Clinical Outcome Measures for Contraversive Lateropulsion or Pusher Behavior after Stroke: An Updated Systematic Review of the Literature.

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Background

- Pusher Behavior (PB) causes individuals to push "strongly towards his hemiplegic side in all positions and resist any attempt at passive correction of his posture; that is, correction which would bring his weight towards or over the midline of his body to the unaffected side."[1,2]
- Prevalence of PB ranges from 10% to greater than 60%[3,4]
- Pusher behavior (PB) can lead to increased hospital length of stay, increased healthcare costs, and delayed functional outcomes in stroke patients.
- Early identification of PB may guide interventional treatment from physical therapists.
- There is a lack of reliable and valid outcome measures to quantify PB.

Purpose

To identify scales used to classify PB in order to investigate literature that addresses clinimetric properties of scales previously identified to provide a valuable resource for clinicians containing recommendations for use of these tools in practice.

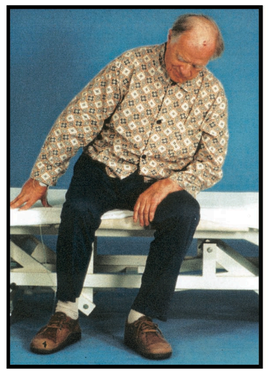
Methods

- 385 articles were identified through PubMed, Embase, and CINAHL.
- 7 studies were included in the qualitative and quantitative synthesis.
- The Consensus-based Standards for the selection of health Measurement INstruments (COSMIN) checklist was applied for methodological quality and quality criteria and consensus was reached on a final rating.

Table 1. Definitions of Measurement Property Terminology

COSMIN Measurement Property	Definition
Internal Consistency	The degree to which subsections of an instrument measure the same concept or construct; the degree of interrelatedness among the items.
Reliability	The extent to which repeated measurements agree with one another. This can include measurement over time (test-retest), by different persons on the same occasion (inter-rater), or by the same person(s) on different occasions (intra-rater).
Validity	The degree to which an instrument measures the construct that it is supposed to measure.
Content validity	The degree to which items in an instrument represent all of the facets of the variable being measured.
Face validity	A subjective assessment of the degree to which an instrument appears to measure what it was designed to measure.
Cross-cultural validity	The degree to which the performance of the items on a translated or culturally adapted instrument are an adequate reflection of the performance of the items of the original version of the instrument.
Criterion validity	The degree to which a measure of interest relates to a measure with established validity (a "gold" or "reference" standard).
Construct validity	The degree to which a measure matches the operational definition of the concept or constructs it is said to represent.
Responsiveness	The ability of a measure to detect change over time in the phenomenon of interest.
Agreement	A form of measurement reliability that indicates how close repeated measures are to one another.

