Scaling properties of pain intensity ratings in paediatric populations using the Faces Pain Scale-revised

Alexander Avian

Institute for Medical Informatics,
Statistics and Documentation

29.11.2019

DFG Deutsche Forschungsgemeinschaft

Medical University of Graz

Insufficient pain assessment

- 2000: 4% - 7% of hospitals have a frequent pain assessment

Table 3. Percentage stating frequent use of pain measurement tools; absolute numbers within parentheses.

Age (y)	0–1	1–4	5–7	>7
Visual Analogue Scale	1% (2)	4% (6)	17% (26)	35% (54)
Faces scale	7% (10)	11% (18)	18% (28)	8% (13)
Behavioural observation scale	8% (11)	6% (10)	3% (5)	3% (5)
Total number of answers	146	158	153	153

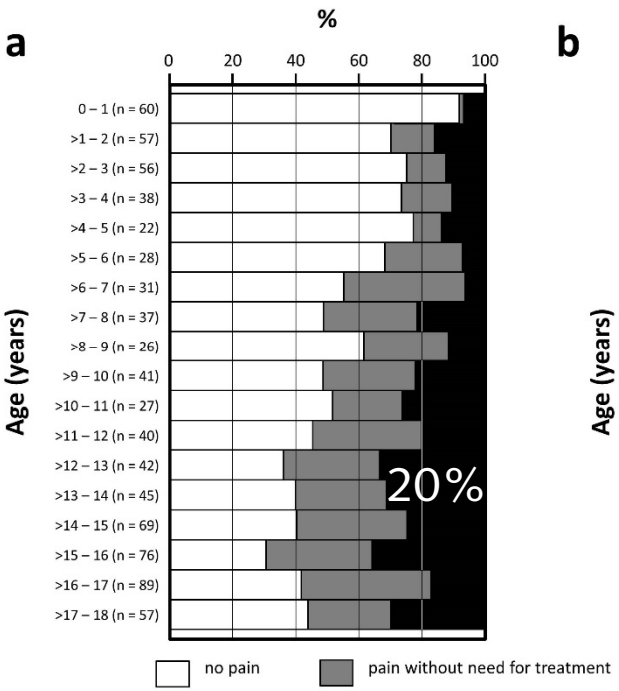
- Acutal: 2/3 of the hospitals asses pain at least once a day

Bremerich et al, 2001; Karling et al. 2002; Emons et al. 2016; Stamer et al. 2005;

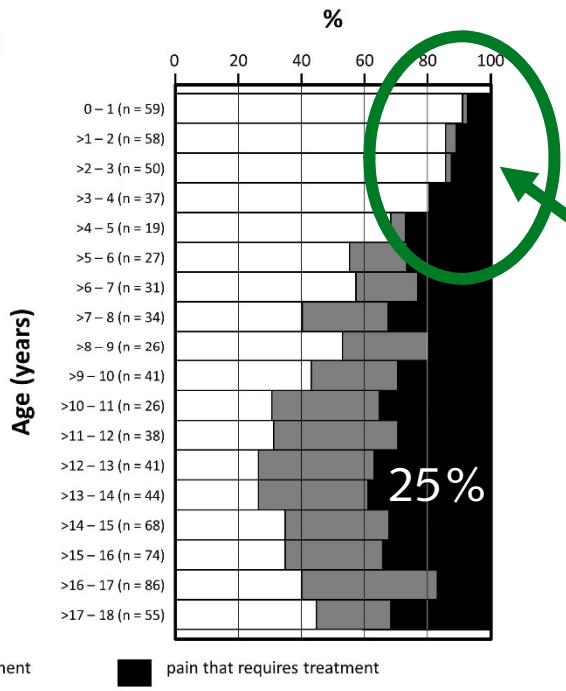
Introduction

- An adequate assessment tool is crucial for effective pain management

Day of surgery



1. postoperative day



n = 845

Pain during hospital stay:

