



Social cognition

Introduction

Social cognition describes the ability to understand the actions and intentions of other people; the cognitive processes underlying social interactions that are used to guide behaviour. Social cognition is crucial for effective communication and relates to social competence and may predict work functioning.

Aspects of social cognition may be altered in people with schizophrenia, including processes such as theory of mind, social perception, emotion processing, and empathy. Theory of mind refers to the ability to infer the mental states of other people. Social perception is an awareness of social cues and norms that dictate social interactions. Emotion processing is the ability to perceive emotional cues, such as the emotional content of facial expressions or vocal inflections (prosody). Empathy involves showing concern for others, understanding their perspective, experiencing distress when exposed to others' negative events, and having the ability to place oneself into fictional situations and empathically relate to the characters ('fantasy'). Self-serving attributional bias involves attributing positive events to oneself and negative event to others. Social reward anticipation is defined as the opportunity to want, detect, and pursue social rewards.

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 approach². 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 35 systematic reviews that met our inclusion criteria³⁻³⁷.

- Moderate to high quality evidence finds large effects of impaired social perception, emotion perception, and emotion processing, and medium-sized effects of impaired social knowledge, biological motion processing, and empathetic abilities in people with schizophrenia. In general, those with predominately negative symptoms show poorer social cognition than those with predominately positive symptoms. Facial emotion perception can be adversely affected by more severe negative symptoms, and non-emotional recognition may be adversely affected by more severe positive symptoms.
- Moderate to high quality evidence finds a medium to large effect of less social reward anticipatory reaction time in people with schizophrenia than in controls.
- Moderate to high quality evidence finds medium-sized deficits in auditory emotion recognition in people with schizophrenia or schizoaffective disorder compared to controls. These were found across all types of emotions (neutral, happy, sad, angry, fear, disgust, and surprise). There were no moderating effects of age, gender, illness duration, auditory stimuli method, or diagnosis.
- Moderate to high quality evidence finds a small effect that people with schizophrenia were more prone to self-serving attributional bias than controls.



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- High quality evidence shows a very small improvement in facial affect processing with antipsychotic medication, particularly second-generation antipsychotics.
- High quality evidence shows a large theory of mind impairment in people with schizophrenia across multiple tasks, regardless of sex or age. People with disorganised symptoms were particularly impaired on theory of mind tasks. Moderate quality evidence finds patients in an acute phase of the illness performed worse than outpatients or patients soon to be discharged from hospital. Generally, poor theory of mind was associated with poor neurocognition. Lower general IQ contributed to lower theory of mind performance only in outpatients or patients soon to be discharged from hospital.
- High quality evidence finds a small to medium-sized theory of mind impairment in relatives of people with schizophrenia, with lower education contributing to lower theory of mind scores. Moderate to high quality evidence also finds medium-sized theory of mind and overall social cognition impairments in people at ultra-high risk of psychosis.
- Moderate to high quality evidence finds associations between better theory of mind and emotion processing, and better social functioning, community functioning and insight. There were also associations between poorer facial recognition, emotion processing, emotion perception, social perception and theory of mind, and poorer performance on cognitive measures and more severe symptoms.
- Moderate quality evidence finds small associations between poor insight (overall unawareness of having the disorder) and poor theory of mind and emotion processing.
- Moderate to high quality evidence finds a medium-sized effect of poorer social cognition in people with schizophrenia than in people with bipolar disorder on theory of mind and negative facial emotion recognition tasks, particularly in males. There were no differences on positive (happy) facial emotion recognition tasks.
- Moderate to high quality evidence shows no differences in social cognition between people with schizophrenia and people with autism. This was found across emotion processing, theory of mind, and reading the mind in the eyes tests.



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Aldridge-Waddon L, Vanova M, Munneke J, Puzzo I, Kumari V

Atypical social reward anticipation as a transdiagnostic characteristic of psychopathology: A meta-analytic review and critical evaluation of current evidence

Clinical Psychology Review 2020; 82: 101942

[View review abstract online](#)

Comparison	Social reward anticipation in people with schizophrenia vs. controls.
Summary of evidence	Moderate to high quality evidence (small to medium-sized sample, consistent, precise, direct) finds a medium to large effect of less social reward anticipatory reaction time in people with schizophrenia.
Social reward anticipation measured by anticipatory reaction times	
<p><i>A medium to large effect of less anticipatory reaction time in people with schizophrenia;</i> 3 studies, N = 270, $g = 0.72$, 95%CI 0.46 to 0.99, $p < 0.00001$, $I^2 = 0\%$ This effect is larger than that found in people with ADHD, autism, mood, or personality disorders.</p>	
Consistency [‡]	Consistent
Precision [§]	Precise
Directness	Direct

Bonfils KA, Lysaker PH, Minor KS, Salyers MP

Empathy in schizophrenia: A meta-analysis of the Interpersonal Reactivity Index

Psychiatry Research 2017; 249: 293-303

[View review abstract online](#)

Comparison	Empathy in people with schizophrenia vs. controls.
Summary of evidence	Moderate to high quality evidence (large samples, mostly inconsistent, precise, direct) finds small to medium-sized effects



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	of less empathetic concern, less perspective-taking and less fantasy ability in people with schizophrenia. However, there was a medium-sized effect of more personal distress.
Empathy	
<p><i>Small to medium-sized effects of less empathetic concern, perspective-taking and fantasy in people with schizophrenia;</i></p> <p>Empathic concern: 32 studies, N = 2,257, $g = 0.28$, 95%CI 0.16 to 0.40, $p < 0.001$, $I^2 = 44%$, $p = 0.005$ Perspective-taking: 32 studies, N = 2,257, $g = 0.53$, 95%CI 0.41 to 0.50, $p < 0.001$, $I^2 = 42%$, $p = 0.007$ Fantasy: 30 studies, N not reported, $g = 0.19$, 95%CI 0.07 to 0.30, $p = 0.001$, $I^2 = 24%$, $p = 0.070$</p> <p><i>Medium-sized effect of more personal distress in people with schizophrenia;</i></p> <p>Personal distress: 32 studies, N = 2,257, $g = -0.71$, 95%CI -0.85 to -0.56, $p < 0.001$, $I^2 = 60%$, $p < 0.001$</p> <p>Moderator analyses found longer illness duration was associated with increased effect size for perspective-taking and a trend effect for empathic concern.</p> <p>Studies with more females found reduced effects for personal distress and increased effects for fantasy.</p> <p>There were no moderating effects of age or medication dose.</p>	
Consistency	Inconsistent, apart from fantasy
Precision	Precise
Directness	Direct

<p><i>Bora E, Yucel M, Pantelis C</i></p> <p>Theory of mind impairment in schizophrenia: Meta-analysis</p> <p>Schizophrenia Research 2009; 109(1-3): 1-9</p> <p>View review abstract online</p>	
Comparison	Theory of mind tasks in people with schizophrenia vs. controls.
Summary of evidence	Moderate to high quality evidence (medium to large samples, precise, inconsistent, direct) suggests a large theory of mind impairment in people with schizophrenia across multiple tasks and regardless of sex or age, with greater impairment in patients with a longer duration of illness. Inpatients performed poorer than outpatients or inpatients that were soon to be discharged



