

Supplementary Material

Search terms used

FEP free search terms: *FEP, FES, first episode psychos*, recent onset psychos*, first onset psychos*, early psychos*, early onset psychos*, first episode schizophren*, recent onset schizophren*, first onset schizophren*, early schizophren*, early onset schizophren**

Cognition search terms: *cogniti* (MeSH), neuropsych* (MeSH), IQ, intelligence (MeSH), attention (MeSH), concentration, memory (MeSH), learning (MeSH), verbal, visual, language (MeSH), spatial, executive function* (MeSH), concept formation (MeSH), inhibition (MeSH), problem solv* (MeSH), flexibility, motor, speed, processing, vigilance, social cogniti*, emotion recog*, affect recog*, theory of mind, mentali*, social perception (MeSH), social knowledge, metacognit* (MeSH)*

DUP search terms: *DUP, duration of untreated psychos*, DUI, duration of untreated illness*

The following cognitive measures were excluded: academic achievement, neurological soft signs (NSS), olfactory identification, EEG studies (e.g., mismatch negativity, prepulse inhibition, etc.), attributional bias/style, jumping to conclusions bias, other cognitive styles or biases.

Supplementary Table 1. Cognitive domains and tests included under each domain

Domain	Battery	Test	Score / Subtest	
Speed of Processing		Colour trails test	1	
		CPT Identical Pairs	Reaction time (mean for 6 trials)	
		CPT-O	Reaction time (seconds)	
		CPT	Reaction time	
		D2 Test of Attention	Speed (corrected for errors)	
		Detection	Reaction time (ms)	
		WAIS-R; WAIS-III	Digit Symbol; Digit Symbol Coding; Symbol Substitution	Age-adjusted score; total number; scaled score
			Digit symbol, symbol search, TMT-A	Processing Speed Domain
		IntegNeuro	Information processing speed	Factor score relative to healthy controls
			OTIS Type Verbal Intelligence	
		CANTAB	Reaction Time	Composite; factor score; choice reaction; simple reaction
		CogLab	Reaction time	
			SDMT	
		CANTAB	Stockings of Cambridge ¹	Initial thinking time, subsequent time, initial thinking time (msec), subsequent thinking time (msec)
		MCCB		Speed of Processing
			Tower of Hanoi ¹	Planning time
			Stroop; Stroop Colour-Word Test	Colour, Word, Colour test, Word raw score, Colour raw score
		BACS; BACS-DK; BACS-J; MCCB	Symbol Coding, BACS Symbol Coding	Total score, processing speed
		WAIS-III	Symbol Search	
			TMT	Part A, Part A Time, Part A Total Seconds, Processing speed z score
			TMT-A, Digit Symbol	Processing speed composite
			Tower of Hanoi	Executed Time
			TMT A & B, cancellation test, digit symbol coding, digit span backward	Speed of processing and executive functioning factor score
				Speed Domain
		WAIS-III/WISC-III		Processing Speed Index
		BACS		Processing Speed Z Score
		MCCB		Speed of Processing
		TAP	Alertness No/With Warning	Reaction time
			COWAT, Digit symbol, TMT A, Stroop trials 1 and 2, Alpha tree test, Alpha curved test	Initiation and speed domain
		WAIS-III		Processing Speed Index
Speed of Processing: Speed of Working Memory Processing		1-back; 2-back	Reaction Time	
		CPT-XO	Reaction time (seconds)	
		TAP	Divided attention (sounds, squares)	Reaction time
			Maintenance of letters task (with or without manipulation)	Reaction time (msec)
			Stroop	Colour-word time, Word test interference score reaction time (secs)
		TAP	Working Memory Levels 1-3	Reaction Time
Speed of Processing:	CogLab	Backward masking task	33-msec interstimulus interval, 49.5-msec interstimulus interval	

