SPANS

Short Parallel Assessments of Neuropsychological Status

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Presentation outline

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Overview of the SPANS

Quick Overview

- Thirty subtests and seven index scores measuring a variety of cognitive, perceptual, and language skills
- Suitable for bed-side inpatient or outpatient clinic assessment
- Parallel version for reliable retest
- Quick administration (30-45 mins)
- Rapid scoring (5-10 mins)
- Age range: 18 – 74 years

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Quick Overview

- Reliable and valid scores that can be trusted to measure what they say they measure
- Flexible administration (i.e. full or clinician/hypothesis-designed assessments, acceptable stopping points during administration)
- Empirically and clinically derived guidelines for interpretation

Quick Overview

- The SPANS Index Scores:

  Orientation
  Attention/Concentration
  Language
  Memory/Learning
  Visuo-Motor Performance
  Efficiency
  Conceptual Flexibility

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Quick Overview

Types of Scores and Classifications

Index Scores

T score	Percentile	Label
≥60	>75th	High
40 – 59	25th – 75th	Average
30 – 39	<25th	Low
20 – 29	<10th	Very low
≤20	<5th	Extremely low

Subtest Scores

Scaled score	Label
4	High
3	Average
2	Low
1	Very low
0	Extremely low

Quick Overview

SPANS can be administered by:

- Clinical Psychologists
- Clinical Neuropsychologists
- Forensic Psychologists
- Occupational Therapists
- Speech and Language Therapists
- Neurology and Psychiatry Teams

History & Development

History & Development

- The concept of the SPANS was developed in the author's job as a clinical psychologist while working on a brain injuries rehabilitation inpatient ward.

- It was developed because a sufficiently brief, yet comprehensive test, normed and validated on adult-aged participants, did not exist.

History & Development

- Initial item selection based on literature review, theoretical, and empirical evidence to:

  A) measure the variety of cognitive skills that may be affected by focal or diffuse brain injury

  B) predict important outcomes when administered ‘early’ in inpatient rehabilitation following brain injury

  C) screen for neurological syndromes including aphasia, rapid forgetting (and PTA), neglect, agnosia, and apraxia

History & Development

- Information from the review, as well as from referrals received on inpatient rehabilitation wards, tasks were developed and trialled
- Tasks were retained if they were perceived as clinically sensitive and useful.
- A prototype test was finalised, parallel version created from precise specifications, and clinical and ‘norming’ data collected for statistical analysis.

SPANS: Index Scores

Orientation Index (ORI)

Subtest	Primary cognitive skill(s) measured
Orientation to Person	Retrieval of well-consolidated, stable personal information, and tracking own (changing) age
Orientation to Place	Either learning, or retrieval of personally relevant information, use of ‘place’ cues
Orientation to Time	Tracking ongoing events, use of time cues, and retrieval of and sense of date and chronology
Orientation to Condition	Personal awareness of (acquired) condition and subsequent limitations, learning new information
Orientation to Political Leadership	Awareness of and retrieval of names of highest ranking political figures in one’s country
Time Estimation	Sense of the passage of time and the ability to estimate ‘how much’ time has passed

Attention/Concentration Index (ACI)

Subtest	Primary cognitive skill(s) measured
Digit Span Forward	Verbal span, or capacity of apprehension
Digit Span Backward	Verbal working memory
Sustained and Divided Listening I	Simple sustained listening
Sustained and Divided Listening II	Sustained, divided listening with response inhibition
Counting Backwards	Verbal working memory
Monetary Calculations	Mental calculations

Language Index (LAI)

Subtest	Primary cognitive skill(s) measured
Repetition	Repetition of multi-syllabic phrases or sentences of various lengths
Naming	Naming 2-dimenstional pictured objects
Yes/No Questions	Answering ‘yes’ or ‘no’ to syntactically-complex questions
Following Directions	Carrying out oral instructions of multiple stages and various syntactic complexity
Writing Sentences	Writing an original and a dictated sentence, clarity, grammar and spelling
Similarities	Verbal expression, abstracting verbal concepts

Memory/Learning Index (MLI)

Subtest	Primary cognitive skill(s) measured
Object Recall	Retrieval of previously-named pictured objects following an interference task
Figures Recall	Retrieval of previously-copied geometric figures following an interference task
List Learning	Learning a word list over multiple presentations
List Recall	Retrieval of that word list following an interference task
List Recognition	Discrimination between words orally presented list or not following a delay
Word-Symbol Paired-Associates	Learning multiple associations between words and abstract symbols

Visuo-Motor Performance Index (VPI)

Subtest	Primary cognitive skill(s) measured
Object Recognition	Visual attention to detail, and visual recognition
Spatial Decision	Visuo-spatial analysis and discrimination
Figures Copy	Visuo-motor integration, paper-and-pencil copying, fine motor coordination
Letter-Number Coding	Visuo-motor integration, visual scanning, fine motor coordination
Figures Recognition	Visual attention and recognition, size and shape discrimination
Unusual Views	Form perception, and attributing label or meaning to distorted object forms
Facial Expressions	Visual scanning, attributing emotional meaning to facial features as a whole
3-and-1 Concept Test	Visual scanning, abstracting visual concepts