- Graz: 61%
- Literature: 40 – 87%

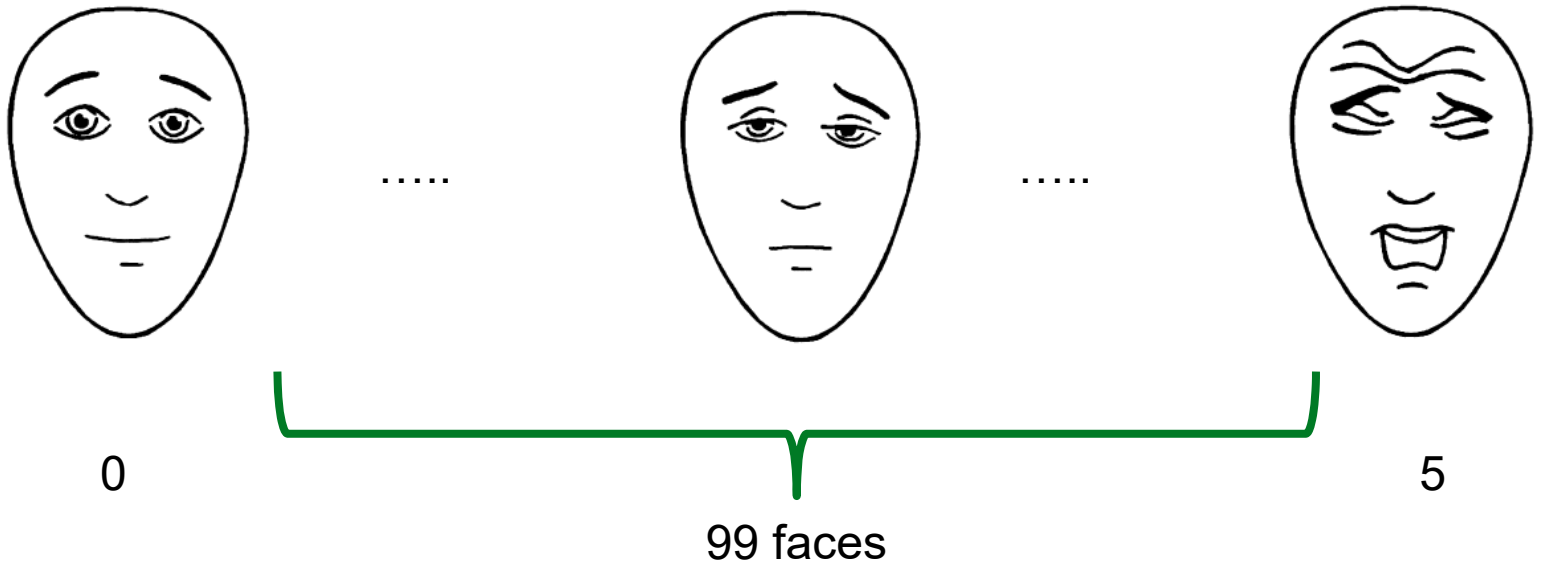
adequate?

Avian et al. 2016b

Introduction

- Numeric scales are too complex for children
- The Faces Pain Scale-revised (FPS-r) has been developed as a linear interval scale.
- In research different approaches are used for analysis:
  - parametric analyses (e.g. Birnie et al., 2016)
  - nonparametric analyses (e.g. de Azevedo et al., 2014)

Introduction: Development of FPS-r



1. scroll back and forth through the facial expression
2. a number between the 0 and 5 endpoints (i.e. 1, 2, 3, or 4) and asked to adjust the facial expression until it was perceived to correspond to that scale value of pain intensity.
3. 20 trial per number
4. in sum 80 trials per respondent

