Supplemental Online Content

Catalan A, Salazar de Pablo G, Aymerich C, et al. Neurocognitive functioning in individuals at clinical high risk for psychosis: a systematic review and meta-analysis. *JAMA Psychiatry*. Published online June 16, 2021. doi:10.1001/jamapsychiatry.2021.1290

eMethods 1. Search terms used in the literature search 4

eMethods 2. Types of CHR-P psychometric interviews included 4

eMethods 3. Neurocognitive domains considered in the current meta-analysis (7 MATRICS domains and 8 CHR-P domains)..... 5

eMethods 4. Extracted variables 7

eMethods 5. Methods for pooling non-independent neurocognitive tasks..... 7

eMethods 6. Meta regression factors 7

eMethods 7. Glossary of terms..... 7

eTable 1. PRISMA statement and checklist..... 9

eTable 2. MOOSE checklist..... 10

eTable 3. Risk of bias (quality) assessment using modified Newcastle-Ottawa Scale for cross-sectional and cohort studies 12

eTable 4. Characteristics of included studies..... 13

eTable 5. Meta-analytical comparisons: CHR-P vs HC..... 18

eTable 6. Meta-analytical comparisons: CHR-P not transitioning vs those transitioning..... 20

eTable 7. Meta-analytical comparisons: CHR-P vs FEP..... 21

eTable 8. Pooled meta-analysis across 15 neurocognitive domains: CHR-P vs HC..... 22

eFigure 1. Pooled meta-analysis across 15 neurocognitive domains: CHR-P vs HC..... 23

eTable 9. Pooled meta-analysis across neurocognitive domains: CHR-P transitioned vs CHR-P non transitioned 24

eFigure 2. Pooled meta-analysis across neurocognitive domains CHR-P transitioning vs CHR-P non transitioning..... 25

eTable 10. Pooled meta-analysis across neurocognitive domains: CHR-P vs FEP 26

eFigure 3. Pooled meta-analysis across neurocognitive domains: CHR-P vs FEP 26

eFigure 4. Funnel plot for processing speed tasks: CHR-P vs HC 27

eFigure 5. Funnel plot for attention/vigilance tasks: CHR-P vs HC..... 27

eFigure 6. Funnel plot for working memory tasks: CHR-P vs HC 28
eFigure 7. Funnel plot for verbal learning tasks: CHR-P vs HC 28
eFigure 8. Funnel plot for visual learning tasks: CHR-P vs HC 30
eFigure 9. Funnel plot for reasoning and problem-solving tasks: CHR-P vs HC 30
eFigure 10. Funnel plot for social cognition tasks: CHR-P vs HC 30
eFigure 11. Funnel plot for general intelligence tasks: CHR-P vs HC 30
eFigure 12. Funnel plot for premorbid IQ: CHR-P vs HC 31
eFigure 13. Funnel plot for visuospatial ability tasks: CHR-P vs HC 31
eFigure 14. Funnel plot for verbal memory tasks: CHR-P vs HC 32
eFigure 15. Funnel plot for visual memory tasks: CHR-P vs HC 32
eFigure 16. Funnel plot executive functioning tasks: CHR-P vs HC 33
eFigure 17. Funnel plot for motor functioning task: CHR-P vs HC 33
eFigure 18. Funnel plot for olfaction task: CHR-P vs HC 34
eFigure 19. Funnel plot for neurocognitive domains by tasks: CHR-P not transitioning vs those transitioning 35
eFigure 20. Funnel plot for neurocognitive domains by tasks: CHR-P vs FEP 37
eResults 1. Metaregressions 38
eDiscussion 1. Additional discussion 40
eTable 11. Metaregressions CHR-P vs HC 40
eTable 12. Metaregressions CHR-transitioning vs CHR-P non transitioning ... 42
eTable 13. Metaregressions: CHR-P vs FEP 43
eDiscussion 2. 43

This supplemental material has been provided by the authors to give readers additional information about their work.

eMethods 1. Search terms used in the literature search

The search terms were: "cognit*" OR "neurocognit*" OR "social cognit*" AND "psychosis risk" OR "prodrom*" OR "ultra-high risk" OR "clinical high risk" OR "genetic high risk" OR "at risk mental state" OR "at-risk mental state" OR "basic symptoms" OR "ultra-high risk".

eMethods 2. Types of CHR-P psychometric interviews included (modified from Fusar-Poli et al. 2020[1])

The CHR-P state comprises the Clinical High Risk for Psychosis (CHR-P) state and/or the Basic Symptoms (BS)[1].

The following CHR-P psychometric interviews were considered to define the UHR state: Comprehensive Assessment of At-Risk Mental States (CAARMS[2]), Structured Interview for Psychosis-risk Syndromes (SIPS[3,4]), Basel Screening Instrument for Psychosis (BSIP[5]) and Early Recognition Inventory (ERIraos[6]).

The following CHR-P psychometric interviews were considered to define the BS[1]: Bonn Scale for the Assessment of Basic Symptoms (BSABS[7]), Schizophrenia Proneness Instrument[8] -Adult (SPI-A) and Child and Youth (SPI-CY) version.

Furthermore, we considered early operationalisations of the CHR-P state, which were based on the Positive and Negative Syndrome Scale (PANSS[9]) and Brief Psychiatric Rating Scale (BPRS[10]).

eMethods 3. Neurocognitive domains considered in the current meta-analysis (7 MATRICS domains and 8 CHR-P domains. Adapted from Fusar-Poli et al. 2012 [11] and Hauser et al. 2017[12]. CHR-P, Clinical High Risk for Psychosis.

As a note, the MATRICS was not designed to be a comprehensive battery for the assessment of cognition but rather was developed with a narrower purpose of creating a brief, highly portable and tolerable consensus battery of neurocognitive domains most likely to be sensitive to both the most common (or best characterized) cognitive impairments in schizophrenia spectrum disorders and to change following targeted treatment (pharmacological or psychological). In fact, the range of cognitive impairment in schizophrenia spectrum disorders is broader and more complex than indexed by the MATRICS, and we should expect no less of its putative clinical high-risk states. As such, in an effort to produce a comprehensive review of the extant literature, we endeavoured to be more inclusive in our approach and thus included additional neurocognitive domains and tasks that have been employed in cognitive studies of CHR-P to date and which are frequently assessed in clinical settings. While the MATRICS represents an organizing framework, it is necessarily limited such that any comprehensive meta-analysis requires the inclusion of a broader set of neurocognitive domains and tests that adhere to a related but non-redundant categorizing scheme.

Neurocognitive domains	**Tasks**
MATRICS domains	
Processing Speed	• Trail Making Test-Part A (TMT-A)[13] • Brief Assessment of Cognition Scale Symbol Coding (BACS SC)[14] • Animal Fluency[15] • Letter Fluency[16] • Digit symbol coding test (DST)[17] • Stroop color word reading (Stroop W)[18] • Stroop color naming task (Stroop C)[18]
Attention/Vigilance	• Continuous Performance Test – Identical Pairs (CPT-IP)*[19,20]
Working Memory	• Wechsler Memory Scale-III Spatial Span Subtest (WMS-III: SS)[21] • Letter Number Span (LNS)[22] • Letter Number Sequencing Test (LNST)[17] • Arithmetic (any WAIS)[21,23] • Self-Ordered Pointing Task (SOPT)[24]
Verbal Learning	• Hopkins Verbal Learning Test—Revised (HVLT-R)**[25] • Rey Auditory Verbal Learning Test (RAVLT)***[26] • California Verbal Learning Test I/II (CVLT)****[26-28]
Visual learning	• Brief Visuospatial Memory Test-Revised (BVMT-R)**[29] • Wechsler Memory Scale Immediate Visual Memory (WMS VM)[21] • Rey–Osterrieth Complex Figure test Immediate Recall (ROCF)[30]
Reasoning and Problem-Solving	• Neuropsychological Assessment Battery Mazes (NAB Mazes)[31]
Social cognition+	• Reading the Mind in the Eyes Test (RMET) [32,33] • Degraded Facial Affect Recognition (DFAR)[34] • Hinting [35]
CHR-P domains	
General intelligence IQ	• Wechsler Adult Intelligence Scale- 3rd edition (WAIS-III)[21] • Wechsler Adult Intelligence Scale-Revised (WAIS-R)[36] • Wechsler Intelligence Scale for Children- 3rd edition (WISC-III) [37]

Premorbid IQ	• National Adult Reading Test (NART)[38] • MehrfachWortschaftz-Intelligenz Test-part B (MWT-B)[39]
Visuospatial ability	• WAIS/WISC Block Design (WAIS/WISC BD)[17,37]
Verbal memory	• RAVLT Delayed Recall (RAVLT DR)[26]
Visual memory	• ROCF Delayed Recall (ROCF DR)[30] • Wechsler Memory Scale Visual Reproduction Delayed Recall (WMS VR)[21]
Executive functioning	• Trail Making Test- Part B (TMT-B)[13] • Wisconsin Card Sorting Test (WCST)[40]: categories, number of correct responses, perseverative errors and perseverative responses • Stroop Test: Interference[41]
Motor functioning	• Finger Tapping Test (Tapping)[42]
Olfaction	• University of Pennsylvania Smell Identification Test (UPSIT)[43]

[+]Social cognition encompassed: (a) emotional processing, (b) social perception and knowledge, (c) theory of mind, and (d) attributional bias). *Mean d' across conditions; **Total Learning Trials 1-3; ***Learning Trials; **** Trials 1-5 Total Correct
Only tasks with 3 or more available studies in the dataset are listed

eMethods 4. Extracted variables

Author, year, follow-up months, type of CHR-P psychometric instrument, type of CHR-P, number of CHR-P baseline, number of healthy controls at baseline, age at baseline (median and SD), range age, male sex %, years of education, white race %, antipsychotic treatment exposure at baseline, cognition domain, the task used, results of the neurocognitive task (mean and SD), number of CHR-P who transitioned to psychosis, follow-up time (months), positive psychotic and negative symptoms at baseline, functioning status at baseline, and NOS quality.

eMethods 5. Methods for pooling non-independent neurocognitive tasks

To account for studies reporting on more than one non-independent neurocognitive tasks within the same neurocognitive domain (in the meta-analysis iv), we followed the methodological guidelines[44,45]. Specifically, in order to estimate the pooled effect size in case of studies reporting more than one non-independent neurocognitive task within the same neurocognitive domains, we assumed a correlation of 0.3 [46-48] between the non-independent tasks. However, to ensure that the results did not depend on this assumption, we also conducted the meta-analysis, assuming that the correlation was either 0.1 or 0.5. We first computed the variance of the average effect size, then we multiplied it by (1+(n.es-1) * r)/n.es, where n.es is the number of combined effect sizes and r the correlation between non-independent neurocognitive tasks.

eMethods 6. Meta regression factors

Meta regression factors tested in the current meta-analysis encompassed age, sex, years of education, ethnicity, functioning, positive psychotic symptoms, negative symptoms, study quality, baseline antipsychotic exposure, type of CHR-P psychometric instrument and follow-up time (for the meta-analysis iv only).

eMethods 7. Glossary of terms

- CHR-P: Clinical High Risk for Psychosis
- HC: Healthy Controls (if help-seeking, it is specified in eTable 4).
- FEP: First Episode Psychosis
- TMT-A and TMT-B: Trail Making Test Part A and B
- BACS SC: Brief Assessment of Cognition Scale Symbol Coding
- DST: Digit symbol coding test

- Stroop W: Stroop color word reading
- Stroop C: Stroop color naming task
- CPT-IP: Continuous Performance Test – Identical Pairs
- WMS-III: SS: Wechsler Memory Scale-III Spatial Span Subtest
- LNS: Letter Number Span
- LNST: Letter Number Sequencing Test:
- SOPT: Self-Ordered Pointing Task
- HVLT-R: Hopkins Verbal Learning Test—Revised
- RAVLT: Rey Auditory Verbal Learning Test
- CVLT: California Verbal Learning Test I/II
- BVMT-R: Brief Visuospatial Memory Test-Revised
- ROCF: Rey–Osterrieth Complex Figure test
- NAB Mazes: Neuropsychological Assessment Battery Mazes
- RMET: Reading the Mind in the Eyes Test
- DFAR: Degraded Facial Affect Recognition
- WAIS-III: Wechsler Adult Intelligence Scale- 3rd edition
- WAIS-R: Wechsler Adult Intelligence Scale-Revised
- WISC-III: Wechsler Intelligence Scale for Children- 3rd edition
- NART: National Adult Reading Test
- MWT-B: MehrfachWortschaftz-Intelligenz Test-part B
- WAIS/WISC BD: WAIS /WISC Block Design: subtest of WAIS/WISC
- WCST: Wisconsin Card Sorting Test
- Tapping: Finger Tapping Test
- UPSIT: University of Pennsylvania Smell Identification Test

eTable 1. PRISMA statement and checklist

Section/topic	#	Checklist item	Page
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both	*Cover page*
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number	*Abstract*
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known	*Introduction*
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS)	*Introduction*
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g. Web address), and, if available, provide registration information including registration number	*Methods*
Eligibility criteria	6	Specify study characteristics (e.g. PICOS length of follow-up) and report characteristics (e.g. years considered, language, publication status) used as criteria for eligibility, giving rationale	*Methods*
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched	*Methods*
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated	*Methods*
Study selection	9	State the process for selecting studies (i.e. screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis)	*Methods*
Data collection process	10	Describe method of data extraction from reports (e.g. piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators	*Methods*
Data items	11	List and define all variables for which data were sought (e.g. PICOS funding sources) and any assumptions and simplifications made	*Methods*

Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis	*Methods*
Summary measures	13	State the principal summary measures	*Methods*
Risk of bias across	15	Specify any assessment of risk of bias (i.e. Newcastle-Ottawa Scale (NOS)), that may affect the cumulative evidence	*Methods*
Additional analyses	16	Describe methods of additional analyses (e.g. sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified	*Methods*
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review with reasons for exclusions at each stage, ideally with a flow diagram	*Results*
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g. study size, PICOS follow-up period) and provide the citations	*Results*
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12)	*Results*
Results of individual studies	20	For all outcomes considered (benefits or harms), present for each study a summary data for each intervention group	*Results*
Synthesis of results	21	Present results of analyses	*Results*
Risk of bias across studies	22	Present results of any assessment of the risk of bias across studies (see Item 15)	*Results*
Additional analysis	23	Give results of additional analyses, if done (e.g. sensitivity or subgroup analyses, meta-regression see Item 16)	*Results*
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g. healthcare providers, users, and policymakers)	*Discussion*
Limitations	25	Discuss limitations at study and outcome level (e.g. risk of bias), and at review-level (e.g. incomplete retrieval of identified research, reporting bias)	*Discussion*
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research	*Discussion*
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g. supply of data), role of funders for the systematic review	*Funding*

eTable 2. MOOSE checklist

Criteria		Brief description of how the criteria were handled in the meta-analysis
Reporting of background should include		
√	Problem definition	To examine at a meta-analytical level whether neurocognitive deficits are evident in Clinical High Risk (CHR-P) for psychosis subjects relative to preferably healthy controls (HC) and to define the specific pattern of these neurocognitive deficits. To identify neurocognitive impairments that specifically predicted the later transition to psychosis in the CHR-P population, controlling for the potential confounding effect of socio-demographical, methodological, and clinical factors.
√	Hypothesis statement	We hypothesized that CHR-P state would have a significant impairment in neurocognitive domains, especially those who develop psychosis.
√	Description of study outcomes	In line with our earlier meta-analysis the different neurocognitive tasks were grouped in neurocognitive domains on the basis of the criteria developed by the MATRICS conference and then discussed by us, according to the indications of the articles included: (1) processing speed, (2) verbal learning, (3) working memory, (4) reasoning and problem-solving, (5) visual learning, (5) attention and vigilance, and (7) social cognition. Further, we have analysed the CHR-P domains of (8) general intelligence, (9) premorbid intelligence, (10) visuospatial ability, (11) verbal memory, (12) visual memory, (13) executive functioning, (14) motor functioning, and (15) olfaction. We reported differences between CHR-P population and HC in these domains, measured by standardised scales. For comprehensiveness, we conducted two supplementary meta-analyses: iii) comparing neurocognitive functioning in CHR-P individuals vs FEP individuals (when these contrasts were reported in the articles retrieved) and iv) estimating the pooled effect sizes across each of the 15 neurocognitive domains. For the latter meta-analysis (iv), we followed meta-analytical guidelines[44,45] to account for studies reporting on more than one non-independent neurocognitive tasks within the same neurocognitive domain.
√	Type of exposure or intervention used	We included individual studies that reported neurocognitive data in CHR-P population.
√	Type of study designs used	Case-control studies, and cohort studies, which investigate the neurocognitive functioning CHR-P for psychosis compared to HC.
√	Study population	CHR-P state.
Reporting of search strategy should include		
√	Qualifications of researchers	The credentials of the investigators are indicated in the author list and in the acknowledgements.
√	Search strategy. including time period included in the synthesis and keywords	We performed a multi-step literature search using the following keywo"ds: "co"nit*" OR "neuroco"nit*" OR "social co"nit*""AND "psychosis"risk" OR "pro"rom*" OR "ultra-high"risk" OR "clinical high"risk" OR "genetic high"risk" OR "at risk mental "tate" OR "at-risk mental "tate" OR "basic sym"toms" OR “ultra-high"risk” from inception until 1st July 2020.
√	Databases and registries searched	Web of Science database (Clarivate Analytics): Web of Science Core Collection, BIOSIS Citation Index, KCI-Korean Journal Database, MEDLINE, Russian Science Citation Index, PubMed and SciELO Citation Index.
√	Use of hand searching	We hand-searched bibliographies of retrieved papers for additional references.
√	List of citations located and those excluded. including justifications	Details of the literature search process are outlined in the results section and in the PRISMA flow-chart.
√	Method of addressing articles published in languages other than English	Only articles in English language were selected.

√	Method of handling abstracts and unpublished studies	Original individual studies were included. Conference proceedings, reviews, editorials, clinical cases and unpublished studies were excluded.
√	Description of any contact with authors	A description of the contact with corresponding authors to request additional data for this study is detailed in methods section.
Reporting of methods should include		
√	Description of relevance or appropriateness of studies assembled for assessing the hypothesis to be tested	Detailed inclusion and exclusion criteria were described in the methods section.
√	Rationale for the selection and coding of data	Data extracted from each of the studies were relevant to the population characteristics, study design, comparison group, exposure and outcomes.
√	Assessment of confounding factors	Confounding factors were systematically assessed in each neurocognitive domain.
√	Assessment of study quality	We adapted the Newcastle-Ottawa Scale for the evaluation of cross-sectional and cohort studies.
√	Assessment of heterogeneity	Heterogeneity was assessed with the I^2 index.
√	Description of statistical methods in sufficient detail to be replicated	Statistical methods are described in detail in the methods section.
√	Provision of appropriate tables and graphics	We included the PRISMA flow-chart and several tables and graphics to describe the literature search and our results.
Reporting of results should include		
√	Graph summarizing individual study estimates and overall estimate	We have appended them in the main text. Additional graphs were presented as supplementary material to fully describe the results.
√	Table giving descriptive information for each study included	We have presented descriptive information for each study in the supplementary material.
√	Results of sensitivity testing	Subgroup analyses were conducted to analyse differences between used task in each neurocognitive domain.
√	Indication of statistical uncertainty of findings	We reported mean estimates for the main outcome and 95% CI.
Reporting of discussion should include		
√	Quantitative assessment of bias	Publication biases were assessed by funnel plots visual inspections and Egger test [49]. The trim and fill methods were used as sensitivity analyses to correct biases if detected.
√	Justification for exclusion	Exclusion criteria and justification are described in the manuscript.
√	Assessment of quality of included studies	We adapted the Newcastle-Ottawa Scale for the evaluation of cross-sectional and cohort studies.
Reporting of conclusions should include		
√	Consideration of alternative explanations for observed results	We discussed other explanations for our findings in the discussion section.
√	Generalization of the conclusions	We have addressed the generalization of the conclusions in the discussion section.
√	Guidelines for future research	We have suggested possible streams of future development and research in the discussion.
√	Disclosure of funding source	Funding source described at the end of the manuscript. No separate funding was necessary for the undertaking of this meta-analysis.

eTable 3. Risk of bias (quality) assessment using modified Newcastle-Ottawa Scale for cross-sectional and cohort studies

Newcastle-Ottawa Scale Criteria	Maximum Score
Cross-Sectional Studies	
Sample representative of target sample (e.g. all eligible or random sample)?	2
Sample size justified and satisfactory?	1
Non-response rate is defined satisfactory. and characteristics of responders/non-responders compared?	1
Ascertainment of exposure (i.e. menstrual cycle) is valid and/or well described?	1
Assessment of outcome with robust tool and/or record linkage?	2
Outcome per group reported appropriately?	1
Cohort Studies	
Representativeness of exposed cohort (e.g. total population or random sample. selected group)	1
Method used to ascertain exposure (menstrual cycle phase) is robust?	1
Exposed and unexposed are matched or adjustment for confounding factors?	2
Assessment of outcome was blind to exposure status or used record linkage. were robust tools used?	2
Follow-up period was sufficiently long for outcomes to occur (e.g. more than one menstrual cycle?	1
Loss to follow-up rate is reported. low (<30%). and same in exposed and non-exposed?	1

eTable 4. Characteristics of included studies. CHR-P, Clinical High Risk for Psychosis; HC, Healthy Controls; FEP, First Episode Psychosis; FUP, Follow-up; mo, months; NOS, Newcastle-Ottawa Scale.