Early Visual Processing		Sensory Perception	Sensory Perception Z Score
		Serial Reaction Time (SRT)	Mean of median RTs blocks 8-7 (ms); Baseline (ms)
Attention/Vigilance	TAP	Alertness No/With Warning	Variability, correct answers
			Attention composite Z Score
	MCCB		Attention and Vigilance
		Brief Test of Attention	Numbers, letters
		Concentration	Summary Z Score
		CPT	Total, d', attentiveness (d')
		CPT Degraded Stimulus Hits and reaction time, Brief Test of Attention	Sustained attention/vigilance factor score
		CPT Degraded Stimulus	
	MCCB	CPT Identical Pairs	Mean hits for 6 trials, false alarms for 6 trials ² , d', mean d-prime 3 trials
		CPT-O	Omissions %
		CPT-XO	Omissions %
		D2 Test of Attention	Attention z score, accuracy (errors in %)
		Detection	Performance %
	WAIS, WAIS-III, WAIS-R, WAIS-R-Hong Kong, WMS-III	Digit Span	Forward, Forward Raw
	TAP	Divided Attention (Normal, sounds, and squares)	Variability, correct answers, errors
		Monotone Counting Test	Total score
		Penn CPT	D'
	CANTAB	RVP, RVP Selective Attention	A', signal simple, signal complex, factor score, signal detection, number of hits, number of misses
		Span of Apprehension	
	WMS-III	Spatial Span	Forward, Forward Raw
	WAIS-R	Stroop trial 3, Trail Making Test B, CPT proportion of hits, letter cancellation task	Sustained and Selective Attention Domain
		Sustained Attention to Response Task	
	IntegNeuro	Vigilance/Sustained Attention	Factor score relative to healthy controls
	CogLab	VSA	
		Visual Pattern Test	Longest span, correct items
			Attention Domain
		1-back, 2-back	Performance %
Working Memory	WAIS-R	Arithmetic	Age-adjusted score, scaled score
	WAIS-R	Arithmetic, Digit Span	Working memory domain
		Arithmetic-R	
		Bergen N-Back Test	D'
		Comp. Visuospatial Working Memory Test	Mean error (5, 15 seconds) minus no delay
		Control Working Memory Task	Accuracy (proportion of correct responses)
	WMS	Digit memory	
	BACS, BACS-DK, BACS-J	Digit Sequence	Correct responses, digit sequencing
	WAIS, WMS-III, WAIS-R, WAIS-III	Digit Span, Digits Backward	Backward
		Digit span distractibility test	Without distractor (neutral) % correct, with distractor % correct

	Gold Letter-Number Span	Total Score
WAIS-III	Letters and numbers, letter/number/space sequence Letter number sequencing, letter number sequencing test	
MCCB	Letter number span	Longest span, total score, verbal working memory
	Maintenance of letters task, manipulation plus maintenance of letters task	Omitted responses (%), accuracy (proportion of correct responses)
	N-back task	Correct responses
	PASAT	
	PASAT, spatial span	Working memory domain
WMS-III, CANTAB	Spatial Span	Backward, length
WMS-III/WAIS-III	Spatial span/digit span	Working memory z score
CANTAB, Cogtest	Spatial working memory	Strategy score, errors, direct touch distance (mm), 2s delay error (mm), 12s delay error (mm), 4-box errors, 6-box errors, 8-box errors, between errors
MCCB	Visuospatial working memory	Spatial span
MCCB	Working Memory	
		Working Memory composite Z Score
IntegNeuro	Working memory capacity	Factor score relative to healthy controls
TAP	Working memory levels 1, 2, 3	Variability, correct answers, omissions
WAIS-III/WISC-III, WMS-III/CMS		Working memory index
BACS		Working memory z score
WMS-III		Working memory
Verbal Learning and Memory	Buschke Selective Reminding Task, Buschke Verbal Selective Reminding Task	Total recall, delayed recall
	BVMT, BVMT-R	Total learning, delayed recall, visual memory domain, total figures recalled
	CVLT	Attempts 1-5 mean hits, attempts 1-5 mean errors, delayed free recall, recognition, total recall, total 1-5, verbal learning index (immediate recall, delayed recall, errors), immediate recall, short delay free recall, long delay free recall, recognition discriminability
BEM-84	History	Immediate recall, delayed recall
	HVLT, HVLT-R	Total learning, delayed recall, verbal learning/memory domain, total words recalled
BACS	List Learning	Total Words Recalled
BEM-84	List of Words	Immediate recall, delayed recall
WMS-III, WMS-R-Hong Kong, WMS, WMS-R, WMS-III/CMS	Logical Memory, Logical Memory I, Logical Memory II	Immediate recall, delayed recall, I, II, verbal memory z score, long term memory, recognition
	RAVLT	Trials 1-5, verbal memory and learning composite, trial 6, trial 7, total learning, delayed recall, recalled words, recall (after 30 minutes), recognition (corrected for errors), short term verbal memory, long term verbal memory, verbal learning and memory factor score (immediate memory span, new learning, short and long delay recall, recognition memory)
WMS-R	RAVLT, Logical memory	Verbal Memory Domain
	Retrospective Item Recognition	Proportion of Correct Responses
MCCB	Verbal Learning	HVLT-R
BACS-DK, BACS-J, IntegNeuro	Verbal Memory	Factor score relative to healthy controls, verbal memory summary z score
WMS	Verbal Paired Associates	