Hicks et al. 2001

Introduction: Development of FPS-r

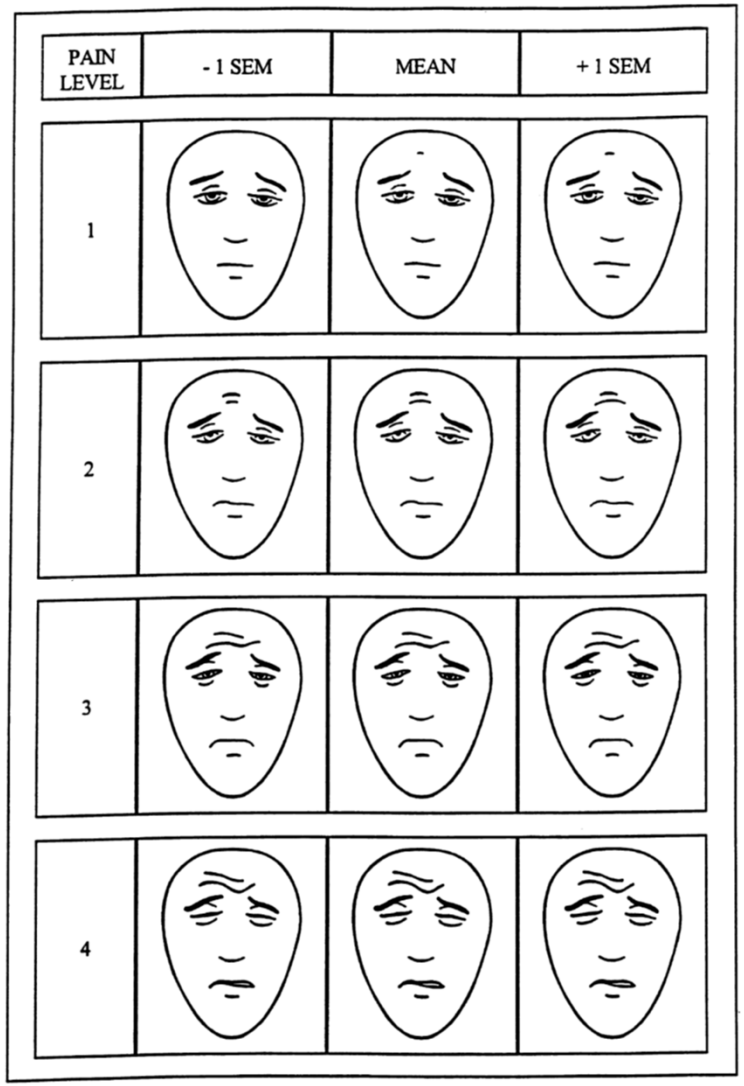


Fig. 2. Study 1: mean face selected (±1 SEM) by hypothetical pain intensity level for FPS-R.

Hicks et al. 2001

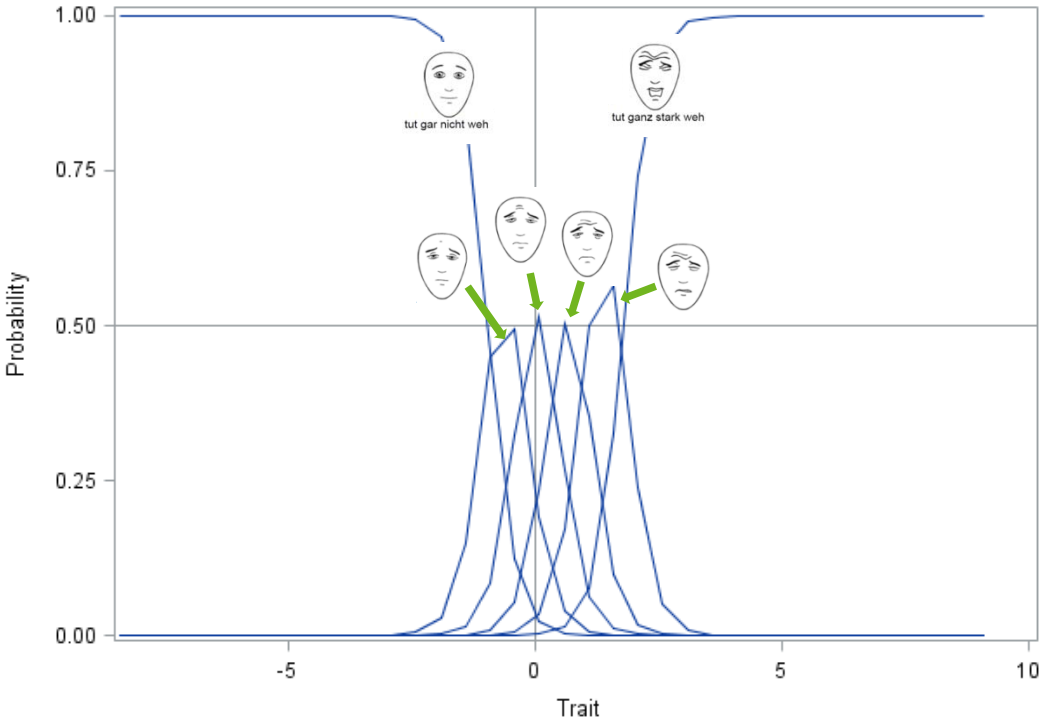
Aim of the Study

The primary aim of the current study was to evaluate the **scale properties of the FPS-r** and therefore assess whether the assumption that they have the properties of an interval scale holds.

