TECHNICAL COMMENTARY

NeuRA
Discover. Conquer. Cure.
SCHIZOPHRENIA LIBRARY

Psychomotor ability

Introduction

Psychomotor functioning refers to a wide range of actions involving physical movement related to conscious cognitive processing. Psychomotor ability may be measured by accuracy or speed (reaction time). Examples of psychomotor tests include the Grooved Pegboard test, and the Purdue Pegboard test that measure visuo-motor coordination. The Finger Tapping test requires study participants to place their dominant hand face-down and tap as quickly as possible. The task is repeated with the non-dominant hand and assesses motor speed, manual dexterity and lateralisation. The Digit Symbol Substitution test involves paired numbers and symbols. Participants are shown several numbers and asked to write the missing corresponding symbols as quickly as possible, measuring motor ability and attention. The Pursuit Rotor Motor task presents participants with a turntable with a dot in the centre that they must hold with a flexible metal wand as the turntable spins, measuring motor coordination and learning. The Star Mirror Tracing task asks participants to trace a star while only looking at their hand in the reflection of a mirror, assessing visuo-motor learning.

Method

We have included only systematic reviews with detailed literature search, methodology, and inclusion/exclusion criteria that were published in full text, in English, from the year 2000. Reviews were identified by searching the databases MEDLINE, EMBASE, and PsycINFO. Reviews with pooled data are prioritized for inclusion. Reviews reporting fewer than 50% of items on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA[1]) checklist have been excluded from the library. The evidence was graded guided by the Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group approach[2]. The resulting table represents an objective summary of the available evidence, although the conclusions are solely the opinion of staff of NeuRA (Neuroscience Research Australia).

Results

We found 19 systematic reviews that met our inclusion criteria[3-21].

- Compared to controls, moderate to high quality evidence suggests poorer psychomotor ability in people with schizophrenia, including people with first-episode schizophrenia or early onset schizophrenia (< 16 years). People at clinical high-risk for psychosis also showed poorer psychomotor ability compared to controls.
- Compared to people with affective psychoses, moderate to high quality evidence suggests a small effect of lower psychomotor and mental speed in people with schizophrenia. No difference in fine motor skills is reported from high quality evidence.
- Moderate quality evidence suggests a large effect of poorer motor performance in people with schizophrenia and antisocial traits compared to people with antisocial traits without schizophrenia.
- In general, high quality evidence suggests greater improvement in motor skills in patients taking second generation antipsychotics compared to first generation antipsychotics. Specifically, moderate quality evidence suggests patients taking clozapine may show improvement after treatment, however patients receiving olanzapine, quetiapine, risperidone or haloperidol show no improvement.
- Moderate to low quality evidence suggests lower levels of work performance and

Margarete Ainsworth Building, Barker Street, Randwick NSW 2031. Phone: 02 9399 1000. Email: info@neura.edu.au

Psychomotor ability

behaviour are associated with poor psychomotor ability.

- High quality evidence suggests a small effect of better psychomotor skills in people with a psychotic disorder and a substance use disorder than in people with a psychotic disorder without a substance use disorder.

Margarete Ainsworth Building, Barker Street, Randwick NSW 2031. Phone: 02 9399 1000. Email: info@neura.edu.au

NeuRA Discover. Conquer. Cure.

SCHIZOPHRENIA LIBRARY

Psychomotor ability

Bora E, Yucel M, Pantelis C

Cognitive functioning in schizophrenia, schizoaffective disorder and affective psychoses: meta-analytic study

The British Journal of Psychiatry 2009; 195: 475-482

View review abstract online

Comparison	**Cognitive functioning in people with schizophrenia vs. people with affective psychosis or schizoaffective disorder.** **Note: the schizophrenia group had more males, with a younger mean age and with fewer years of education, which may account for any observed effects.**
Summary of evidence	**Moderate quality evidence (unclear sample size, direct, precise, inconsistent) suggests a small effect of lower performance on psychomotor speed tasks in people with schizophrenia compared with people with affective psychosis or schizoaffective disorder.**

Psychomotor speed

A significant, small effect suggests worse psychomotor speed in people with schizophrenia compared with people with affective psychosis or schizoaffective disorder;

17 studies (N = not reported), *d* = 0.24, 95%CI 0.07 to 0.42, *p* = 0.0055, Q_W, *p* = 0.001

Subgroup analysis shows that this effect is significant for both comparisons with affective psychosis and with schizoaffective psychosis;

Schizophrenia vs. affective psychosis: 11 studies, *d* = 0.27, 95%CI 0.03 to 0.51, *p* = 0.03, Q_W *p* = 0.001

Schizophrenia vs. schizoaffective disorder: 8 studies, *d* = 0.22, 95%CI 0.02 to 0.43, *p* = 0.03, Q_W *p* = 0.05

Subgroup analysis shows that the effect sizes were non-significant when using only gender-matched studies (statistics not reported).