	<p>from hospital, and lower IQ contributed to lower theory of mind scores in outpatients or inpatients just before discharge from hospital.</p>
<p>Combined theory of mind score</p>	
<p><i>A significant, large effect of impaired performance on theory of mind tasks in people with schizophrenia;</i> 36 studies, N = 2,117, $d = 1.10$, 95%CI 0.95 to 1.25, $p < 0.0001$, Q_W test $p < 0.001$ Authors report possible publication bias.</p> <p><i>Subgroup analysis revealed inpatients performed significantly poorer than outpatients or inpatients just before discharge;</i> Inpatients: $d = 1.21$, 95%CI 1.05 to 1.37, $p < 0.0001$ Outpatients/inpatients just before discharge: $d = 0.80$, 95%CI 0.57 to 1.03, $p < 0.0001$ Q_B test $p < 0.0001$</p> <p><i>Meta-regressions revealed that longer duration of illness in all patients, and lower IQ in outpatients/inpatients just before discharge, were related to greater impairment. There were no effects according to age or sex.</i></p>	
<p>Hinting task</p>	
<p><i>A significant, large effect of impaired performance in people with schizophrenia;</i> 7 studies, N = 552, $d = 1.06$, 95%CI 0.78 to 1.34, $p < 0.0001$, Q_W test $p < 0.04$ Authors report possible publication bias.</p>	
<p>Eyes task</p>	
<p><i>A significant, large effect of impaired performance in people with schizophrenia;</i> 8 studies, N = 420, $d = 0.90$, 95%CI 0.64 to 1.17, $p < 0.0001$, Q_W test $p < 0.194$</p>	
<p>False Belief – Sequencing task</p>	
<p><i>A significant, large effect of impaired performance in people with schizophrenia;</i> 11 studies, N = 722, $d = 1.08$, 95%CI 0.72 to 1.43, $p < 0.0001$, Q_W test $p < 0.001$ Authors report possible publication bias.</p>	
<p>False Belief – Stories task</p>	



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<p><i>A significant, large effect of impaired performance in people with schizophrenia; 11 studies, N = 838, $d = 1.06$, 95%CI 0.76 to 1.37, $p < 0.0001$, Q_w test $p < 0.001$ Authors report possible publication bias.</i></p>	
Consistency	Inconsistent
Precision	Precise
Directness	Direct

<p><i>Bora E, Pantelis C</i></p> <p>Theory of mind impairments in first-episode psychosis, individuals at ultra-high risk for psychosis and in first-degree relatives of schizophrenia: Systematic review and meta-analysis</p> <p>Schizophrenia Research 2013; 144(1-3): 31-36 View review abstract online</p>	
Comparison 1	Assessing performance on theory of mind tasks in relatives of patients with schizophrenia vs. controls.
Summary of evidence	High quality evidence (medium to large samples, precise, consistent, direct) suggests a small to medium-sized theory of mind impairment in relatives of people with schizophrenia. Lower education contributed to lower theory of mind scores.
Combined theory of mind score	
<p><i>Small to medium effect showing impaired performance in relatives vs. controls; 12 studies, N = 3,117, $d = 0.37$, 95%CI 0.19 to 0.54, $p < 0.001$, $I^2 = 0\%$</i></p> <p>Note; Meta-regression analyses suggested longer duration of education in the control groups vs. relatives explains some of the between-group differences ($B = 0.41$, $p = 0.002$).</p>	
Theory of mind verbal	
<p><i>Small effect showing impaired performance in relatives vs. controls; 8 studies, N = 2,946, $d = 0.24$, 95%CI 0.13 to 0.33, $p < 0.001$, $I^2 = 0\%$</i></p>	



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Theory of mind visual	
<i>Small to medium effect showing impaired performance in relatives vs. controls; 9 studies, N = 555, d = 0.36, 95%CI 0.10 to 0.63, p < 0.001, I² = 0%</i>	
Eyes task	
<i>No differences between groups; 5 studies, N = 261, d = 0.19, 95%CI -0.10 to 0.48, p = 0.19, I² = 0%</i>	
Consistency	Consistent
Precision	Precise
Directness	Direct
Comparison 2	Assessing performance on theory of mind tasks in people at ultra-high risk of psychosis vs. controls.
Summary of evidence	Moderate to high quality evidence (medium-sized samples, precise, consistent, direct) suggests a medium-sized theory of mind impairment in people at ultra-high risk of psychosis across verbal and visual tasks.
Combined theory of mind score	
<i>Medium effect showing impaired performance in ultra-high risk groups vs. controls; 7 studies, N = 581, d = 0.45, 95%CI 0.23 to 0.67, p < 0.001, I² = 0%</i>	
Theory of mind verbal	
<i>Medium effect showing impaired performance in ultra-high risk groups vs. controls; 4 studies, N = 329, d = 0.49, 95%CI 0.26 to 0.72, p < 0.001, I² = 0%</i>	
Theory of mind visual - eyes	
<i>Medium effect showing impaired performance in ultra-high risk groups vs. controls; 6 studies, N = 497, d = 0.40, 95%CI 0.14 to 0.70, p = 0.003, I² = 0%</i>	
Consistency	Consistent



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Precision	Precise
Directness	Direct
Comparison 3	Assessing performance on theory of mind tasks in people with first-episode psychosis vs. controls.
Summary of evidence	Moderate to high quality evidence (medium-sized samples, precise, consistent, direct) suggests a large theory of mind impairment in people with first-episode psychosis across verbal and visual tasks.
Combined theory of mind score	
<i>Large effect showing impaired performance in first-episode psychosis groups vs. controls; 8 studies, N = 513, d = 1.00, 95%CI 0.81 to 1.18, p < 0.001, I² = 0%</i>	
Theory of mind verbal	
<i>Large effect showing impaired performance in first-episode psychosis groups vs. controls; 4 studies, N = 320, d = 0.99, 95%CI 0.76 to 1.23, p < 0.001, I² = 0%</i>	
Theory of mind visual - eyes	
<i>Large effect showing impaired performance in first-episode psychosis groups vs. controls; 5 studies, N = 261, d = 0.94, 95%CI 0.69 to 1.20, p < 0.001, I² = 0%</i>	
Consistency	Consistent
Precision	Precise
Directness	Direct

Bora E, Binnur Akdede B, Alptekin K

Neurocognitive impairment in deficit and non-deficit schizophrenia: a meta-analysis

Psychological Medicine 2017; 47: 2401-13

[View review abstract online](#)



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Comparison	Social cognition in people with deficit schizophrenia vs. people with non-deficit schizophrenia. Both groups were also compared to controls.
Summary of evidence	Moderate quality evidence (medium to large samples, mostly inconsistent, some imprecision, direct) suggests people with deficit schizophrenia are more impaired than people with non-deficit schizophrenia on measures of social cognition.
Social cognition	
<p><i>Significant, medium-sized effects of poorer social cognition in people with deficit schizophrenia compared to people with non-deficit schizophrenia;</i></p> <p>Social cognition: 9 studies, N = 1,215, $d = 0.56$, 95%CI 0.24 to 0.88, $p < 0.001$, $I^2 = 81%$, $p < 0.001$</p> <p>Label 3 studies, N = 257, $d = 0.93$, 95%CI 0.54 to 1.31, $p < 0.001$, $I^2 = 55%$, $p = 0.11$</p> <p>Discrimination: 5 studies, N = 900, $d = 0.36$, 95%CI -0.02 to 0.73, $I^2 = 75%$, $p = 0.003$</p> <p><i>Significant, large effects of poorer social cognition in people with deficit schizophrenia compared to controls and in people with non-deficit schizophrenia compared to controls;</i></p> <p>Deficit: 6 studies, N = 426, $d = 1.44$, 95%CI 0.64 to 2.24, $p < 0.001$, $I^2 = 95%$, $p < 0.001$</p> <p>Non-deficit: 6 studies, N = 485, $d = 0.84$, 95%CI 0.59 to 1.09, $p < 0.001$, $I^2 = 57%$, $p = 0.06$</p>	
Consistency	Mostly inconsistent
Precision	Some imprecision
Directness	Direct