Author year	Country	N CHR-P	N HC	N FEP	Age mean (SD)	FUP (mo)	NOS	Task used
Addington 2012[50]	Canada-USA	146	85		CHR-P 19.8 (4.5) Help-seeking 19.4 (3.5)	24	6	WAIS-III/WISC-III
Addington 2017[51]	Canada-USA	145			CHR-P 19.84 (4.7)	172	6	Animal Fluency, DST, TMT-A. LNST, WAIS-III/WISC-III, WCST
Atkinson 2017[52]	Austria	102	62		CHR-P 18.6 (2.7) HC 19.1 (3.2)	0	6	LNST, CVLT-II, UPSIT, RMET, Hinting
Becker 2010[53]	The Netherlands	41	17		CHR-P 19.85 (3.6) HC 19.4 (3.8)	18	6	CPT-IP, NART, ROCF, Tapping
Blanchard 2010[54]	Ireland	17	20		CHR-P 12 (6.9) HC 12.58 (4.2)	0	4	TMT-A, TMT- B
Bolt 2019[55]	Australia	294			CHR-P 19.13 (4.5)	41	7	WAIS-III
Brewer 2003[56]	Australia	81	31		CHR-P 20.26 (3.5) HC 21.1 (3.9)	18	7	NART, UPSIT
Brockhous-Dumke 2005[57]	Germany	43	33		CHR-P 25.4 (5.8) HC 24.5 (3.3)	0	4	WCST
Broome 2012[58]	UK	28			CHR-P 24.41 (4.2)	21	6	NART
Chu 2019[59]	Hong Kong	71	68	69	CHR-P 20.8 (6.5) HC 24.5 (8.0) FEP 23.87 (7.2)	0	6	LNS, WMS VR
Chung 2008[60]	South Korea	33	36		CHR-P 20.88 (3.2) HC 21.97 (2.5)	0	8	WCST
Corcoran 2015[61]	USA	49	31		CHR-P 20.6 (3.8) HC 21.4 (3.1)	0	7	WAIS-III
Couture 2008[62]	Canada-USA	88	41		CHR-P 18.9 (4.6) HC 24.9 (5.1)	0	7	RMET
Cui 2020[63]	China.	217	133		CHR-P 18.56 (4.9) HC 18.77 (4.3)	12	8	BACS SC, Animal Fluency, TMT-A, CPT-IP, WMS-III: SS, HVLT-R, BVMT-R, NAB mazes
Eastvold 2007[64]	USA	40	36	15	CHR-P 20.8 (3.5) HC 21.8 (3.4) FEP 21.5 (5.2)		8	WCST, Stroop W, Stroop C, Stroop interference
Egloff 2019[65]	Switzerland	59		31	CHR-P 25 (6.0) FEP 27.3 (6.0)	0	7	CVLT-I
Eisenacher 2018[66]	Germany	38	38		CHR-P 22.9 (4.2) HC 24.3 (5.8)	0	6	HVLT-R, BVMT-R, MWT-B, TMT- B, WCST, NAB Mazes
Epstein 2014[67]	USA	21	55		CHR-P 16.1 (3.3) HC 16.5 (2.6)	0	6	CPT-IP

Frommann 2011[68]	Germany	89	87		CHR-P 25.3 (6.4) HC 25.5 (4.4)	0	7	DS, Letter Fluency, TMT-A, CPT-IP, LNST, RAVLT, MWT-B, SOPT, RAVLT, TMT- B
Gill 2013[69]	USA	71	36		CHR-P 19.33 (3.6) HC 21.7 (4.6)	0	6	WAIS-III, UPSIT
Goghari 2014[70]	UK	96	23	28	CHR-P 23.3 (4.4) HC 25.2 (5.4) FEP 22.6 (4.4)	0	5	WAIS-III
Gupta 2014[71]	USA	53	35		CHR-P 18.6 (2.1) HC 18.8 (1.7)	0	7	BACS SC, TMT-A, BVMT-R, WMS-III: SS
He 2019[72]	China	190	37		CHR-P 20.47 (4.6) HC 22.08 (3.35)	0	6	TMT-A, TMT- B
Healey 2013[73]	USA	147	85		CHR-P 19.79 (4.7) Help-seeking 19.41 (4.08)	24	6	RMET
Hou 2016[74]	China-Australia	40	40	40	CHR-P 29.1 (7.0) HC 24.4 (5.1) FEP 26.4 (6.5)	0	7	DST, Stroop C, Stroop W, TMT-A, HVLT-R
Hur 2012[75]	South Korea	41	40		CHR-P 20.95 (3.8) HC 21.2 (3.1)	0	6	Stroop interference
Hur 2013[76]	South Korea	55	58		CHR-P 21.96 (3.3) HC 23.1 (2.96)	0	6	WCST
Hwang 2019[77]	South Korea	40	85	85	CHR-P 20.55 (3.0) HC 21.24 (2.3) FEP 21.87 (3.6)	0	6	WCST
Ilonen 2010[78]	Finland	22	187		CHR-P 15.7 (1.7) Help-seeking 15.5 (1.7)	0	5	WAIS-R/WISC-III
Jahshan 2010[79]	USA	46	29	18	CHR-P 19.8 (4.1) HC 19.9 (5.7) FEP 21 (5.7)	6-36	5	Stroop W, Stroop C, Stroop interference
Kamath 2014[80]	USA	10	17		CHR-P 19.9 (2.6) Help-seeking 21 (2.5)	0	5	UPSIT
Kang 2018[81]	South Korea	65	83		CHR-P 20.1 (3.4) HC 20.8 (3.6)	0	6	WAIS-III (Korean Version)
Kim 2011[82]	South Korea	45	49		CHR-P 21.07 (3.9) HC 22.7 (3.5)	0	7	Stroop C, TMT-A. CVLT-I, WMS-III: Spatial Span
Kim 2019[83]	South Korea	60	71	47	CHR-P 20.3 (3.5) HC 22 (3.4) FEP 23 (4.1)	0	7	TMT-A, CVLT-I, ROCF, TMT- B, WCST
Koren 2019[84]	Israel	21	34		CHR-P 15.9 (1.4) HC 15.8 (1.0)	0	6	RAVLT, WAIS-R, WCST, Hinting
Korver 2010[85]	The Netherlands	29	30		CHR-P 18.8 (2.4) HC 19.8 (3.4)	0	6	Letter Fluency, CVLT-I
Koshiyama 2018[86]	Japan	30	20	26	CHR-P 20.8 (4.0)	0	5	NART

					HC 23 (5.0) FEP 23.9 (6.4)			
Koutsoluleris 2011[87]	Germany	48	30		CHR-P 24.7 (5.8) HC 26 (2.7)	0	6	DST, Letter Fluency, TMT-A, LNS, LNST, RAVLT, MWT-B, SOPT, RAVLT, TMT- B
Kristensen 2019[88]	Denmark	116	49		CHR-P 23.8 (4.2) HC 24.4 (3.4)	0	7	BACS SC, WAIS-III
Lee 2014[89]	South Korea	75	75		CHR-P 19.97 (3.8) HC 19.9 (2.5)	0	7	TMT-A, ROCF, K-WAI, TMT- B, WCST
Lee 2015[90]	South Korea	40	46	24	CHR-P 19.9 (3.6) HC 20.8 (3.5) FEP19.9 (3.6)	0	6	WAIS-III (Korean Version)
Lepock 2019[91]	Canada	36	21		CHR-P 21.7 (3.0) HC 21.3 (3.4)	0	5	NART
Li 2018[92]	China.	34	37		CHR-P 21.5 (3.5) HC 20.8 (3.1)	0	7	BACS SC, Stroop W, Stroop C, CPT-IP, HVLT-R, BVMT-R
Lin 2013[93]	Australia. UK	124	36		CHR-P 19.13 (3.3) HC 20.75 (4.4)	0	7	DST, TMT-A, Arithmetic, RAVLT, WMS VR, WAIS-R- WAIS/WISC BD, TMT- B
Lindgren 2010[94]	Finland	62	72		CHR-P 16.5 (0.9) HC 16.5 (0.9)	0	5	BACS SC, Animal Fluency, TMT-A, WMS-III: SS, CVLT-I, WMS VR, TMT- B, Tapping
Liu 2019[95]	China-USA	73	72		CHR-P 23.3 (4.5) HC 24 (2.9)	0	7	WMS VM
Magaud 2014[96]	France	104	64	30	CHR-P 20.9 (3.5) Help-seeking 21.3 (3.8) FEP 22.5 (4.3)	0	6	Arithmetic, WAIS-R
Menghini – Muller 2019[97]	Switzerland	343	67		CHR-P 22.4 (4.9) HC 22.9 (4.09)	0	6	DST, TMT-A, Arithmetic, RAVLT, WAIS-III, WAIS/WISC BD. RAVLT, TMT- B
Metzler 2015[98]	Switzerland	72		12	CHR-P 20.52 (5.9) FEP 19.1 (4.8)	18	6	Animal Fluency, DST
Millman 2014[99]	USA	37	35		CHR-P 18.6 (1.8) HC 18.1 (2.3)	0	7	BACS SC, Animal Fluency, TMT-A
Mirzakhanian 2013[100]	USA	109	102	90	CHR-P 19.1 (4.1) HC 20.8 (4.6) FEP 20.9 (5.4)	0	7	CPT-IP
Mittal 2010[101]	USA	90			CHR-P 15.64 (3.0)	24	6	WAIS-III/WISC-III
Modinos 2015[102]	UK	18	18	22	CHR-P 24.4 (4.1) HC 27.9 (5.0) FEP 23.8 (4.6)	0	6	NART
Montalvo 2014[103]	Spain	23	29	55	CHR-P 22.5 (4.3) HC 26.4 (4.3) FEP 24.5 (5.3)	0	7	HVLT-R, BVMT-R, NAB mazes
Ohmuro 2016[104]	Japan	36	25	40	CHR-P 20.9 (4.7) HC 21.3 (1.0) FEP 22.9 (6.3)	0	7	NART

Ohmuro 2018[105]	Japan	50	29		CHR-P 20 (4.1) HC 21.2 (1.0) FEP 22.9 (6.3)	0	7	NART, WCST
Pflueger 2018[106]	Switzerland	116	57	90	CHR-P 25.7 (6.5) HC 24.9 (6.4) FEP 28.3 (7.9)	0	5	CVLT-I, WCST
Pukrop 2006[107]	Germany	128	179		CHR-P 24.43 (6.0) HC 29.23 (8.4)	0	5	MWT-B
Pukrop 2007[108]	Germany	39	44		CHR-P 24.92 (5.3) HC 25.08 (3.2)	0	5	DST, CPT-IP, LNS, LNST, SOPT, ROCF, TMT- B, WCST
Randers 2020[109]	Denmark	220	50		CHR-P 22.4 (3.3) HC 23.5 (4.4)	0	5	TMT-A, WMS-III: SS, WAIS/WISC BD, TMT- B, DFAR
Sanada 2018[110]	Spain-Japan	13	30		CHR-P 22.2 (8.0) HC 24 (6.3)	6	7	Stroop W, Stroop C, Stroop Interference, LNST, WCST
Seidman 2010[111]	USA-Canada	216	109		CHR-P 18.31 (4.73) HC 18.8 (4.5)	30	6	CPT-IP, WAIS-R, TMT- B, WCST
Seidman 2016[46]	USA-Canada	689	264		CHR-P 18.5 (4.2) HC 19.8 (4.7)	24	5	BACS SC, Animal Fluency, CPT-IP, WMS-III: Spatial Span, LNS, HVLT-R, BVMT-R, WAIS/WISC BD, UPSIT, NAB Mazes
Shin 2016[112]	South Korea	47	28		CHR-P 19.3 (3.3) HC 27 (6.0)	24	5	Letter Fluency
Simon 2007[113]	Switzerland	93	49	43	CHR-P 20.81 (5.0) HC 21.8 (4.9)	0	5	Animal Fluency, Letter Fluency, LNS, RAVL, MWT-B, RAVLT, TMT- B, WCST
Standford 2011[114]	USA	63	38		CHR-P 19.6 (3.6) HC 23.98 (7.5)	0	5	WAIS-R, RMET
Studerus 2018[115]	Switzerland	168	109		CHR-P 25.4 (7.2) HC 25 (5.3)	0	5	CVLT
Szily 2009[116]	Hungary	26	50		CHR-P 22 (8.7) HC 21.1 (6.3)	0	5	WAIS-R, RMET
Takahashi 2018[117]	Japan	38	61		CHR-P 18.4 (3.9) HC 25.6 (3.2)	0	5	NART
Thompson 2012[118]	Australia	30	30	40	CHR-P 19.1 (2.8) HC 19.3 (2.9)	0	6	WMS-III: Spatial Span, LNST, WAIS-III, Hinting
Tognin 2020[119]	UK	309	51		CHR-P 22.63 (4.8) HC 23.37 (3.9)	24	7	WAIS-III, DFAR
Tor 2019[120]	Spain	81	39		CHR-P 15.11 (1.8) HC 15.58 (1.5)	0	7	TMT-A, WMS VM, ROCF, WAIS-III, TMT- B
Üçok 2013[121]	Tukey	81	35	53	CHR-P 22.13 (6.0) HC 20 (3.7)	0	5	TMT-A, TMT- B, WCST, Stroop C, Stroop interference
Van Rijin 2011[122]	The Netherlands	36	21		CHR-P 15.2 (2.1) HC 15.9 (1.4)	0	5	DFAR
Wood 2007[123]	Australia	16	17		CHR-P 19.4 (3.5) HC 19.7 (2.4)	12	5	RAVLT, WMS VM

Woodberry 2013[124]	USA	53	32		CHR-P 16.3 (2.6) HC 16 (2.4)	12	6	CPT-IP, CVLT-I, WCST, Tapping
Zhang 2016[125]	China.	83	90		CHR-P 20.3 (1.7) HC 19.1 (2.0)	12	5	RMET
Ziermans 2014[126]	The Netherlands	43	44		CHR-P 15.22 (2.2) HC 15.4 (1.3)	72	5	Letter Fluency, CPT-IP, WAIS-III, WCST, Tapping

CHR-P Clinical High risk for Psychosis; HC healthy controls; FEP First Episode Psychosis

TMT-A Trail Making Test-Part A; BACS SC Basic Assessment of Cognition Scale Symbol Coding; DST Digit Symbol coding test; CPT-IP Continuous Performance Test Identical Pairs; WMS-III: SS Wechsler Memory Scale. 3rd ed. spatial span subtest; LNS Letter Number Span; LNST Letter Number Sequencing Test; HVLT-R Hopkins Verbal Learning Test-Revised; RAVLT Rey Auditory Verbal Learning Test; CVLT California Verbal Learning Test; BVMT-R Brief Visuospatial Memory Test-Revised; ROCT Rey-Osterrieth Complex Figure Test; NAB Mazes Neuropsychological Assessment Battery Mazes; DFAR Degraded Facial Affect Recognition; RMET Reading the Mind in the Eyes; WAIS Wechsler Intelligence Scale; NART National Adult Reading Test; MWT-B. MehrfachWortschaftz-Intelligenz Test-part B; SOPT Self-Ordered Pointing Task; RAVLT DR Rey Auditory Verbal Learning Test Delayed Recall; ROCF Rey- Osterrieth Complex Figure Test; WMS VR Weschler Memory Scale Visual Reproduction Delayed Recall; TMT-B Trail Making Test-Part B; WCST categories Wisconsin Card Sorting Test categories; WCST number of corrects responses Wisconsin Card Sorting Test number of correct responses; WCST perseverative errors Wisconsin Card Sorting Test perseverative errors; WCST perseverative responses Wisconsin Card Sorting Test perseverative responses; UPSIT University of Pennsylvania Smell Identification Test.

eTable 5. Meta-analytical comparisons: CHR-P vs HC. CHR-P, Clinical High Risk for Psychosis; HC, Healthy Controls

Neurocognitive domains	Tasks	*k*	N CHR-P	N HC	Hedges' g	CI95%		z	p	Heterogeneity			Publication bias		
										Q	I^2	p	Funnel plots asymmetry	Egger test	trim and fill bias
Processing Speed	**TMT-A**	16	1336	861	-0.34	-0.59	-0.09	-2.65	**0.01**	84.01	86.16	<0.001	N	ns	n.a.
	BACS SC	5	1109	518	-0.67	-0.95	-0.39	-4.63	**<0.001**	16.37	79.75	<0.001	N	ns	n.a.
	Animal Fluency	5	1098	553	-0.39	-0.54	-0.24	-5.06	**<0.001**	6.5	38.23	0.165	N	ns	n.a.
	Letter Fluency	6	349	268	-0.31	-0.59	-0.04	-2.23	**0.03**	15.56	63.94	0.082	Y	ns	n.a.
	DST	6	686	305	-0.74	-1.19	-0.29	-3.23	**0.001**	28.77	88.56	<0.001	Y	ns	n.a.
	Stroop W	3	87	107	-1.17	-1.86	-0.48	-3.35	**<0.001**	10.6	78.62	<0.001	N	ns	n.a.
	Stroop C	5	182	107	-0.69	-1.44	0.05	-1.83	0.067	51.58	91.14	<0.001	N	ns	n.a.
Attention/Vigilance	**CPT-IP**	11	1591	1059	-0.39	-0.49	-0.29	-7.79	**<0.001**	14.14	21.75	0.17	Y	ns	n.a.
Working Memory	**WMS-III: SS**	5	1044	528	-0.43	-0.6	-0.27	-5.1	**<0.001**	6.12	41.29	0.19	N	ns	n.a.
	LNS	5	922	455	-0.46	-0.57	-0.34	-7.78	**<0.001**	5.15	0	0.27	N	ns	n.a.
	LNST	5	280	237	-0.39	-0.57	-0.22	-4.56	**<0.001**	3.8	0	0.45	N	ns	n.a.
	Arithmetic	3	571	167	-0.32	-0.67	0.03	-1.78	0.07	7.63	73.05	0.02	Y	ns	n.a.
	SOPT	3	161	176	-0.48	-1.12	0.15	-1.49	0.14	12.64	86.84	<0.001	N	ns	n.a.
Verbal Learning	**HVLT-R**	7	1087	570	-0.86	-1.43	-0.28	-2.93	**<0.001**	57.03	95.22	<0.001	N	ns	n.a.
	RAVLT	6	684	287	-0.5	-0.78	-0.21	-3.43	**<0.001**	16.55	70.98	<0.001	Y	ns	n.a.
	CVLT	7	497	379	-0.5	-0.64	-0.36	-7.11	**<0.001**	6.78	0	0.34	N	ns	n.a.
Visual learning	**BVMT-R**	6	1054	536	-0.47	-0.66	-0.28	-4.78	**<0.001**	10.76	53.14	0.06	N	ns	n.a.
	WMS VM	5	374	288	-0.49	-0.73	-0.25	-4.05	**<0.001**	9.07	55.63	0.06	N	ns	n.a.
	ROCF	3	216	185	-0.37	-0.76	0.02	-1.86	0.06	7.21	72.91	0.03	N	ns	n.a.
Reasoning and Problem-Solving	**NAB Mazes**	4	997	464	-0.46	-0.74	-0.19	-3.27	**0.001**	14.14	73.23	<0.001	Y	ns	n.a.
Social cognition	**RMET**	6	509	365	-0.32	-0.66	0.03	-1.8	0.072	27.74	83.26	<0.001	Y	ns	n.a.
	DFAR	3													
	anger		367	122	0.05	-0.47	0.57	0.15	0.85	8.52	76.26	0.01	N	ns	n.a.
	fear		367	122	0,00	-0.23	0.23	-0.01	0.99	0.9	0	0.64	N	ns	n.a.
	happy		367	122	-0.05	-0.28	0.18	-0.39	0.69	0.2	0	0.9	N	ns	n.a.
	neutral		367	122	-0.19	-0.72	0.34	-0.71	0.48	7.11	76.62	0.03	N	ns	n.a.
	Hinting	3	153,00	125,00	-0.53	-0.77	-0.28	-4.21	**<0.001**	0.61	0	0.74	N	ns	n.a.
General intelligence	**IQ**	17	1973	1074	-0.31	-0.45	-0.17	-4.28	**0.001**	45.8	63.62	<0.001	N	ns	n.a.