Results for individual psychomotor speed tasks:

Verbal fluency (authors report that this task is highly correlated with mental speed tasks, so is indicative of mental speed) – trend for worse performance in schizophrenia for all comparisons;

Schizophrenia vs. affective psychosis/schizoaffective: 9 studies, *d* = 0.22, 95%CI -0.03 to 0.48, *p* = 0.09, Q_W *p* = 0.002

Schizophrenia vs. affective psychosis: 6 studies, *d* = 0.29, 95%CI -0.01 to 0.59, *p* = 0.06, Q_W *p* =

Margarete Ainsworth Building, Barker Street, Randwick NSW 2031. Phone: 02 9399 1000. Email: info@neura.edu.au

0.01 Schizophrenia vs. schizoaffective disorder: 5 studies, *d* = 0.32, 95%CI 0.00 to 0.64, *p* = 0.05, Q_W *p* = 0.15 *Mental speed - worse performance in schizophrenia for all comparisons;* Schizophrenia vs. affective psychosis/schizoaffective: 12 studies, *d* = 0.26, 95%CI 0.03 to 0.49, *p* < 0.05, Q_W *p* < 0.0001 Schizophrenia vs. affective psychosis: 8 studies, *d* = 0.26, 95%CI -0.10 to 0.61, *p* = 0.15, Q_W *p* < 0.0001 Schizophrenia vs. schizoaffective disorder: 5 studies, *d* = 0.24, 95%CI 0.01 to 0. 47, *p* = 0.04, Q_W *p* = 0.02 *Meta-regression showed that schizophrenia samples with more severe symptoms, fewer years of education and younger age showed the greatest impairments compared with people with schizoaffective/ affective psychosis;* Negative symptoms: 6 studies, B = 0.39, SE = 0.09, *p* < 0.001 Positive symptoms: 20 studies, B = 0.59, SE = 0.29, *p* = 0.04 Fewer years of education (number of studies not reported): B = 0.69, SE = 0.32, *p* = 0.03 Younger age: 10 studies, B = 0.17, SE = 0.19, *p* = 0.05	
Consistency in results‡	Inconsistent
Precision in results§	Precise
Directness of results‖	Direct

Bora E, Pantelis C

Meta-analysis of Cognitive Impairment in First-Episode Bipolar Disorder: Comparison With First-Episode Schizophrenia and Healthy Controls

Schizophrenia Bulletin 2015; 41(5): 1095-1104

View review abstract online

Comparison	**Cognitive functioning in people with first-episode schizophrenia vs. people with first-episode bipolar disorder.**
Summary of evidence	**Moderate to high quality evidence (medium to large samples, inconsistent, precise, direct) shows a small effect of poorer psychomotor speed in people with first-episode schizophrenia compared to people with first-episode bipolar disorder.**

NeuRA Discover. Conquer. Cure.

SCHIZOPHRENIA LIBRARY

Psychomotor ability

Psychomotor speed	
A significant, small to medium-sized effect of poorer psychomotor speed in people with first-episode schizophrenia compared with first-episode bipolar disorder; All psychomotor speed tasks: 6 studies, N = 679, *d* = 0.33, 95%CI 0.08 to 0.59, *p* = 0.009, I^2 = 59%, *p* = 0.03 TMT A: 3 studies, N = 328, *d* = 0.45, 95%CI 0.23 to 0.68, *p* < 0.001 TMT B: 3 studies, N = 328, *d* = 0.47, 95%CI 0.14 to 0.80, *p* = 0.006 Digit symbol: 3 studies, N = 450, *d* = 0.71, 95%CI 0.36 to 1.06, *p* < 0.001 Authors report no publication bias. No differences were found for males vs. females or younger vs. older patients.	
Consistency in results	Inconsistent
Precision in results	Precise
Directness of results	Direct

Catalan A, Salazar De Pablo G, Aymerich C, Damiani S, Sordi V, Radua J, Oliver D, McGuire P, Giuliano AJ, Stone WS, Fusar-Poli P

Neurocognitive Functioning in Individuals at Clinical High Risk for Psychosis: A Systematic Review and Meta-analysis

JAMA Psychiatry 2021; 78(8): 859-67

View review abstract online

Comparison 1	**Motor functioning in individuals at clinical high-risk of psychosis vs. controls.**
Summary of evidence	**Moderate to high quality evidence (medium-sized sample, inconsistent, precise, direct) shows a small effect of poorer motor functioning in people at clinical high-risk for psychosis compared to controls.**
Motor functioning	
A small effect showed people at clinical high-risk of psychosis performed more poorly than controls on motor functioning:	

Margarete Ainsworth Building, Barker Street, Randwick NSW 2031. Phone: 02 9399 1000. Email: info@neura.edu.au

4 studies, N = 364, *g* = -0.24, 95%CI -0.45 to -0.04, *p* = 0.02 (Tapping Test)	
Consistency in results	Authors report moderate to high heterogeneity
Precision in results	Precise
Directness of results	Direct
Comparison 2	**Motor functioning in individuals at high-risk of psychosis who made the transition to psychosis vs. individuals at high-risk of psychosis who did not make the transition to psychosis.**
Summary of evidence	**Moderate quality evidence (small sample, inconsistent, precise, direct) shows no differences in motor functioning.**
Motor functioning	
There were no significant differences on motor functioning; 3 studies, N = 141, *g* = 0.07, 95%CI -0.31 to 0.45, *p* = 0.72 (Tapping Test)	
Consistency in results	Authors report moderate to high heterogeneity
Precision in results	Precise
Directness of results	Direct

Christensen T

The influence of neurocognitive dysfunctions on work capacity in schizophrenia patients: a systematic review of the literature

International Journal of Psychiatry in Clinical Practice 2007; 11(2): 89-101

View review abstract online

Comparison	**Association between work capacity and psychomotor functioning/speed performance in people with schizophrenia.** **Note: work capacity is the obtain and maintain competitive work**

	and work behaviours and skills.
Summary of evidence	**Moderate to low quality evidence (small sample, direct, unable to assess consistency or precision) suggests that lower levels of work performance and behaviour are associated with poor psychomotor ability.**
Psychomotor ability	
2 studies (N = 208) reported that poor psychomotor functioning/speed was associated with worse work performance and behavior.	
Consistency	Unable to assess; no measure of consistency is reported.
Precision	Unable to assess; no measure of precision is reported.
Directness	Direct