Bora E, Pantelis C

Social cognition in schizophrenia in comparison to bipolar disorder: A meta-analysis

Schizophrenia Research 2016; 175: 72-8

[View review abstract online](#)

Comparison	Social cognition in people with bipolar disorder vs. people with schizophrenia.
Summary of evidence	Moderate to high quality evidence (large samples, inconsistent, precise, direct) suggests a medium-sized effect of poorer social



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	cognition in people with schizophrenia than in people with bipolar disorder on theory of mind and negative facial emotion recognition tasks, particularly for male patients. There were no differences on positive (happy) facial emotion recognition tasks.
Social cognition	
<p><i>A significant, medium-sized effect of poorer social cognition in people with schizophrenia;</i> Overall social cognition: 26 studies, N = 2,376, $d = 0.45$, 95%CI 0.31 to 0.60, $p < 0.001$, $Qp < 0.001$ The effect size was slightly smaller when the analysis included only samples of patients with bipolar disorder I ($d = 0.39$).</p> <p>The effect size was larger for theory of mind tests than for facial emotion recognition tests ($d = 0.57$ vs. $d = 0.39$). The effect was significant only for negative, angry, and sad facial emotion recognition tests, and not happy facial emotion recognition tests.</p> <p>Effect sizes were larger in studies that had a higher percentage of males in their schizophrenia sample.</p> <p>There were no effects of diagnostic tool (DSM-IV/IV-TR vs. DSM-III-R), study setting (acute vs. non-acute), age, negative or positive symptoms, and age of onset and duration of bipolar disorder.</p>	
Consistency	Inconsistent
Precision	Precise
Directness	Direct

<p><i>Bora E</i></p> <p>Relationship between insight and theory of mind in schizophrenia: A meta-analysis</p> <p>Schizophrenia Research 2017; 190: 11-7 View review abstract online</p>	
Comparison	Association between theory of mind and insight in people with schizophrenia.
Summary of evidence	High quality evidence (large sample, direct, consistent, precise) suggests a small association between better insight and better theory of mind.



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Theory of mind and insight	
<p><i>Significant, small association between increased theory of mind scores and increased clinical insight;</i></p> <p>14 studies, N = 1,029, $r = 0.28$, 95%CI 0.20 to 0.36, $p < 0.001$, $I^2 = 35%$, $p = 0.10$</p> <p>There were no differences in results according to mean age, gender, duration of education, duration of illness, or severity of symptoms.</p>	
Consistency	Consistent
Precision	Precise
Directness	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	Social cognition in individuals at clinical high-risk of psychosis vs. controls.
Summary of evidence	Moderate to high quality evidence (large samples, inconsistent, precise, direct) shows a small effect of poorer social cognition in people at clinical high-risk of psychosis.
Social cognition	
<p><i>Small effect showed people at clinical high-risk of psychosis performed more poorly than controls on social cognition tasks:</i></p> <p>11 studies, N = 1,478, $g = -0.29$, 95%CI -0.50 to -0.07, $p = 0.01$</p> <p>(Hinting Task. There were no differences on the Degraded Facial Affect Recognition or Reading the Mind in the Eyes Test)</p>	
Consistency	Authors report moderate to high heterogeneity



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Precision	Precise
Directness	Direct

Chan R, Li H, Cheung E, Gong QY

Impaired facial emotion perception in schizophrenia: A meta-analysis

Psychiatry Research 2010; 178: 381-390

[View review abstract online](#)

Comparison	Facial emotional perception and non-emotional facial or age recognition (control task) in people with schizophrenia vs. controls.
Summary of evidence	<p>Moderate to high quality evidence (large samples, inconsistent, precise, direct,) shows large effects of poor facial emotion perception, identification, discrimination, and recognition in people with schizophrenia compared to controls.</p> <p>Worse performance on facial emotion perception may be found in patients with more severe negative symptoms, and worse performance on facial recognition (non-emotion) tasks may be found in patients with more severe positive symptoms and a longer duration of the illness.</p>

Facial emotion perception

Large effects suggest people with schizophrenia performed significantly worse than controls on facial emotion perception, identification and discrimination tasks;

28 studies, N = 1,820

Facial emotion perception: $d = -0.85$, 95%CI -1.04 to -0.66, $Q_w = 97.57$, $p < 0.001$

21 studies, N = 1,354

Facial emotion identification: $d = -1.03$, 95%CI -1.29 to -0.78, $Q_w = 88.50$, $p < 0.001$

16 studies, N = 1,028

Facial emotion discrimination: $d = -0.81$, 95%CI -0.99 to -0.64, $Q_w = 25.98$, $p < 0.05$

A large effect was found for poor facial emotion perception in patients with more severe negative symptoms;

Negative symptoms (PANSS): 7 studies, $d = -1.11$, 95%CI -1.63 to -0.60, $p < 0.001$, $Q_w = 46.64$



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Studies using the SANS to measure negative symptoms did not find a significant result.

A medium-sized effect was found for poor facial recognition in patients with more severe positive symptoms and a longer duration of illness;

Positive symptoms (PANSS): 7 studies, $d = -0.70$, 95%CI -1.08 to -0.31, $p < 0.001$, $Q_w = 24.98$

Duration of the illness: 16 studies, $d = -0.70$, 95%CI -0.94 to -0.46, $p < 0.001$, $Q_w = 17.36$

Studies using the SAPS to measure positive symptoms did not find a significant result.

Consistency	Inconsistent
Precision	Precise
Directness	Direct

Chung Y, Barch D, Strube M

A Meta-Analysis of Mentalizing Impairments in Adults With Schizophrenia and Autism Spectrum Disorder

Schizophrenia Bulletin; 2013: doi:10.1093/schbul/sbt048

[View review abstract online](#)

Comparison	Performance on mentalising tasks in patients with schizophrenia vs. controls.
Summary of evidence	Moderate to high quality evidence (medium to large samples, inconsistent, precise, direct) suggests a large effect of poorer performance on mentalising tasks compared to controls.

Mentalising

A significant, large effect of poorer performance on mentalising tasks in patients with schizophrenia than controls;

Intention/belief inference: 11 studies, $N = 557$, $g = 0.99$, 95%CI 0.78 to 1.20, $p < 0.01$, Q-test $p = 0.05$

Emotion recognition from eyes: 16 studies, $N = 950$, $g = 0.73$, 95%CI 0.56 to 0.90, $p < 0.01$, Q-test $p = 0.06$

Similar effect sizes are reported for adults with autism spectrum disorders.

Egger's regression test showed possible publication bias for the Eyes test.

Meta-regression analyses to investigate heterogeneity showed no demographic characteristics or clinical symptoms had an impact on effect sizes.