	Verbal IQ	4	232	333	-0.23	-0.52	0.07	-1.5	0.13	6.63	55.85	0.08	N	ns	n.a.
	Performance IQ	5	348	382	-0.2	-0.42	0.01	-1.86	0.06	6.49	38.21	0.17	N	ns	n.a.
Premorbid IQ	**NART**	7	294	197	-0.52	-1.01	-0.03	-2.07	**0.04**	37.32	84.33	<0.001	N	ns	n.a.
	MWT-B	5	396	383	-0.33	-0.62	-0.03	-2.15	**0.03**	19.15	72.01	<0.001	N	ns	n.a.
Visuospatial ability	**WAIS/WISC BD**	5	1192	444	-0.32	-0.44	-0.2	-5.06	**<0.001**	3.07	6.54	0.55	Y	ns	n.a.
Verbal memory	**RAVLT DR**	4	573	233	-0.45	-0.67	-0.22	-3.89	**<0.001**	5.76	45.98	0.12	N	ns	n.a.
Visual memory	**ROCF DR**	4	218	170	-0.34	-0.65	-0.03	-2.13	**0.03**	6.44	53.87	0.09	N	ns	n.a.
	WMS VR	3	159	128	-0.75	-1.36	-0.14	-2.42	**0.02**	7.07	80.98	0.03	Y	**0.008**	ns
Executive functioning	**TMT- B**	16	1328	860	-0.49	-0.72	-0.27	-4.27	**<0.001**	85.97	82.03	<0.001	Y	ns	n.a.
	WCST categories	6	382	282	-0.36	-0.66	-0.07	-2.39	**0.02**	16.97	71.61	<0.001	Y	ns	n.a.
	WCST number of correct responses	4	148	135	-0.54	-1.14	0.06	-1.76	0.08	16.45	81.74	<0.001	N	ns	n.a.
	WCST perseverative errors	9	665	509	-0.21	-0.35	-0.07	-3.1	**0.002**	9.57	18.66	0.3	Y	**0.006**	g=-0.15; 95%CI [-0.29, -0.01], p=0.03
	WCST perseverative responses	4	185	186	-0.25	-0.45	-0.05	-2.43	**0.01**	1.64	0,00	0.65	N	ns	n.a.
	Stroop interference	5	221	170	0.15	-0.31	0.61	0.63	0.53	19.95	79.01	<0.001	N	ns	n.a.
Motor functioning	**Tapping**	4	199	165	-0.24	-0.45	-0.04	-2.29	**0.02**	2.49	0	0.48	N	ns	n.a.
Olfaction	**UPSIT**	5	953	409	-0.55	-0.97	-0.12	-2.49	**0.01**	20.35	86.9	<0.001	Y	ns	n.a.

k number of studies; ns not significant. n.a. not applicable

TMT-A Trail Making Test-Part A; BACS SC Basic Assessment of Cognition Scale Symbol Coding; DST Digit Symbol Coding Test; Stroop W Stroop color word reading task; Stroop C Stroop color naming task; CPT-IP Continuous Performance Test Identical Pairs; WMS-III: SS. Wechsler Memory Scale-III: Spatial Span; LNS Letter Number Span; LNST Letter Number Sequencing task; HVLT Hopkins Verbal Learning Test; RAVLT Rey Auditory Verbal Learning Test; CVLT California Verbal Learning Test; BVMT-R. Brief Visuospatial Memory Test-Revised; ROCT Rey- Osterrieth Complex Figure Test; NAB Mazes Neuropsychological Assessment Battery Mazes; DFAR Degraded Facial Affect Recognition; RMET Reading the Mind in the Eyes Test; IQ Intelligence Quote; NART National Adult Reading Test; MWT-B. MehrfachWortschaftz-Intelligenz Test Part B; SOPT Self-Ordered Pointing Task; RAVLT DR Rey Auditory Verbal Learning Test Delayed Recall; ROCF DR Rey- Osterrieth Complex Figure Test Delayed Recall; WMS VR Weschler Visual Memory Delayed Recall; TMT-B Trail Making Test-Part B; WCST Categories Wisconsin Card Sorting Test categories completed; WCST number of corrects responses Wisconsin Card Sorting Test number of correct responses; WCST perseverative errors Wisconsin Card Sorting Test perseverative errors; WCST perseverative responses Wisconsin Card Sorting Test perseverative responses; UPSIT University of Pennsylvania Smell Identification Test

eTable 6. Meta-analytical comparisons: CHR-P not transitioning vs those transitioning: CHR-P, Clinical High Risk for Psychosis

Neurocognitive domains	Task	*k*	N CHR-P Transition	N CHR-P non transitioning	Hedges 'g	CI95%		z	p	Heterogeneity			Publication bias		
										Q	I^2	p	Funnel plots asymmetry	Egger test p	trim and fill bias
Processing Speed	**TMT-A**	5	141	404	-0.29	-0.48	-0.09	-2.85	**<0.001**	0.44	0	0.98	Y	ns	n.a.
	Animal Fluency	4	171	941	-0.51	-1.12	0.09	-1.66	0.096	18.97	90.76	<0.001	N	ns	n.a.
	DST	7	278	1075	-0.39	-0.63	-0.14	-3.12	**0.002**	13.9	61.18	0.03	Y	**0.02**	ns
Attention/Vigilance	**CPT-IP**	5	214	809	-0.29	-0.51	-0.08	-2.68	**0.007**	4.9	31.96	0.3	N	ns	n.a.
Working Memory	**LNST**	5	107	306	-0.29	-0.67	0.099	-1.46	0.14	9.28	59,00	0.054	N	ns	n.a.
Verbal Learning	**CVLT**	3	23	121	-0.58	-1.12	-0.05	-2.12	**0.03**	2.7	23.19	0.26	Y	ns	n.a.
General intelligence	**IQ**	8	239	923	-0.26	-0.4	-0.11	-3.52	**<0.001**	7.27	0	0.4	Y	ns	n.a.
Premorbid IQ	**NART**	3	44	106	-0.19	-0.54	0.16	-1.04	0.3	0.81	0	0.67	N	ns	n.a.
Visual memory	**ROCF DR**	3	75	124	-0.44	-0.74	-0.14	-0.84	**<0.001**	0.05	0	0.98	N	ns	n.a.
Executive functioning	**WCST perseverative errors**	5	147	344	-0.27	-0.54	0.007	-1.91	0.06	7.25	40.67	0.123	Y	**0.02**	g= -0.42; 95%CI [-0.77, -0.07], p=0.019
Motor functioning	**Tapping**	3	37	104	0.07	-0.31	0.45	0.36	0.72	0.2	0	0.9	N	ns	n.a.
Olfaction	**UPSIT**	3	137	778	-0.137	-0.761	0.486	-0.43	0.67	14.09	86.14	<0.001	N	ns	n.a.

k number of studies; ns not significant. n.a. not applicable

TMT-A Trail Making Test-Part A; DST Digit Symbol Coding Test; CPT-IP Continuous Performance Test Identical Pairs; LNST Letter Number Sequencing task; CVLT California Verbal Learning Test; IQ Intelligence Quote; NART National Adult Reading Test; ROCF DR Rey- Osterrieth Complex Figure Test Delayed Recall; WCST perseverative responses Wisconsin Card Sorting Test perseverative responses; UPSIT University of Pennsylvania Smell Identification Test

eTable 7. Meta-analytical comparisons: CHR-P vs FEP. CHR-P, Clinical High Risk for Psychosis; FEP, First Episode Psychosis

Neurocognitive domains	Task	*k*	N CHR-P	N FEP	Hedges'g	CI95%		z	p	Heterogeneity			Publication bias		
										Q	I^2	p	Funnel plots asymmetry	Egger test p	trim and fill bias
Processing Speed	**TMT-A**	3	140	181	0.38	-0.08	0.84	1.63	0.1	8.25	78.45	**0.02**	N	ns	n.a.
Verbal Learning	**HVLT-R**	3	109	113	0.58	0.22	0.95	3.11	**<0.001**	3.36	39.23	0.19	N	ns	n.a.
	CVLT	3	235	168	0.4	0.2	0.6	3.95	**<0.001**	1.42	0	0.49	N	ns	n.a.
General intelligence	**IQ**	3	124	82	0.63	0.35	0.91	4.38	**<0.001**	2.23	17.14	0.33	N	ns	n.a.
Premorbid IQ	**NART**	3	84	88	-0.14	0.74	0.47	-0.45	0.66	7.13	74.48	**0.03**	Y	**0.012**	ns
Executive functioning	**TMT- B**	3	234	143	0.07	-0.14	0.28	0.66	0.51	0.19	0	0.91	N	ns	n.a.
	WCST categories	3	234	143	0.25	0.01	0.5	2.02	0.04	2.81	26.98	0.25	N	ns	n.a.
	WCST perseverative errors	4	309	265	0.37	0.16	0.57	-3.51	**<0.001**	4.51	29.63	0.21	N	ns	n.a.
	Stroop interference	3	161	108	0.33	-0.47	1.12	0.81	0.42	22.1	88.97	**<0.01**	N	ns	n.a.

k number of studies; ns not significant. n.a. not applicable

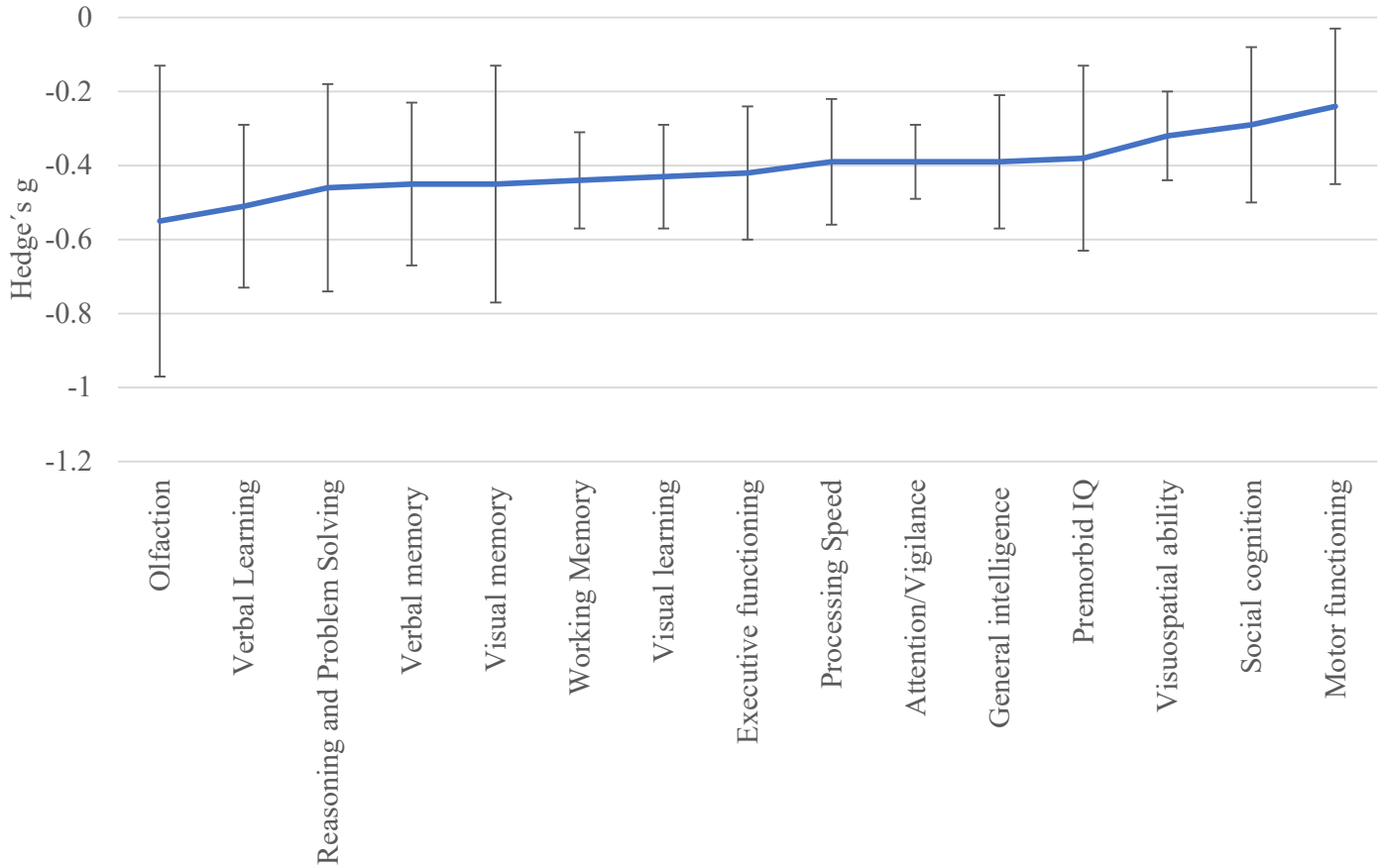
TMT-A Trail Making Test-Part A; HVLT Hopkins Verbal Learning Test; CVLT California Verbal Learning Test; WAIS full Weschler Adult Intelligence Scale; NART National Adult Reading Test; WCST Categories Wisconsin Card Sorting Test categories; WCST perseverative errors Wisconsin Card Sorting Test perseverative errors

eTable 8. Pooled meta-analysis across 15 neurocognitive domains: CHR-P vs HC. CHR-P Clinical High Risk for Psychosis; HC healthy controls

Neurocognitive domains	*k*	N CHR-P	N HC	Hedges'g			z	p
				Effect size	95%CI			
Processing Speed	27	2534	1510	-0.39	-0.56	-0.21	-4.36	**<0.001**
Attention/Vigilance	11	1591	1059	-0.39	-0.49	-0.29	-7.79	**<0.001**
Working Memory	15	2070	1064	-0.44	-0.57	-0.31	-6.63	**<0.001**
Verbal Learning	21	2289	1270	-0.51	-0.63	-0.39	-8.43	**<0.001**
Visual learning	13	1563	970	-0.43	-0.57	-0.29	-6.08	**<0.001**
Reasoning and Problem-Solving	4	997	464	-0.46	-0.74	-0.19	-3.27	**<0.001**
Social cognition	11	927	551	-0.29	-0.50	-0.07	-2.49	**0.01**
General intelligence	19	2244	1205	-0.39	-0.57	-0.20	-4.09	**<0.001**
Premorbid IQ	12	690	580	-0.38	-0.63	-0.13	-2.98	**<0.001**
Visuospatial ability	5	1192	444	-0.32	-0.44	-0.20	-5.06	**<0.001**
Verbal memory	4	573	233	-0.45	-0.67	-0.22	-3.89	**<0.001**
Visual memory	6	296	259	-0.45	-0.78	-0.13	-2.72	**0.01**
Executive functioning	29	1971	1403	-0.42	-0.60	-0.24	-4.62	**<0.001**
Motor functioning	4	199	165	-0.24	-0.45	-0.04	-2.29	**0.02**
Olfaction	5	953	409	-0.44	-0.87	-0.02	-2.49	**0.01**

k number of studies

eFigure 1. Pooled meta-analysis across 15 neurocognitive domains: CHR-P vs HC

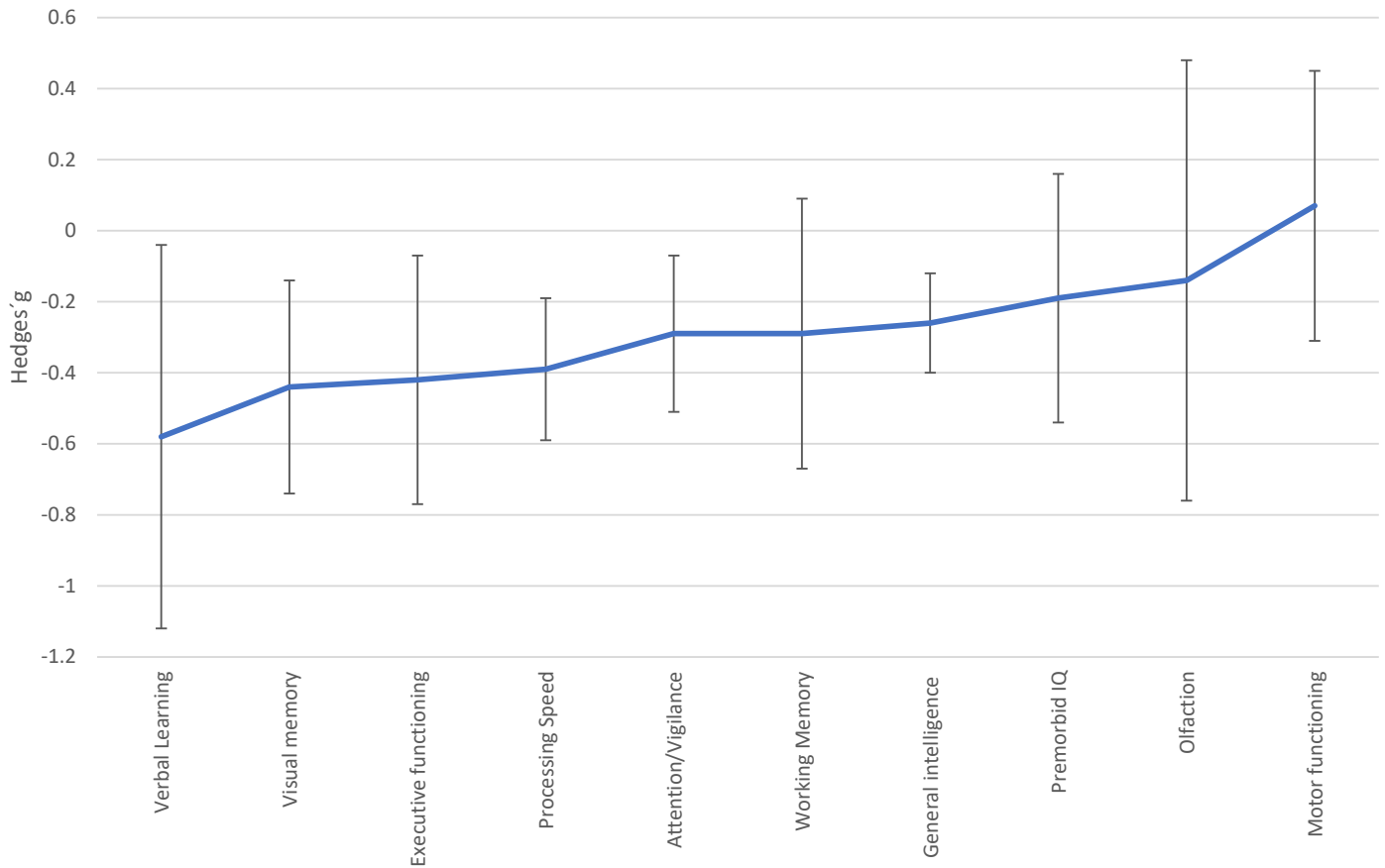


eTable 9. Pooled meta-analysis across neurocognitive domains: CHR-P transitioned vs CHR-P non transitioned