Cohen A, Saperstein A, Gold J, Kirkpatrick B, Carpenter W, Buchanan R

Neuropsychology of the deficit syndrome: New data and meta-analysis of findings to date

Schizophrenia Bulletin 2007; 33(5): 1201-1212

View review abstract online

Comparison	**Psychomotor ability in people with deficit schizophrenia vs. people with non-deficit schizophrenia.**
Summary of evidence	**Low quality evidence (direct, unable to assess consistency or precision, unclear sample) is unable to determine psychomotor ability in people with schizophrenia vs. deficit subtypes.**
Psychomotor ability	
Authors report that two studies found poorer psychomotor ability in people with deficit schizophrenia when compared with controls. People with the deficit subtype generally performed worse on psychomotor tasks than did patients with non-deficit schizophrenia. Tests included grooved pegboard, finger tapping and stroop colour. Sample sizes, effect sizes, Q and *p*-values are not reported.	
Consistency	Unable to assess; no measure of consistency is reported.

Psychomotor ability

Precision	Unable to assess; no measure of precision is reported.
Directness	Direct

Dickinson D, Ramsey ME, Gold JM

Overlooking the Obvious: A meta-analytic comparison of digit symbol coding tasks and other cognitive measures in schizophrenia

Archives of General Psychiatry 2007; 64: 532-542

View review abstract online

Comparison	**Motor speed in people with schizophrenia vs. controls.**
Summary of evidence	**Moderate to high quality (large samples, direct, unable to assess consistency, precise) suggests a large effect of poorer performance on grooved pegboard tasks (dominant and non-dominant), and a medium-sized effect of poorer performance on finger tapping tasks (dominant and non-dominant) compared with controls.**

Motor speed

Large effect size suggests people with schizophrenia showed poorer motor speed performance compared with controls on tasks including;

Grooved pegboard dominant: 7 studies, N = 728, *g* = -0.92, SE = 0.08, 95%CI -1.09 to -0.75, $p < 0.05$

Grooved pegboard non-dominant: 6 studies, N = 648, *g* = -0.98, SE = 0.10, 95%CI -1.17 to -0.79, $p < 0.05$

Medium effect size suggests people with schizophrenia showed poorer motor speed performance compared with controls on tasks including;

Finger tapping dominant: 9 studies, N = 1,073, *g* = -0.68, SE = 0.11, 95%CI -0.90 to -0.46, $p < 0.05$

Finger tapping non-dominant: 9 studies, N = 1,073, *g* = -0.52, SE = 0.09, 95%CI -0.71 to -0.34, $p < 0.05$

Consistency	Unable to assess; no measure of consistency is reported.
Precision	Precise
Directness	Direct

Psychomotor ability

Donoghue K, Doody GA

Effect of Illegal Substance Use on Cognitive Function in Individuals With a Psychotic Disorder, A Review and Meta-Analysis

Neuropsychology 2012; 26 (6): 785-801

View review abstract online

Comparison	**Cognitive functioning in people with a psychotic disorder and a substance use disorder vs. people with a psychotic disorder without a substance use disorder.**
Summary of evidence	**High quality evidence (medium to large samples, consistent, precise, direct) suggests a small effect of better psychomotor skills in people with a psychotic disorder and a substance use disorder than people with a psychotic disorder without a substance use disorder.**

Psychomotor ability in people with a polysubstance use disorder

A significant small effect suggests people with a psychotic disorder and a polysubstance use disorder showed better psychomotor skills than people with a psychotic disorder without a substance use disorder;

Attention and psychomotor: 8 studies, N = 513, g = 0.295, 95%CI 0.110 to 0.479, p = 0.002, I^2 = 0%, p = 0.780

Psychomotor ability in people with a cocaine use disorder

A significant small effect suggests people with a psychotic disorder and a cocaine use disorder showed better psychomotor skills than people with a psychotic disorder without a substance use disorder;

Attention and psychomotor: 5 studies, N = 236, g = 0.326, 95%CI 0.035 to 0.616, p = 0.028, I^2 = 15%, p = 0.316

Psychomotor ability in people with a cannabis use disorder

A significant small effect suggests people with a psychotic disorder and a cannabis use disorder showed better psychomotor skills than people with a psychotic disorder without a substance use disorder;

Attention and psychomotor: 3 studies, N = 551, g = 0.316, 95%CI 0.144 to 0.488, p < 0.001, I^2 =

0%, p = 0.968	
Consistency in results	Consistent
Precision in results	Precise
Directness of results	Direct

Guilera G, Pino O,Gomez-Benito J, Rojo JE

Antipsychotic effects on cognition in schizophrenia: A meta-analysis of randomised control trials

The European Journal of Psychiatry 2009; 23(2): 77-89

View review abstract online

Comparison	**Psychomotor performance in people with schizophrenia on second generation antipsychotics vs. first generation antipsychotics.**
Summary of evidence	**Moderate to high quality evidence (medium to large sample, direct, precise, unable to assess consistency) suggests greater psychomotor ability in people with schizophrenia receiving second-generation antipsychotics compared with those receiving first-generation antipsychotics.**
Psychomotor ability	
A significantly small effect size showed greater psychomotor ability in people with schizophrenia receiving second-generation antipsychotics compared those receiving first-generation antipsychotics; 5 RCTs, N = 387, g = 0.29, 95%CI 0.11 to 0.47, p < 0.01	
Consistency	Unable to assess; no measure of consistency is reported.
Precision	Precise
Directness	Direct

