

# Validation of the Paediatric Pain Profile, a behaviour rating scale to assess pain in children with severe neurological impairment

Anne Hunt <sup>1,2</sup>, Ann Goldman <sup>2</sup>, Kate Seers <sup>1</sup>, Kiki Mastroyannopoulou <sup>3</sup>, Nicola Crichton <sup>1</sup>, Vivien Moffat <sup>4</sup>, Kate Oulton <sup>1</sup>, Mick Brady <sup>5</sup>.

<sup>1</sup>Royal College of Nursing Institute, Oxford, UK. <sup>2</sup>Institute of Child Health and Great Ormond Street Hospital NHS Trust, London. <sup>3</sup>School of Health Policy and Practice, University of East Anglia, Norwich. <sup>4</sup>Lothian University Hospitals NHS Trust, Edinburgh. <sup>5</sup>Martin House Hospice for Children, Wetherby, Yorkshire, UK.

**INTRODUCTION:** Children with severe neurological and learning impairments are at risk for undetected and untreated pain. Pain assessment in these children is complicated by their inability to communicate verbally and the need for carers to interpret their behavioural manifestations of pain. A 20-item behaviour rating scale, the Paediatric Pain Profile (PPP) has been developed to assess pain in this population. A clinical validation of the scale is presented.

**AIMS:** To assess internal and external reliability, and face, concurrent and construct validity of the Paediatric Pain Profile (PPP), a 20-item behaviour rating scale designed to assess pain in children with severe neurological impairment.

**METHODS:** Children with severe neurological impairment were recruited from five healthcare settings. A baseline interview was conducted in which parents retrospectively rated their child's behaviour at their best and when they had pain. Later, parents and a second rater concurrently and independently rated the child's behaviour to assess inter-rater reliability. In a subset of children who received an "as required" analgesic, behaviour was rated before and for four hours after to assess the ability of the scale to respond to change in pain behaviour with relief of pain.

**RESULTS:** 140 children aged 1-18 years (mean 9.9 ± 4.6 years) were recruited. Mean developmental age (Vineland Adaptive Behaviour Scales) ranged from < 1 month to 32 months (mean 7.6 ± 5.9 months). Diagnostic categories are listed in Table 1.

**Table 1. Diagnostic categories of 140 children**

Diagnostic Category	N	%
Cerebral palsy	60	42.9
Neurodegenerative disease	34	24.3
Congenital or chromosomal disorder	17	12.1
Developmental delay	13	9.3
Brain damage following infection or trauma	5	3.6
Diagnosis unknown or unrecorded	11	7.8

**Baseline assessments:** 134 (96%) parents reported that their child had at least one recent or recurring pain (Pain A) and 59 (42%) reported a second pain (Pain B). Sources of pain are listed in Table 2.

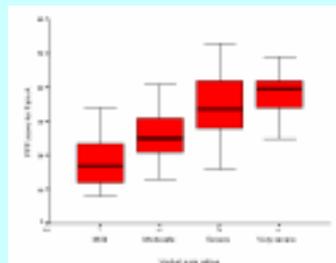
**Table 2. Sources of pain reported by parents**

Pain sources	Pain	
	A	B
Gastro-intestinal	55	15
Musculo-skeletal	34	11
Muscle spasms	10	2
Headache	4	11
Dental / oral	4	2
Ear, nose or throat	3	5
Period pain	3	2
Seizure	2	5
Other and not known	18	6

**Face and concurrent validity:** Mean PPP scores for Pains A and B were 31.3 ± 9.9 and 26.9 ± 10.9 respectively out of a possible score of 60. Both were significantly greater than the child's score "at best" (11.1 ± 6.3) (95% Confidence Intervals for the difference from baseline were -21.80 to -18.62 (Pain A) and -18.25 to -12.57 (Pain B).

Mean PPP score increased with each point in line with the parents' evaluation of pain on a verbal rating scale (ANOVA test for linear trend F=48.217 (Pain A); F=21.767 (Pain B), p < 0.001). (Figure 1).

**Figure 1. Boxplot of PPP score against verbal pain rating.**



**Internal reliability:** Internal consistency of the scale was 0.82 for Pain A and 0.86 for Pain B (Cronbach's alpha).

**Inter-rater reliability:** The behaviour of 111 children (not necessarily in pain) was assessed concurrently by two raters. Depending on the item, inter-rater reliability varied from 0.14 to 0.76 (mean 0.51). Reliability of the summated scale was 0.74 (intra-class correlation).

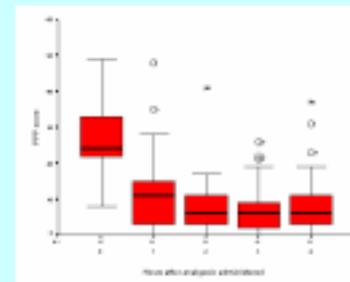
**Responsiveness of scale / construct validity:** A subset of 39 children whose pain was rated as "moderate" to "very severe" on a verbal rating scale received an "as required" analgesic.

Pains reported were gastrointestinal (n=8), postoperative (n=7), musculo-skeletal (n=4), dental or oral (n=4), headache (n=2), period pain (n=1). The source of pain was unrecorded or unknown in 13 cases.

Analgesics administered were paracetamol (n=21), codeine (n=5) and ibuprofen or diclofenac (n=6). The analgesic given was unrecorded in 7 cases.

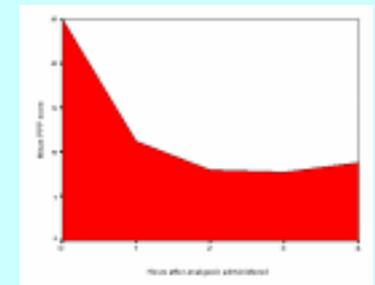
Mean PPP score pre-dose was significantly greater than later assessments (paired-sample t-tests p < 0.001). (Figure 2).

**Figure 2. Boxplot of PPP score against time after analgesic administration**



Treatment resulted in pain relief (reduction in pain behaviour) by 50% or more in 24/39 children (62%). Six children (15%) had less than 30% reduction in pain score (Figure 3).

**Figure 3. Plot of mean area under the curve for PPP scores from before administration of analgesia to four hours afterwards.**



**Internal and external reliability:** Internal consistency for the scale in this setting of children with pain was 0.89 (Cronbach's alpha). Inter-rater reliability ranged from 0.19 to 0.84 (mean 0.64). Reliability for the summated scale was 0.87 (Intraclass correlation).

**CONCLUSIONS:** Results suggest that the Paediatric Pain Profile is internally consistent and demonstrates concurrent and face validity in clinical settings. In addition it is responsive to change in behaviour following administration of analgesics demonstrating construct validity. Reliability for the summated scale is good. The Paediatric Pain Profile appears a valid and reliable tool for assessing and monitoring pain in children with severe neurological impairments.

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