Neurocognitive domains	k	N CHR-P transitioning	N CHR-P not transitioning	Hedges'g				
				Effect size	95%CI		z	p
Processing Speed	8	292	1136	-0.39	-0.59	0.188	0.20	**<0.001**
Attention/Vigilance	5	214	809	-0.29	-0.51	-0.08	0.22	**0.007**
Working Memory	5	107	306	-0.29	-0.67	0.099	0.38	0.14
Verbal Learning	3	23	121	-0.58	-1.12	-0.05	0.54	**0.03**
General intelligence	8	239	923	-0.26	-0.40	-0.11	0.14	**<0.001**
Premorbid IQ	3	44	106	-0.19	-0.54	0.16	0.35	0.3
Visual memory	3	75	124	-0.44	-0.74	-0.14	0.30	**<0.001**
Executive functioning	5	147	344	-0.42	-0.77	-0.07	0.27	0.06
Motor functioning	3	37	104	0.07	-0.31	0.45	0.38	0.72
Olfaction	4	137	778	-0.14	-0.76	0.49	0.62	0.67

k number of studies

eFigure 2. Pooled meta-analysis across neurocognitive domains CHR-P transitioning vs CHR-P non transitioning

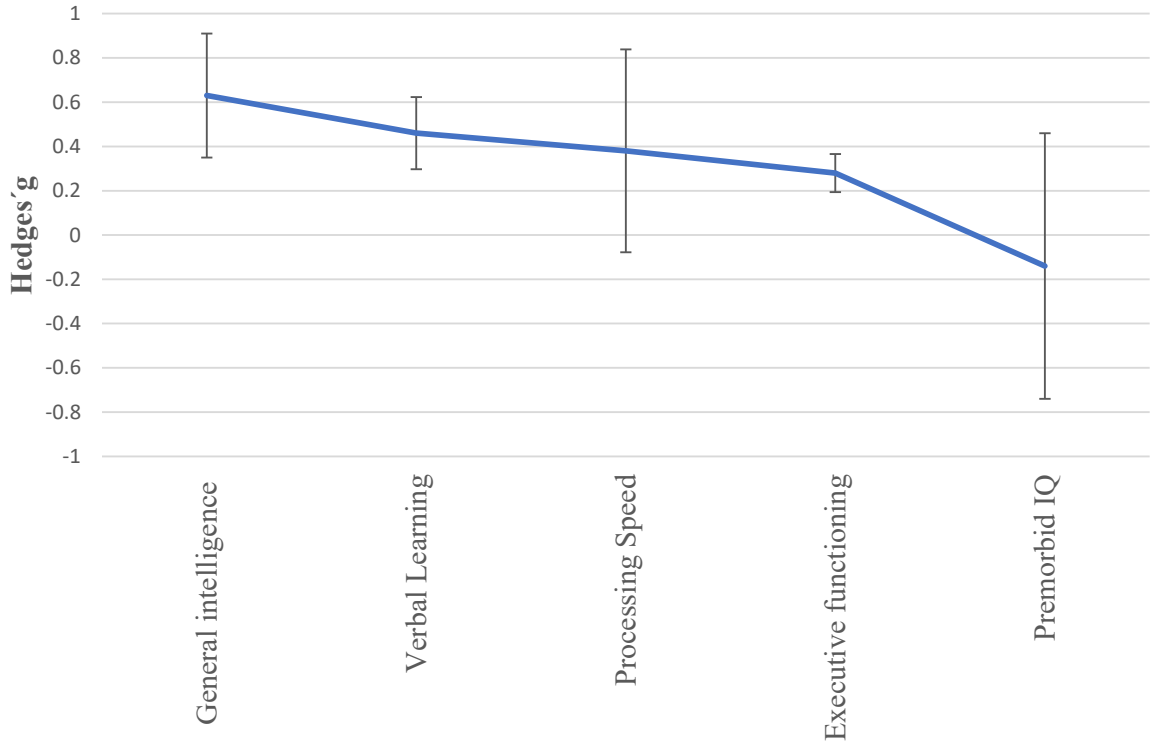


eTable 10. Pooled meta-analysis across neurocognitive domains: CHR-P vs FEP

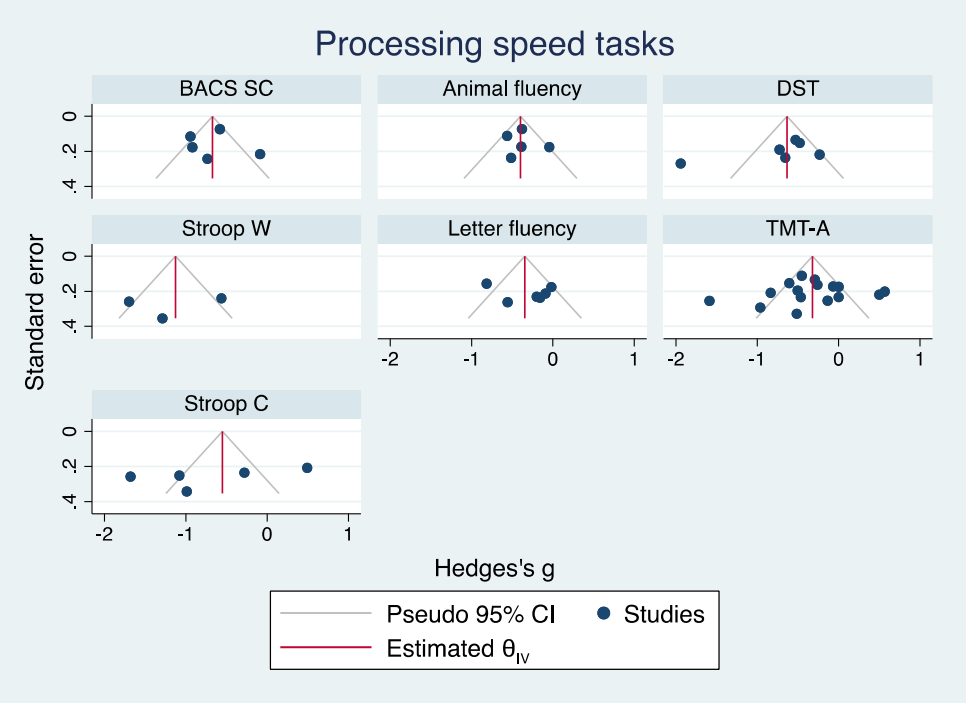
Neurocognitive domains	k	N CHR-P	N FEP	Hedges'g				
				Effect size	CI95%		z	p
Processing Speed	3	140	181	0.38	-0.08	0.84	1.63	0.10
Verbal Learning	6	344	281	0.46	0.30	0.62	5.50	**<0.001**
General intelligence	3	124	82	0.63	0.35	0.91	4.38	**<0.001**
Premorbid IQ	3	84	88	-0.14	-0.74	0.47	-0.45	0.66
Executive functioning	8	470	373	0.34	0.11	0.56	2.94	**<0.001**

k number of studies

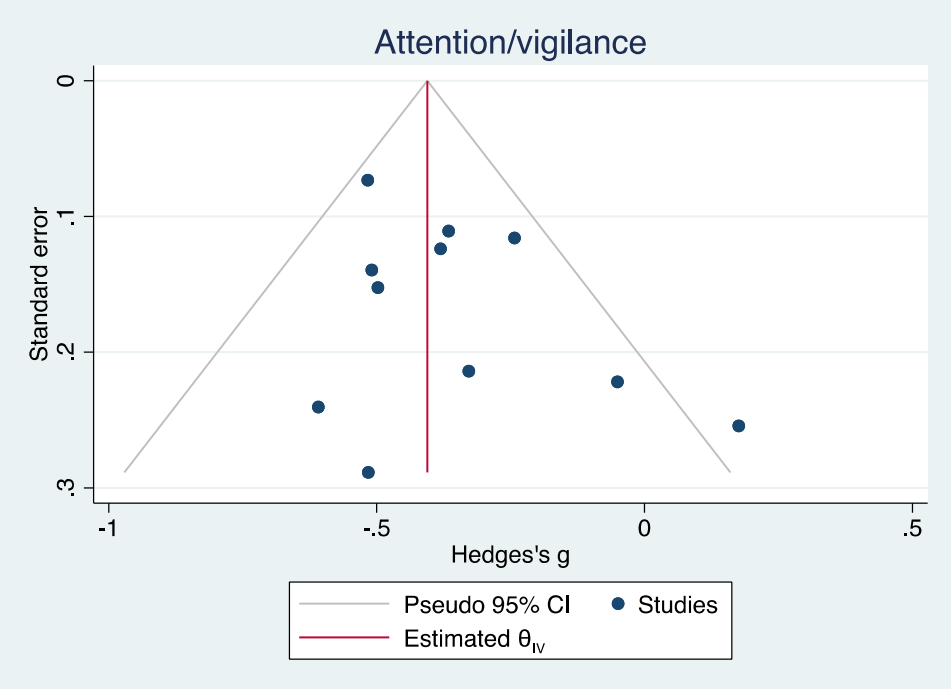
eFigure 3. Pooled meta-analysis across neurocognitive domains: CHR-P vs FEP



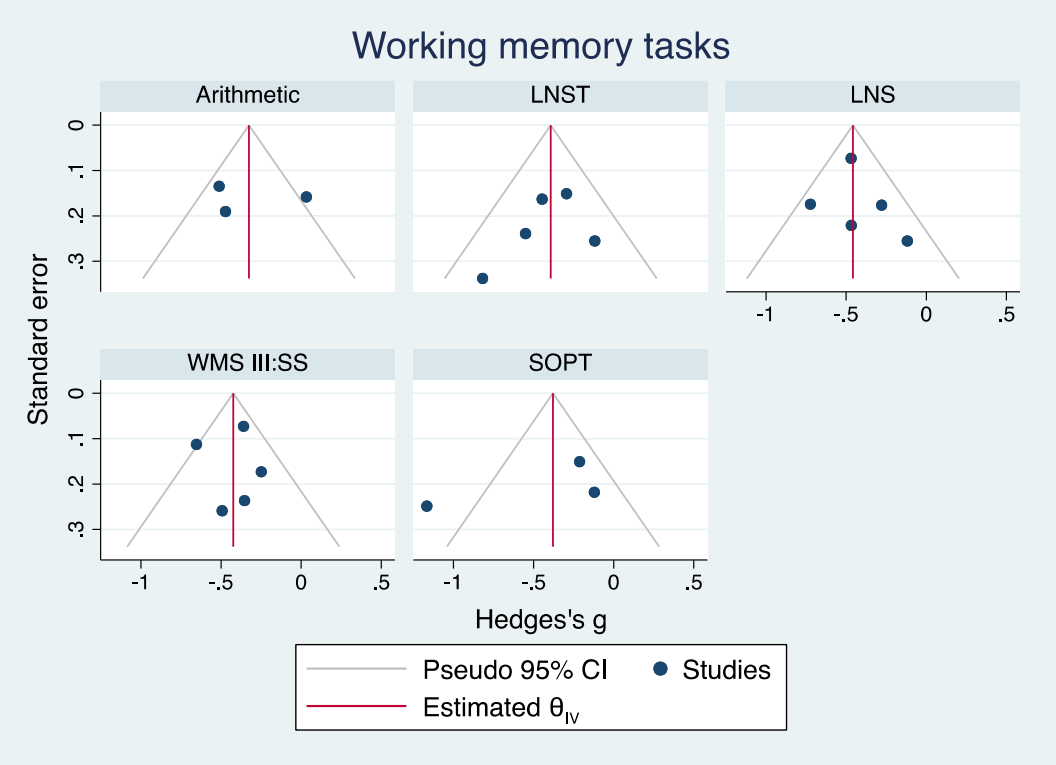
eFigure 4. Funnel plot for processing speed tasks: CHR-P vs HC. CHR-P, Clinical High Risk for Psychosis; HC, Healthy Controls



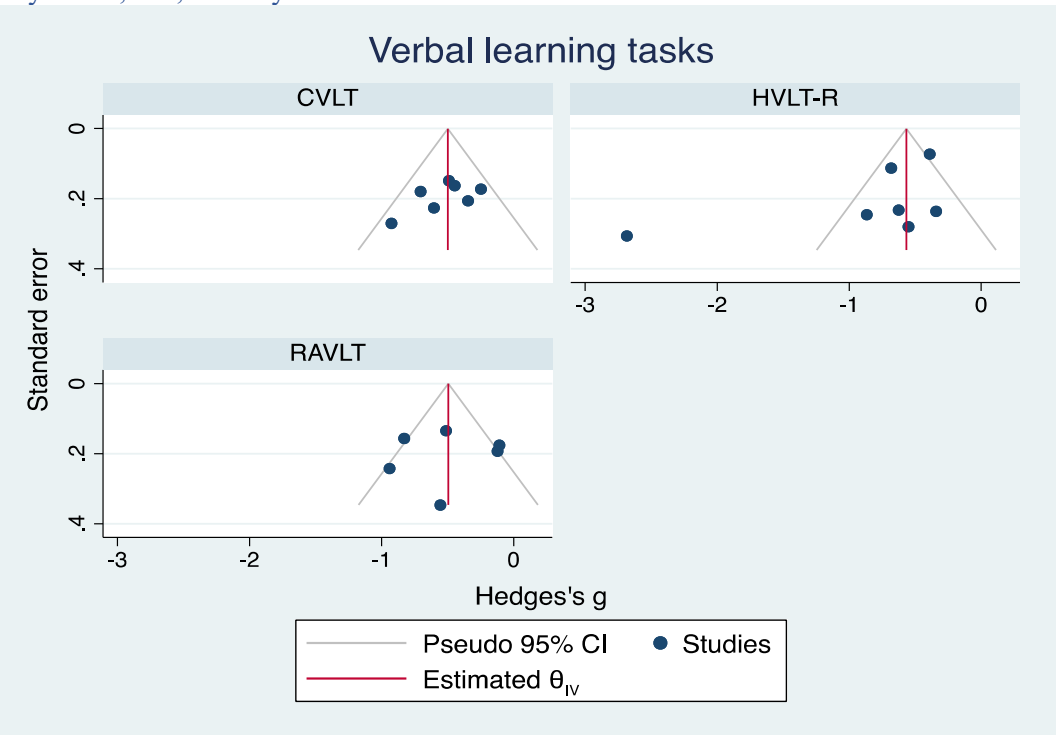
eFigure 5. Funnel plot for attention/vigilance tasks: CHR-P vs HC. CHR-P, Clinical High Risk for Psychosis; HC, Healthy Controls



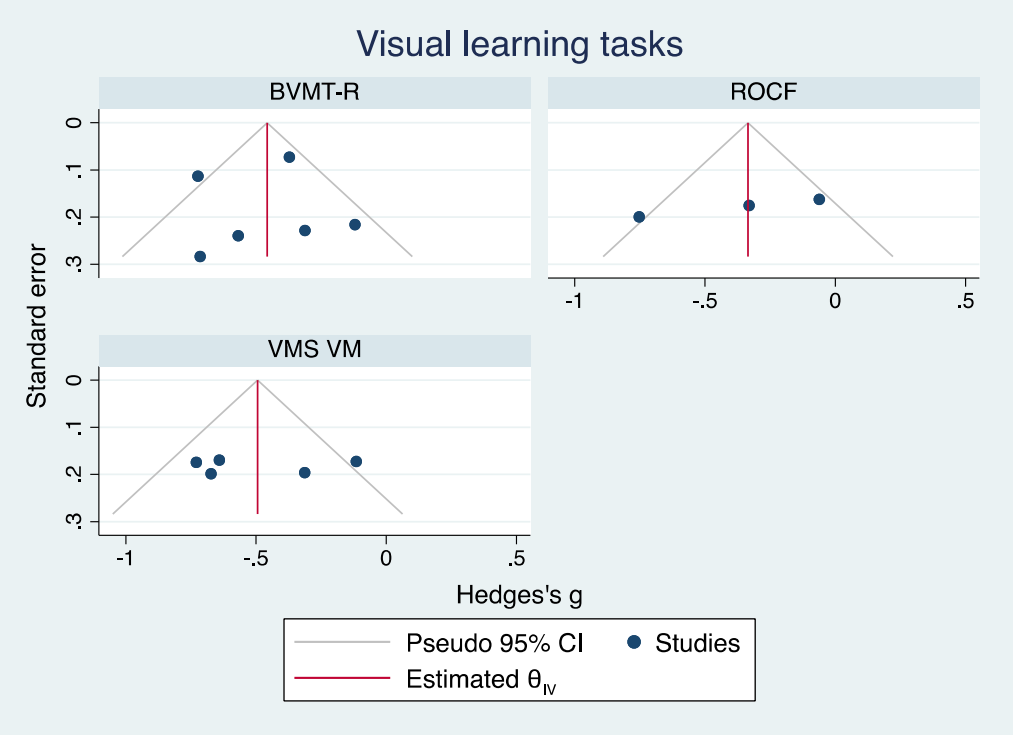
eFigure 6. Funnel plot for working memory tasks: CHR-P vs HC. CHR-P, Clinical High Risk for Psychosis; HC, Healthy Controls



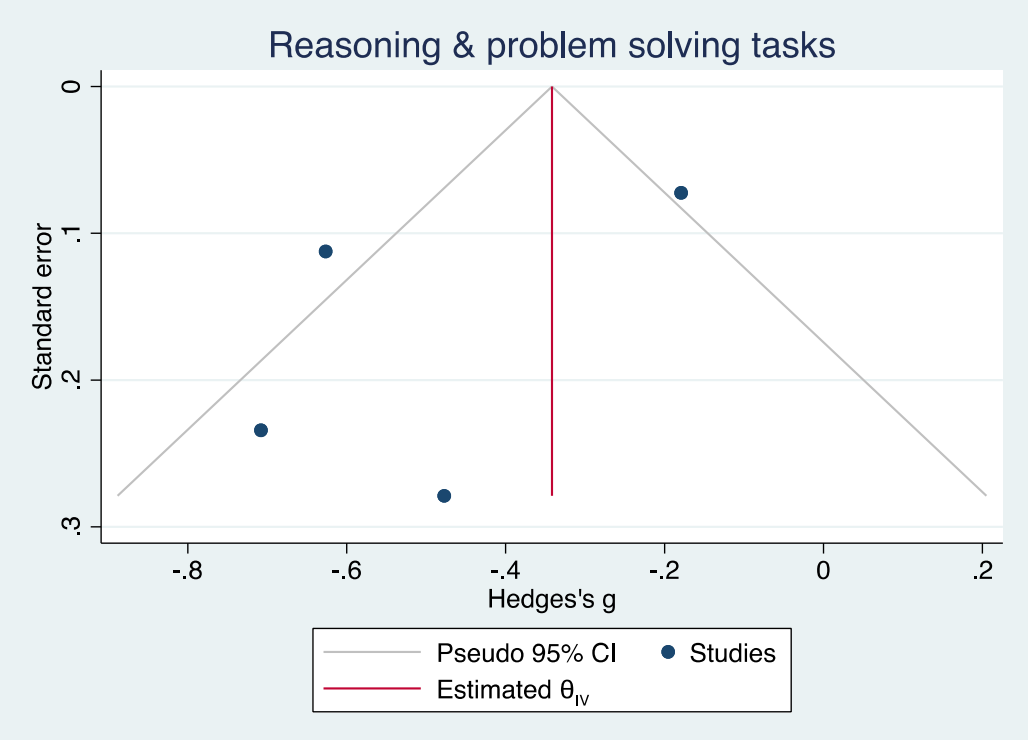
eFigure 7. Funnel plot for verbal learning tasks: CHR-P vs HC. CHR-P, Clinical High Risk for Psychosis; HC, Healthy Controls