Efficiency Index (ECI)

Subtest	Primary cognitive skill(s) measured
Sustained and Divided Listening II	Response/reaction time under complex divided listening conditions
Spatial Decision	Speed/efficiency of visual scanning and making spatial-based judgments
Letter-Number Coding	Speed/efficiency of visual scanning, working memory, and visuo-motor integration
Counting Backwards	Speed/efficiency in working memory tasks
Monetary Calculations	Speed/efficiency of making mental calculations

Conceptual Flexibility Index (CFI)

Subtest	Primary cognitive skill(s) measured
Similarities	Verbal concepts, verbal abstraction
3-and-1 Concept Test	Visual concepts and abstraction, cognitive flexibility

SPANS: Technical Details

(Norms, Reliability and Validity)

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Clinical Norms

Clinical Sample:

- *N* = 136
- Age range 18 to 74

  (*M* = 43.2 years, *SD* = 13.7 years)
- 77% male
- Inpatient and outpatient clinical settings
- 43% traumatic brain injury, 16% haemorrhage, 11% hypoxic brain injury, 9% stroke, 21% other neurological conditions

Control Norms

Healthy control sample

- *N* = 122
- Age range 18 to 74

  (*M* = 46.9 years, *SD* = 17.3 years)
- 52% male
- Healthy, community-dwelling individuals
- Exclusion criteria = brain injury, neurological, and/or significant psychiatric condition; WTAR estimated IQ above 110 or below 90

Reliability

Interpretation: 0.70 (Adequate), 0.80 (Good), 0.90 (Excellent)

Internal consistency: Cronbach's alpha

ORI	0.79
ACI	0.83
LAI	0.86
MLI	0.90
VPI	0.85
ECI	0.87
CFI	0.77

Alternate version test-retest reliability

ORI	0.93
ACI	0.88
LAI	0.97
MLI	0.95
VPI	0.89
ECI	0.88
CFI	0.74

Construct Validity

Correctly measures theoretically predicted cognitive skills – i.e. what's on the label ($p < .01$)

	ORI	ACI	LAI	MLI	VPI	ECI	CFI
WAIS Verbal IQ			.657				
WAIS Working Memory		.626	.509			.491	
WAIS Performance IQ					.693	.673	.513
WAIS Perceptual Organization					.674	.595	.605
WMS Auditory Memory I		.479	.495	.563			.453
WMS Auditory Memory II	.479	.456		.712			
Rey Visual Memory I				.667	.684	.637	
Rey Visual Memory II				.652	.689	.599	
Trail Making Test A		.564			.574	.612	
Trail Making Test B	.785	.753		.555	.901	.857	

Discriminative Validity

Differentiates between levels of cognitive impairment

	Post-acute	Long-term	'Norm'	*p*
ORI *M (SD)*	*17.3 (4.8)*	*20.0 (3.3)*	*21.7 (0.6)*	$p < .01$
ACI *M (SD)*	*33.7 (9.5)*	*37.8 (6.4)*	*42.4 (2.9)*	$p < .01$
LAI *M (SD)*	*42.6 (10.8)*	*47.6 (4.6)*	*50.9 (1.9)*	$p < .01$
MLI *M (SD)*	*42.6 (16.5)*	*54.6 (10.1)*	*60.5 (5.0)*	$p < .01$
VPI *M (SD)*	*48.9 (16.3)*	*58.6 (10.1)*	*65.1 (3.8)*	$p < .01$
ECI *M (SD)*	*30.3 (11.4)*	*36.4 (9.3)*	*44.2 (3.5)*	$p < .01$
CFI *M (SD)*	*21.3 (6.4)*	*25.5 (3.4)*	*27.0 (1.4)*	$p < .01$

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Discriminative Validity

Differentiates between left and right hemisphere damage

SPANS Index	**Left or Right ABI**	**Mean (SD)**	***p***
Language Index	Left	38.4 (12.7)	.001
	Right	47.6 (4.6)	
Visuo-Motor Performance Index	Left	54.3 (15.0)	.030
	Right	46.9 (10.6)	

Sensitivity / Specificity

Index Scores are Sensitive and Specific

- Receiver Operating Characteristics (ROC) curves showed that all of the SPANS indices were significantly able to discriminate between people with and without an acquired brain injury or neurological condition

- The most sensitive and specific index was the Efficiency Index (AUC .881), least the Conceptual Flexibility Index (AUC .785)

Construct Validity

Three Index Scores Supported by Exploratory Factor Analysis

- EFA extracted 3 factors that largely corresponded with the LAI (language), MLI (memory), and VPI (visual/motor) indexes
- Orientation (ORI) re-distributed between the ‘memory’ and ‘visual/motor’ factors, suggesting orientation involves learning and retrieval, aided by visual attention
- Attention (ACI) largely loaded on the ‘language’ factor, reflecting the ACI’s high representation of alpha-numeric/calculation items
- The SPANS 7 index structure was maintained for clinical utility, largely theoretically supported by EFA

Frequently Asked Questions (FAQ's)

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Q: How long does the SPANS take to administer?

