Analysis of patient and proxy ratings on the Dysexecutive Questionnaire: an application of Rasch analysis

R C K Chan,[1,2] R K Bode[3]

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[1] Neuropsychology and Applied Cognitive Neuroscience Laboratory, Institute of Psychology, Chinese Academy of Sciences, Beijing, China; [2] Key Laboratory of Mental Health, Institute of Psychology, Chinese Academy of Sciences, Beijing, China; [3] Centre for Rehabilitation Outcomes Research, Rehabilitation Institute of Chicago, Chicago, Illinois, USA

Correspondence to: Professor R Chan, Institute of Psychology, Chinese Academy of Sciences, Beijing 100101, China; rckchan@psych.ac.cn

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ABSTRACT

Background: We provide an alternate method of analysing self-report and proxy-report data on subjective complaints of dysexecutive symptoms among a group of patients with traumatic brain injury.

Objective: The purpose of this study was to examine differences in the ratings of patients and proxies on a measure of the dysexecutive syndrome and further explore the insight impairment problem in patients with traumatic brain injury.

Methods: Rasch analysis was conducted on the ratings of the Dysexecutive Questionnaire (DEX) by a sample of patients and their proxies.

Results: While the average scores based on patient and proxy ratings were approximately the same (mean patient raw score = 30.12 and mean proxy raw score = 31.32), differential item functioning was found in five DEX items. As a result, the relationship between measures obtained from patient and proxy ratings was only in the moderate range (intraclass correlation = 0.46).

Conclusions: Identification of differential item functioning in five of the 20 DEX items reflected the different perspectives of patients and their proxies in reporting the frequency of dysexecutive behaviour and suggests that these ratings are not interchangeable.

Awareness of cognitive deficits or insight impairment is commonly found in patients with traumatic brain injury (TBI) or postconcussion symptoms.[1–3] These patients usually demonstrate poor estimation of their cognitive deficits or functional capacities and significantly underreport corresponding cognitive, behavioural and emotional complaints.[2 4] Awareness deficit is one of the most crucial factors contributing to the poor overall rehabilitation outcome of this clinical group.[5]

The most commonly used method for clinicians to examine awareness deficits in patients with TBI is to contrast a patient's self-rating with a supposedly more objective rater.[6] Data from significant others is referred to as proxy data. To determine proxy effects, both patient and proxy responses are needed for patients who vary in the overall severity of their impairment (eg, the Dysexecutive Questionnaire (DEX)).[7]

However, conventional methods of studying these insight deficits using DEX and other similar scales are limited to computation of score differences between patient and proxy data. Although a comparison of the perspectives in a patient–proxy dyad is of interest in clinical practice, this method has a number of psychometric limitations (eg, treating ordinal data as if continuous data and simply adding all items to a total score). Moreover, patients and significant others may view the same item on a questionnaire differently and, as a result, may report the frequency of dysexecutive behaviour in everyday life very differently. This phenomenon is thought of as a type of measurement invariance or differential item functioning (DIF).[8] It is a crucial, but mostly neglected, issue in interpreting the results of insight deficits in clinical groups.

Given the crucial role and clinical feasibility of using questionnaires in quantifying the impact of cognitive deficits on everyday functioning and, particularly in the case of executive or insight deficits, in identifying difficulties not captured by formal ability tests, we explored the insight deficits in patients with TBI using the DEX with patients and their proxies.

The present study attempted to approach this issue from a statistical perspective and see whether state-of-the-art psychometrics, in addition to professional knowledge, can help us to better understand this phenomena. In particular, we examined: (1) the psychometric properties of the DEX, (2) DIF between patients and proxies and (3) the relationship of these two estimates.

PATIENTS AND METHODS

The sample consisted of 92 patients (66 men, 26 women) and 92 informants. Patients attending the outpatient specialty clinics of two main regional hospitals in Hong Kong were recruited for the present study. All had persistent complaints of postconcussive symptoms. Qualified medical officers made all of the diagnoses within the first 24 h of the injury. Mean age and education of the patients were 37.6 years (SD 9.62) and 9.39 years (SD 3.38), respectively. Eligible proxies were significant others of the patients who were 18 years of age or older, and had lived with the patients for at least the past year.