Hicks et al. 2001

Methods

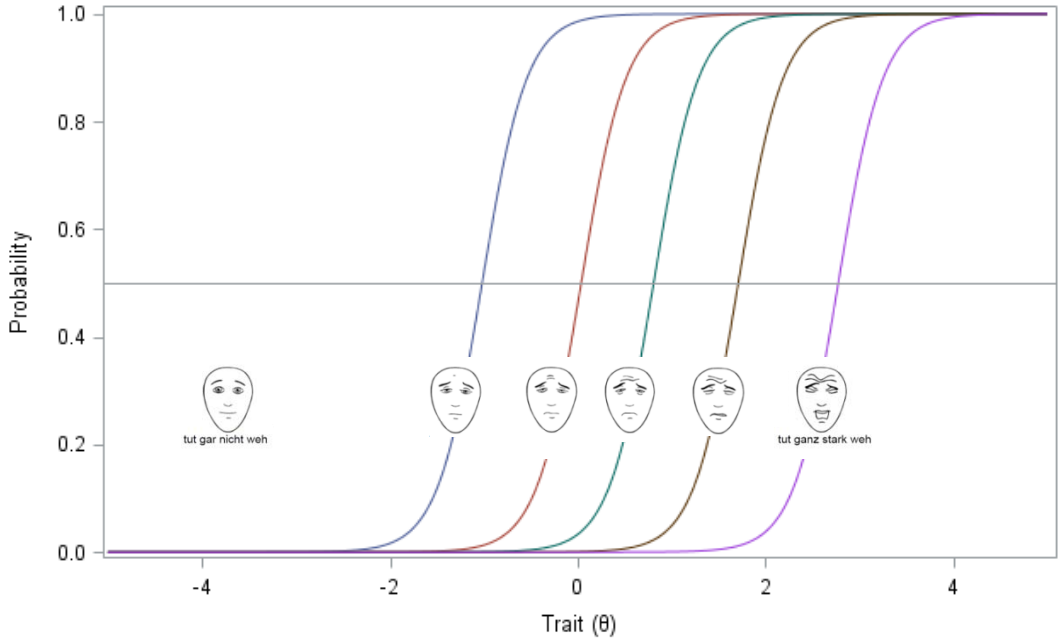
- Analysis of responses:
  - response categories order
  - response category widths
  - fit of three different item response theory models for polytomous responses (Ostini and Nering, 2006).



- Category response curves

Methods

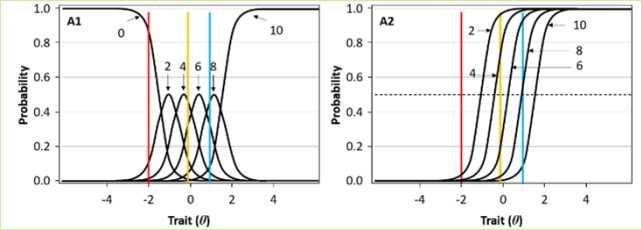
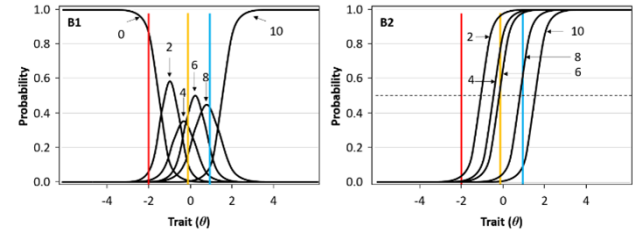
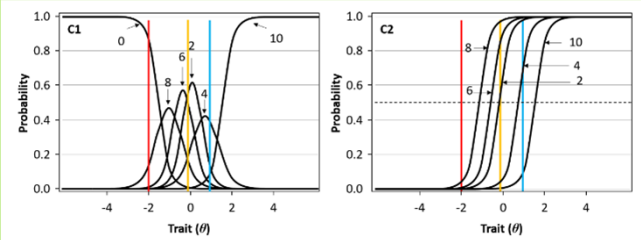
- Analysis of responses:
  - response categories order
  - response category widths
  - fit of three different item response theory models for polytomous responses (Ostini and Nering, 2006).



- Category boundary curves

Methods

- Analysis of responses:
  - response categories order
  - response category widths
  - fit of three different item response theory models for polytomous responses (Ostini and Nering, 2006).