- It depends on clinician need and patient capability…
- The whole SPANS takes 30-45 minutes to administer in clinical settings
- ‘Shorter’, tailor-made administrations are possible because subtests and index scores are individually norm-referenced, making interpretation possible at any level

Q: How long does the SPANS take to score?

- 5 – 10 mins
- A ‘throw-out’ page in the scoring booklets, and easy-access conversion tables in the Test Manual makes transfer of raw scores to scaled scores easy and efficient

Q: Why a parallel version?

- A problem with single version tests is patients' previous exposure to content and items designed for one-off 'novelty'
- This is particularly the case with memory and executive functioning-type tests
- A parallel version, with the same length, same instructions, same difficulty level, but different content allows accurate retest

Q: How does SPANS differ from the RBANS?

- The SPANS has 30 subtests and 7 index scores, the RBANS 10 subtests and 5 index scores
- The SPANS has more, briefer subtests overall, and more subtests per index score making more internally reliable index scores (i.e. Cronbach's alpha), and making the test more engaging for patients
- The SPANS has better alternate-version test-retest reliability across all index scores
- The SPANS takes about 5 to 10 minutes longer to administer and score, but provides a wider variety of observations, including screening for neurological syndromes that the RBANS does not

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Q: Why is there not an ‘Executive Function Index’?

- In the original design and trial stages, subtests classed as ‘executive functioning’ were included
- As data were gathered, such tasks did not correlate, but psychometrically found a better fit within generic ‘visual’ or ‘verbal’ domains
- Two original subtests were removed from the final prototype, and three were re-distributed to the LAI, VPI, and ACI, and used to form the CFI
- It was concluded that executive functioning is not a unitary concept, but some of its various skills are distributed throughout several of the indices

Q: In what settings can the SPANS be administered?

- The SPANS was developed on adult-aged acquired brain injury rehabilitation wards, but has scope to be used more widely
- Given its design and empirical evidence supporting sensitivity to even mild cognitive impairment throughout adulthood, it is appropriate in many settings, depending on clinician choice and need
- It is a measure of impairment, not a general measure of intellectual functioning (IQ)

Q: Can SPANS be used patients with visual, language, motor, and/or awareness deficits?

- The SPANS was designed to provide a variety of subtests, some with low visual, language, motor, or awareness demands
- The SPANS administrator is offered guidance in the Test Manual as to how best the SPANS may be used in such circumstances
- Flexible administration makes this possible

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Q: Is SPANS appropriate for use with younger and/or older people?

- The SPANS is currently normed on adults
- Evidence suggests it may be appropriate for children as young as 8, and very likely by age 11
- Experience suggests that the SPANS loses specificity with lower functioning normal adults after the age of 74, but that it is a useful addition to a battery in the assessment of earlier onset dementias (i.e. before 74)
- All these areas require further investigation

Q: Could SPANS be used in research?

- The SPANS has been and would be useful in future research studies
- The high internal and test-retest reliabilities suggest that the SPANS measures real cognitive skills, and that reliable re-measure of these skills and change, can occur at two time points
- The SPANS would therefore be useful when any research questions require this capability in its measures
- Discounts are available for institutions who would like to use the SPANS in research

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Q: What does the kit contain?

- Test Manual
- Stimulus Book A
- Stimulus Book B
- 25 Scoring/Response Booklets each for SPANS A and SPANS B
- Scoring template for the Letter-Number Coding subtest
- Carrier box with handle
- Clipboard
- Soundless stopwatch

Q: What is included in the Test Manual?

- Background to the development of the SPANS, including rationale and literature review
- Detailed administration & scoring instructions
- Guidelines for interpretation
- Reliability, validity and standardisation information
- Special administration and interpretation circumstances
- Case studies
- Areas for future research and development

Q: How could someone get involved?

- We would be particularly interested in working with researchers involved in:

A) Comparison studies with the RBANS

B) Studies that could contribute to the clinical and normative data collected for adults with ABI and other conditions

C) Studies that could contribute clinical and normative data collected with young people and older adult samples

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About the Author

Originally from California, Dr Gerald Burgess earned his PsyD from James Madison University in Virginia, USA. He is a Consultant Clinical Psychologist with eight years experience working privately and in the NHS in the UK in neuropsychology services.

He completed a post-doc MSc in Clinical Neuropsychology, while working on ABI rehabilitation wards, where he developed the SPANS based on clinical experience, and he hopes other clinicians find the SPANS of use and practical value.

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For further information,

to express an interest taking part, or
to purchase a kit, visit
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