		Verbal Paired Associates Learning Task	Learning & Memory Trial 1, 2, 3, 4: concrete and abstract, Interference trial 1, 2: concrete and abstract, post-interference recall: concrete and abstract	
		BACS	Verbal Memory Z Score	
		WMS-III	Auditory immediate, auditory delayed, auditory recognition	
Visual Learning and Memory		BEM-84	Complex figure	
		WMS-R	Design Reproduction	
		RBANS	Figure recall	
		CANTAB	Pattern recognition memory	
			Penn Face Memory Test	
			RCFT, ROCF, Rey Complex Figure	
			ROCT; Benton Visual Retention Test	
			Serial Anticipation Task	
			Serial Generation Task	
			Serial Reaction Time	
			Spatial Memory	
		CANTAB	Spatial recognition memory	
		BEM-84	Visual	
		MCCB	Visual Learning	
		WMS	Visual recall memory	
		WMS-III, WMS-R, WMS-R-Hong Kong, WMS	Visual Reproduction, I, II	
		MCCB	Visual Learning	
		WMS-III	Visual immediate, visual delayed	
	Executive Functioning		CogLab	Asarnow
			CANTAB	Attention Set Shifting
			Colour Trail, Colour Trails II	
			Colour-Word Interference Test	
			CPT False Alarms	
		IntegNeuro	Executive Function	
			Executive Functioning Tasks	
			Fluency	
			Hayling Sentence Completion (parts A and B)	
		CANTAB	IED Set Shift	
		WAIS-IV, WAIS-III	Matrix Reasoning	
		WISC-III	Mazes	
			Modified WCST	
			Penn Conditional Exclusion Test	
		CANTAB	Planning	

	Raven's Coloured Progressive Matrices RPM-R	Set AB, set B
MCCB	Reasoning and problem solving	NAB Mazes Response Inhibition composite z score
Cogtest	Set Shifting Test Six Elements Test	Reaction time increase after shift, error increase after shift Number of rule break, raw score, number of set change, profile score, total profile score
CANTAB	Stockings of Cambridge ¹	Minimum moves, mean moves, planning efficiency factor score, planning efficiency mean number of moves, planning efficiency problems solved in minimum moves
	Stroop Test, Stroop Colour Word Test, Computerized Stroop	Colour-word, colour-word correct, colour-word errors, colour-word raw score, interference, interference score errors %, total error rate, errors incongruent, errors word reading (reversed Stroop effect), interference effect, facilitation effect, reverse Stroop interference effect, reverse Stroop facilitation effect
	TMT-B, letter number span, Raven's Progressive Matrices	Executive Functioning/Working Memory Composite
BACS, BACS-DK, BACS-J	Tower of London	Total score, number of movements
	TMT	Part A – error, Part B, Part B - time, B – error, factor score, Part B – Part A
WAIS-III	Trail Making Test B / Block Design WCST	Problem Solving Z Score No. of cards used, total no. of errors, perseverative errors, non-perseverative errors, perseverative responses, % perseverative errors, unique errors, other errors, category, completed categories, categories correct, factor score, categories achieved, trials to first category, failure to maintain set, correct response, executive functioning index
	WCST categories and perseverative errors; Shipley Institute of Living scale abstractions; WAIS-R comprehension; similarities; picture completion; picture arrangement	Problem Solving Domain
	WCST, Stroop, verbal fluency, TMT-B	Executive Functioning Composite Executive Functioning Domain
BACS MCCB		Executive Functions Z Score Reasoning/Problem Solving
Verbal Fluency	BACS-J, MCCB	Category Fluency COWAT
		Total score in 3 trials Letters (mean C, F, L), categories (mean animal, fruit), FAS words, category instances, FAS sum of the three conditions, verbal fluency total
		Fluency Factor score, phonological verbal fluency, semantic verbal fluency
	BACS-J	Letter Fluency Phonological Fluency
		Semantic Category Fluency, semantic fluency, semantic verbal fluency Animal fluency
BACS-DK, BACS	Verbal fluency Word Fluency	Letter, category, category fluency, F and S words, correct response (animals), sum FAS, animals, letter (starting with P), phonemic (ending with O), category (animals), z score Written, oral Fluency domain
Verbal/Language Skills	WAIS-R, WAIS-III	Comprehension
	WAIS-R, WAIS-III	Comprehension & vocabulary, short form, verbal subtests
	WAIS-R, WAIS-R-Hong Kong	Information
		Verbal IQ Scaled score, age-adjusted score