The DEX is a 20 item checklist that is rated on a five point frequency scale from "never" to "very often." It measures three broad factors (cognitive, behavioural and emotional) and asks individuals to rate the frequency of occurrence of certain dysexecutive characteristics (eg, abstract thinking, impulsivity, confabulation and planning problems). Parallel versions of the questionnaire were developed, one to be completed by the patient and one by a close friend or relative about the patient. Impressive psychometric properties of this

Table 1 Summary of Dysexecutive Questionnaire item measures

	Patient			Proxy			Difference
Item	Measure	Error	InfitMnSq	Measure	Error	InfitMnSq	Measure
(17) Knowing–doing dissociation	0.61	0.10	0.95	0.16	0.10	1.06	0.45
(12) Aggression	0.06	0.10	1.29	−0.31	0.09	1.16	0.37
(16) Inability to inhibit response	0.39	0.10	0.81	0.02	0.10	1.00	0.37
(9) Disinhibition	0.62	0.10	1.08	0.31	0.10	1.14	0.31
(3) Confabulation*	0.84	0.11	1.43	0.64	0.11	1.44	0.20
(2) Impulsivity	0.27	0.10	1.14	0.13	0.10	0.95	0.14
(13) Lack of concern	0.26	0.10	0.74	0.12	0.10	0.74	0.14
(14) Perseveration*	0.19	0.10	1.04	0.14	0.10	1.46	0.05
(8) Apathy and lack of drive	−0.28	0.09	0.81	−0.31	0.09	0.96	0.03
(10) Variable motivation	0.31	0.10	0.95	0.28	0.10	0.96	0.03
(11) Shallowing of affective responses	−0.30	0.09	0.76	−0.31	0.09	1.14	−0.01
(7) Lack of insight and social awareness	0.04	0.10	0.74	0.06	0.10	0.66	−0.02
(1) Abstract thinking problems	−0.24	0.09	0.86	−0.20	0.09	0.81	−0.04
(5) Euphoria	−0.14	0.09	0.87	−0.08	0.10	1.20	−0.06
(20) No concern for social rules	−0.44	0.09	1.08	−0.35	0.09	0.97	−0.07
(4) Planning problems	−0.80	0.09	0.84	−0.57	0.09	0.88	−0.29
(15) Restlessness–hyperkinesis*	0.56	0.10	1.77	0.91	0.11	1.59	−0.35
(18) Distractibility	−0.88	0.09	0.69	−0.46	0.09	0.84	−0.42
(6) Temporal sequencing problems	−0.47	0.09	0.85	−0.04	0.10	0.92	−0.43
(19) Poor decision making ability	−0.59	0.09	0.68	−0.14	0.10	0.81	−0.45

*Items that misfit in each analysis.
Difference = patient minus proxy.

questionnaire have been reported elsewhere.[4 7 9] The Chinese version was adopted.[10]

The university and corresponding hospital ethics committees approved the research plan and the recruitment procedure for the participants with persisting postconcussive symptoms. Consent was obtained from all of the participants prior to the testing session in accordance with the Declaration of Helsinki. Patients and their significant others were assessed on an individual basis and were requested to complete the questionnaire independently in a separate room.

Using the Rasch model,[11] structural construct validity is determined by examining the deviations from model expectations—whether the individual tasks fit within the latent construct—in terms of fit statistics.[12] Identification of unexpected responses and misfit in the Rasch model is conceptually similar to a simple χ^2 analysis. The Rasch model provides two indicators of fit, the infit and the outfit statistics. Infit indicates unexpected responses to tasks targeted to their cognitive level whereas outfit indicates a problem with task coherence when items are targeted to other cognitive levels, or outliers. For this study, we used a criterion fit statistic of greater than 1.4 to identify misfitting polytomously scored items.