Psychomotor ability

Irani F, Kalkstein S, Moberg E, Moberg P

Neuropsychological performance in older patients with schizophrenia: A meta-analysis of cross-sectional and longitudinal studies

Schizophrenia Bulletin 2010; doi: 10.1093/schbul/sbq057

View review abstract online

Comparison	**Psychomotor performance in older people with schizophrenia (mean age 64 years).**
Summary of evidence	**Low quality evidence (direct, unable to assess consistency or precision, unclear sample) is unable to determine psychomotor ability in older people with schizophrenia.**
Psychomotor skills	
Authors report a large effect of poorer psychomotor performance in older people with schizophrenia compared with the age-matched control group; Number of studies, sample sizes, effect size, Q and p-values are not reported. Subgroup analysis suggests global cognition may be associated with age, sex, education, ethnicity, diagnosis, living status, age of onset/duration of illness and clinical symptoms.	
Consistency	Unable to assess; no measure of consistency is reported.
Precision	Unable to assess; no measure of precision is reported.
Directness	Direct

Krabbendam L, Arts B, van Os J, Aleman A

Cognitive functioning in patients with schizophrenia and bipolar disorder: A quantitative review

Schizophrenia Research 2005; 80: 137-149

View review abstract online

Comparison	**Cognitive performance in people with schizophrenia vs. people with bipolar disorder.**

Psychomotor ability

Summary of evidence	**Moderate to high quality evidence (medium to large sample, inconsistent, precise, direct) suggests a medium-sized effect of slower mental speed in people with schizophrenia compared with people with bipolar disorder. No difference in fine motor skills is found.**
Psychomotor skills	
A significant, medium effect suggests people with schizophrenia showed more impaired performance on mental speed, but not fine motor skills compared with people with bipolar disorder; Mental speed: 11 studies, N = 872, *d* = 0.50, 95%CI 0.10 to 0.89, *p* = 0.01, Q_w = 70.5, *p* < 0.001 Fine motor skills: 4 studies, N = 339, *d* = 0.06, 95%CI -0.16 to 0.27, *p* = 0.61, Q_w = 3.0, *p* = 0.39	
Consistency	Consistent for fine motor skills.
Precision	Precise
Directness	Direct

Knowles E, David A, Reichenberg A

Processing speed deficits in schizophrenia: Reexamining the evidence

American Journal of Psychiatry 2010; 167: 828-835

View review abstract online

Comparison	**Digit symbol coding performance in people with schizophrenia vs. controls.**
Summary of evidence	**Moderate to high quality evidence (large sample, direct, inconsistent, precise) suggests impaired psychomotor performance in people with schizophrenia compared with controls.**
Psychomotor performance	
A large effect size suggests impaired performance on digit symbol coding in people with schizophrenia compared with controls; 47 studies, N = 6,427, *g* = -1.50, 95%CI -1.63 to -1.35, *p* < 0.05, I^2 = 78%, *p* < 0.001	
Consistency	Inconsistent

Psychomotor ability

Precision	Precise
Directness	Direct

Mesholam-Gately R, Giuliano A, Goff K, Faraone S, Seidman L

Neurocognition in first-episode schizophrenia: a meta analytic review

Neuropsychology 2009; 23(3): 315-335

View review abstract online

Comparison	**Psychomotor skills in people with first-episode schizophrenia vs. controls.** **Note: participants defined as 'first-episode' had either a first presentation of psychosis, initial psychiatric hospitalisation, or a minimal duration of illness/treatment.**
Summary of evidence	**Moderate to high quality evidence (large sample, direct, inconsistent, precise) suggests a medium-sized effect of poorer psychomotor skills in people with first-episode schizophrenia compared to controls.**

Psychomotor skills

Medium effect size suggests people with first-episode schizophrenia showed significantly poorer psychomotor skills compared with controls;

9 studies, N = 1,355, d = -0.64, 95%CI -0.77 to -0.52, $p < 0.001$, $Q_w = 53.49$, $p < 0.001$

Larger effect sizes were associated with a higher proportion of first-episode participants on antipsychotics, male controls, younger patient samples, older control samples, and controls with a higher education. Smaller effect sizes were associated with a higher proportion of right-handed controls.

Consistency	Inconsistent
Precision	Precise
Directness	Direct

Nieto R, Castellanos F

Psychomotor ability

A Meta-Analysis of Neuropsychological Functioning in Patients with Early Onset Schizophrenia and Paediatric Bipolar Disorder

Journal of Clinical Child & Adolescent Psychology 2012; 40(2): 266-280

View review abstract online

Comparison	**Cognitive performance in patients with early onset schizophrenia (EOS: mean age 15.8 years) and in paediatric bipolar disorder (PBD: mean age 13.6 years) vs. controls.**
Summary of evidence	**Moderate quality evidence (imprecise, consistent, direct, medium to large sample) suggests a large effect of slower processing speed, and a medium effect of poor motor skills in EOS vs. controls.** **High quality evidence (precise, consistent, direct, large sample) suggests a medium to large effect of slower processing speed in PBD vs. controls.** **Low quality evidence (1 small study) is unable to determine any differences in motor skills between PBD and controls.**

Processing speed

Large effect of poorer processing speed in EOS and PBD vs. controls, with EOS showing significantly larger effect than PBD;

EOS: 8 studies, N = 624, g = -1.27, 95%CI -1.99 to -0.55, $p < 0.005$, Q = 0.05, $p = 0.99$

PBD: 7 studies, N = 478, g = -0.79, 95%CI -1.23 to -0.35, $p < 0.005$, Q = 2.63, $p = 0.85$

Processing speed was significantly lower in EOS vs. controls than PBD vs. controls ($p < 0.001$).