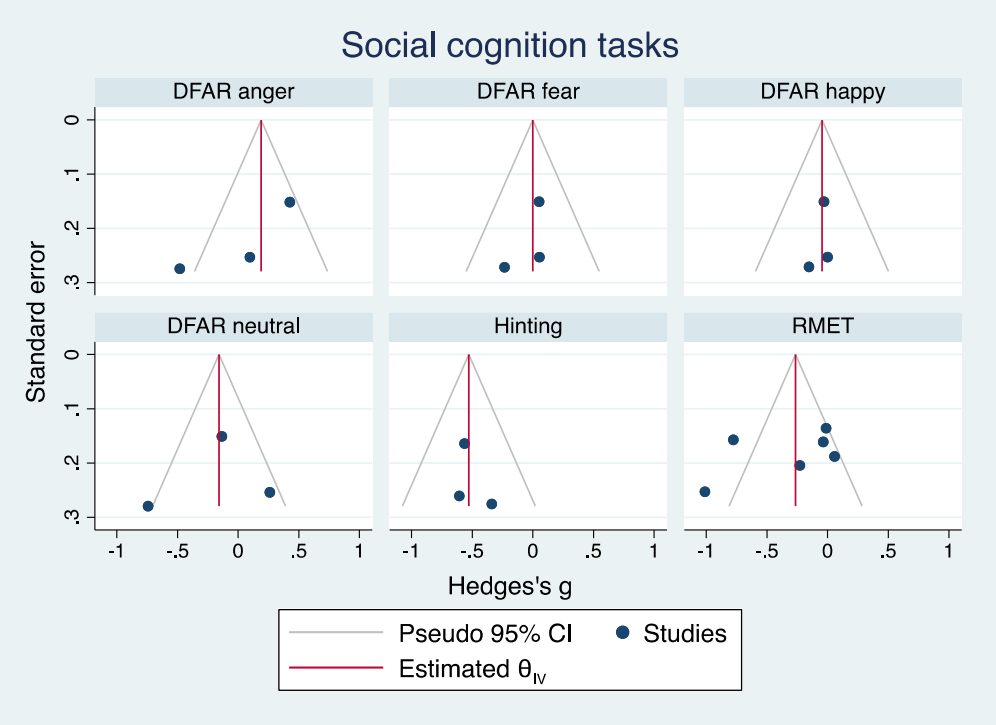
eFigure 8. Funnel plot for visual learning tasks: CHR-P vs HC. CHR-P, Clinical High Risk for Psychosis; HC, Healthy Controls



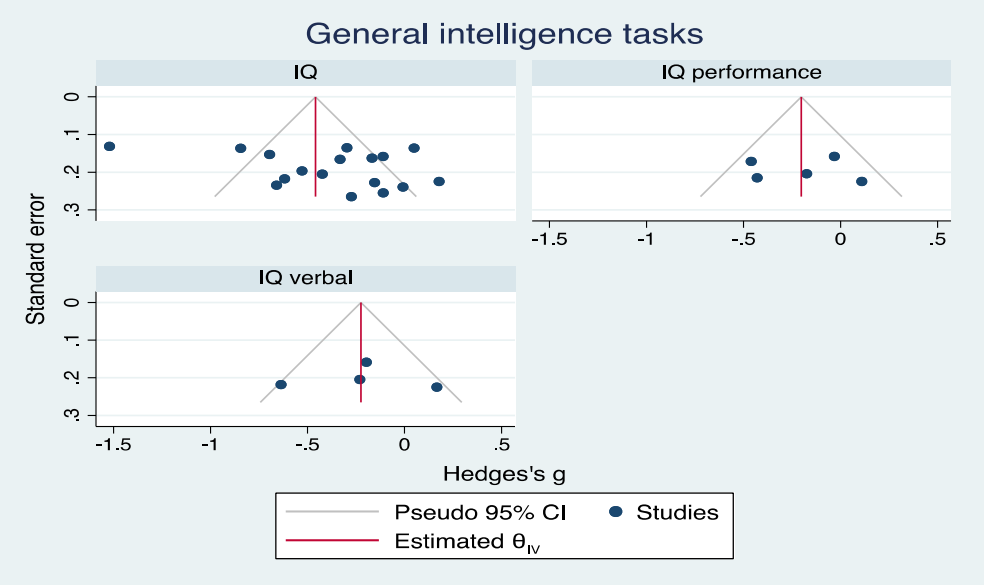
eFigure 9. Funnel plot for reasoning and problem-solving tasks: CHR-P vs HC. CHR-P, Clinical High Risk for Psychosis; HC, Healthy Controls



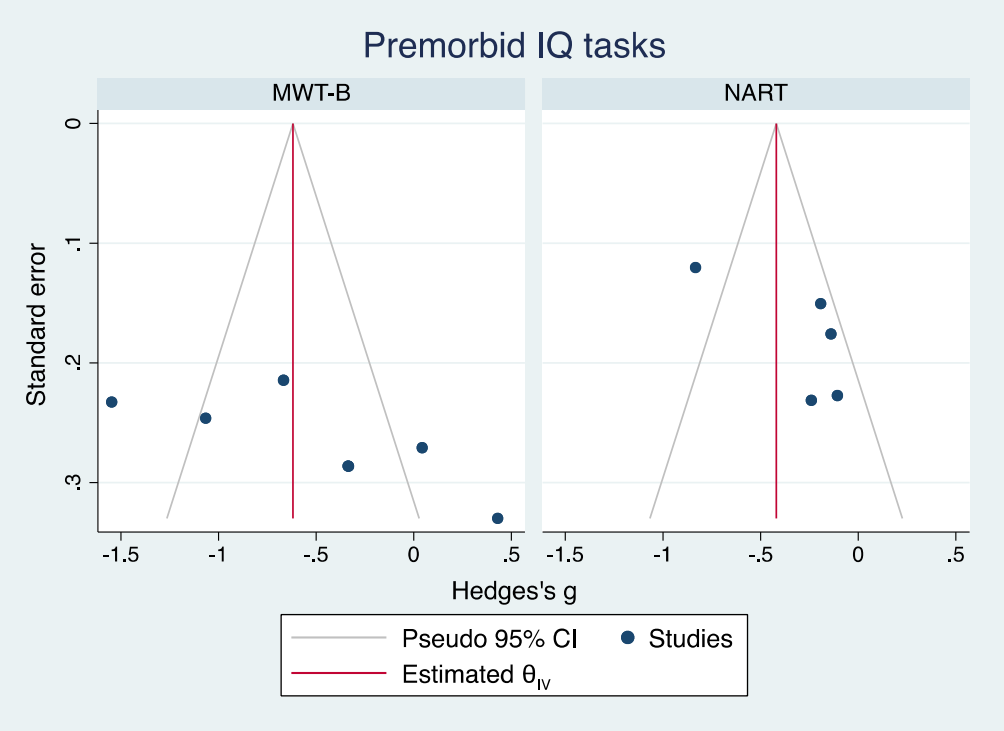
eFigure 10. Funnel plot for social cognition tasks: CHR-P vs HC. CHR-P, Clinical High Risk for Psychosis; HC, Healthy Controls



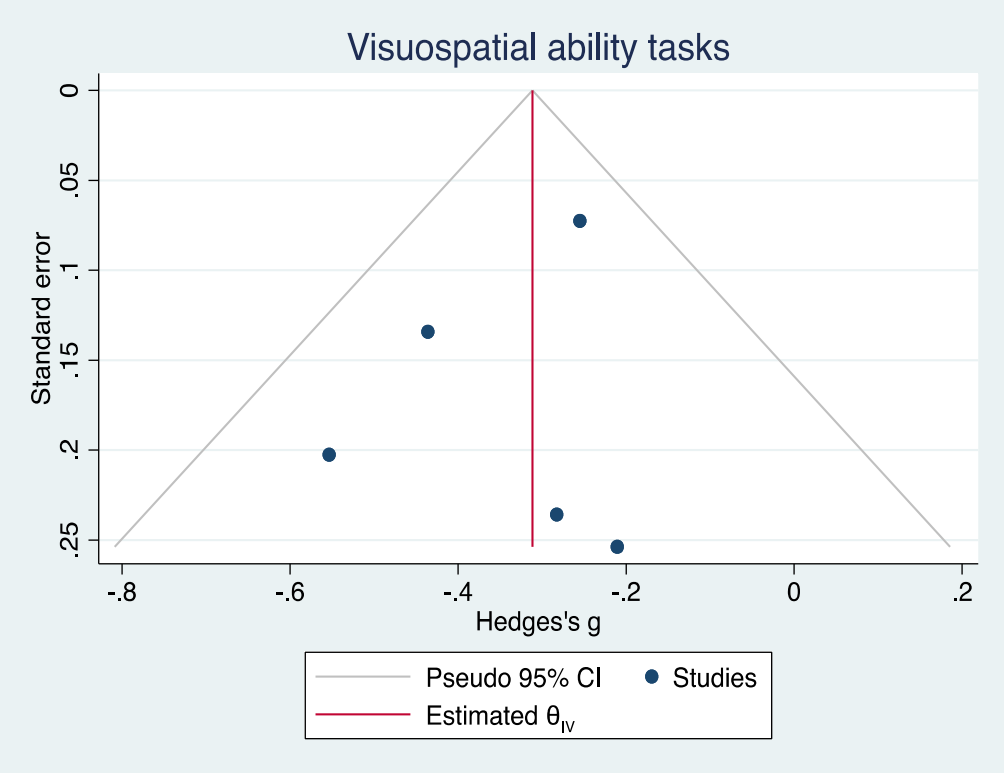
eFigure 11. Funnel plot for general intelligence tasks: CHR-P vs HC. CHR-P, Clinical High Risk for Psychosis; HC, Healthy Controls



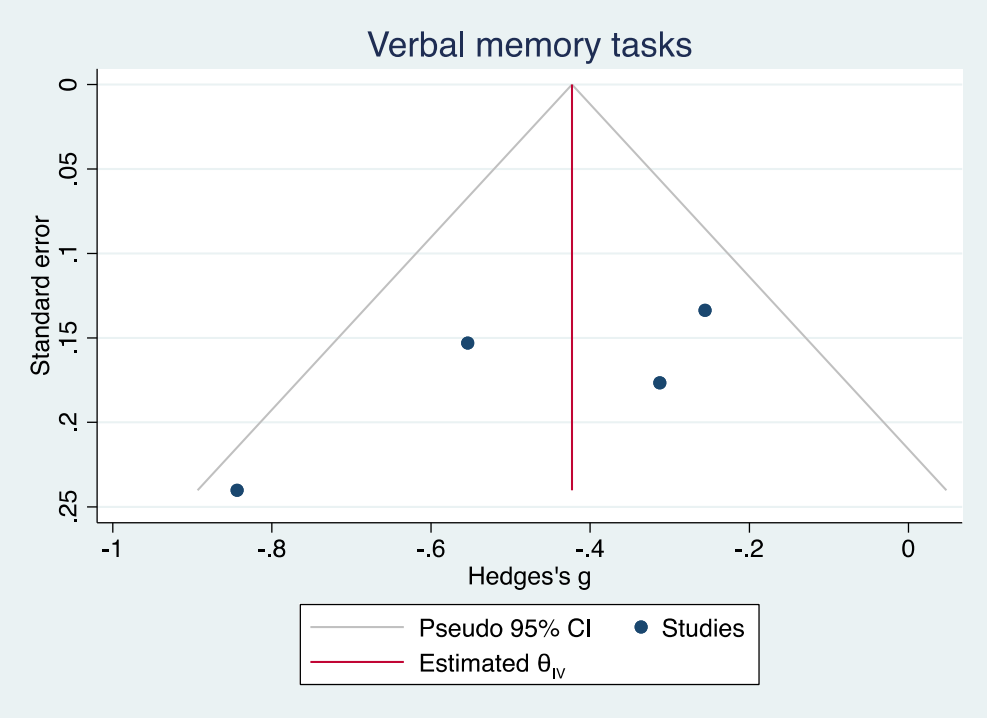
eFigure 12. Funnel plot for premorbid IQ: CHR-P vs HC. CHR-P, Clinical High Risk for Psychosis; HC, Healthy Controls



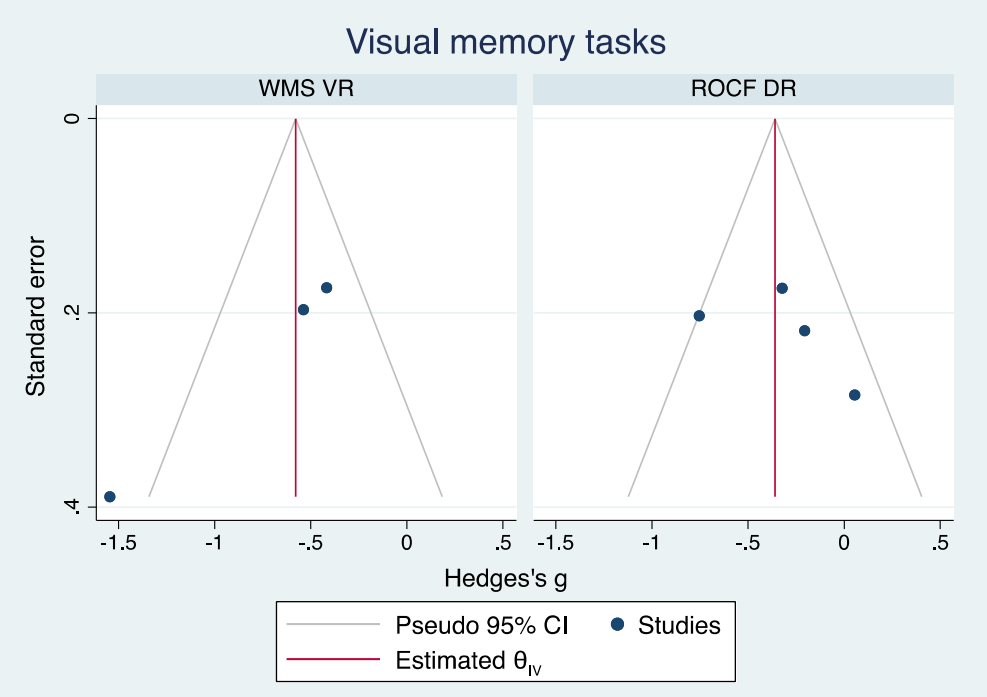
eFigure 13. Funnel plot for visuospatial ability tasks: CHR-P vs HC. CHR-P, Clinical High Risk for Psychosis; HC, Healthy Controls



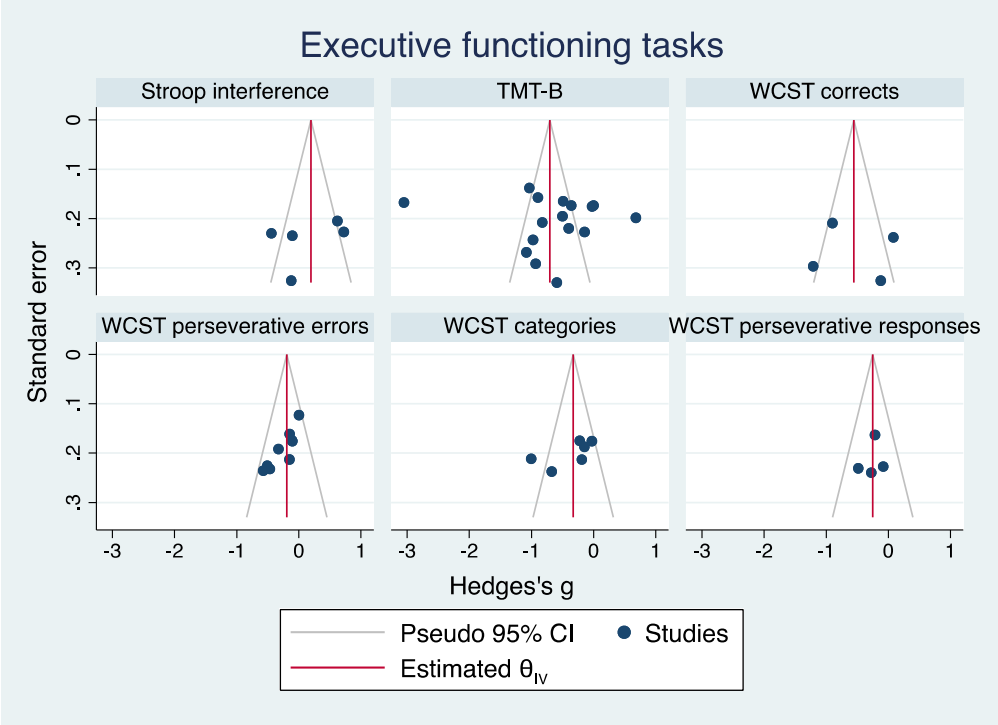
eFigure 14. Funnel plot for verbal memory tasks: CHR-P vs HC. CHR-P, Clinical High Risk for Psychosis; HC, Healthy Controls



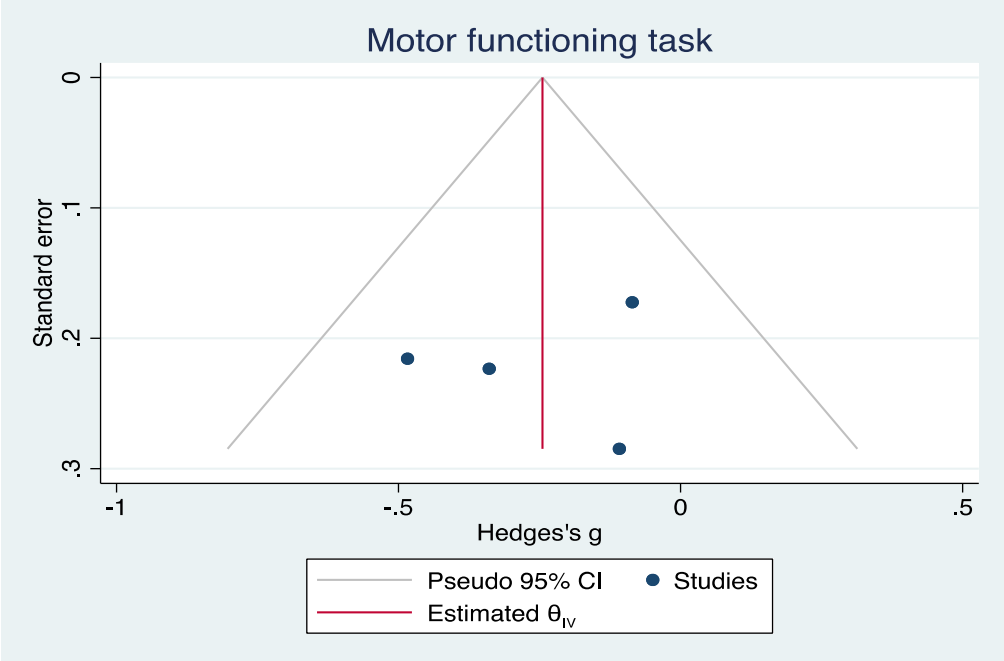
eFigure 15. Funnel plot for visual memory tasks: CHR-P vs HC. CHR-P, Clinical High Risk for Psychosis; HC, Healthy Controls