		Language	Language summary z score
		Multiple Choice Vocabulary Intelligence Test	Intellectual performance
		SCOLP	
	WAIS, WAIS-R, WAIS-III	Similarities	
		Similarities-R	
	IntegNeuro	Verbal Processing	Factor score relative to healthy controls
	WAIS, WAIS-R, WAIS-III, WAIS-IV	Vocabulary	Scaled score
	WAIS-R	Vocabulary; Shipley Institute of Living vocabulary	Language skills domain
	WAIS-III	Vocabulary, Similarities, Information, Comprehension	Verbal comprehension abilities factor score
	WAIS-III/WISC-III		Verbal Comprehension Index
	WAIS-III		Verbal Communication Index
Visuo-Spatial Skills	WAIS-R, WAIS-III	Block Design	Scaled score
	WAIS-R, WAIS-III	Block design & digit symbol, performance subtests, short form	Performance IQ
		Judgement of Line Orientation	
	WAIS-R, WAIS-III	Object Assembly	
	WAIS-R, WAIS-III	Picture Arrangement	
	WAIS-R, WAIS-III	Picture Completion	
		RCFT, Rey Complex Figure	Copy
	WAIS-R	ROCF, Block Design, Object Assembly, Judgement of Line Orientation	Visuospatial Skills Domain
	WAIS-III/WISC-III, WAIS-III		Perceptual organization index
	Motor Speed and Dexterity		Finger tapping left and right hand averages; Purdue Pegboard left, right, and both hands
Cogtest		Finger Tapping	Dominant Hand; Both hands; motor speed index; total taps
		Grooved Pegboard	Motor dexterity factor score, dominant hand, non-dominant hand, motor speed domain, two trial mean, mean both hands, total
CANTAB		Motor Task	Response latency (msec)
CANTAB		Movement time	Factor score, simple movement time, choice movement time
CANTAB		Reaction Time	Choice movement, simple movement
IntegNeuro		Sensorimotor function	Factor score relative to healthy controls
BACS; BACS-DK; BACS-J		Token Motor Task	Score, total tokens
BACS			Motor Speed Z Score
Prospective Memory			Cambridge Prospective Memory Test
		Prospective Memory Screening	
		Prospective Memory Test	Event based prospective memory, time based prospective memory, sum of z scores of prospective memory performance
Full Scale IQ/Estimated IQ	WAIS-III	11 Subtests	FSIQ
	WASI	4 Subtests	FSIQ, age adjusted IQ score
	WAIS-R	All other subtests/FSIQ/VIQ/PIQ	
	WAIS-R	Arithmetic, similarities, digit span	IQ Estimate

	WAIS-R	Comprehension, vocabulary, block design, digit symbol	FSIQ
	WAIS-R		IQ Estimate
	WAIS-R	K-4: arithmetic, similarities, picture completion, digit symbol	FSIQ
	WAIS-III; WASI	Matrix Reasoning, Block Design, Vocabulary, Similarities	FSIQ; Estimated IQ
			Estimated IQ
	WAIS-III; WAIS-R	Short form	Estimated IQ; Total IQ
		TONI-2	General IQ
	WISC-R/WAIS III	Vocabulary and block design	Estimated IQ
	WAIS-R	Vocabulary, Comprehension, Digit symbol, Block design	FSIQ
	WAIS-R; WAIS-III		FSIQ
Global Cognition	RBANS	All RBANS Tests	Average of 5 Domain Scores
		All tests	Global Cognition Z Score
	BACS-J; BACS		Composite Score
	MCCB		Composite Score
		COWAT, Digit Span Distractibility Test, CPT Hits	Working Memory/Fluency Index
		Global Cognitive Function	Z Score
		WCST, Digit Symbol, CVLT or RAVLT, WMR-R	Neurocognitive Composite Z Score
		Visual Reproduction, Verbal Fluency	
General Memory	BEM-84		Total Score
	WMS		Total Score
			Memory Domain
	WMS-III		General Index
	WMS-III		Immediate Memory
Cognitive Deterioration		Deterioration Estimate NART-WAIS III	FSIQ, VIQ, PIQ
	WAIS-III, WAIS-R	Information, vocabulary, digit symbol coding	Deterioration Index
		Otis-type verbal intelligence test	Change from premorbid
		RPM-R	Change from premorbid