Moderator analyses revealed significantly smaller effect sizes in studies with a lower percentage of patients taking medications in both diagnostic groups.

In studies of PBD, there were smaller effect sizes in studies with higher rates of euthymia and lower rates of comorbid attention deficit hyperactivity disorder (ADHD).

In studies of EOS, there were smaller effect sizes in studies with higher percentages of right-handed participants and higher percentages of stable patients.

No publication bias.

Motor skills

Medium effect in EOS and very small effect in PBD of poorer motor skills vs. controls;

EOS: 4 studies, N = 242, g = -0.58, 95%CI -1.19 to 0.03, $p = 0.04$, Q = 0.07, $p = 0.99$

PBD: 1 study, N = 84, *g* = -0.07, 95%CI -0.15 to 0.01, *p* = 0.04 Motor skills were significantly lower in EOS vs. controls than PBD vs. controls (*p* < 0.01). No significant moderators or publication bias.	
Consistency	Consistent
Precision	Imprecise for EOS
Directness	Direct, apart from EOS vs. PBD

Rajji TK, Mulsant BH

Nature and course of cognitive function in late-life schizophrenia: a systematic review

Schizophrenia Research 2008; 102: 122-140

View review abstract online

Comparison	**Psychomotor functioning in people with schizophrenia aged over 50 years (late-life schizophrenia).**
Summary of evidence	**Moderate to low quality evidence (mixed samples, direct, unable to assess consistency or precision) suggests people with late-life schizophrenia may have impaired psychomotor functioning compared with controls. No difference was reported in psychomotor functioning between people with late-life schizophrenia and early-onset schizophrenia.**
Psychomotor function	
Three studies (N = 487) reported impaired motor speed and speed of information processing in ambulatory patients with late-life schizophrenia compared with controls. Two of these studies (N = 321) reported no difference in psychomotor functioning between people with early-onset schizophrenia and late-onset schizophrenia. One study (N = 83) reported no deficits in people with late-life schizophrenia on the digit symbol substitution test compared with controls. No data is reported.	
Consistency	Unable to assess; no measure of consistency is reported.
Precision	Unable to assess; no measure of precision is reported.

Psychomotor ability

Directness	Direct

Rajji TK, Ismail Z, Mulsant BH

Age at onset and cognition in schizophrenia: meta-analysis

The British Journal of Psychiatry 2009; 195: 286-293

View review abstract online

Comparison	**Psychomotor speed of processing in people with schizophrenia with different age of onset (first-episode schizophrenia, youth-onset schizophrenia and late-onset schizophrenia) vs. controls.** **Note: maximum age for youth-onset was 19 years; minimum age for late-onset was 40 years; people with any other age at onset were classified as first-episode schizophrenia.**
Summary of evidence	**Moderate quality evidence (large samples, direct, unable to assess consistency or precision) suggests poorer performance in psychomotor speed of processing in people with first-episode, youth-onset and late-onset schizophrenia compared with controls. The evidence suggests that people with youth-onset schizophrenia may have impaired psychomotor speed of processing compared with people with first episode schizophrenia.**
Psychomotor speed of processing	
N > 5010 (4057 first-episode schizophrenia, 692 youth-onset schizophrenia, 261 late-onset schizophrenia, controls not reported). *All three groups showed considerable psychomotor speed of processing impairment, with significant between group variability;* First-episode schizophrenia: 62 studies, d = 0.65, SE 0.02 Youth-onset schizophrenia: 17 studies, d = 0.92, SE 0.06 Late-onset schizophrenia: 2 studies, d = 1.01, SE 0.21 Q_B = 19.68, p < 0.01	
Consistency	Unable to assess; no measure of consistency is reported.
Precision	Unable to assess; no measure of precision is reported.

Directness	Direct

Schug R, Raine A

Comparative meta-analyses of neuropsychological functioning in antisocial schizophrenic persons

Clinical Psychological Review 2009; 29: 230-242

View review abstract online

Comparison 1	**Motor performance in people with schizophrenia and antisocial traits vs. people with schizophrenia without antisocial traits.** **Note: Authors state that antisocial behaviour was broadly defined as assaultive, criminal, psychopathic, or violent behaviours and included individuals who had committed specific crimes (i.e. homicide, assault) or who had specific mental disorder diagnoses (i.e. antisocial personality disorder, psychopathy).**
Summary of evidence	**Moderate to high quality evidence (unclear sample size, direct, consistent, precise) suggests no difference in motor performance in people with schizophrenia and antisocial traits vs. people with schizophrenia without antisocial traits.**
Motor performance	
No significant difference in motor performance; 7 studies, $g = 0.079$, $p > 0.05$, 95%CI -0.133 to 0.292, $Q_w = 14.965$, $p > 0.05$	
Consistency	Consistent
Precision	Precise
Directness	Direct
Comparison 2	**Motor performance in people with schizophrenia and antisocial traits vs. people without schizophrenia with antisocial traits.**
Summary of evidence	**Moderate quality evidence (unclear sample size, direct, consistent, imprecise) suggests a large effect showing poorer motor performance in people with schizophrenia and antisocial**

	traits vs. people without schizophrenia with antisocial traits.
Motor performance	
Significant, large effect size suggests people with schizophrenia and antisocial traits have impaired motor performance compared with antisocial controls; 3 studies, g = -1.003, p < 0.001, 95%CI -1.497 to -0.508, Q_w = 1.664, p > 0.05	
Consistency	Consistent
Precision	Imprecise
Directness	Direct