IRT Model		Scale
Rating scale model		interval
Graded response model		ordinal
Partial credit model		nominal

Methods

- Three different samples

Sample		Pain items	n	Age (years)	f/m
1	Avian et al. 2016a	3	246	14.4 ± 2.0 range: 10 - 18	101/145
2	Avian et al. 2017	9	240	14.7 ± 1.9 range: 10 - 18	103/137
3	Avian et al. 2017	3	2266	13.3 ± 2.7 range: 4 - 18	1041/1200 (missing: 25)

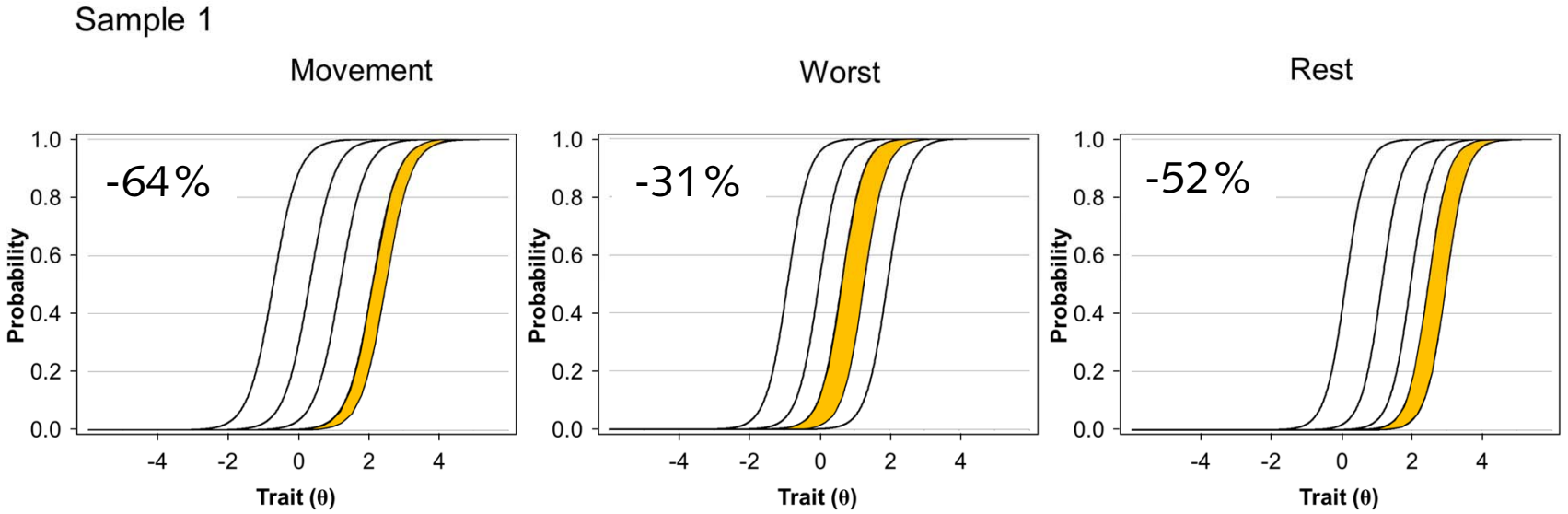
Results

- Response category order

		ordered
Sample 1	Movement	yes
	Worst	yes
	At rest	yes
Sample 2	worst	yes
	getting up from bed	yes
	turning over in the bed	yes
	coughing	**no**
	lying in bed	yes
	eating	yes
	drinking	yes
Sample 3	Movement	yes
	Worst	yes
	At rest	yes