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Consistency	Inconsistent
Precision	Precise
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	Social cognition in people with deficit schizophrenia (predominantly negative symptoms) vs. people with non-deficit schizophrenia.
Summary of evidence	Moderate to low quality evidence (unclear sample size, direct, unable to assess consistency or precision) suggests people with deficit schizophrenia may show poorer social cognition than people with non-deficit schizophrenia.
Social cognition	
<i>A medium effect size suggests greater social cognition impairment in people with deficit schizophrenia compared to non-deficit schizophrenia;</i> 2 studies, ES = 0.56, 95%CI -2.09 to 3.21. Sample sizes, Q and <i>p</i> -values are not reported.	
Consistency	Unable to assess; no measure of consistency is reported.
Precision	Unable to assess; no measure of precision is reported.
Directness	Direct



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Couture SM, Penn DL, Roberts DL

The Functional Significance of Social Cognition in Schizophrenia: A Review

Schizophrenia Bulletin 2006; 32(S1): S44-S63

[View review abstract online](#)

<p>Comparison</p>	<p>Effect of deficits in various social cognition domains on functional outcome in schizophrenia spectrum disorders.</p>
<p>Summary of evidence</p>	<p>Moderate to low quality evidence (small to medium-sized samples, unable to assess consistency or precision, direct) suggests increased social perception may improve community function and social behaviour, as well as social problem solving. Better emotional perception may also improve community function and social behaviour and social skills. A stable attribution style may increase community function and social behaviour.</p>

Social perception (SP) and functional outcome

Social perception is a person's ability to perceive social cues from behaviour in a social context, and incorporates knowledge of social rules and conventions;

Three of four studies (N = 207) reported a significant medium to large positive relationship between SP and social behaviour in treatment settings, with increases in SP correlating positively with improved social behaviour.

Three studies (N = 116) reported a significant small to medium positive relationship between increased SP and better community functioning, and one study (N = 162) showed a small effect, that SP could predict inpatient or outpatient status, with increased SP predicting higher outpatient status.

Three studies of inpatients (N = 158) reported a significant medium to large positive effect associating increased SP with increased social problem -solving skills.

Two studies (N = 172) reported a significant medium positive association between increased SP and increased social skills, while two studies reported no association (N = 75).

Emotional perception (EP) and functional outcome



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Emotional perception is the ability to infer emotional information from facial expressions and vocal inflections;

Four of six studies (N = 126) reported a significant medium to large positive relationship between increased EP and better social behaviour in treatment settings.

Three of four studies (N = 131) showed a significant small relationship between increased EP and better social skills.

Three studies (N = 260) found a consistent significant medium relationship between improved EP and greater community function, including work function and independent living scales.

Attributional Style (AS) and functional outcome

Attributional style refers to a person's tendencies toward explaining the cause of events (blaming people versus situations);

One study (N = 40) reported a significant, medium effect that stable attributions were related to better community function.

One study (N = 29) found that hostile attributional bias had a significant small relationship with aggressive inpatient behaviour.

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

Daban C, Martinez-Aran A, Torrent C, Tabarés-Seisdedos R, Balanzá-Martínez V, Salazar-Fraile J, Selva-Vera G, Vieta E

Specificity of cognitive deficits in bipolar disorder versus schizophrenia: A systematic review

Psychotherapy and Psychosomatics 2006; 75: 72-84

[View review abstract online](#)

Comparison	Cognitive performance in people with schizophrenia vs. people with bipolar disorder.
Summary of evidence	Moderate to low quality evidence (small sample, unable to assess consistency or precision, direct) suggests people with schizophrenia may show impaired psychosocial functioning compared to people with bipolar disorder.



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Psychosocial functioning	
2 studies (N = 198) reported more impaired psychosocial functioning in people with schizophrenia compared to people with bipolar disorder.	
Consistency	Unable to assess; no measure of consistency is reported
Precision	Unable to assess; no measure of precision is reported
Directness	Direct

Fett AK, Viechtbauer W, Dominguez M, Penn D, van Os J, Krabbendam L

The relationship between neurocognition and social cognition with functional outcomes in schizophrenia: A meta-analysis

Neuroscience and Biobehavioural Reviews 2011; 35: 573-588

[View review abstract online](#)

Comparison	Association between functional outcomes (community function, social behaviour, social problem solving, social skills) and performance on various cognitive domains in patients with schizophrenia.
Summary of evidence	Moderate to high quality evidence (mixed sample sizes, direct, mostly consistent, mostly precise) shows that increased community functioning has a small to medium size association with better performance on theory of mind, emotion processing, information processing, verbal learning, working memory, and reasoning tasks. Improved social behaviour is associated with better emotion processing, verbal learning, and reasoning ability. Greater problem-solving ability showed associations with better attention, working memory, verbal learning, and reasoning ability. Better social skills were associated with improved attention, visual learning, reasoning ability and verbal learning.
Community functioning (work performance, social interaction)	



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<p><i>Significant positive association between increased performance on theory of mind task and greater community functioning;</i></p> <p>3 studies, N = 114, estimated average correlation = 0.48, 95%CI 0.32 to 0.61, $p < 0.001$, $Q_w = 0.81$, $I^2 = 1\%$, $p > 0.05$</p>
<p><i>Significant positive association between increased performance on emotional perception and processing tasks and greater community functioning;</i></p> <p>5 studies, N = 378, estimated average correlation = 0.31, 95%CI 0.21 to 0.40, $p < 0.001$, $Q_w = 1.67$, $I^2 = 0\%$, $p > 0.05$</p>
<p><i>Significant positive association between increased performance on attention tasks and greater community functioning;</i></p> <p>9 studies, N = 481, estimated average correlation = 0.16, 95%CI 0.04 to 0.27, $p = 0.01$, $Q_w = 13.15$, $I^2 = 38.17\%$, $p > 0.05$</p>
<p><i>Significant positive association between increased performance on a processing speed task and greater community functioning;</i></p> <p>8 studies, N = 465, estimated average correlation = 0.25, 95%CI 0.13 to 0.37, $p < 0.001$, $Q_w = 12.36$, $I^2 = 42.94\%$, $p > 0.05$</p>
<p><i>Significant positive association between increased performance on working memory task and greater community functioning;</i></p> <p>7 studies, N = 495, estimated average correlation = 0.22, 95%CI 0.05 to 0.38, $p = 0.01$, $Q_w = 18.89$, $I^2 = 69.30\%$, $p < 0.05$</p>
<p><i>Significant positive association between increased performance on verbal learning tasks and greater community functioning;</i></p> <p>17 studies, N = 1,125, estimated average correlation = 0.26, 95%CI 0.15 to 0.37, $p < 0.001$, $Q_w = 69.54$, $I^2 = 71.65\%$, $p < 0.05$</p>
<p><i>Significant positive association between increased performance on visual learning task and greater community functioning;</i></p> <p>6 studies, N = 230, estimated average correlation = 0.20, 95%CI 0.07 to 0.33, $p = 0.003$, $Q_w = 2.90$, $I^2 = 0\%$, $p > 0.05$</p>
<p><i>Significant positive association between increased performance on reasoning and problem-solving tasks and greater community functioning;</i></p> <p>16 studies, N = 901, estimated average correlation = 0.19, 95%CI 0.12 to 0.26, $p < 0.001$, $Q_w = 16.19$, $I^2 = 9.95\%$, $p > 0.05$</p>
<p>Social behaviour</p>