Szöke A, Tranfafir A, Dunpont ME, Méary A, Schürhoff F

Longitudinal studies of cognition in schizophrenia: meta-analysis

The British Journal of Psychiatry 2008; 192: 248-257

View review abstract online

Comparison	**Cognitive testing in people with schizophrenia one two separate occasions more than 1 month apart, with no training in between tests.**
Summary of evidence	**Moderate quality evidence (small to medium-sized samples, precise, direct, unable to assess consistency) suggests that people with schizophrenia may show improved performance on the digit symbol substitution task.**
Psychomotor	
Significant, small effect suggests people with schizophrenia showed improved performance on the digit symbol substitution (psychomotor performance, sustained attention) at retest compared with baseline; 7 studies, N = 215, g = 0.28, 95%CI 0.10 to 0.48, p < 0.05 *Subgroup analysis suggests no significant difference between controls and people with schizophrenia;* 5 studies, N = 136, g = 0.38, 95%CI 0.13 to 0.63, p < 0.05	
Consistency	Unable to assess; no measure of consistency is reported.

NeuRA Discover. Conquer. Cure.

SCHIZOPHRENIA LIBRARY

Psychomotor ability

Precision	Precise
Directness	Direct

Woodward ND, Purdon SE, Meltzer HY, Zald DH

A meta-analysis of neuropsychological change to clozapine, olanzapine, quetiapine, and risperidone in schizophrenia

International Journal of Neuropsychopharmacology 2005; 8: 457-472

View review abstract online

Comparison	**Motor skills in people with schizophrenia receiving second generation antipsychotics (clozapine, olanzapine, risperidone and quetiapine) vs. first generation antipsychotics (various) or pre- to post-treatment comparison with second generation antipsychotics.**
Summary of evidence	**High quality evidence (large sample, consistent, precise, direct) suggests greater improvement in motor skills in patients receiving second generation antipsychotics compared with first generation antipsychotics.** **Moderate quality evidence (small to medium-sized samples, unable to assess precision) suggests patients receiving clozapine show improvement pre- to post-treatment, however patients receiving olanzapine, quetiapine or risperidone show no improvement.**

Motor skills

Greater improvement in motor skills was reported in patients receiving second generation antipsychotics compared with patients receiving first generation antipsychotics;

9 studies, N= 3,226, g = 0.21, 95%CI 0.05 to 0.37, p = 0.010, Q-test $p > 0.05$

Post-treatment, patients receiving clozapine showed improved performance;

Clozapine: 4 studies, N = 68, g = 0.64, (CI not reported), $p < 0.006$, Q-test $p > 0.05$

Patients receiving olanzapine, risperidone or quetiapine showed no improvement post medication;

Olanzapine: 5 studies, N = 238, g = 0.25, (CI not reported), $p > 0.05$, Q-test $p > 0.05$

Risperidone: 2 studies, N = 65, g = 0.22, (CI not reported), $p > 0.05$, Q-test $p > 0.05$

Margarete Ainsworth Building, Barker Street, Randwick NSW 2031. Phone: 02 9399 1000. Email: info@neura.edu.au

Quetiapine: 2 studies, N = 34, *g* = 0.20, (CI not reported), *p* > 0.05, Q-test *p* > 0.05	
Consistency	Consistent
Precision	Precise for first vs. second generation antipsychotics, unable to assess pre-post comparison.
Directness	Direct

Woodward ND, Purdon SE, Meltzer HY, Zald DH

A meta-analysis of cognitive changes with haloperidol in clinical trials of atypical antipsychotics: Dose effects and comparison to practice effects

Schizophrenia Research 2007; 89: 211-224

View review abstract online

Comparison	**Motor skills in people with schizophrenia receiving haloperidol to assess pre-post treatment effects.**
Summary of evidence	**Moderate to high quality evidence (small to medium-sized studies, consistent, precise, direct) shows no improvements on motor skills tasks post treatment with haloperidol.**
Motor skills	
No improvements on finger tapping/ oscillation test or grooved pegboard test post treatment; Finger tapping/ oscillation: all studies: 4 studies, N = 128, *g* = -0.05, 95%CI -0.30 to 0.20, *p* > 0.05 Low dose: 2 studies, N = 92, *g* = -0.06, 95%CI -0.35 to 0.23, *p* > 0.05 High dose: 2 studies, N = 36, *g* = -0.04, 95%CI -0.50 to 0.43, *p* > 0.05 Grooved pegboard test: all studies: 5 studies, N = 196, *g* = 0.01, 95%CI -0.17 to 0.19, *p* > 0.05 Low dose: 3 studies, N = 104, *g* = -0.08, 95%CI -0.34 to 0.18, *p* > 0.05 High dose: 2 studies, N = 92, *g* = 0.09, 95%CI -0.17 to 0.35, *p* > 0.05	
Consistency	Authors report all results are consistent (using fixed effects model).
Precision	Precise