Results

- Response category widths

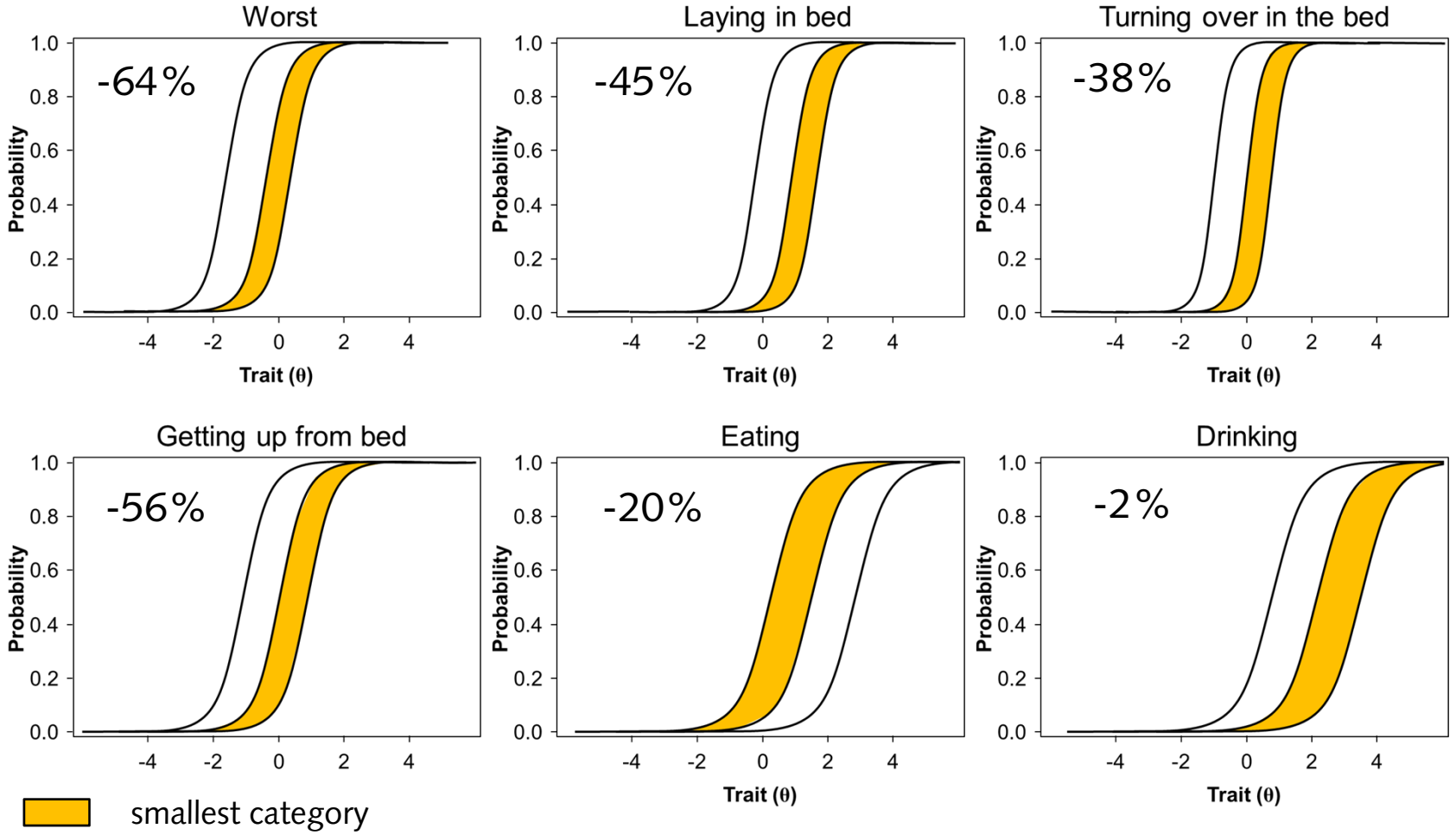


smallest category

Results

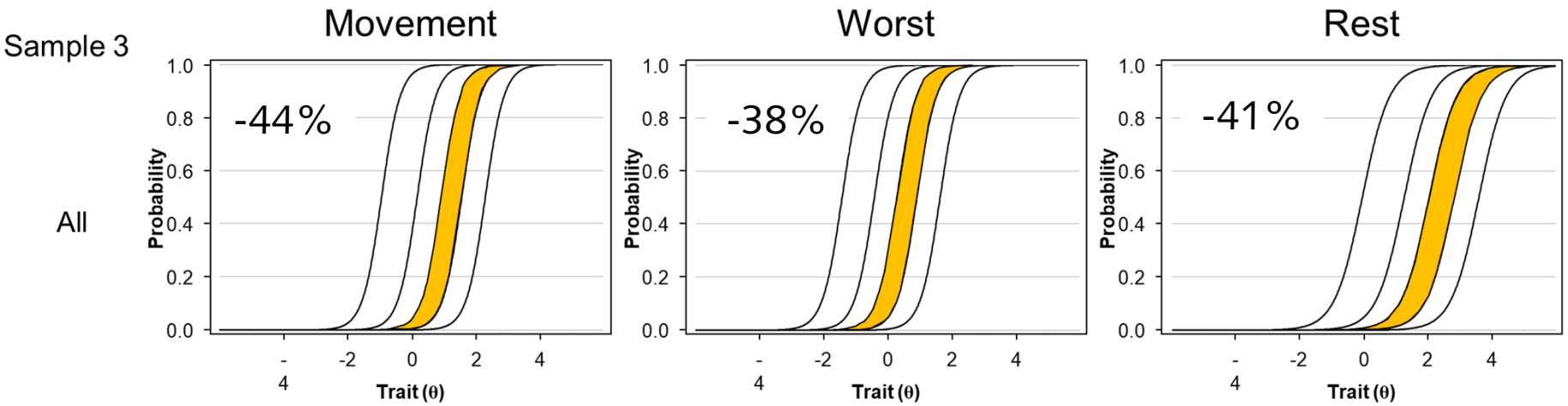
- Response category widths

Sample 2



Results

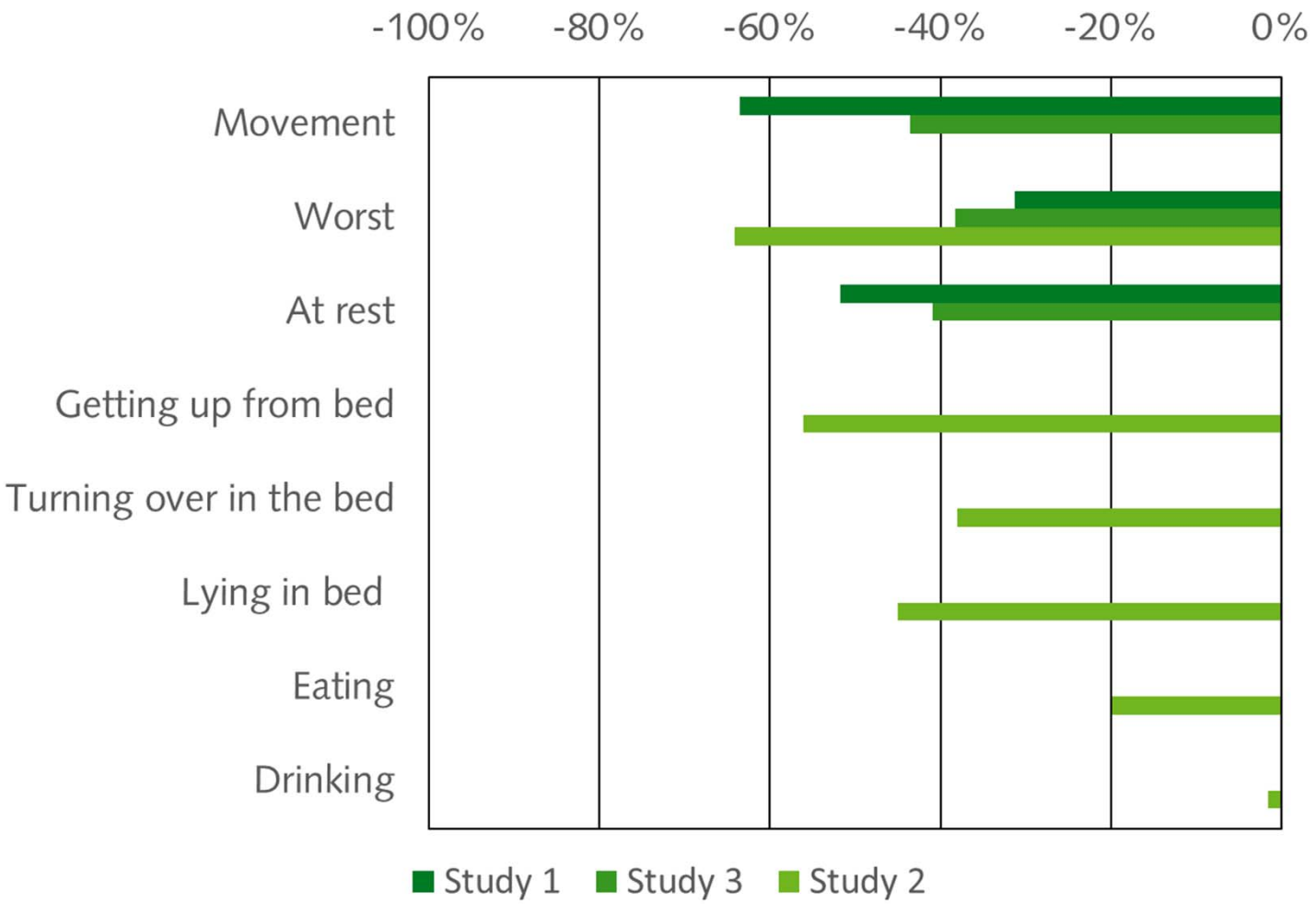
- Response category widths



smallest category

Results

- Response category widths



Results

- Fit of three different item response theory models for polytomous responses

		AIC	AICc	BIC	SABIC	RSM vs. PCM sign. (df; χ^2)
Study 1	RSM	1789.1	1789.7	**1817.2**	1791.8	.131 (8; 12.5)
	GRM	**1779.5**	**1782.5**	1842.6	**1785.5**	
	PCM	1792.6	1795.0	1848.7	1798.0	
Study 2	RSM	3120.3	3121.2	3155.1	3123.4	**<.001 (12; 67.4)**
	GRM	**3062.7**	**3070.4**	3160.1	**3071.4**	
	PCM	3076.9	3081.5	**3153.4**	3083.7	
Study 3	RSM	17107.5	17107.6	17153.3	17127.9	.052 (8; 15.4)
	GRM	**16936.7**	**16937.0**	**17039.7**	**16982.5**	
	PCM	17108.1	17108.4	17199.7	17148.9	

Conclusion

- **Responses to the FPS-r cannot be assumed interval scaled.**
  - Nonparametric parameters (e.g. median, interquartile range) or the number of patients above/below a certain pain level should be used.
  - Parametric parameters (e.g. mean, standard deviation) for reporting FPS-r responses should not be used.

- **In children/adolescents no influence of age (data not shown)**