Social cognition

<p><i>Significant positive association between increased performance on emotional perception and processing tasks and improved social behaviour;</i></p> <p>6 studies, N = 265, estimated average correlation = 0.22, 95%CI 0.10 to 0.34, $p < 0.001$, $Q_w = 3.08$, $I^2 = 0\%$, $p > 0.05$</p>
<p><i>No association between performance on attention tasks and social behaviour;</i></p> <p>4 studies, N = 234, estimated average correlation = 0.19, 95%CI -0.11 to 0.45, $p = 0.21$, $Q_w = 14.95$, $I^2 = 74.16\%$, $p < 0.05$</p>
<p><i>Significant positive association between increased performance on verbal learning tasks and improved social behaviour;</i></p> <p>4 studies, N = 253, estimated average correlation = 0.32, 95%CI 0.15 to 0.47, $p < 0.001$, $Q_w = 4.84$, $I^2 = 39.22\%$, $p > 0.05$</p>
<p><i>Significant positive association between better performance on visual learning task and improved social behaviour;</i></p> <p>4 studies, N = 122, estimated average correlation = 0.30, 95%CI 0.10 to 0.47, $p = 0.002$, $Q_w = 3.47$, $I^2 = 11.76\%$, $p > 0.05$</p>
<p><i>Significant positive association between increased performance on a reasoning and problem-solving tasks and improved social behavior;</i></p> <p>5 studies, N = 257, estimated average correlation = 0.23, 95%CI 0.11 to 0.35, $p < 0.001$, $Q_w = 2.06$, $I^2 = 0\%$, $p > 0.05$</p>
<p>Social problem solving</p>
<p><i>Significant positive association between increased performance on attention tasks and greater social problem solving;</i></p> <p>3 studies, N = 100, estimated average correlation = 0.25, 95%CI 0.07 to 0.47, $p = 0.007$, $Q_w = 1.45$, $I^2 = 0\%$, $p > 0.05$</p>
<p><i>Significant positive association between increased performance on working memory task and greater social problem solving;</i></p> <p>4 studies, N = 127, estimated average correlation = 0.25, 95%CI 0.07 to 0.41, $p = 0.007$, $Q_w = 0.29$, $I^2 = 0\%$, $p > 0.05$</p>
<p><i>Significant positive association between increased performance on verbal learning tasks and greater social problem solving;</i></p> <p>4 studies, N = 117, estimated average correlation = 0.26, 95%CI 0.07 to 0.43, $p = 0.003$, $Q_w = 0.44$, $I^2 = 0\%$, $p > 0.05$</p>



Social cognition

<p><i>Significant positive association between increased performance on a reasoning and problem-solving tasks and greater social problem solving;</i></p> <p>3 studies, N = 90, estimated average correlation = 0.29, 95%CI 0.08 to 0.47, $p = 0.008$, $Q_w = 0.73$, $I^2 = 0\%$, $p > 0.05$</p>	
<p>Social skills</p>	
<p><i>Significant to large positive association between increased performance on attention tasks and better social skills;</i></p> <p>3 studies, N = 119, estimated average correlation = 0.39, 95%CI 0.22 to 0.53, $p < 0.001$, $Q_w = 0.22$, $I^2 = 0\%$, $p > 0.05$</p>	
<p><i>Significant positive association between increased performance on verbal learning task and better social skills;</i></p> <p>7 studies, N = 250, estimated average correlation = 0.18, 95%CI 0.06 to 0.31, $p = 0.005$, $Q_w = 8.54$, $I^2 = 0\%$, $p > 0.05$</p>	
<p><i>Significant positive association between increased performance on visual learning task and better social skills;</i></p> <p>4 studies, N = 149, estimated average correlation = 0.28, 95%CI 0.07 to 0.46, $p = 0.008$, $Q_w = 5.22$, $I^2 = 30.81\%$, $p > 0.05$</p>	
<p><i>Significant association between improved performance on a reasoning and problem-solving tasks and better social skills;</i></p> <p>3 studies, N = 119, estimated average correlation = 0.34, 95%CI 0.17 to 0.50, $p < 0.001$, $Q_w = 1.04$, $I^2 = 0\%$, $p > 0.05$</p>	
Consistency	Consistent for all outcomes except for community function and working memory, and social behaviour and attention.
Precision	Precise for all outcomes except social behaviour and attention.
Directness	Direct

Gabay AS, Kempton MJ, Mehta MA

Facial affect processing deficits in schizophrenia: A meta-analysis of antipsychotic treatment effects

Journal of Psychopharmacology 2015; 29(2): 224-229



Social cognition

[View review abstract online](#)

Comparison	Effects of antipsychotics on facial affect processing.
Summary of evidence	High quality evidence (medium to large sample, consistent, precise, direct) suggests a very small effect of improved facial affect processing with antipsychotic medication. This effect may only be observed in patients taking second generation antipsychotics, and is not moderated by age, gender, duration of treatment or symptom severity.
Facial affect processing	
<p><i>Overall, a small significant improvement on facial affect processing tasks in people with schizophrenia on antipsychotic medication;</i></p> <p>16 studies, N = 1,162, $g = 0.13$, 95%CI 0.05 to 0.21, $p = 0.002$, Q-test $p = 0.85$</p> <p>No evidence of publication bias.</p> <p><i>A small significant effect of improved facial affect processing in people with schizophrenia on second generation antipsychotics;</i></p> <p>10 studies, N = 896, $g = 0.11$, 95%CI 0.02 to 0.21, $p = 0.01$, Q-test $p = 1.0$</p> <p>No evidence of publication bias.</p> <p><i>No significant improvement in patients on first generation antipsychotics;</i></p> <p>6 studies, N = 266, $g = 0.17$, 95%CI -0.09 to 0.43, $p = 0.16$, Q-test $p = 0.16$</p> <p>No evidence of publication bias.</p> <p>Meta-regression analyses suggest no differences in effect sizes according to age, gender, duration of treatment or symptom severity.</p>	
Consistency	Consistent
Precision	Precise
Directness	Direct

Gong B, Li Q, Zhao Y, Wu C

Auditory emotion recognition deficits in schizophrenia: A systematic review and meta-analysis

Asian Journal of Psychiatry 2021; 65: 102820



Social cognition

[View review abstract online](#)

Comparison	Auditory emotion recognition in people with schizophrenia or schizoaffective disorders vs. controls.
Summary of evidence	Moderate to high quality evidence (large samples, mostly inconsistent and precise, direct) suggests medium-sized deficits in auditory emotion recognition in people with schizophrenia or schizoaffective disorder compared to controls. These were found across all types of emotions (neutral, happy, sad, angry, fear, disgust, and surprise). There were no moderating effects of age, gender, illness duration, auditory stimuli method, or diagnosis.
Auditory emotion recognition	
<p><i>Medium-sized effects showed deficits in auditory emotion recognition in people with schizophrenia;</i> Neutral: 16 studies, N = 915, SMD = -0.67, 95%CI -0.93 to -0.41, $p < 0.00001$, $I^2 = 70%$, $p < 0.00001$ Happy: 16 studies, N = 929, SMD = -0.63, 95%CI -0.89 to -0.37, $p < 0.00001$, $I^2 = 71%$, $p < 0.00001$ Sad: 13 studies, N = 894, SMD = -0.72, 95%CI -1.00 to -0.44, $p < 0.00001$, $I^2 = 74%$, $p < 0.00001$ Angry: 17 studies, N = 981, SMD = -0.72, 95%CI -0.93 to -0.51, $p < 0.00001$, $I^2 = 59%$, $p < 0.00001$ Fear: 14 studies, N = 876, SMD = -0.81, 95%CI -1.14 to -0.49, $p < 0.00001$, $I^2 = 79%$, $p < 0.00001$ Disgust: 8 studies, N = 539, SMD = -0.64, 95%CI -1.17 to -0.12, $p = 0.02$, $I^2 = 87%$, $p < 0.00001$ Surprise: 6 studies, N = 490, SMD = -0.57, 95%CI -0.84 to -0.29, $p < 0.0001$, $I^2 = 51%$, $p = 0.07$ There were no moderating effects of age, gender, illness duration, auditory stimuli, or diagnosis. Increased sadness, anger, and disgust deficits were associated with increased negative symptoms.</p>	
Consistency	Inconsistent, apart from surprise
Precision	Precise, apart from disgust
Directness	Direct