Psychomotor ability

Directness	Direct

Explanation of acronyms

CI = Confidence Interval, *d* = Cohen's *d* and *g* = Hedges' *g* = standardised mean differences (see below for interpretation of effect size), ES = effect size, I^2 = the percentage of the variability in effect estimates that is due to heterogeneity rather than sampling error (chance), N = number of participants, *p* = statistical probability of obtaining that result ($p < 0.05$ generally regarded as significant), Q = Q statistic for the test of heterogeneity, Q_B = test for between group differences (heterogeneity between groups of studies for an outcome of interest), Q_w = test for within group differences (heterogeneity in study results within a group of studies – measure of study consistency), RCT = randomised control trial, SE = standard error, SMD = standard mean difference, vs = versus

Margarete Ainsworth Building, Barker Street, Randwick NSW 2031. Phone: 02 9399 1000. Email: info@neura.edu.au

NeuRA Discover. Conquer. Cure.

SCHIZOPHRENIA LIBRARY

Psychomotor ability

Explanation of technical terms

* Bias has the potential to affect reviews of both RCT and observational studies. Forms of bias include; reporting bias – selective reporting of results; publication bias - trials that are not formally published tend to show less effect than published trials, further if there are statistically significant differences between groups in a trial, these trial results tend to get published before those of trials without significant differences; language bias – only including English language reports; funding bias - source of funding for the primary research with selective reporting of results within primary studies; outcome variable selection bias; database bias - including reports from some databases and not others; citation bias - preferential citation of authors. Trials can also be subject to bias when evaluators are not blind to treatment condition and selection bias of participants if trial samples are small[22].

† Different effect measures are reported by different reviews.

Prevalence refers to how many existing cases there are at a particular point in time. Incidence refers to how many new cases there are per population in a specified time period. Incidence is usually reported as the number of new cases per 100,000 people per year. Alternatively some studies present the number of new cases that have accumulated over several years against a person-years denominator. This denominator is the sum of individual units of time that the persons in the population are at risk of becoming a case. It takes into account the size of the underlying population sample and its age structure over the duration of observation.

Reliability and validity refers to how accurate the instrument is. Sensitivity is the proportion of actual positives that are correctly identified (100% sensitivity = correct identification of all actual positives) and specificity is the proportion of negatives that are correctly identified (100% specificity = not identifying anyone as positive if they are truly not).

Weighted mean difference scores refer to mean differences between treatment and comparison groups after treatment (or occasionally pre to post treatment) and in a randomised trial there is an assumption that both groups are comparable on this measure prior to treatment. Standardised mean differences are divided by the pooled standard deviation (or the standard deviation of one group when groups are homogenous) that allows results from different scales to be combined and compared. Each study's mean difference is then given a weighting depending on the size of the sample and the variability in the data. Less than 0.4 represents a small effect, around 0.5 a medium effect, and over 0.8 represents a large effect[22].

Odds ratio (OR) or relative risk (RR) refers to the probability of a reduction (< 1) or an increase (> 1) in a particular outcome in a treatment group, or a group exposed to a risk factor, relative to the comparison group. For example, a RR of 0.75 translates to a reduction in risk of an outcome of 25% relative to those not receiving the treatment or not exposed to the risk factor. Conversely, a RR of 1.25 translates to an increased risk of 25% relative to those not receiving treatment or not having been exposed to a risk factor. A RR or OR of 1.00 means there is no difference between groups. A medium effect is considered if RR > 2 or < 0.5 and a large effect if RR > 5 or < 0.2[23]. lnOR stands for logarithmic OR where a lnOR of 0 shows no difference between groups. Hazard ratios

Margarete Ainsworth Building, Barker Street, Randwick NSW 2031. Phone: 02 9399 1000. Email: info@neura.edu.au

measure the effect of an explanatory variable on the hazard or risk of an event.

Correlation coefficients (eg, r) indicate the strength of association or relationship between variables. They can provide an indirect indication of prediction, but do not confirm causality due to possible and often unforseen confounding variables. An r of 0.10 represents a weak association, 0.25 a medium association and 0.40 and over represents a strong association. Unstandardised (*b*) regression coefficients indicate the average change in the dependent variable associated with a 1 unit change in the independent variable, statistically controlling for the other independent variables. Standardised regression coefficients represent the change being in units of standard deviations to allow comparison across different scales.

‡ Inconsistency refers to differing estimates of effect across studies (i.e. heterogeneity or variability in results) that is not explained by subgroup analyses and therefore reduces confidence in the effect estimate. I^2 is the percentage of the variability in effect estimates that is due to heterogeneity rather than sampling error (chance) - 0% to 40%: heterogeneity might not be important, 30% to 60%: may represent moderate heterogeneity, 50% to 90%: may represent considerable heterogeneity and over this is considerable heterogeneity. I^2 can be calculated from Q (chi-square) for the test of heterogeneity with the following formula;[22]

$$I^2 = \left(\frac{Q - df}{Q}\right) \times 100\%$$

§ Imprecision refers to wide confidence intervals indicating a lack of confidence in the effect estimate. Based on GRADE recommendations, a result for continuous data (standardised mean differences, not weighted mean differences) is considered imprecise if the upper or lower confidence limit crosses an effect size of 0.5 in either direction, and for binary and correlation data, an effect size of 0.25. GRADE also recommends downgrading the evidence when sample size is smaller than 300 (for binary data) and 400 (for continuous data), although for some topics, these criteria should be relaxed.[24]

‖ Indirectness of comparison occurs when a comparison of intervention A versus B is not available but A was compared with C and B was compared with C that allows indirect comparisons of the magnitude of effect of A versus B. Indirectness of population, comparator and/or outcome can also occur when the available evidence regarding a particular population, intervention, comparator, or outcome is not available and is therefore inferred from available evidence. These inferred treatment effect sizes are of lower quality than those gained from head-to-head comparisons of A and B.