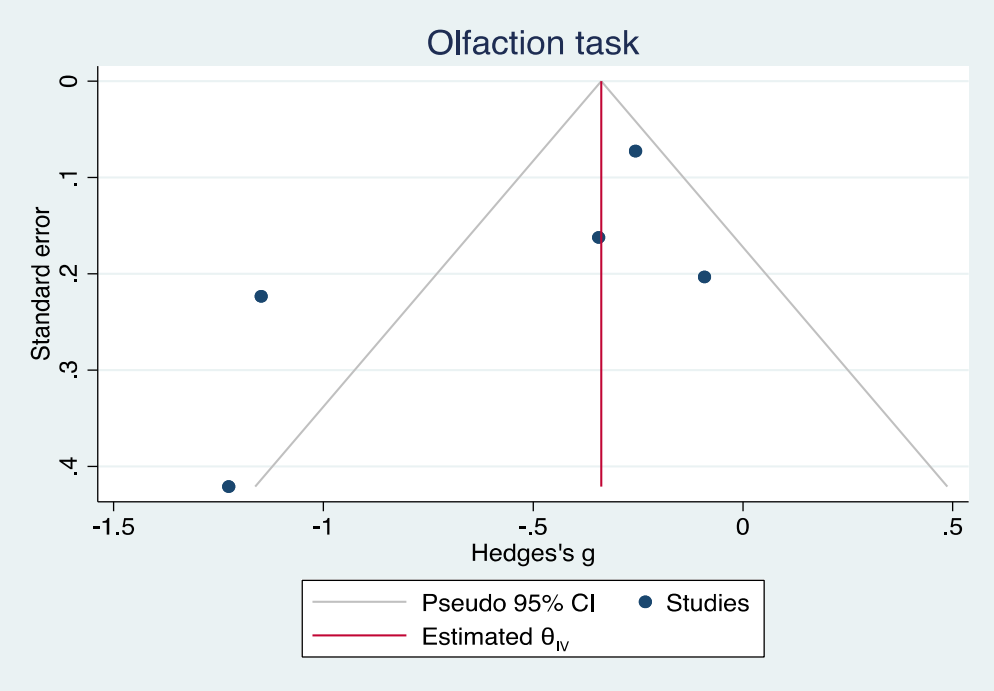
eFigure 16. Funnel plot executive functioning tasks: CHR-P vs HC. CHR-P, Clinical High Risk for Psychosis; HC, Healthy Controls



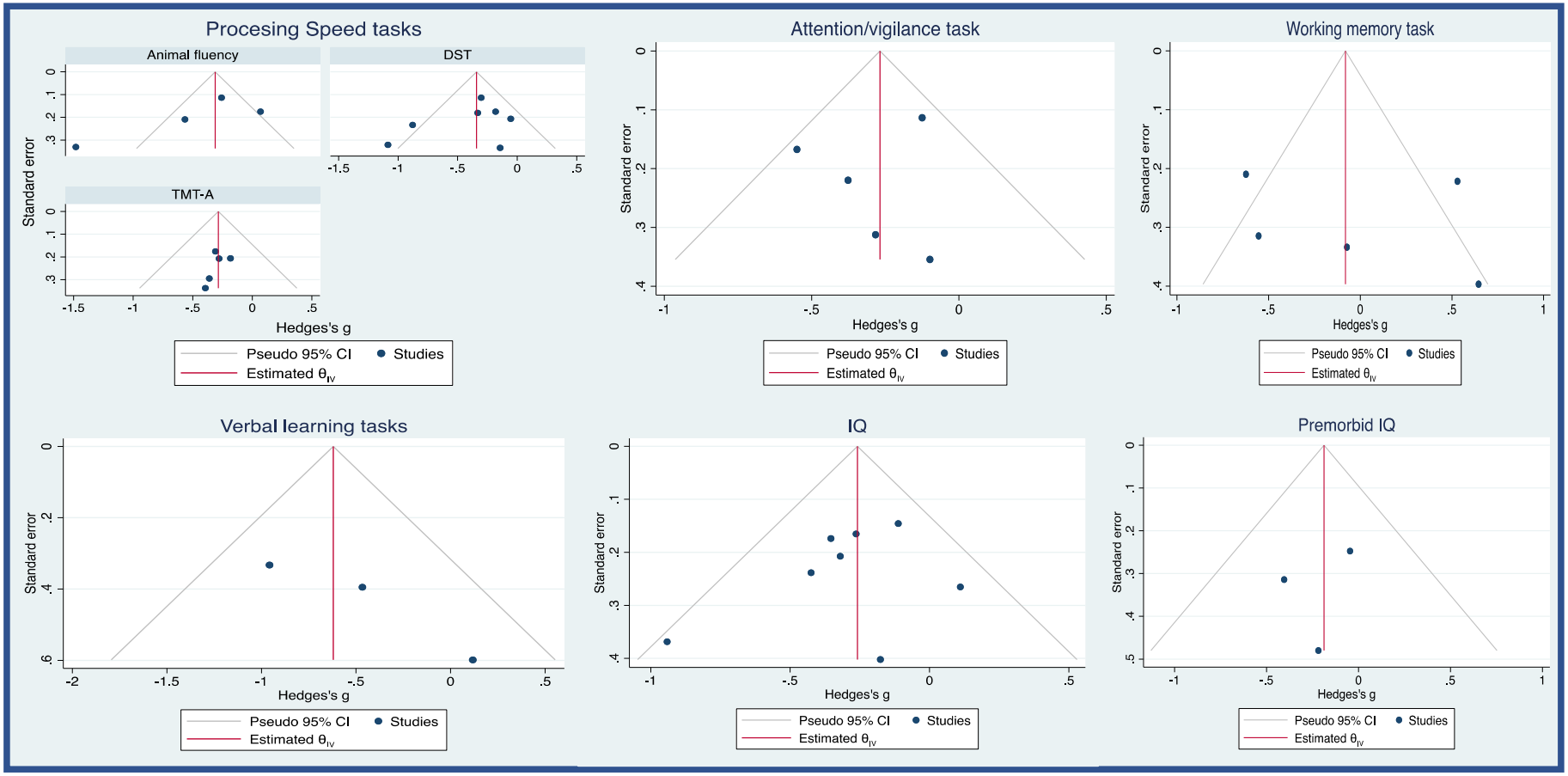
eFigure 17. Funnel plot for motor functioning task: CHR-P vs HC. CHR-P, Clinical High Risk for Psychosis; HC, Healthy Controls

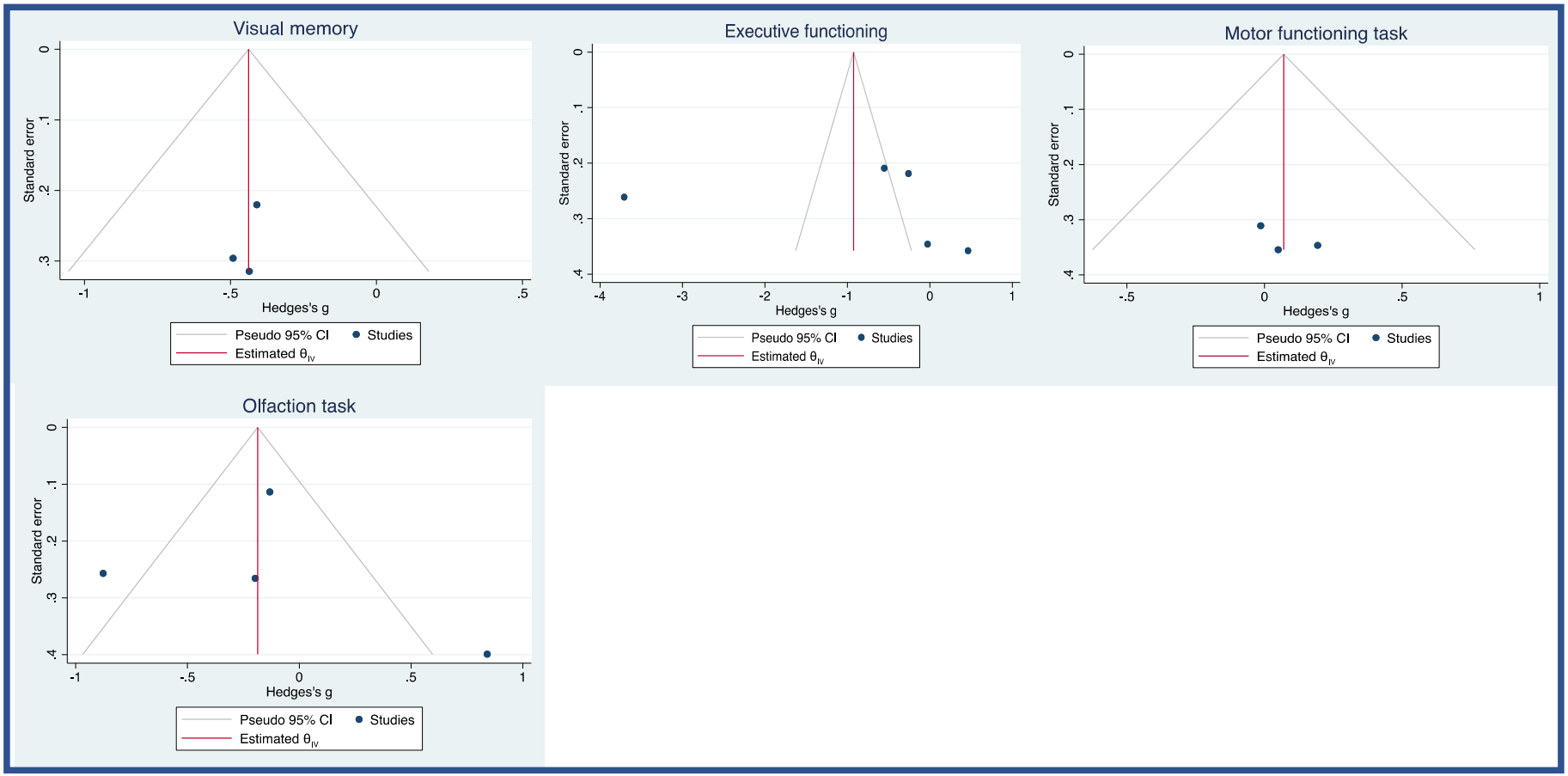


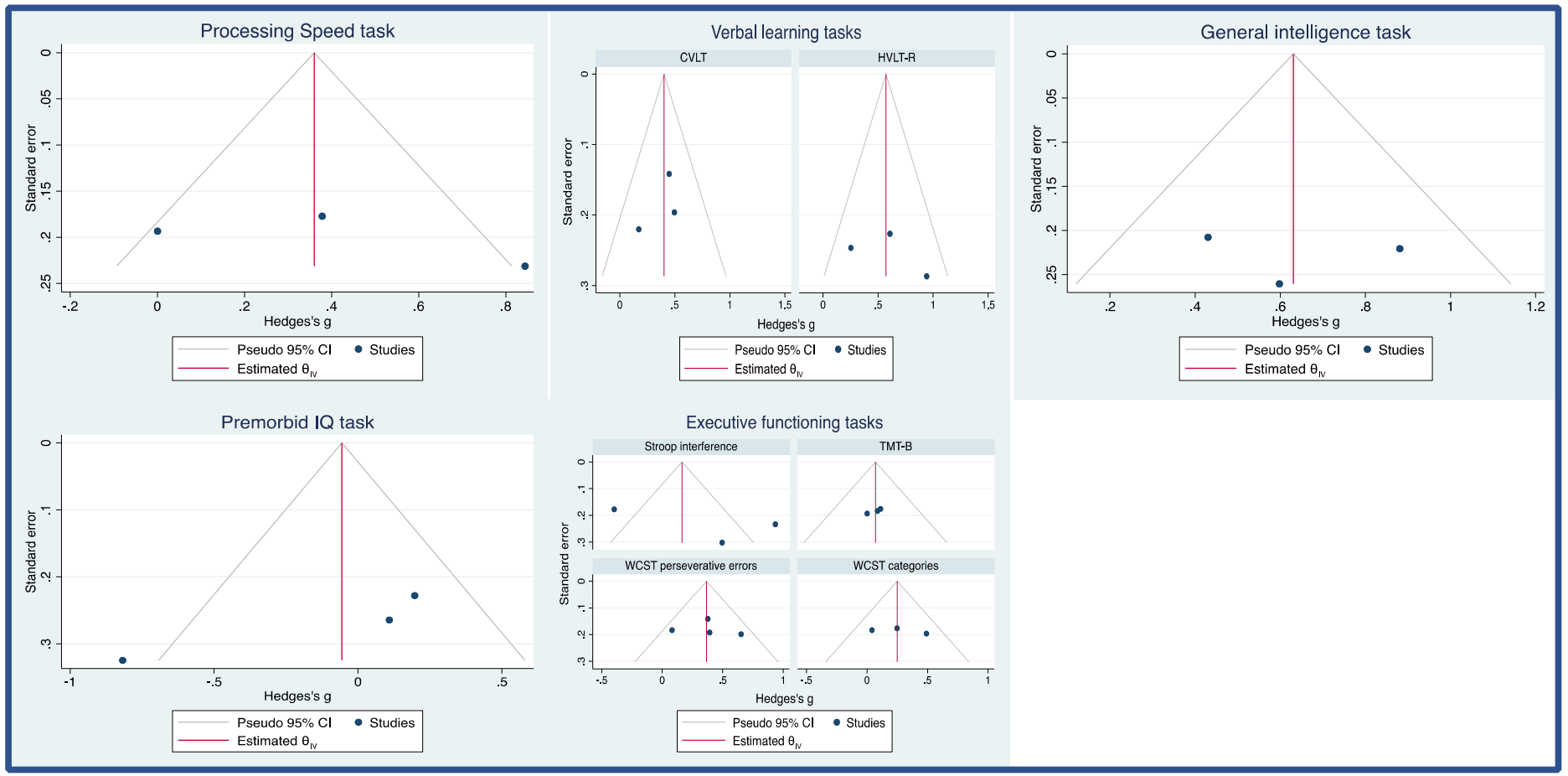
eFigure 18. Funnel plot for olfaction task: CHR-P vs HC. CHR-P, Clinical High Risk for Psychosis; HC, Healthy Controls



eFigure 19. Funnel plot for neurocognitive domains by tasks: CHR-P not transitioning vs those transitioning: CHR-P, Clinical High Risk for Psychosis






Processing Speed task
Standard error
0
.05
.1
.15
.2
.25
-.2
0
.2
.4
.6
.8
Hedges's g
Pseudo 95% CI
Studies
Estimated θIV
Verbal learning tasks
CVLT
HVLT-R
Standard error
0
.1
.2
.3
0
.5
1
1.5
Hedges's g
Pseudo 95% CI
Studies
Estimated θIV
General intelligence task
Standard error
0
.05
.1
.15
.2
.25
.2
.4
.6
.8
1
1.2
Hedges's g
Pseudo 95% CI
Studies
Estimated θIV
Premorbid IQ task
Standard error
0
.1
.2
.3
-1
-.5
0
.5
Hedges's g
Pseudo 95% CI
Studies
Estimated θIV
Executive functioning tasks
Stroop interference
TMT-B
WCST perseverative errors
WCST categories
Standard error
0
.1
.2
.3
-.5
0
.5
1
Hedges's g
Pseudo 95% CI
Studies
Estimated θIV

eResults 1. Metaregressions

Metaregressions for the CHR-P vs HC analysis revealed that age (ß=-0.06, p=0.022), and years of education (ß=0.17, p= 0.003) were associated with processing speed. Younger age was related to higher differences while higher years of education were associated with lower differences between groups. There were not enough data to perform meta-regressions in reasoning and problem-solving, visuospatial ability, verbal memory, visual memory, motor function and olfaction (eTable 11).

Metaregressions for the analysis comparing CHR-P transitioning and not revealed that age (ß=-0.08, p= 0.028) was associated with processing speed (eTable 12). Younger age was related to higher differences. No moderators were found for the CHR-P vs FEP analysis (eTable 13). Again, for several domains, metaregressions were not feasible because of the lack of data.

eDiscussion. Additional discussion

We also found some differences between tasks in the same domains, for example between the NART and Verbal IQ. First, the number of studies (7 vs 3) employed for each of these neurocognitive domains is different, thus the effect size estimates are not directly comparable (and in fact were not compared against each other). Second, these measures are not intended to measure the same construct. Although Verbal IQ is less sensitive to conditions than visual IQ, nonverbal measures (e.g. Performance IQ); it is obtained as a measure of current neurocognitive function. Conversely, the NART, as used in these circumstances, is a measure of academic achievement that is intended to estimate premorbid IQ. In this capacity, it also functions as a proxy for cognitive reserve in CHR-P individuals and could reasonably show a different relationship to comparison groups than current verbal IQ. In fact, while these two tasks are categorized within the same broad neurocognitive domain, their actual correlation is not 1.00 (but rather 0.66)[127].