Figure 1. Presentation of Pusher Behavior



[2]Karnath, 2003

Results

Table 2. Comparison of Four Scales Used to Identify PB

Scale Component	Scale for Contraversive Pushing (SCP)	Swedish Scale for Contraversive Pushing (S-SCP)	Modified Scale for Contraversive Pushing (M-SCP)	Burke Lateropulsion Scale (BLS)
Postures in which patients are assessed	(3) components scored in both sitting and standing: 1. Spontaneous body posture (SBP) 2. Extension/abduction of uninvolved extremities (EAE) 3. Resistance to passive correction (RPC)	Identical to SCP. Translated into Swedish with modified verbal instruction for patient cueing.	(4) testing positions: 1. Sitting 2. Standing 3. Sitting transfer 4. Standing transfer	(5) testing positions: 1. Supine rolling 2. Sitting 3. Transferring 4. Standing 5. Walking
Scoring	1. SBP- (0, 0.25, 0.75, 1 = severe tilt) 2. EAE-(0, 0.5, 1 = performed spontaneously at rest) 3. RPC- (0, 1 = resistance occurs). **Total Max Score = 6** 0= no tilt, extension, resistance 6= severe tilt, resistance, extension	Identical to SCP.	Each scored 0–2 0= no pushing 2= pushes continuously with force enough to fall if not supported, abducts uninvolved arm and/or leg spontaneously, even at rest. **Total maximum = 8**	Scoring based on degree and point of onset of resistance to passive correction (sit, stand) or degree of pushing evident (supine, transfer, walking) 0–3 scale except for standing (0–4). **Total max score =17** 0=no PB, ≥ 2= showing PB
Cut-off scores indicative of Pusher Syndrome	Not definitively established. Originally >1 on each section. Later recommended >0 for each section.[3]	Total score ≥ 3	Total score ≥ 3	≥ 2 points has been used inconsistently as the cut-off score. Recent studies have recommended >2.[4]
Clinimetric Properties				
Reliability:	[2]**Inter-rater Reliability:** SCP total: ICC = 0.97 [2]**Internal Consistency:** Cronbach's α: 0.92 [3]**Diagnostic Agreement:** Criteria 1: 54.3%, Cohen κ = 0.212; Criteria 2: 98.1%, Cohen κ = 0.93; Criteria 3: 94.3%; Cohen κ = 0.75 [2]**Diagnostic Agreement** (cut off scores of ≥1 and >0): Abnormal test ≥ 1: 73.1%; Abnormal test > 0: 96.2% [2]**Pearson Correlation Coefficients:** Section A/SCP Total: r_p = 0.91*; Section B/SCP Total: r_p = 0.96*; Section C/SCP Total: r_p = 0.91*; Section A/Section B: r_p = 0.86*	[8]**Inter-rater Reliability:** S-SCP total score: ICC = 0.84 †, PA 48% Pusher syndrome diagnosis: κ = 0.71 † †, PA = 86% † = p < 0.05, † † = p < 0.01	[10]**Inter-rater Reliability:** M-SCP total score: κ = 0.51 at IE and κ = 0.73 at DC. r_s = 0.82 at IE and r_s = 0.94 at DC.	[6]**Inter-rater Reliability :** ICC = 0.93* [6]**Intra-rater Reliability:** ICC = 0.94* [4]**Diagnostic Agreement of pusher behavior based on SCP (cut off > 0) and the BLS:** χ^2 = 54.26; κ = 0.564, SE = 0.062.
Validity:	[3]**Construct Validity** (balance and function): Barthel Index: r_s = -0.63; FM-B: r_s = -0.67; LIND-MOB: r_s = -0.60. [3]**Criterion Validity**: Criterion 1: SN 100%, SP 46%; Criterion 2: SN 100%, SP 98%; Criterion 3: SN 65%, SP 100%	Not reported	[8]**Concurrent Validity of BBS:** r_s = -0.52 at IE and -0.49 second evaluation. [8]**Concurrent Validity of S-COVS:** r_s = -0.43 IE and -0.45 second evaluation. [8]**Correlation between BBS and S-COVS:** r_s = 0.90, both evaluations	[6]**Criterion Validity of BLS with the SCP:** SN: 100%, SP: 67% [6]**Concurrent Validity:** FM-B: r_s = -0.57*; IE FIM mobility: r_s = -0.56**; DC FIM mobility: r_s = -0.58**; Length of rehabilitation stay: r_s = 0.60
Responsiveness:	[4]Change detected in 28% of cases on the SCP.	Not reported	Not reported	[5]Mean change from IE to DC on the BLS was 4.7 ± 3.6, SRM = 1.30 [4] BLS found to be more responsive to small changes than SCP. Change detected in 42% of cases.

FIM = Functional Independence Measure, FM = Fugl Meyer, M-B = Fugl-Meyer Assessment Balance subscore, BBS = Berg Balance Scale, S-COVS = Swedish Physiotherapy Clinical Outcome Measure, LIND-MOB = subscore of the mobility section of the motor assessment chart developed by Lindmark and Hamrin, † = p < 0.05, † † = p < 0.01, * = p < 0.001, ** = p < 0.0001, κ = Cohen's kappa, r_s = Spearman's rank order correlation coefficient, x^2 = chi-square, NPV = negative predictive value, PPV = positive predictive value, PA = Percent agreement, SN = sensitivity, SP = specificity, ICC = intraclass correlation coefficient, SRM = standardized response mean, DC = discharge, IE = initial evaluation, SBP = spontaneous body posture

Results (cont.)

Table 3. Summary of COSMIN findings

Lateropulsion Outcome Measure	Internal Consistency	Reliability	Cross-Cultural Validity	Criterion Validity	Responsiveness	Content Validity
Scale for Contraversive Pushing (SCP)	Poor	Poor	No studies	Mixed-poor to excellent	Poor	Poor
Swedish Scale for Contraversive Pushing (S-SCP)	No studies	Poor	Poor	No studies	No studies	Poor
Modified Scale for Contraversive Pushing (M-SCP)	No studies	Poor	No studies	Poor	No studies	Poor
Burke Lateropulsion Scale (BLS)	No studies	Mixed-good to poor	No studies	Mixed-good to poor	Mixed-fair to poor	Poor

Summary of quality ratings based on the most frequent quality rating in each category. For measurement properties with mixed evidence, a range of quality ratings is given.

- Psychometric property investigation was most robust for the SCP which evaluated internal consistency, reliability, criterion validity, responsiveness, and content validity.
- The BLS examined these measurement properties with the exception of internal consistency.
- The M-SCP and S-SCP were each examined in one study.
- Cross cultural validity has not been fully investigated in scales used outside country of origin.

Conclusions

- The SCP has been the most extensively studied.
- Implementation of the COSMIN checklist revealed 'Poor' quality ratings for most evaluated measurement properties secondary to small sample sizes.
- The BLS was found to be more responsive than the SCP, indicating that it may better detect small changes in presence of PB.

Clinical Relevance

- Persistent pusher behavior interferes with motor recovery and has been shown to protract recovery time after stroke, emphasizing a need for consistent use of a clinical outcome measure in the clinic and in future interventional research.
- The BLS is the only scale originally published in English.
- The BLS is recommended for early detection of PB in English-speaking countries due to its higher reported responsiveness and inclusion of dynamic postures not evaluated by the SCP.
- Further study is warranted with larger, more heterogeneous patient populations to improve the quality of measurement property examination and to make better recommend regular clinical use.

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