How good is the neurophysiology of pain questionnaire? A Rasch analysis of psychometric properties

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The neurophysiology of pain questionnaire (NPQ) was developed to assess the level of understanding a patient had for the biological mechanisms that underpin chronic pain. That one’s conceptualisation of what causes their pain modulates its intensity and can contribute to chronicity is well established. The NPQ has been used in clinical trials and has provided important information about the relationship between knowledge, thoughts (catastrophising), coping strategies, pain and disability. It has also been successfully used to assess the effect of cognitive/educational interventions.

The NPQ is widely used in clinical practice. Clinicians use it to plan and evaluate treatment of chronic pain patients. Despite its widespread use in research and clinical practice, the psychometric properties of the NPQ have not, until now, been interrogated.

We undertook a comprehensive interrogation of the questionnaire, using a contemporary statistical technique called Rasch analysis.

DESIGN
Rasch analysis of NPQ data.

PARTICIPANTS
300 random chronic spine pain patients randomly selected from a clinical audit database of 1200.

ANALYSIS
Rasch analysis uses a mathematical model to formally assess outcome scales. It is a probabilistic model that proposes that the likelihood of a person successfully answering a test item is a logistic function of the difference between that person’s ability and the difficulty of the item. The model assumes that all test items assess a single underlying trait and thus form a unidimensional scale – a requirement if the items in a scale are to be summed to provide a valid total score. Rasch analysis also interrogates other issues crucial to measurement including internal consistency, item invariance, category ordering and item bias. The analysis provides fit indices to detect items that breach these assumptions and require further attention.

We assessed the following Rasch components:
• Person fit – persons with erratic response strings were assessed. Those suspected of guessing were removed from further analysis.
• Targeting – the extent to which the difficulty of the test matches the ability of the sample.
• Unidimensionality – identifies items that function unexpectedly and may produce a construct other than pain knowledge.
• Reliability – internal consistency indicate whether the scale is suitable for group or individual use.
• Item bias – items should not bias subgroups within the sample. We compared gender, age, diagnosis and ability.

Items exhibiting excessive fit indices were examined. Those deemed to function poorly were removed and the dataset was then reanalysed with the remaining items.

NPQ
1. Receptors on nerves work by opening ion channels in the wall of the nerve.
2. When part of your body is injured, special pain receptors convey the pain message to your brain.
3. Pain only occurs when you are injured or at risk of being injured.
4. Special nerves in your spinal cord convey ‘danger’ messages to your brain.
5. Pain is not possible when there are no nerve messages coming from the painful body part.
6. Pain occurs whenever you are injured.
7. The brain sends messages down your spinal cord that can change the message going up your spinal cord.
8. The brain decides when you will experience pain.
9. Nerves adapt by increasing their resting level of excitement.
10. Chronic pain means that an injury hasn’t healed properly.
11. The body tells the brain when it is in pain.
12. Nerves can adapt by producing more receptors.
13. Worse injuries always result in worse pain.
14. Nerves adapt by making ion channels stay open longer.
15. Descending neurons are always inhibitory.
16. When you injure yourself, the environment that you are in will not affect the amount of pain you experience, as long as the injury is exactly the same.
17. It is possible to have pain and not know about it.
18. When you are injured, special receptors convey the danger message to your spinal cord.
19. All other things being equal, an identical finger injury will probably hurt the left little finger more than the right little finger in a violinist but not a piano player.

RESULTS
Whilst the true-false nature of the questionnaire made it susceptible to guesses, the NPQ showed acceptable internal consistency for assessment of individuals and effectively targeted the ability of the sample and principal component analysis suggested it constitutes a unidimensional scale. Only four persons scored zero suggesting the scale possesses neither floor, nor ceiling effects. However, the analysis identified several items that either functioned poorly, exhibited item bias or were psychometrically redundant.

Re-analysis of the revised NPQ (R-NPQ), after removal of the problematic items (highlighted in colour), demonstrated superior psychometric properties. The R-NPQ targeted the sample effectively, possessed minimal floor and ceiling effects, showed good internal consistency and was less influenced by poor fit statistics and item bias. Our findings suggest that the R-NPQ constitutes a unidimensional scale and is preferable to the NPQ for measuring pain-related knowledge in chronic spine pain patients. A PSI of 0.88 suggests it is suitable to assess pain-related knowledge in individuals and to monitor their change in knowledge.

The psychometric properties of the revised NPQ (R-NPQ) are superior to those of the original. Recipients of the R-NPQ should utilise the undecided response option as the true-false nature of the test appears to be susceptible to guesses. Despite this limitation, the R-NPQ is easy to administer and can be recommended to provide a useful measure of pain knowledge, and a vehicle for identifying gaps in patient knowledge, in health-care practice and future research.