

Introduction

The Numerical Rating Scale (NRS) is one of the most commonly used measures of pain intensity. In adults it has shown excellent psychometric properties, and it is often recommended over other measures because of its many strengths and relatively few weaknesses. The NRS is also widely used to assess pediatric pain (McGrath et al., 2008). Despite some recent and relevant results (von Baeyer et al., 2009), little is known about the psychometric properties of the NRS when used with children and adolescents.

The main objectives of this study were (1) to determine the psychometric properties of the NRS-11 when administered orally to assess pediatric pain intensity, in two samples: a sample of schoolchildren aged between 8 and 12 years old (Study #1) and a sample of children aged between 6 and 16 years old undergoing minor surgery (Study #2), and (2) to analyze participants' preference for one of two widely used scales in the assessment of pediatric pain intensity: the NRS-11 and the Faces Pain Scale – Revised (FPS-R) (Study #1).

Method

Participants

Study #1: 175 schoolchildren -101 boys (58%) and 74 girls (42%)-, with an average age of 9.95 years (range = 8-12; SD=1.20).

Study #2: 63 consecutive surgical patients -52 boys (83%) and 11 girls (17%), with a mean age of 10.46 (range = 6-16; SD = 3.11).

Procedure

Study #1:

Information was collected in individual interviews that took place during school hours. We asked participants if they had experienced pain somewhere in their body in the last three months. If the answer to this question was affirmative, we then asked: (1) what was the most frequent pain, and (2) what was the highest intensity of the pain they had experienced. They rated the level of pain intensity on the NRS-11 and the FPS-R. The NRS-11 and the FPS-R were counterbalanced across participants. We next asked whether they preferred reporting pain intensity on the NRS-11 or the FPS-R and why they preferred one over the other. Finally, the children were asked to report their pain-related affect and pain-related disability, using the FAS and the FDI, respectively.

Study #2

One week after surgery, when children returned to the hospital for a check up, we asked them whether during the previous week they had experienced any pain due to the surgery. If so, the highest pain intensity was measured with the NRS-11 and the FPS-R, whereas the children's pain-related affect information was collected with the FAS. At one month after surgery, the children were requested to answer to the PedsQL and the FDI.

Measures

Pain intensity: The *Numerical Rating Scale* (NRS) and the *Faces Pain Scale – Revised* (FPS-R; Hicks et al., 2001) were used.

Pain-related affect: *Facial Affective Scale* (FAS; McGrath et al., 1996).

Disability: *Functional Disability Inventory* (FDI; Walker and Greene, 1991).

Quality of life: *Quality of Life Inventory™ Version 4.0* (PedsQL; Varni et al., 2001) was used in study #2.

Results

Psychometric properties of the NRS-11

In Table 1 we present a summary of the findings.

Table 1. Summary of the psychometric properties of the NRS-11 in the two studies

	Construct validity		Criterion related validity	
	Convergent validity	Discriminant validity	Predictive validity	Concurrent validity
Study 1 (school-children)	$r_{\text{NRS-11-FPS-R}} = 0.78$ (n=175)	$r_{\text{NRS-11-FAS}} = 0.58$ (n=164)	----	$r_{\text{NRS-11-FDI}} = 0.22$ (n=175) $r_{\text{NRS-11-FAS}} = 0.58$ (n=164)
Study 2 (surgical patients)	$r_{\text{NRS-11-FPS-R}} = 0.93$ (n=63)	$r_{\text{NRS-11-FAS}} = 0.66$ (n=63)	$r_{\text{NRS-11-FDI}} = 0.39$ (n=61) $r_{\text{NRS-11-PedsQL}} = -0.46$ (n=61)	$r_{\text{NRS-11-FAS}} = 0.66$ (n=63)

Participants' preference: NRS-11 vs. FPS-R

Table 2. Preference for the NRS-11 and the FPS-R according to participants' school grade

	Boys	Girls	
Sample size: N	96	69	
Mean age (SD)	9.98 (1.12)	9.87 (1.33)	
Prefer the FPS-R N (%)	57 (59.4)	47 (68.1)	
Prefer the NRS-11 N (%)	39 (40.6)	22 (31.9)	
Z	1.84	2.99 ^a	^a p < 0.01

Table 3. Preference for the NRS-11 and the FPS-R according to participants' sex.

	Grades 4- 5	Grades 6-7	Total sample	
Sample size: N	86	79	165 ^a	
Mean age (SD)	9.05 (0.85)	10.90 (0.69)	9.93 (1.21)	
Prefer FPS-R N (%)	57 (66.28)	47 (59.49)	104 (63)	
Prefer NRS-11 N (%)	29 (33.72)	32 (40.51)	61 (37)	
Z	2.42 ^b	1.30	2.65 ^b	^a Information is missing in 10 cases of the total sample (N=175). ^b p < 0.01

Conclusions

Our findings provide evidence in favour of the validity of the NRS-11 when it is used with a sample of schoolchildren and a sample of children undergoing minor surgery. Specifically, the NRS-11 demonstrated:

- Good *convergent validity* when it was compared with the FPS-R.
- Good *discriminant validity* when it was contrasted with measures of disability and pain-related affect.
- Acceptable *criterion-related validity* when it was contrasted against measures of pain-related affect, disability and quality of life.

Participants preferred the FPS-R, but this preference was more marked among girls and younger children.

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