Hauser M, Zhang JP, Sheridan EM, Burdick KE, Mogil R, Kane JM, Auther A, Carrion RE, Cornblatt BA, Correll CU

Neuropsychological Test Performance to Enhance Identification of Subjects at Clinical High Risk for Psychosis and to Be Most Promising for



Social cognition

Predictive Algorithms for Conversion to Psychosis: A Meta-Analysis

Journal of Clinical Psychiatry 2017; 78: e28-e40

[View review abstract online](#)

Comparison	Social cognition in individuals at clinical high-risk of psychosis vs. controls.
Summary of evidence	Moderate to high quality evidence (large sample, inconsistent, precise, direct) shows a medium-sized effect of poorer social cognition in people at clinical high-risk for psychosis.
Social cognition	
<p><i>Significant, medium-sized effect of poorer social cognition in people at clinical high-risk;</i> 6 studies, N = 755, $g = -0.43$, 95%CI -0.68 to -0.18, $p = 0.001$, $I^2 = 63\%$ This effect was significant in studies using the False Belief and Strange Story tasks, but not the Eye test.</p>	
Consistency	Inconsistent
Precision	Precise
Directness	Direct

Hoekert M, Kahn RS, Pijnenborg M, Aleman A

Impaired recognition and expression of emotional prosody in schizophrenia: Review and meta-analysis

Schizophrenia Research 2007; 96: 135-145

[View review abstract online](#)

Comparison	Emotional prosody (tone of voice perception) in people with schizophrenia vs. controls.
Summary of evidence	Moderate to low quality evidence (small to medium samples, direct, inconsistent, imprecise) finds a large effect of poorer perception of emotional prosody in people with schizophrenia compared with controls.



Social cognition

Emotional Prosody

Large effect size suggests significantly poorer perception of emotional prosody in people with schizophrenia compared with controls;

17 studies, N = 623, $d = -1.240$, 95%CI -0.42 to -2.46, $p < 0.05$, $Q_w = 82.0$, $p < 0.0005$

No significant differences for expression of emotional prosody;

7 studies, N = 186, $d = -1.11$, 95%CI 0.87 to -2.0, $p > 0.05$, $Q_w = 44.8$, $p < 0.0005$

Subgroup analysis suggests no effect of patient status, age, duration of the illness, medication status, group size, level of education or task complexity.

Consistency	Inconsistent
Precision	Imprecise
Directness	Direct

Huang J, Xu T, Chan RCK

Do patients with schizophrenia have a general or specific deficit in the perception of social threat? A meta-analytic study

Psychiatry Research 2011; 185: 1-8

[View review abstract online](#)

Comparison	Social threat in people with schizophrenia vs. controls.
Summary of evidence	Moderate quality evidence (medium-sized samples, precise, unable to assess consistency, direct) suggests poorer performance on both social threat and non-threat tasks in people with schizophrenia, with or without delusions compared to controls. This deficit was not seen in people at clinical high risk of delusions.

Reaction to social threat and non-threat stimuli

Facial expression recognition

Medium to large effect of poorer performance in people with delusions vs. controls;

Non-threat condition: 6 studies, N = 273, $d = -0.732$, 95%CI -1.088 to -0.375, $p < 0.0001$

Threat condition: 7 studies, N = 308, $d = -0.748$, 95%CI -1.091 to -0.406, $p < 0.0001$



Social cognition

No differences in effect sizes between conditions: Q_B 0.003, $p = 0.955$

Medium to large effect of poorer performance in people with schizophrenia vs. controls;

Non-threat condition: 12 studies, $N = 716$, $d = -0.509$, 95%CI -0.747 to -0.271, $p < 0.0001$

Threat condition: 11 studies, $N = 699$, $d = -0.741$, 95%CI -0.998 to -0.484, $p < 0.0001$

No differences in effect sizes between conditions: Q_B 1.616, $p = 0.204$

No differences in people at risk of delusions vs. controls;

Non-threat condition: 3 studies, $N = 149$, $d = -0.171$, 95%CI -0.670 to 0.328, $p = 0.503$

Threat condition: 3 studies, $N = 149$, $d = -0.059$, 95%CI -0.553 to -0.434, $p = 0.814$

No differences in effect sizes between conditions: Q_B 0.002, $p = 0.967$

Subgroup analyses revealed a significant difference in effect sizes for the threat condition between the subclinical sample and the deluded sample (Q_B 6.541, $p = 0.011$), and between the subclinical sample and the schizophrenia sample (Q_B 6.659, $p = 0.010$), with the clinical groups showing similarly greater deficits.

Meta-regression analysis revealed that studies with older participants reported larger effect sizes between patients with schizophrenia and controls in both threat ($b = -0.04$, $p = 0.002$) and non-threat conditions ($b = -0.035$, $p = 0.005$).

Consistency	Unable to assess (Q_W is not reported)
Precision	Precise
Directness	Direct

Irani F, Seligman S, Kamath V, Kohler C, Gur RC

A meta-analysis of emotion perception and functional outcomes in schizophrenia

Schizophrenia Research 2012; 137: 203-211

[View review abstract online](#)

Comparison	Emotion perception and functional outcomes in people with schizophrenia.
Summary of evidence	Moderate quality evidence (large sample, inconsistent, precise, direct) suggests a medium-sized association between poor emotion identification and poor community functioning, social problem solving, observed social skills, independent living skills, nonverbal communication, and social skills.



Emotion perception and functional outcomes

Small to medium-sized association between emotional perception and functional outcomes;

25 studies, N = 1,306, $r = 0.31$, 95%CI 0.13 to 0.49, $p = 0.001$, $I^2 = 54.55%$, $p < 0.001$

Subgroup analyses to assess heterogeneity revealed tasks assessing emotion identification were statistically significant ($r = 0.36$, $p = 0.001$, $I^2 = 60.63%$, $p < 0.001$), while tasks assessing emotion differentiation were not ($r = 0.16$, $p = 0.24$).

Subgroup analyses to assess heterogeneity across emotion identification tasks revealed community functioning ($p = 0.03$), social problem solving ($p = 0.002$), observed social skills ($p < 0.001$), independent living skills ($p = 0.003$), nonverbal communication ($p = 0.03$) and social skills/functioning ($p < 0.001$) were positively associated with emotion identification abilities, while social behaviour in the milieu was not ($p = 0.86$). Effect sizes were higher with increased severity of symptoms (SANS $p = 0.002$, SAPS $p = 0.002$, PANSS $p = 0.001$), percentage of males ($p = 0.02$), and decreased number of Caucasians ($p = 0.027$). There were no differences according to visual vs. auditory tasks, patient age, education, marital status, diagnosis, medication status, age at illness onset, or duration of illness. A trend effect showed outpatients had greater associations between emotional identification than inpatients or mixed settings.

Authors report no evidence of publication bias.

Consistency	Inconsistent
Precision	Precise
Directness	Direct

Kohler C, Walker J, Martin E, Healey K, Moberg P

Face emotion perception in schizophrenia: A meta-analytic review

Schizophrenia Bulletin 2010; 36(5): 1009-1019

[View review abstract online](#)

Comparison	Facial emotion perception in people with schizophrenia vs. controls.
Summary of evidence	Moderate to high quality evidence (large sample, precise, inconsistent, direct) suggests impaired facial emotion perception in people with schizophrenia compared to controls. The results also suggest that impairments may be associated with greater symptom severity.