While there is a moderate average relationship between Stroop color word reading and Stroop color naming task in healthy subjects (based on standard scores; Word reading is usually higher than Color naming using raw scores), there is a good deal of individual variation, similar to the case for WAIS performance and WMS performance, which was also co-normed on the same individuals. Moreover, and also similar to the case for the WAIS and the WMS, on the Stroop color word reading and Stroop color naming task scales is separable due to a number of factors, such as age, education level, IQ, psychiatric conditions including schizophrenia and certain types of neurological conditions or acquired injuries. Similarly, the WAIS BD was one of 5 subtests that comprised the WAIS Performance scale in a few previous versions of the test (the current version no longer divides the subtests into Verbal and Performance scales). One could easily differ on WAIS BD or on other Performance scale subtests but not on the Performance scale composite score if performance on the scale's subtests was heterogeneous.

eTable 11. Metaregressions CHR-P vs HC

	k	ß	SE	z	p	95% CI
Processing Speed						
Age	27	-0.058	0.025	-2.29	**0.022**	-0.109, -0.008
Sex male	27	0.002	0.009	-0.18	0.860	-0.019, 0.016
Years of education	16	0.171	0.057	2.97	**0.003**	0.058, 0.284
Caucasian	n.a.					
GAF	12	0.000	0.000	-0.04	0.970	-0.000, 0.000
Psychotic positive symptoms	15	-0.047	0.060	-0.74	0.458	-0.163, 0.073
Psychotic negative symptoms	15	-0.028	0.055	-0.52	0.605	-0.136, 0.079
NOS	27	-0.041	0.075	-0.62	0.532	-0.169, 0.088
Baseline AP exposure	n.a.					
Type of CHR-P instrument	23					
	SIPS	-0.027	0.222	-0.12	0.903	-0.462, 0.408
	Others	-0.268	0.510	-0.58	0.562	-1.248, 0.712
Working memory						
Age	16	-0.018	0.025	-0.74	0.457	-0.068, 0.031
Sex male	16	0.003	0.007	0.50	0.618	-0.011, 0.016
Years of education	11	-0.019	0.021	-0.64	0.523	-0.060, 0.022
Caucasian	n.a.					
GAF	n.a					
Psychotic positive symptoms	n.a					
Psychotic negative symptoms	n.a					
NOS	16	-0.056	0.052	-1.10	0.274	-0.142, 0.046
Baseline AP exposure	n.a					
Type of CHR-P instrument	13					
	SIPS	-0.186	0.176	-1.05	0.291	-0.532, 0.159
	Others	0.211	0.284	0.74	0.458	-0.346, 0.769
Verbal learning						
Age	20	-0.075	0.031	-2.41	0.016	-0.146, -0.014
Sex male	20	0.001	0.012	0.06	0.951	-0.023, 0.025
Years of education	12	0.168	0.095	1.77	0.077	-0.018, 0.355
Caucasian	n.a					
GAF	8	-0.015	0.014	-0.36	0.718	-0.033, 0.023
Psychotic positive symptoms	9	0.013	0.102	0.02	0.982	-0.199, 0.203
Psychotic negative symptoms	9	0.195	0.138	1.52	0.127	-0.056, 0.457
NOS	20	-0.155	0.089	-1.85	0.065	-0.299, 0.001
Baseline AP exposure	7	0.016	0.003	1.79	0.073	-0.000, 0.013
Type of CHR-P instrument	18					
	SIPS	-0.508	0.280	-1.81	0.070	-1.061, 0.041
	BSIP	-0.145	0.555	-0.26	0.794	-1.233, 0.943
	Others	-0.387	0.431	-0.90	0.368	-1.232, 0.456
Visual learning						
Age	13	-0.026	0.027	-0.98	0.328	-0.079, 0.0267
Sex male	13	0.007	0.006	1.05	0.293	-0.006, 0.020
Years of education	8	0.083	0.139	0.59	0.552	-0.191, 0.357
Caucasian	n.a.					
GAF	n.a.					
Psychotic positive symptoms	8	0.108	0.074	1.47	0.142	-0.036, 0.253
Psychotic negative symptoms	8	0.088	0.074	1.11	0.266	-0.059, 0.216
NOS	13	-0.019	0.064	-0.30	0.762	-0.145, 0.106
Baseline AP exposure	n.a.					
Type of CHR-P instrument	12					
	SIPS	0.164	0.200	0.82	0.410	-0.227, 0.557
	Others	0.263	0.357	0.74	0.461	-0.447, 0.964
General Intelligence						
Age	20	-0.015	0.031	-0.18	0.856	-0.087, 0.057
Sex male	20	0.002	0.008	-0.32	0.747	-0.019, 0.014
Years of education	8	0.049	0.156	0.30	0.765	-0.275, 0.374
Caucasian	n.a.					
GAF	13	0.00	<0.001	1.30	0.193	<0.001
Psychotic positive symptoms	8	0.024	0.043	0.56	0.570	-0.060, 0.109
Psychotic negative symptoms	8	0.003	0.024	0.14	0.885	-0.044, 0.051
NOS	20	-0.034	0.098	-0.30	0.766	-0.245, 0.138

Baseline AP exposure	9	0.003	0.009	0.35	0.725	-0.015, 0.022
Type of CHR-P instrument	19					
	SIPS	-0.031	0.200	-0.16	0.875	-0.424, 0.361
Premorbid IQ						
Age	12	0.065	0.075	0.86	0.391	-0.081, 0.212
Sex male	11	0.021	0.015	1.40	0.160	-0.008, 0.051
Years of education	7	0.289	0.164	1.70	0.089	-0.042, 0.601
Caucasian	n.a.					
GAF	8	0.039	0.034	1.14	0.252	-0.027, 0.106
Psychotic positive symptoms	9	-0.031	0.059	-0.52	0.605	-0.148, 0.086
Psychotic negative symptoms	9	-0.009	0.103	-0.09	0.929	-0.211, 0.192
NOS	12	0.017	0.116	0.15	0.877	-0.210, 0.246
Baseline AP exposure	n.a.					
Type of CHR-P instrument	12					
	SIPS	0.195	0.341	0.57	0.567	-0.472, 0.863
	Others	0.458	0.445	1.03	0.303	-0.414, 1.333
Executive functioning						
Age	29	0.001	0	0.04	0.966	-0.000, 0.000
Sex male	28	-0.003	0.009	-0.36	0.722	-0.022, 0.015
Years of education	18	0.070	0.089	0.79	0.432	-0.105, 0.246
Caucasian	n.a					
GAF	16	0	0	0.10	0.923	-0.000, 0.000
Psychotic positive symptoms	13	-0.054	0.050	-1.08	0.278	-0.153, 0.044
Psychotic negative symptoms	13	-0.070	0.047	-1.50	0.133	-0.162, 0.021
NOS	29	-0.014	0.075	0.05	0.961	-0.143, 0.151
Baseline AP exposure	13	0.001	0.009	-0.16	0.875	-0.018, 0.016
Type of CHR-P instrument	26					
	SIPS	-0.151	0.247	-0.64	0.523	-0.626, 0.313
	BSIP	0.187	0.588	0.32	0.752	-0.926, 1.270
	BSABS	-0.142	0.582	-0.24	0.807	-1.288, 0.999
	Others	-0.196	0.422	-0.46	0.649	-1.012, 0.639

n.a. not applied; Positive and negative psychotic symptoms measured by PANSS scale or SIPS; CAARMS Comprehensive Assessment of At-Risk Mental States reference category in type of CHR-P instrument; SIPS Structured Interview for Psychosis-risk Syndromes; BSIP Basel Screening Instrument for Psychosis; SPI-A Schizophrenia Proneness Instrument-Adult; SPI-CY Child and Youth version; BSABS Bonn Scale for the Assessment of Basic Symptoms; Others: Early Recognition Inventory (ERIraos), Positive and Negative Syndrome Scale (PANSS) and Brief Psychiatric Rating Scale (BPRS)

eTable 12. Metaregressions CHR-transitioning vs CHR-P non transitioning

	k	ß	SE	z	p	95% CI
Processing Speed						
Age	8	-0.077	0.035	-2.19	**0.028**	-0.155, -0.008
Sex male	8	-0.013	0.012	-1.16	0.244	-0.046, 0.009
Years of education	n.a					
Caucasian	n. a.					
GAF	n.a					
Positive psychotic symptoms	n.a					
Negative symptoms	n.a					
NOS	8	0.083	0.074	1.12	0.263	-0.062, 0.238
Baseline AP exposure	n.a					
Follow-up time	8	0.002	0.002	0.73	0.463	-0.003, 0.006
Type of CHR-P instrument	n.a.					
	SIPS	0.038	0.203	0.15	0.88	-0.378, 0.439
	SPI-A or SPI-CY	-1.036	0.401	-2.56	0.01	-1.811, -0.241
General intelligence						
Age	8	0.115	0.124	0.93	0.355	-0.139, 0.369
Sex male	8	-0.028	0.034	-0.55	0.583	-0.084, 0.047
Years of education	n. a.					
Caucasian	n.a					
GAF	n.a					
Positive psychotic symptoms	n.a					
Negative symptoms	n.a					
NOS	8	0.224	0.353	0.64	0.525	-0.477, 0.916
Baseline AP exposure	n.a					
Follow-up time	8	-0.001	0.001	-0.78	0.437	-0.004, 0.002
Type of CHR-P instrument	8					
	SIPS	-0.254	0.899	-0.28	0.778	-2.016, 1.508

n.a. not applied; Positive and negative psychotic symptoms measured by PANSS scale or SIPS; CAARMS Comprehensive Assessment of At-Risk Mental States reference category in type of CHR-P instrument; SIPS Structured Interview for Psychosis-risk Syndromes; BSIP Basel Screening Instrument for Psychosis; SPI-A Schizophrenia Proneness Instrument-Adult; SPI-CY Child and Youth version; BSABS Bonn Scale for the Assessment of Basic Symptoms; Others: Early Recognition Inventory (ERIraos), Positive and Negative Syndrome Scale (PANSS) and Brief Psychiatric Rating Scale (BPRS)

eTable 13. Metaregressions: CHR-P vs FEP

	k	ß	SE	z	p	95% CI
Executive function						
Age	7	0.059	0.047	1.25	0.210	-0.034, 0.153
Sex male	7	-0.016	0.012	-1.33	0.182	-0.041, 0.007
Years of education	n.a					
Caucasian	n. a.					
GAF	n. a.					
Positive psychotic symptoms	n.a					
Negative symptoms	n. a.					
NOS	7	0.132	0.058	2.27	0.06	0.018, 0.246
Baseline AP exposure	n. a.					
Type of CHR-P instrument	n.a					

n.a. not applied; Positive and negative psychotic symptoms measured by PANSS scale or SIPS; CAARMS Comprehensive Assessment of At-Risk Mental States reference category in type of CHR-P instrument; SIPS Structured Interview for Psychosis-risk Syndromes; BSIP Basel Screening Instrument for Psychosis; SPI-A Schizophrenia Proneness Instrument-Adult; SPI-CY Child and Youth version; BSABS Bonn Scale for the Assessment of Basic Symptoms; Others: Early Recognition Inventory (ERIraos), Positive and Negative Syndrome Scale (PANSS) and Brief Psychiatric Rating Scale (BPRS)

eLimitations

In addition to the limitations addressed in the main text, we did not differentiate affective vs non-affective psychoses at outcomes because these data were hardly ever reported by the primary studies. Furthermore, the mean age of the samples and the associated follow-up are not past the age of peak risk. Another limitation is that outcomes other than transition to psychosis were not addressed because of the lack of longitudinal data. Neurocognitive features remain relatively more highly predictive of functional outcomes in both established schizophrenia spectrum and related psychotic disorders and their risk states. Neurocognitive impairment is prominent, persistent and disabling across illness phases. As such, future studies should fully investigate whether the neurocognitive dysfunction observed in CHR-P individuals is associated with functional outcomes at follow-up. This is particularly relevant considering that most CHR-P individuals who will not transition to psychosis will nevertheless continue displaying functional impairment over time (and therefore, these individuals cannot be truly defined as “false positives”), with remission rates accounting for only 15% of the baseline sample[128].

A further important limitation is that the comparison with HC groups may have amplified the neurocognitive deficit observed. A subset of studies compared the neurocognitive functioning with help-seeking samples, but these were not enough to perform sensitivity analyses. However, we included a clinical comparison group composed of FEP patients. An associated issue is that neurocognitive dysfunction is also common (i.e. transdiagnostic) among psychiatric disorders (albeit to varying degrees). The CHR-P

paradigm is already partially transdiagnostic, in light of the frequent non-psychotic comorbidities (mostly affective or personality disorders[129]) and transdiagnostic conceptualisation of some CHR-P assessment instruments (e.g. the CAARMS, which allows comorbid mental disorders[2]). However, future studies should perform more extensive transdiagnostic neurocognitive comparisons with other psychiatric and/or high-risk samples. This would facilitate careful ascertainment of the specificity vs transdiagnosticity[130,131] of cognitive biomarkers across different psychopathological dimensions. Given the heterogeneity in the course and symptom profiles (including neurocognitive profiles) of psychiatric disorders, characterising cognition in CHR-P states may contribute to more homogeneous cross-disorder subtyping according to shared phenotypic features (i.e., symptom profile, neurocognitive profile, brain-based assessments, genetics, etc.). The neurocognitive dysfunctions observed in the current study can, therefore, contribute to the broader literature on subtyping within and across diagnostic groups based on neurocognitive features of psychiatric disorders and their risk states.

A final limitation is that we did not address sensitivity to change over time and disorder progression for the neurocognitive dysfunction observed[132]. Dynamic investigations of the time course of neurocognitive and neurobiological alterations in CHR-P individuals are emerging, and not enough studies are yet available for a meta-analytic summary."

References

1. Fusar-Poli P, Salazar de Pablo G, Correll CU, et al. Prevention of Psychosis: Advances in Detection, Prognosis, and Intervention. *JAMA Psychiatry.* 2020.

2. Yung AR, Yuen HP, McGorry PD, et al. Mapping the onset of psychosis: the Comprehensive Assessment of At-Risk Mental States. *Aust N Z J Psychiatry.* 2005;39(11-12):964-971.

3. Fusar-Poli P, Cappucciati M, Rutigliano G, et al. Towards a Standard Psychometric Diagnostic Interview for Subjects at Ultra High Risk of Psychosis: CAARMS versus SIPS. *Psychiatry J.* 2016;2016:7146341.

4. McGlashan T WB, Woods S. *The psychosis-risk syndrome: handbook for diagnosis and follow-up.*: Oxford: Oxford University 2010.

5. Riecher-Rössler A, Aston J, Ventura J, et al. [The Basel Screening Instrument for Psychosis (BSIP): development, structure, reliability and validity]. *Fortschr Neurol Psychiatr.* 2008;76(4):207-216.

6. Haefner H, Bechdolf A, Klosterkotter J, Maurer K. Early detection and intervention in psychosis. A practice handbook. In: Stuttgart: Schattauer; 2011.

7. Vollmer-Larsen A, Handest P, Parnas J. Reliability of measuring anomalous experience: the Bonn Scale for the Assessment of Basic Symptoms. *Psychopathology.* 2007;40(5):345-348.

8. Fux L, Walger P, Schimmelmann BG, Schultze-Lutter F. The Schizophrenia Proneness Instrument, Child and Youth version (SPI-CY): practicability and discriminative validity. *Schizophr Res.* 2013;146(1-3):69-78.

9. Kay SR, Fiszbein A, Opler LA. The positive and negative syndrome scale (PANSS) for schizophrenia. *Schizophr Bull.* 1987;13(2):261-276.

10. Overall J, Gorham D. The Brief Psychiatric Rating Scale (BPRS): recent developments in ascertainment and scaling. *Psychopharmacol Bull.* 1988;24:97-99.

11. Fusar-Poli P, Deste G, Smieskova R, et al. Cognitive Functioning in Prodromal Psychosis A Meta-analysis. *Archives of General Psychiatry.* 2012;69(6):562-571.

12. Hauser M, Zhang J-P, Sheridan EM, et al. Neuropsychological Test Performance to Enhance Identification of Subjects at Clinical High Risk for Psychosis and to Be Most Promising for Predictive Algorithms for Conversion to Psychosis: A Meta-Analysis. *Journal of Clinical Psychiatry.* 2017;78(1):E28-E40.

13. Reitan RM, Wolfson D. *The Halstead–Reitan Neuropsycholgical Test Battery: Therapy and clinical interpretation.* Tucson, AZ: Neuropsychological Press.; 1985.

14. Keefe RSE. *Brief Assessment of Cognition in Schizophrenia (BACS) Manual—A: Version 2.1.* Durham, NC: Duke University Medical Center; 1999.

15. Spreen O, Strauss E. *A Compendium of Neuropsychological Tests.* New York: xford University; 1991.

16. Thurstone LL. Primary mental abilities. *Psychometric Monographs.* 1938;1.

17. Wechsler D. *Wechsler Adult Intelligence Scale—3rd ed (WAISIII): Administration and Scoring Manual.* San Antonio, Tex: Psychological Corp; 1997.

18. Golden CJ. *Stroop Color and Word Test.* Chicago, Illinois: Stoelting Company; 1978.

19. Nuechterlei KH, Edell WS, Norris M, Dawson ME. Attentionalvulnerability indicators, thought disorder, and negative symptoms. *Schizophrenia bulletin.* 1986;12:408–426.

20. Cornblatt BA, Risch NJ, Faris G, Friedman D, Erlenmeyer-Kimling L. The Continuous Performance Test, Identical Pairs version (CPT-IP), I: new findings about sustained attention in normal families. *Psychiatry research.* 1988;26:223-238.

21. Wechsler D. *The Wechsler Memory Scale, 3rd ed.* . San Antonio, Tex: Psychological Corp (Harcourt); 1997.

22. Gold JM, Carpenter C, Randolph C, Goldberg TE, Weinberger DR. Auditory working memory and Wisconsin Card Sorting Test performance in schizophrenia. *Archives of general psychiatry.* 1997;54:159–165.

23. Wechsler D. *Wechsler Abbreviated Scale of Intelligence.* San Antonio, TX.: Psychological Corporation; 1999.

24. Petrides M, Alivisatos B, Evans AC. Functional activation of the human ventrolateral frontal cortex during mnemonic retrieval of verbal information. *Proc Natl Acad Sci U S A.* 1995;92(13):5803-5807.

25. Brandt J, R.H.B. B. *The Hopkins Verbal Learning Test—Revised: Professional Manual.* . Odessa, Fla: Psychological AssessmentcResources, Inc.; 2001.

26. Lezak MD. *Neuropsychological Assessment.* Oxford University Press; 2004.

27. Woods SP, Delis DC, Scott JC, Kramer JH, Holdnack JA. The California Verbal Learning Test-second edition: Test-retest reliability, practice effects, and reliable change indices for the standard and alternate forms. *Archives of clinical neuropsychology : the official journal of the National Academy of Neuropsychologists.* 2006;21:413-420.

28. Delis DC, Kramer JH, Kaplan E, Ober BA. *California Verbal Learning Test Manual — II.* The Psychological Corporation, San Antonio, TX; 2000.

29. Benedict RHB. *Benedict RHB: Brief Visuospatial Memory Test—Revised: Professional Manual.* Odessa, Fla: Psychological Assessment Resources, Inc.; 1997.

30. Rey A. *L'examen clinique en psychologie.* Presses Un, Parisi, M.1964.

31. White T, Stern RA. *Neuropsychological Assessment Battery: Psychometric and Technical Manual.* Lutz, Fla: Psychological Assessment Resources, Inc; 2003.

32. Baron-Cohen S, Jolliffe T, Mortimore C, Robertson M. Another advanced test of theory of mind: evidence from very high functioning adults with autism or asperger syndrome. *J Child Psychol Psychiatry.* 1997;38(7):813-822.

33. Baron-Cohen S, Wheelwright S, Hill J, Raste Y, Plumb I. The "Reading the Mind in the Eyes" Test revised version: a study with normal adults, and adults with Asperger syndrome or high-functioning autism. *J Child Psychol Psychiatry.* 2001;42(2):241-251.

34. van 't Wout M, Aleman A, Kessels RP, Laroi F, Kahn RS. Emotional processing in a non-clinical psychosis-prone sample. *Schizophrenia research.* 2004;68(2-3):271-281.

35. Corcoran R, Mercer G, Frith CD. Schizophrenia, symptomatology and social inference: Investigating "theory of mind" in people with schizophrenia. *Schizophrenia research.* 1995;17:5-13.

36. Wechsler D. *WAIS-R : Wechsler adult intelligence scale-revised.* New York, N.Y. : Psychological Corporation; 1981.

37. Wechsler D. *Wechsler Intelligence Scale for Children, 3rd edition* New York, N. Y,: Psychological Corporation; 1991.

38. Nelson HE. *National Adult Reading Test (NART): Test manual.* Windsor: NFER-Nelson.; 1982.

39. Maurer K, Hafner H. [Early diagnosis of schizophrenia]. *MMW Fortschritte der Medizin.* 2007;149(13):36-38.

40. Grant DA. *Computer version of the Wisconsin Card Sorting Test, WCST.* Odessa, Fla: Psychological Assessment Resources; 2000.

41. Stroop JR. Studies of interference in serial verbal reactions. *J Exp Psychol.* 1935;18:643-662.

42. *Finger Tapping Test* [computer program]. Lelystad: BuroTesteR; 2002.

43. Doty RL, Shaman P, Kimmelman CP, Dann MS. University of Pennsylvania Smell Identification Test: a rapid quantitative olfactory function test for the clinic. *Laryngoscope.* 1984;94(2 Pt 1):176-178.

44. Cochrane Handbook for Systematic Reviews of Interventions. Version 5.1.0. [updated March 2011]. The Cochrane Collaboration. Available from www.handbook.cochrane.org. Published 2011. Accessed.

45. Borenstein M, Hedges LV, Higgins JPT, Rothstein HR. Part 5. Chapter 22. Complex Data Structures In: *Introduction to Meta-Analysis.* John Wiley & Sons, Ltd. ; 2009.

46. Seidman LJ, Shapiro DI, Stone WS, et al. Association of Neurocognition With Transition to Psychosis: Baseline Functioning in the Second Phase of the North American Prodrome Longitudinal Study. *JAMA psychiatry.* 2016;73(12):1239-1248.

47. Westwood SJ, Radua J, Rubia K. Noninvasive brain stimulation in children and adults with attention-deficit/hyperactivity disorder: a systematic review and meta-analysis. *Journal of psychiatry & neuroscience : JPN.* 2020;45(6):190179.