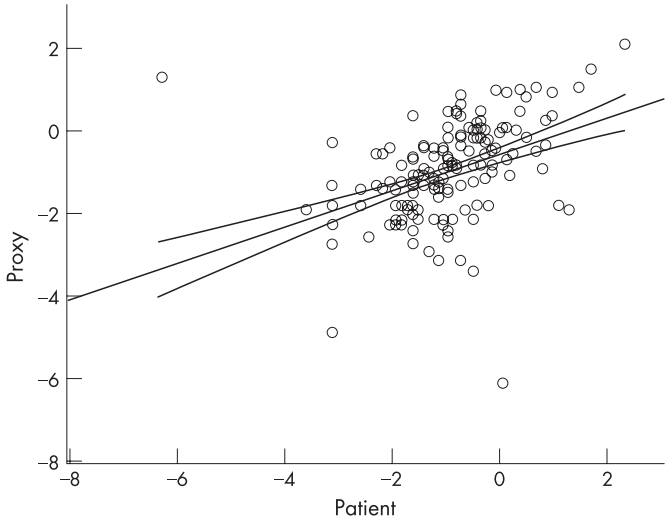

Figure 1 Relationship of measures based on patient and proxy ratings.

Data were analysed using WINSTEPS.[13] Items on which patient and proxy ratings differed unexpectedly in their ratings were identified using DIF techniques. In the Rasch DIF procedure, also conducted using WINSTEPS, responses for patients and proxies are combined into a single analysis. Adjustments were made in the difficulty estimates for both samples to control for differences in their overall trait levels to produce DIF values for each group. The sum of the DIF values across items was zero. When the patients reported the occurrence of the behaviour more frequently than the proxies, the DIF values were positive, and when the proxies reported the occurrence of the behaviour more frequently than the patients, the DIF values were negative. Comparisons were then made between the DIF values using t tests. Because of the multiple comparisons, items were considered as exhibiting DIF when the t statistic was greater than 2.58 (alpha = 0.01). Finally, we compared the measures obtained from patient and proxy ratings using intraclass correlations to examine the effect of these different perspectives.

RESULTS

Although the average raw scores based on patient and proxy ratings were approximately the same (patient mean = 30.12; proxy mean = 31.32), differences were found when these ratings were calibrated. Rasch calibration of the separate patient and proxy data showed slightly higher estimates of reliability for proxies (0.91) than for patients (0.89).

In terms of fit to the Rasch model, the ratings for *restlessness* misfit for both patients (Infit MnSq = 1.77) and proxies (1.59), suggesting that this item might be measuring a different construct than the rest of the items, regardless of who does

the rating. In addition, ratings for *confabulation* misfit marginally in both groups (1.43 and 1.44, respectively, for patients and proxies) and ratings for *perseveration* (1.46) misfit marginally, but only when rated by proxies. The complete item statistics for the patient and proxy ratings are presented in table 1.

DIF was found in five items: distractibility, temporal sequencing problems, poor decision making ability, knowing–doing dissociation and lack of concern. As a result of these differences, the two estimates were only moderately correlated (intraclass correlation = 0.46, disattenuated for measurement error). Figure 1 illustrates the relationship between measures based on patient and proxy ratings. The proxy data explained about 17.1% of the variance of the patient data.

DISCUSSIONS

The results of this study confirm the findings of previous studies that there were no significant differences between self-reported and proxy-reported symptoms of DEX.[4 6] However, these findings were limited to the total DEX score. The finding of only a moderate relationship between patient and proxy ratings in this study suggests that, despite essentially equal total scores, proxies do not provide the same rating as patients. The DIF for the patient and proxy ratings confirm that there are discrepancies in the frequencies of dysexecutive complaints reported by patients and proxies. These results also confirm the findings of our previous study in which we conducted an item by item analysis between the two versions of DEX and found mild to moderate discrepancies in various items.[4] Ostensibly, some symptoms are reported more frequently than others by carers. Burgess and Robertson[14] found that items on which there was the most disagreement were lack of insight and concern, unconcern for social rules, distractibility, decision making ability and some other emotional regulation problems such as aggression and euphoria. Taken together, these results point to one message, that clinicians and researchers need to be cautious when interpreting data from patients and proxies.

The methods used in this study were useful in guiding the examination of each dysexecutive symptom as performed by patients and proxies. Understanding the different perspectives of patients and proxies is aided by knowing that patients and proxies do not differ in their perception of the difficulty in reporting all items but only some. Given the difference between patient and proxy ratings, methods for equating or articulating such differences would be particularly useful for clinical practice. Such an analysis was not attempted in this study because of the relatively small number of patients with severe impairments. To accurately reflect the association of estimates based on patient and proxy ratings, a sufficient range of severity would be needed. In addition, future studies should include professional staff as the proxy source and explore whether a conversion table between patients, significant others and professional staff could be established.[15]

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