Social cognition

Facial emotion perception	
<p><i>A large effect suggests impaired facial emotion perception in people with schizophrenia compared to controls;</i></p> <p>Number of studies is unclear, $N = 3,822$, $d = -0.91$, 95%CI -0.97 to -0.84, $Q_W = 295.7$, $p < 0.001$</p> <p><i>Significant associations were reported between impaired facial emotion perception and greater symptom severity;</i></p> <p>Negative symptoms, SANS: 20 studies, $Z = -4.13$, $p < 0.001$</p> <p>Positive symptoms, SAPS: 18 studies, $Z = -4.48$, $p < 0.001$</p> <p>Overall symptoms, BPRS: 6 studies, $Z = -3.08$, $p = 0.002$</p> <p><i>However, no association was found for PANSS positive, negative or total symptom scores.</i></p> <p>Samples with a later age of onset, increased age, higher proportion of male controls, unmedicated patients, inpatients, or patients taking first generation antipsychotics were most impaired.</p> <p>There were no differences according to medication dose, number of hospitalisations, level of education, percentage of Caucasians, duration of illness, diagnosis, or type task.</p>	
Consistency	Inconsistent
Precision	Precise
Directness	Direct

<p><i>Li W, Zhou FC, Zhang L, Ng CH, Ungvari GS, Li J, Xiang YT</i></p> <p>Comparison of cognitive dysfunction between schizophrenia and bipolar disorder patients: A meta-analysis of comparative studies</p> <p>Journal of Affective Disorders 2020; 274: 652-61</p> <p>View review abstract online</p>	
Comparison	Social cognition in people with schizophrenia vs. people with bipolar disorder.
Summary of evidence	Moderate to high quality evidence (large sample, inconsistent, precise, direct) finds a large effect suggesting people with schizophrenia showed impaired performance on social cognition tasks compared to people with bipolar disorder.
Social cognition	



Social cognition

A significant, large effect suggests people with schizophrenia showed impaired performance on social cognition tasks compared to people with bipolar disorder;

8 studies, N = 1,211, SMD = -0.86, 95%CI -1.13 to -0.58, $p < 0.00001$, $I^2 = 70%$, $p < 0.0001$

Consistency	Inconsistent
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	Social cognition in people with first-episode schizophrenia vs. controls.
Summary of evidence	Moderate quality evidence (small to medium-sized sample, inconsistent, precise, direct) shows a medium-sized effect of poorer social cognition in people with first-episode schizophrenia compared to controls.

Social cognition

Medium effect size suggests people with first-episode schizophrenia showed significantly poorer social cognition than controls;

5 studies, N = 289, $d = -0.77$, 95%CI -1.01 to -0.54, $p < 0.001$, $Q_w = 56.59$, $p < 0.001$

Larger effect sizes were associated with increased mean age of controls, recency of publication, and higher proportion of males in the patient group. Smaller effect sizes were associated with studies conducted outside the US, higher proportion of males in the control group, and higher proportion of patients receiving antipsychotics.

Consistency	Inconsistent
Precision	Precise
Directness	Direct



Social cognition

Muller H, Betz LT, Bechdorf A

A comprehensive meta-analysis of the self-serving bias in schizophrenia spectrum disorders compared to non-clinical subjects

Neuroscience and Biobehavioral Reviews 2021; 120: 542-9

[View review abstract online](#)

Comparison	The relationship between symptoms and self-serving attributional bias in people with schizophrenia vs. controls. Self-serving attributional bias involves attributing positive events to oneself and negative event to others.
Summary of evidence	Moderate to high quality evidence (large sample, inconsistent, precise, direct) finds a small effect that people with schizophrenia were more prone to self-serving attributional bias than controls.
Self-serving attributional bias	
<p><i>A small effect showed people with schizophrenia were more prone to self-serving attributional bias;</i> 56 studies, N = 5,102, $g = 0.17$, 95%CI 0.006 to 0.35, $p = 0.043$, $I^2 = 86\%$</p> <p>Subgroup analysis showed the effect was largest in people who were in the state of active persecutory delusion, in those who scored high in paranoid ideation, in those who tended to jump to conclusions, in those with high self-esteem, and in those with low depression scores.</p>	
Consistency	Inconsistent
Precision	Precise
Directness	Direct

Okruszek L, Pilecka I

Biological motion processing in schizophrenia - Systematic review and meta-analysis

Schizophrenia Research 2017; 190: 3-10

[View review abstract online](#)



Social cognition

Comparison	Biological motion processing in people with schizophrenia vs. controls.
Summary of evidence	Moderate to high quality evidence (large sample, unable to assess consistency, precise, direct) shows a medium-sized effect of less biological motion processing in people with schizophrenia compared to controls.
Biological motion processing	
<p><i>A medium-sized effect of less biological motion processing in people with schizophrenia;</i> 14 studies, N = 1,053, SMD = 0.66, 95%CI -0.79 to -0.54, $p < 0.001$ Subgroup analysis of individual tasks showed similar results (basic vs. emotion tasks).</p>	
Consistency	Unable to assess; no measure of consistency is reported
Precision	Precise
Directness	Direct

Oliver LD, Moxon-Emre I, Lai MC, Grennan L, Voineskos AN, Ameis SH

Social Cognitive Performance in Schizophrenia Spectrum Disorders Compared with Autism Spectrum Disorder: A Systematic Review, Meta-analysis, and Meta-regression

JAMA Psychiatry 2021; 78: 281-92

[View review abstract online](#)

Comparison	Social cognition in people with schizophrenia vs. people with autism.
Summary of evidence	Moderate to high quality evidence (large samples, inconsistent, precise, direct) shows no differences in social cognition between people with schizophrenia and people with autism. This was found across emotion processing, theory of mind and reading the mind in the eyes tests.
Social cognition	



Social cognition

<p><i>No significant differences in;</i></p> <p>Emotion processing: 15 studies, N = 1,171, $g = 0.12$, 95%CI -0.07 to 0.30, $p = 0.21$, $I^2 = 51\%$</p> <p>Theory of mind: 17 studies, N = 1,050, $g = -0.01$ 95%CI -0.21 to 0.19, $p = 0.92$, $I^2 = 56\%$</p> <p>Reading the Mind in the Eyes Test: 13 studies, N = 857, $g = 0.25$, 95%CI -0.04 to 0.53, $p = 0.10$, $I^2 = 75\%$</p>	
Consistency	Inconsistent
Precision	Precise
Directness	Direct

<p><i>Pickup GJ</i></p> <p>Relationship between theory of mind and executive functioning in schizophrenia: A systematic review</p> <p>Psychopathology 2008; 41: 206-213</p> <p>View review abstract online</p>	
Comparison	The association between theory of mind and executive functioning in people with schizophrenia vs. controls
Summary of evidence	Moderate to low quality evidence (small to medium-sized samples, unable to assess consistency and precision, direct) suggests impaired performance on various theory of mind tasks in people with schizophrenia compared to controls, which may be associated with greater symptom severity. The evidence also suggests that theory of mind tasks may be correlated with executive functioning tasks.
Performance on theory of mind tasks	
<p><i>Authors reported poorer performance in people with schizophrenia compared to controls on;</i></p> <p>False Beliefs (FB) picture sequencing tasks (8 studies, N = 392), theory of mind questionnaire and vignettes (3 studies, N = 201), comprehension (1 study, N = 54), hinting tasks (2 studies, N = 220), 1st- and 2nd- order FB stories (4 studies, N = 201), and 1st-order FB stories (1 study, N = 60).</p>	
Theory of mind association with executive functioning	



Social cognition

Authors reported that six studies (N = 227) suggest overall theory of mind performance was associated with executive functioning tasks, including capture picture-sequencing (N = 56), Weigl (N = 60), key search and zoo map (N = 41) and trails B (N = 50). 4 studies reported no association with ToL task (N = 56), WCST task (N = 41), capture (N = 63) or SCWT task (N = 50).

