinical sample.

Relationships between physical disability with pain site, age, gender, and educational attainment

Pain site

The scores of disability on seven different pain sites were compared, using a series of ANOVAs. A significant effect emerged for pain site [F (6,586)=8.34, P=0.0001)]. Post hoc comparison [Tukey's honestly significant difference (HSD)] showed that patients with pain in their backs and lower backs were more physically disabled on the P-RMDQ compared to patients who reported pain in other pain sites, with the exception of abdomen and/or pelvic (Table 4).

Gender

Males and females with chronic pain (total sample, n=600) were compared on physical disability using a univariate analysis of covariance (ANCOVA) model. In this model, pain site was entered as a covariate. The results are presented in Table 4. As can be seen, there were significant gender-related differences in relation

Table 4. Physical disability by pain site, gender, age, and education.

Variable	Mean	SD	N	Test of significance
Pain site				
Head	8.4	5.8	34	
Neck	6.1	3.7	26	
Shoulder	7.5	4.9	31	F=8.34, P<0.001
Chest	7.5	5.8	20	
Abdomen and/or pelvic	9.8	6.7	49	
Limbs	9.1	5.3	247	
Back and lower back	11.8	5.8	187	
Gender				
Female	10.9	5.6	258	F=11.23, P<0.001
Male	8.8	5.8	342	
Age				
<30	8.9	5.6	95	
39–30	9.7	5.8	169	F=3.8, P=0.005
49–40	9.2	6.1	180	
59–50	9.8	5.7	100	
60 or more	12.5	5.1	54	
Education				
Less than 10 years of education	11.7	5.2	191	F=18.66, P<0.001
Between 10 to 12 years of education	9.2	5.7	244	
More than 12 years of education	8.1	6.0	165	

to physical disability; compared to males, females scored significantly higher on the physical disability measure [F (1,593)=11.23, P=0.001].

Age

The sample was grouped into five age categories (<30, 30–39, 40–49, 50–59, >60 years). The severity of disability across each of these five age-related groups was compared, using ANCOVAs (covariate pain site). As Table 4 shows, a significant effect emerged for age [F (4,593)=3.88, P=0.005]. *Post hoc* comparison (Tukey's HSD) showed that the oldest group (60 years and older) reported significantly more disability than the three youngest age groups (<30, 30–39, and 40–49 years). However, there was no significant difference in severity of disability between the oldest group (i.e., 60 years and over) and 50–59 years group.

Education

The sample was grouped into three levels of educational achievement. The severity of disability scores across these three groups was compared using ANCOVAs (covariate pain site). As Table 4 shows, a significant effect emerged for education [F (2,596)=18.66, P=0.0001]. *Post hoc* comparison (Tukey HSD) indicated that patients with the lowest level of education (i.e., less than 10 years of formal education) were significantly more physically disabled than the other two groups (i.e., those with 10 – 12 years of education or those with more than 12 years of education).

Discussion

The present research supports the psychometric properties of the M-RMDQ in an Iranian sample of heterogenous chronic pain patients. The present research is consistent with previous findings from Western countries[6,9,29,30] as well as corroborating the results of a previous study with 100 Iranian chronic low back patients.[10] This study extends the results of Mousavi et al.'s study[10] on patients with chronic low back pain to chronic pain patients with pain in parts of their bodies other than the lower back. Interestingly, the mean physical disability score in the Mousavi et al. study was 9.47 (*SD*=4.75) while in the present study the mean physical disability score for the total (heterogeneous) sample was 9.70 (*SD*=5.81), but for those with back and low back pain (n=187) the mean was 11.8 (*SD*=5.83). The reason for this difference is unclear but it may relate to a referral bias.

There were significant differences on the M-RMDQ according to pain site, with people with back pain scoring significantly higher than the other pain site groups. This difference is to be expected as it probably reflects the selection of items in the original scale to assess activities those with back pain might find difficult.[6] For example, there are no items specifically assessing upper limb use. Interestingly, this finding is consistent with the results of Chibnall and Tait's study[31] in which low back pain patients have reported slightly more disability, as measured by the PDI,[32] than patients with upper extremity pain (i.e., pain in shoulder, arm, and hand).

When controlling for the effects of pain site, the results of the present study suggest significant differences in physical disability according to gender, age, and education. Women had significantly higher levels of physical disability compared to men. This finding agrees with a prior study[33] in which women with osteoarthritic pain scored higher on a physical disability measure (i.e., Arthritis Impact Measurement Scales[34,35]) than men with osteoarthritic pain. In the present study, people with lower levels of educational achievement have reported more severe physical disability than those with higher levels of educational achievement. This finding is consistent with a previous study[36] on a sample of 299 chronic pain patients in the USA. In Roth and Geisser's[36] study, lower levels of education were significantly related to the report of greater pain related disability as measured by the Physical Disability Index (PDI).[32]

The present research establishes the psychometric properties of a Persian-language version of the Physical Disability Questionnaire in a sample of heterogeneous chronic pain patients in Iran. However, some limitations of the study should be acknowledged. These include the use of some self-report measures (i.e., depression and pain intensity) to provide data for examining the validity of the M-RMDQ, as opposed to use of objective measures of physical activity, such as observed speed of walking, stairs climbed in a set time or lifting tolerance. In addition, because the validity of the M-RMDQ was examined by comparing it with other self-report measures, any relationships found may be partially due to shared method variance. Nevertheless, the finding that the non-clinical (working) sample used in this study was less disabled on the M-RMDQ than the pain clinic sample is consistent with previous research that pain clinic attendees are more disabled by their pain.[20] The finding that the clinic sample in the present study had

experienced their pain for a significantly shorter period than the non-clinic (working) sample is interesting and may suggest that the working sample had largely accepted their pain and/or the lack of effective treatments and were getting on with their lives (i.e., Blyth et al.[37]).

More research is needed to compare the results of the M-RMDQ with objective measures of functioning. Because people with chronic pain differ across treatment sites,[38] the present results cannot be assumed to necessarily generalize to other chronic pain populations. Another limitation of this study is the relatively low number of participants with pain in sites such as the head, neck, shoulder and chest. Replication of current findings in other samples of chronic pain patients would help clarify their generalizability and consistency. However, it is likely that there will still be differences in mean scores between groups with different pain sites. Thus, if the M-RMDQ is to be used with Iranian chronic pain patients the scores obtained should be compared to appropriate comparison samples, especially according to pain site, as described by Nicholas et al.[39] The sample in the present study was not selected at random, so these patients may not be representative of all Iranian chronic pain patients. Finally, further research is needed to determine the factorial structure of the M-RMDQ, using more sophisticated methods such as exploratory and confirmatory factor analysis.

The present study suggests that the M-RMDQ has acceptable psychometric properties and can be used among Iranian chronic pain patients, regardless of pain site, when a measure of physical disability is needed.

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