- **Similar results in:**
  - other pain scales (data not shown)
  - adults (data not shown)

- **In general: Responses to pain scales cannot be assumed interval scaled. (e.g. numeric rating scale, FPS-r)**

Avian, A; Messerer, B; Frey, A; Meissner, W; Weinberg, A; Ravekes, W; Berghold, A. Scaling properties of pain intensity ratings in paediatric populations using the Faces Pain Scale-revised: Secondary analyses of published data based on the item response theory. Int J Nurs Stud. 2018; 87:49-59

References

- Avian, A., Messerer, B., Weinberg, A., Meissner, W., Schneider, C., Berghold, A., 2016a. The impact of item order and sex on pain expression in children and adolescents. Health Psychol. 35, 483–491.
- Avian, A; Messerer, B; Wünsch, G; Weinberg, A; Kiesling, AS; Berghold, A. Postoperative paediatric pain prevalence: A retrospective analysis in a university teaching hospital. Int J Nurs Stud. 2016b; 62(7):36-43
- Avian, A., Messerer, B., Meissner, W., Sandner-Kiesling, A., Kammel, J., Labugger, M., Weinberg, A., Berghold, A., 2017. Using a worst pain intensity measure in children and adolescents. J. Adv. Nurs. 73, 1873–1883.
- Birnie, K.A., Chambers, C.T., Chorney, J., Fernandez, C.V., McGrath, P.J., 2016. Dyadic analysis of child and parent trait and state pain catastrophizing in the process of children's pain communication. Pain 157, 938–948.