BEM = Battery of memory efficiency; BVMT = Brief Visuospatial Memory Test; CANTAB = Cambridge Neuropsychological Test Automated Battery; COWAT = Controlled Oral Word Association Test; CPT = Continuous Performance Test; CVLT = California Verbal Learning Test; FSIQ = Full Scale IQ; HVLT = Hopkins Verbal Learning Test; IED = Intra-extra dimensional; MCCB = MATRICS Consensus Cognitive Battery; PASAT = Paced Auditory Serial Addition Test; PIQ = Performance IQ; RAVLT = Rey Auditory Verbal Learning Test; RCFT = Rey Complex Figure Test; ROCF = Rey-Osterrieth Complex Figure; RPM = Raven's Progressive Matrices; RVP = Rapid Visual Processing; RBANS = Repeatable Battery for the Assessment of Neuropsychological Status Update; SCOLP = Speed and Capacity of Language Processing Test; SDMT = Symbol Digit Modalities Test; TAP = Test Battery for Attentional Performance; TMT = Trail Making Test; VIQ = Verbal IQ; VSA = Vigilance – Span of Apprehension; WAIS = Wechsler Adult Intelligence Scale; WCST = Wisconsin Card Sort Task; WISC = Wechsler Intelligence Scale for Children; WMS = Wechsler Memory Scale

References

1. Bestawros, A., et al., *Relationship between choice reaction time and the Tower of Hanoi test*. Percept Mot Skills, 1999. **88**(2): p. 355-62.
2. Burton, C.Z., et al., *Factor structure of the MATRICS Consensus Cognitive Battery (MCCB) in schizophrenia*. Schizophr Res, 2013. **146**(1-3): p. 244-8.

Supplementary Table 2. Scoring system used for rating the methodological quality of included studies, adapted from Anderson, Rodrigues ³.

Scoring Criteria	2	1	0
Non-participation Rate	Low rate (<20%) and differences described	High rate (>20%) and differences described	High rate OR not stated OR no description of differences
Exclusion criteria	Clear description of exclusion criteria and excluded participants reported	Mention of exclusion criteria, but lacking detail or excluded participants not reported	Not described or unclear
Definition of FEP	Based on first presentation to a clinical setting (truly/somewhat representative), OR medication naïve, OR ≤6 months duration of treatment	Based on first hospitalisation only, or >6 months duration of antipsychotic treatment (selected group)	No description of the derivations of the sample or includes participants who are/may not be first episode
Definition of DUP/DUI	Clear definition of DUP or DUI in methods or results (including description of start and end point)	N/A	No definition of DUP/DUI (e.g., no description of start or endpoint)
Measurement of DUP/DUI	Use of a standardised measurement tool for rating DUP (structured or semi-structured interview)	N/A	Not described or no use of a standardised measurement tool
Source of DUP/DUP data	Patient report corroborated with medical record review or third party information (family member, treating doctor)	Patient report only (self-report)	Not described or medical record review/third party report only
Data and statistical reporting	All raw data reported (means and standard deviations of cognitive tests and DUP/DUI), OR all statistics examining DUP/DUI and cognition relationship (including all p values, even if non-significant)	Only some raw data reported, OR only some statistics examining DUP/DUI and cognition relationship reported	Data on findings are not included (raw data or statistical analyses)

1. Bestawros A, Langevin J, Lalonde R, Botez-Marquard T. Relationship between choice reaction time and the Tower of Hanoi test. *Percept Mot Skills* 1999; **88**(2): 355-62.
2. Burton CZ, Vella L, Harvey PD, Patterson TL, Heaton RK, Twamley EW. Factor structure of the MATRICS Consensus Cognitive Battery (MCCB) in schizophrenia. *Schizophrenia research* 2013; **146**(1-3): 244-8.
3. Anderson KK, Rodrigues M, Mann K, et al. Minimal evidence that untreated psychosis damages brain structures: a systematic review. *Schizophrenia Research* 2015; **162**(1-3): 222-33.

Supplementary Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-analyses

(PRISMA) flow diagram of studies included in the meta-analysis