48. Norman LJ, Carlisi C, Lukito S, et al. Structural and Functional Brain Abnormalities in Attention-Deficit/Hyperactivity Disorder and Obsessive-Compulsive Disorder: A Comparative Meta-analysis. *JAMA psychiatry.* 2016;73(8):815-825.

49. Egger M, Davey Smith G, Schneider M, Minder C. Bias in meta-analysis detected by a simple, graphical test. *BMJ (Clinical research ed).* 1997;315(7109):¡629-634.

50. Addington J, Piskulic D, Perkins D, Woods SW, Liu L, Penn DL. Affect recognition in people at clinical high risk of psychosis. *Schizophrenia research.* 2012;140(1-3):87-92.

51. Addington J, Liu L, Perkins DO, Carrion RE, Keefe RS, Woods SW. The Role of Cognition and Social Functioning as Predictors in the Transition to Psychosis for Youth With Attenuated Psychotic Symptoms. *Schizophrenia bulletin.* 2017;43(1):57-63.

52. Atkinson RJ, Fulham WR, Michie PT, et al. Electrophysiological, cognitive and clinical profiles of at-risk mental state: The longitudinal Minds in Transition (MinT) study. *PloS one.* 2017;12(2).

53. Becker HE, Nieman DH, Wiltink S, et al. Neurocognitive functioning before and after the first psychotic episode: does psychosis result in cognitive deterioration? *Psychological medicine.* 2010;40(10):1599-1606.

54. Blanchard MM, Jacobson S, Clarke MC, et al. Language, motor and speed of processing deficits in adolescents with subclinical psychotic symptoms. *Schizophrenia research.* 2010;123(1):71-76.

55. Bolt LK, Amminger GP, Farhall J, et al. Neurocognition as a predictor of transition to psychotic disorder and functional outcomes in ultra-high risk participants: Findings from the NEURAPRO randomized clinical trial. *Schizophrenia research.* 2019;206:67-74.

56. Brewer WJ, Wood SJ, McGorry PD, et al. Impairment of olfactory identification ability in individuals at ultra-high risk for psychosis who later develop schizophrenia. *The American journal of psychiatry.* 2003;160(10):1790-1794.

57. Brockhaus-Dumke A, Tendolkar I, Pukrop R, Schultze-Lutter F, Klosterkötter J, Ruhrmann S. Impaired mismatch negativity generation in prodromal subjects and patients with schizophrenia. *Schizophrenia research.* 2005;73(2-3):297-310.

58. Broome M, Day F, Valli I, et al. Delusional ideation, manic symptomatology and working memory in a cohort at clinical high-risk for psychosis: a longitudinal study. . *European psychiatry : the journal of the Association of European Psychiatrists.* 2012;27:258–263.

59. Chu AOK, Chang WC, Chan SKW, Lee EHM, Hui CLM, Chen EYH. Comparison of cognitive functions between first-episode schizophrenia patients, their unaffected siblings and individuals at clinical high-risk for psychosis. *Psychological medicine.* 2019;49(11):1929-1936.

60. Chung YS, Kang D-H, Shin NY, Yoo SY, Kwon JS. Deficit of theory of mind in individuals at ultra-high-risk for schizophrenia. *Schizophrenia research.* 2008;99(1-3):111-118.

61. Corcoran CM, Keilp JG, Kayser J, et al. Emotion recognition deficits as predictors of transition in individuals at clinical high risk for schizophrenia: a neurodevelopmental perspective. *Psychological medicine.* 2015;45(14):2959-2973.

62. Couture SM, Penn DL, Addington J, Woods SW, Perkins DO. Assessment of social judgments and complex mental states in the early phases of psychosis. *Schizophrenia research.* 2008;100(1-3):237-241.

63. Cui H, Giuliano AJ, Zhang T, et al. Cognitive dysfunction in a psychotropic medication-naive, clinical high-risk sample from the ShangHai-At-Risk-for-Psychosis (SHARP) study: Associations with clinical outcomes. *Schizophrenia research.* 2020.

64. Eastvold AD, Heaton RK, Cadenhead KS. Neurocognitive deficits in the (putative) prodrome and first episode of psychosis. *Schizophrenia research.* 2007;93(1-3):266-277.

65. Egloff L, Lenz C, Studerus E, et al. No associations between medial temporal lobe volumes and verbal learning/memory in emerging psychosis. *European Journal of Neuroscience.* 2019;50(6):3060-3071.

66. Eisenacher S, Rausch F, Ainser F, et al. Early cognitive basic symptoms are accompanied by neurocognitive impairment in patients with an 'at-risk mental state' for psychosis. *Early intervention in psychiatry.* 2018;12(4):586-595.

67. Epstein KA, Cullen KR, Mueller BA, Robinson P, Lee S, Kumra S. White matter abnormalities and cognitive impairment in early-onset schizophrenia-spectrum disorders. *Journal of the American Academy of Child and Adolescent Psychiatry.* 2014;53(3):362-372.e361-362.

68. Frommann I, Pukrop R, Brinkmeyer J, et al. Neuropsychological Profiles in Different At-Risk States of Psychosis: Executive Control Impairment in the Early-and Additional Memory Dysfunction in the Late-Prodromal State. *Schizophrenia bulletin.* 2011;37(4):861-873.

69. Gill KE, Evans E, Kayser J, et al. Smell identification in individuals at clinical high risk for schizophrenia. *Psychiatry Research* 2014;220(1-2):201-204.

70. Goghari VM, Brett C, Tabraham P, et al. Spatial working memory ability in individuals at ultra high risk for psychosis. *Journal of psychiatric research.* 2014;50:100-105.

71. Gupta T, Mittal VA. Nicotine usage is associated with elevated processing speed, spatial working memory, and visual learning performance in youth at ultrahigh-risk for psychosis. *Psychiatry research.* 2014;220(1-2):687-690.

72. He Y, Li Z, Ma X, et al. Olfactory and cognitive functions in Chinese individuals at clinical high risk for psychosis. *Psychiatry research.* 2019;272:51-53.

73. Healey KM, Penn DL, Perkins D, Woods SW, Addington J. Theory of mind and social judgments in people at clinical high risk of psychosis. *Schizophrenia research.* 2013;150(2-3):498-504.

74. Hou CL, Xiang YT, Wang ZL, et al. Cognitive functioning in individuals at ultra-high risk for psychosis, first-degree relatives of patients with psychosis and patients with first-episode schizophrenia. *Schizophrenia research.* 2016;174(1-3):71-76.

75. Hur JW, Shin NY, Jang JH, et al. Clinical and neurocognitive profiles of subjects at high risk for psychosis with and without obsessive-compulsive symptoms. *The Australian and New Zealand journal of psychiatry.* 2012;46(2):161-169.

76. Hur JW, Byun MS, Shin NY, et al. General intellectual functioning as a buffer against theory-of-mind deficits in individuals at ultra-high risk for psychosis. *Schizophrenia research.* 2013;149(1-3):83-87.

77. Hwang WJ, Lee TY, Shin WG, et al. Global and Specific Profiles of Executive Functioning in Prodromal and Early Psychosis. *Frontiers in psychiatry.* 2019;10:356.

78. Ilonen T, Heinimaa M, Korkeila J, Svirskis T, Salokangas RKR. Differentiating adolescents at clinical high risk for psychosis from psychotic and non-psychotic patients with the Rorschach. *Psychiatry research.* 2010;179(2):151-156.

79. Jahshan C, Heaton RK, Golshan S, Cadenhead KS. Course of Neurocognitive Deficits in the Prodrorne and First Episode of Schizophrenia. *Neuropsychology.* 2010;24(1):109-120.

80. Kamath V, Turetsky BI, Calkins ME, et al. Olfactory processing in schizophrenia, non-ill first-degree family members, and young people at-risk for psychosis. *The world journal of biological psychiatry : the official journal of the World Federation of Societies of Biological Psychiatry.* 2014;15(3):209-218.

81. Kang M, Bang M, Lee SY, Lee E, Yoo SW, An SK. Coping styles in individuals at ultra-high risk for psychosis: Associations with cognitive appraisals. *Psychiatry research.* 2018;264:162-168.

82. Kim HS, Shin NY, Jang JH, et al. Social cognition and neurocognition as predictors of conversion to psychosis in individuals at ultra-high risk. *Schizophrenia research.* 2011;130(1-3):170-175.

83. Kim D, Lee S, Choi M, et al. Diffusion tensor imaging reveals abnormal brain networks in elderly subjects with subjective cognitive deficits. *Neurological sciences : official journal of the Italian Neurological Society and of the Italian Society of Clinical Neurophysiology.* 2019;40(11):2333-2342.

84. Koren D, Scheyer R, Stern Y, et al. Metacognition strengthens the association between neurocognition and attenuated psychosis syndrome: Preliminary evidence from a pilot study among treatment-seeking versus healthy adolescents. *Schizophrenia research.* 2019;210:207-214.

85. Korver N, Nieman DH, Becker HE, et al. Symptomatology and neuropsychological functioning in cannabis using subjects at ultra-high risk for developing psychosis and healthy controls. *The Australian and New Zealand journal of psychiatry.* 2010;44(3):230-236.

86. Koshiyama D, Kirihara K, Tada M, et al. Association between mismatch negativity and global functioning is specific to duration deviance in early stages of psychosis. *Schizophrenia research.* 2018;195:378-384.

87. Koutsouleris N, Davatzikos C, Bottlender R, et al. Early recognition and disease prediction in the at-risk mental states for psychosis using neurocognitive pattern classification. *Schizophrenia bulletin.* 2012;38(6):1200-1215.

88. Kristensen TD, Mandl RCW, Raghaya JM, et al. Widespread higher fractional anisotropy associates to better cognitive functions in individuals at ultra-high risk for psychosis. *Human brain mapping.* 2019;40(18):5185-5201.

89. Lee TY, Shin YS, Shin NY, et al. Neurocognitive function as a possible marker for remission from clinical high risk for psychosis. *Schizophrenia research.* 2014;153(1-3):48-53.

90. Lee SY, Bang M, Kim KR, et al. Impaired facial emotion recognition in individuals at ultra-high risk for psychosis and with first-episode schizophrenia, and their associations with neurocognitive deficits and self-reported schizotypy. *Schizophrenia research.* 2015;165(1):60-65.

91. Lepock JR, Ahmed S, Mizrahi R, et al. Relationships between cognitive event-related brain potential measures in patients at clinical high risk for psychosis. *Schizophrenia research.* 2019.

92. Li RR, Lyu HL, Liu F, et al. Altered functional connectivity strength and its correlations with cognitive function in subjects with ultra-high risk for psychosis at rest. *CNS neuroscience & therapeutics.* 2018;24(12):1140-1148.

93. Lin A, Yung AR, Nelson B, et al. Neurocognitive predictors of transition to psychosis: medium- to long-term findings from a sample at ultra-high risk for psychosis. *Psychological medicine.* 2013;43(11):2349-2360.

94. Lindgren M, Manninen M, Laajasalo T, et al. The relationship between psychotic-like symptoms and neurocognitive performance in a general adolescent psychiatric sample. *Schizophrenia research.* 2010;123(1):77-85.

95. Liu Y, Wang G, Jin H, et al. Cognitive deficits in subjects at risk for psychosis, first-episode and chronic schizophrenia patients. *Psychiatry research.* 2019;274:235-242.

96. Magaud E, Morvan Y, Rampazzo A, et al. Subjects at Ultra High Risk for psychosis have 'heterogeneous' intellectual functioning profile: a multiple-case study. *Schizophrenia research.* 2014;152(2-3):415-420.

97. Menghini-Muller S, Studerus E, Ittig S, et al. Sex differences in cognitive functioning of patients at-risk for psychosis and healthy controls: Results from the European Gene-Environment Interactions study. *European psychiatry : the journal of the Association of European Psychiatrists.* 2020;63(1):e25-e25.

98. Metzler S, Dvorsky D, Wyss C, et al. Changes in neurocognitive functioning during transition to manifest disease: comparison of individuals at risk for schizophrenic and bipolar affective psychoses. *Psychological medicine.* 2015;45(10):2123-2134.

99. Millman ZB, Goss J, Schiffman J, Mejias J, Gupta T, Mittal VA. Mismatch and lexical retrieval gestures are associated with visual information processing, verbal production, and symptomatology in youth at high risk for psychosis. *Schizophrenia research.* 2014;158(1-3):64-68.

100. Mirzakhanian H, Singh F, Seeber K, Shafer KM, Cadenhead KS. A Developmental Look at the Attentional System in the At Risk and First Episode of Psychosis: Age related Changes in Attention along the Psychosis Spectrum. *Neurocognitive Neuropsychiatry.* 2013;18(0):26–43.

101. Mittal VA, Walker EF, Bearden CE, et al. Markers of basal ganglia dysfunction and conversion to psychosis: neurocognitive deficits and dyskinesias in the prodromal period. *Biological psychiatry.* 2010;68(1):93-99.

102. Modinos G, McGuire P. The prodromal phase of psychosis. *Current Opinion in Neurobiology.* 2015;30:100-105.

103. Montalvo I, Gutierrez-Zotes A, Creus M, et al. Increased prolactin levels are associated with impaired processing speed in subjects with early psychosis. *PloS one.* 2014;9(2):e89428.

104. Ohmuro N, Katsura M, Obara C, et al. Deficits of cognitive theory of mind and its relationship with functioning in individuals with an at-risk mental state and first-episode psychosis. *Psychiatry research.* 2016;243:318-325.

105. Ohmuro N, Katsura M, Obara C, et al. The relationship between cognitive insight and cognitive performance among individuals with at-risk mental state for developing psychosis. *Schizophrenia research.* 2018;192:281-286.

106. Pflueger MO, Calabrese P, Studerus E, et al. The neuropsychology of emerging psychosis and the role of working memory in episodic memory encoding. *Psychology research and behavior management.* 2018;11:157-168.

107. Pukrop R, Schultze-Lutter F, Ruhrmann S, et al. Neurocognitive functioning in subjects at risk for a first episode of psychosis compared with first- and multiple-episode schizophrenia. *Journal of clinical and experimental neuropsychology.* 2006;28(8):1388-1407.

108. Pukrop R, Ruhrmann S, Schultze-Lutter F, Bechdolf A, Brockhaus-Dumke A, Klosterkötter J. Neurocognitive indicators for a conversion to psychosis: comparison of patients in a potentially initial prodromal state who did or did not convert to a psychosis. *Schizophrenia research.* 2007;92(1-3):116-125.

109. Randers L, Jepsen JRM, Fagerlund B, et al. Associations between facial affect recognition and neurocognition in subjects at ultra-high risk for psychosis: A case-control study. *Psychiatry research.* 2020;290:112969.

110. Sanada K, Ruiz de Azua S, Nakajima S, et al. Correlates of neurocognitive functions in individuals at ultra-high risk for psychosis - A 6-month follow-up study. *Psychiatry research.* 2018;268:1-7.

111. Seidman LJ, Giuliano AJ, Meyer EC, et al. Neuropsychology of the Prodrome to Psychosis in the NAPLS Consortium Relationship to Family History and Conversion to Psychosis. *Archives of general psychiatry.* 2010;67(6):578-588.

112. Shin YS, Kim SY, Lee TY, et al. Longitudinal change in neurocognition and its relation to symptomatic and functional changes over 2years in individuals at clinical high-risk for psychosis. *Schizophrenia research.* 2016;174(1-3):50-57.

113. Simon AE, Cattapan-Ludewig K, Zmilacher S, et al. Cognitive functioning in the schizophrenia prodrome. *Schizophrenia bulletin.* 2007;33(3):761-771.

114. Standford AD, Messinger J, Malaspina D, Corcoran C. Theory of Mind in patients at clinical high risk for psychosis. *Schizophrenia research.* 2011;131:11–17.

115. Studerus E, Corbisiero S, Mazzariello N, et al. Can neuropsychological testing facilitate differential diagnosis between at-risk mental state (ARMS) for psychosis and adult attention-deficit/hyperactivity disorder (ADHD)? *European psychiatry : the journal of the Association of European Psychiatrists.* 2018;52:38-44.

116. Szily E, Kéri S. Anomalous subjective experience and psychosis risk in young depressed patients. *Psychopathology.* 2009;42(4):229-235.

117. Takahashi T, Nakamura M, Sasabayashi D, et al. Olfactory deficits in individuals at risk for psychosis and patients with schizophrenia: relationship with socio-cognitive functions and symptom severity. *European archives of psychiatry and clinical neuroscience.* 2018;268(7):689-698.

118. Thompson A, Papas A, Bartholomeusz C, et al. Social cognition in clinical "at risk" for psychosis and first episode psychosis populations. *Schizophrenia research.* 2012;141(2-3):204-209.

119. Tognin S, Catalan A, Modinos G, et al. Emotion Recognition and Adverse Childhood Experiences in Individuals at Clinical High Risk of Psychosis. *Schizophrenia bulletin.* 2020;46(4):823-833.

120. Tor J, Dolz M, Sintes-Estevez A, et al. Neuropsychological profile of children and adolescents with psychosis risk syndrome: the CAPRIS study. *European child & adolescent psychiatry.* 2020.

121. Üçok A, Direk N, Koyuncu A, et al. Cognitive deficits in clinical and familial high risk groups for psychosis are common as in first episode schizophrenia. *Schizophrenia research.* 2013;151(1-3):265-269.

122. van Rijn S, Aleman A, de Sonneville L, et al. Misattribution of facial expressions of emotion in adolescents at increased risk of psychosis: the role of inhibitory control. *Psychological medicine.* 2011;41(3):499-508.

123. Wood SJ, Brewer WJ, Koutsouradis P, et al. Cognitive decline following psychosis onset - Data from the PACE clinic. *British Journal of Psychiatry.* 2007;191:S52-S57.

124. Woodberry KA, McFarlane WR, Giuliano AJ, et al. Change in neuropsychological functioning over one year in youth at clinical high risk for psychosis. *Schizophrenia research.* 2013;146(1-3):87-94.

125. Zhang T, Cui H, Tang Y, et al. Correlation of social cognition and neurocognition on psychotic outcome: a naturalistic follow-up study of subjects with attenuated psychosis syndrome. *Scientific reports.* 2016;6.

126. Ziermans T, de Wit S, Schothorst P, et al. Neurocognitive and clinical predictors of long-term outcome in adolescents at ultra-high risk for psychosis: a 6-year follow-up. *PloS one.* 2014;9(4):e93994.

127. Bright P, van der Linde I. Comparison of methods for estimating premorbid intelligence. *Neuropsychol Rehabil.* 2020;30(1):1-14.

128. Rutigliano G, Valmaggia L, Landi P, et al. Persistence or recurrence of non-psychotic comorbid mental disorders associated with 6-year poor functional outcomes in patients at ultra high risk for psychosis. *J Affect Disord.* 2016;203:101-110.

129. Fusar-Poli P, Nelson B, Valmaggia L, Yung AR, McGuire PK. Comorbid depressive and anxiety disorders in 509 individuals with an at-risk mental state: impact on psychopathology and transition to psychosis. *Schizophr Bull.* 2014;40(1):120-131.

130. Fusar-Poli P. TRANSD recommendations: improving transdiagnostic research in psychiatry. *World Psychiatry.* 2019;18(3):361-362.

131. Fusar-Poli P, Davies C, Rutigliano G, Stahl D, Bonoldi I, McGuire P. Transdiagnostic Individualized Clinically Based Risk Calculator for the Detection of Individuals at Risk and the Prediction of Psychosis: Model Refinement Including Nonlinear Effects of Age. *Front Psychiatry.* 2019;10:313.

132. Seabury RD, Cannon TD. Memory Impairments and Psychosis Prediction: A Scoping Review and Theoretical Overview. *Neuropsychol Rev.* 2020;30(4):521-545.