- Bremerich DH, Neidhart G, Roth B, Kessker P, Behne M. Postoperative Schmerztherapie im Kindesalter. Ergebnisse einer reprsentativen Umfrage. Anaesthesist 2001a;50:102–12.
- de Azevedo, C.B., Carenzi, L.R., de Queiroz, D.L.C., Anselmo-Lima, W.T., Valera, F.C.P., Tamashiro, E., 2014. Clinical utility of PPPM and FPS-R to quantify post-tonsillectomy pain in children. Int. J. Pediatr. Otorhinolaryngol. 78, 296–299.
- Emons MI, Petzke F, Stamer UM, Meißner W, Koschwitz R, Erlenwein J. Current practice of acute pain management in children—a national follow-up survey in Germany. Pediatric Anesthesia 2016. 26 (2016) 883–890
- Hicks, C.L., von Baeyer, C.L., Spafford, P.A., van Korlaar, I., Goodenough, B., 2001. The faces Pain Scale - revised: toward a common metric in pediatric pain measurement. Pain 93, 173–183.
- Karling M, Remstrom M, Ljungman G. Acute postoperative pain in children: a Swedish nationwide survey. Acta Paediatr 2002;91:660–6.
- Ostini, R., Nering, M.L., 2006. Polytomous Item Response Theory Models. Sage Publications, Thousand Oaks CA.
- Stamer UM, Mpasios N, Maier Ch, Stuber. Postoperative analgesia in children – current practice in Germany. European Journal of Pain 9 (2005) 555–560.