References

1. Moher D, Liberati A, Tetzlaff J, Altman DG, PRISMAGroup (2009): Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *British Medical Journal* 151: 264-9.
2. GRADEWorkingGroup (2004): Grading quality of evidence and strength of recommendations. *British Medical Journal* 328: 1490.
3. Bora E, Yucel M, Pantelis C (2009): Cognitive functioning in schizophrenia, schizoaffective disorder and affective psychoses: meta-analytic study. *British Journal of Psychiatry* 195: 475-82.
4. Christensen TO (2007): The influence of neurocognitive dysfunctions on work capacity in schizophrenia patients: A systematic review of the literature. *International Journal of Psychiatry in Clinical Practice* 11: 89-101.
5. Cohen AS, Saperstein AM, Gold JM, Kirkpatrick B, Carpenter WT, Jr., Buchanan RW (2007): Neuropsychology of the deficit syndrome: new data and meta-analysis of findings to date. *Schizophrenia Bulletin* 33: 1201-12.
6. Guilera G, Pino O, Gómez-Benito J, Rojo JE (2009): Antipsychotic effects on cognition in schizophrenia: A meta-analysis of randomised controlled trials. *The European Journal of Psychiatry* 23: 77-89.
7. Irani F, Kalkstein S, Moberg EA, Moberg PJ (2011): Neuropsychological Performance in Older Patients With Schizophrenia: A Meta-Analysis of Cross-sectional and Longitudinal Studies. *Schizophrenia Bulletin* 37: 1318-26.
8. Mesholam-Gately RI, Giuliano AJ, Goff KP, Faraone SV, Seidman LJ (2009): Neurocognition in first-episode schizophrenia: a meta-analytic review. *Neuropsychology* 23: 315-36.
9. Rajji TK, Ismail Z, Mulsant BH (2009): Age at onset and cognition in schizophrenia: meta-analysis. *British Journal of Psychiatry* 195: 286-93.
10. Rajji TK, Mulsant BH (2008): Nature and course of cognitive function in late-life schizophrenia: a systematic review. *Schizophrenia Research* 102: 122-40.
11. Schug RA, Raine A (2009): Comparative meta-analyses of neuropsychological functioning in antisocial schizophrenic persons. *Clinical Psychology Review* 29: 230-42.
12. Szoke A, Trandafir A, Dupont ME, Meary A, Schurhoff F, Leboyer M (2008): Longitudinal studies of cognition in schizophrenia: meta-analysis. *British Journal of Psychiatry* 192: 248-57.
13. Woodward ND, Purdon SE, Meltzer HY, Zald DH (2005): A meta-analysis of neuropsychological change to clozapine, olanzapine, quetiapine, and risperidone in schizophrenia. *International Journal of Neuropsychopharmacology* 8: 457-72.
14. Woodward ND, Purdon SE, Meltzer HY, Zald DH (2007): A meta-analysis of cognitive change with haloperidol in clinical trials of atypical antipsychotics: dose effects and comparison to practice effects. *Schizophrenia Research* 89: 211-24.
15. Dickinson D, Ramsey ME, Gold JM (2007): Overlooking the obvious: a meta-analytic comparison of digit symbol coding tasks and other cognitive measures in schizophrenia. *Archives of General Psychiatry* 64: 532-42.
16. Knowles EEM, David AS, Reichenberg A (2010): Processing speed deficits in schizophrenia: reexamining the evidence. *American Journal of Psychiatry* 167: 828-35.
17. Krabbendam L, Arts B, van Os J, Aleman A (2005): Cognitive functioning in patients with schizophrenia and bipolar disorder: a quantitative review. *Schizophrenia Research* 80: 137-49.
18. Nieto RG, Xavier Castellanos F (2012): A meta-analysis of neuropsychological functioning in patients with early onset schizophrenia and pediatric bipolar disorder. *Journal of Clinical Child and Adolescent Psychology* 40: 266-80.
19. Donoghue K, Doody GA (2012): Effect of illegal substance use on cognitive function in individuals with a psychotic disorder: a review and meta-analysis. *Neuropsychology* 26: 785-801.

20. Bora E, Pantelis C (2015): Meta-analysis of cognitive impairment in first-episode bipolar disorder: Comparison with first-episode schizophrenia and healthy controls. *Schizophrenia Bulletin* 41: 1095-104.
21. Catalan A, Salazar De Pablo G, Aymerich C, Damiani S, Sordi V, Radua J*, et al.* (2021): Neurocognitive Functioning in Individuals at Clinical High Risk for Psychosis: A Systematic Review and Meta-analysis. *JAMA Psychiatry* 78(8): 859-67.
22. CochraneCollaboration (2008): Cochrane Handbook for Systematic Reviews of Interventions. Accessed 24/06/2011.
23. Rosenthal JA (1996): Qualitative Descriptors of Strength of Association and Effect Size. *Journal of Social Service Research* 21: 37-59.
24. GRADEpro (2008): [Computer program]. Jan Brozek, Andrew Oxman, Holger Schünemann. *Version 32 for Windows*