3 studies (N = 148) suggest FB scores were associated with executive functioning tasks, including capture (2 studies, N = 90), ToL (1 study, N = 45) and WCST (1 study, N = 58).

1 study (N = 128) reported that hinting scores correlated negatively with Trails B and positively with the WCST task.

Theory of mind association with symptoms

Poorer theory of mind performance was associated with greater severity of negative symptoms (2 studies, N = 107), positive symptoms (1 study, N = 40), paranoid symptoms (1 study, N = 63), poor insight (1 study, N = 55), behavioural problems (1 study, N = 60), disorganised symptoms (2 studies, N = 94), psychomotor poverty (1 study, N = 52) and positive formal thought disorder (3 studies, N = 236). Better theory of mind performance was associated with better social functioning (3 studies, N = 201). However, two studies reported that theory of mind was not associated with general symptoms (N = 127), negative symptoms (N = 56) or paranoid symptoms (1 study, N = 56).

Increased negative and positive symptom severity was associated with poorer performance on the hinting task (1 study, N = 50), and increased negative symptoms were associated with poorer picture sequencing and capture errors performance (1 study, N = 56).

Greater social functioning was associated with better performance on the reading the mind in the eyes task (1 study, N = 50), and better 2nd order FB scores were associated with greater insight (N = 1 study, N = 58).

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

Savla GN, Vella L, Armstrong CC, Penn DL, Twamley EW

Deficits in Domains of Social Cognition in Schizophrenia: A Meta-Analysis of the Empirical Evidence

Schizophrenia Bulletin 2013; 39(5): 979-992

[View review abstract online](#)



Social cognition

Comparison	Social cognition in people with schizophrenia vs. controls.
Summary of evidence	<p>Moderate to high quality evidence (large samples, mostly inconsistent, precise, direct) suggests a large effect of impaired social perception, theory of mind, emotion perception, and emotion processing, and a medium effect of impaired social knowledge in people with schizophrenia.</p>
<p>Social and emotion perception</p>	
<p><i>Significant, large effect of poorer performance on social perception in people with schizophrenia;</i> 13 studies, N = 953, $g = 1.04$, 95%CI ± 25, $p < 0.001$, $Q_W 37.91$, $p < 0.001$</p> <p>Subgroup analyses to assess significant heterogeneity across results revealed that inpatients had greater deficits than outpatients. No differences in age, education, gender, illness duration, first-episode status, and English-speaking status.</p> <p><i>Significant, large effect of poorer performance on theory of mind tasks in people with schizophrenia;</i> 50 studies, N = 3,296, $g = 0.96$, 95%CI ± 13, $p < 0.001$, $Q_W 146.19$, $p < 0.001$</p> <p>Subgroup analyses to assess significant heterogeneity across results revealed no differences in inpatient status, age, education, gender, illness duration, and English-speaking status.</p> <p><i>Significant, large effect of poorer performance on emotion perception tasks in people with schizophrenia;</i> 62 studies, N = 3,650, $g = 0.89$, 95%CI ± 17, $p < 0.001$, $Q_W 324.63$, $p < 0.001$</p> <p>Subgroup analyses to assess significant heterogeneity across results revealed that inpatients had greater deficits than outpatients. No differences in age, education, gender, illness duration, first-episode status, and English-speaking status.</p> <p><i>Significant, large effect of poorer performance on emotion processing tasks in people with schizophrenia;</i> 12 studies, N = 1,212, $g = 0.88$, 95%CI ± 30, $p < 0.001$, $Q_W 54.56$, $p < 0.001$</p> <p>Subgroup analyses to assess significant heterogeneity across results revealed that longer illness duration accounted for more pronounced deficits than shorter illness duration. No differences in age, education, gender, inpatients status, first-episode status, and English-speaking status.</p> <p><i>Significant, medium effect of poorer performance on social knowledge tasks in people with schizophrenia;</i> 7 studies, N = 561, $g = 0.54$, 95%CI ± 17, $p < 0.001$, $Q_W 10.48$, $p < 0.106$</p> <p>No subgroup analyses were conducted due to homogenous data.</p> <p><i>No differences between groups for externalising or personalising bias;</i> Externalising bias: 5 studies, N = 446, $g = -0.02$, 95%CI ± 38, $p = 0.918$, $Q_W 14.56$, $p = 0.006$</p>	



Social cognition

Personalising bias: 5 studies, N = 446, $g = -0.17$, 95%CI ± 55 , $p = 0.532$, $Q_W 29.33$ $p < 0.001$ No publication bias.	
Consistency	Inconsistent, apart from social knowledge
Precision	Precise
Directness	Direct

So S, Garety P, Peters E, Kapur S

Do antipsychotics improve reasoning bias? A review

Psychosomatic Medicine 2010; 72: 681-693

[View review abstract online](#)

Comparison	Relationship between performance on theory of mind tasks, symptoms, and antipsychotic medication type.
Summary of evidence	Moderate to low quality evidence (small samples, unable to assess precision or consistency, direct) is unable to determine relationships between theory of mind tasks, symptoms and antipsychotic medication type.

Positive and negative symptoms

1 observational study, N = 128 (medication not reported), measured performance on a hinting task.

Theory of mind performance correlated with PANSS positive, negative and delusion scores, with increased performance being related to reduction in symptoms. Patients with disorganized symptoms tended to perform worse than those with positive and negatives symptoms.

1 observational study, N = 77 (22 patients on antipsychotics vs. 55 controls), measured performance on a computerized mental inference task.

Affective theory of mind was associated with negative symptoms (SANS alogia, SANS attention and SANS total symptoms), whereas cognitive theory of mind was associated with positive symptoms (PANSS). The authors concluded that theory of mind performance was more strongly related to negative symptoms and thought disorder than to positive symptoms.

1 observational study, N = 71 (on atypical (88.6%) and typical (11.4%) antipsychotics), measured performance on a hinting task.

Theory of mind performance correlated with PANSS negative symptoms, general and total score, but not positive score on the PANSS.



Delusions	
<p>1 observational study, N = 21 (10 fully remitted, 5 partially remitted, 6 acutely deluded), 15 patients were on antipsychotics, measured performance on a picture-sequencing task and theory of mind questionnaire.</p> <p>No group differences, authors concluded that theory of mind performance was not related to severity of delusions.</p> <p>1 observational study, N = 128 (39 currently paranoid, 29 remitted paranoid, 27 non-psychotic depressed, 33 healthy controls), measured performance on theory of mind stories.</p> <p>Patients with persecutory delusions scored lower on the theory of mind task. Performance on theory of mind stories correlated significantly with delusional preoccupation and distress, but the picture-sequencing task did not and there was no correlation with antipsychotic dosage.</p>	
Effects of antipsychotic medications on task performance	
<p>1 observational study, N = 108 (84 patients (77 schizophrenia, 7 schizoaffective) and 24 healthy controls), on first generation/clozapine/olanzapine/risperidone for 4 months, most on mood stabilizers or other medications and performance on 1st- and 2nd- order belief task and faux-pas task.</p> <p>Mean score on BPRS was highest in the clozapine group, and lowest in those receiving first generation antipsychotics and olanzapine.</p> <p>The olanzapine and clozapine groups performed similarly to controls on the theory of mind task, but those on first generation antipsychotics and risperidone performed worse than the other groups.</p> <p>1 longitudinal study, N = 17 patients who were drug-free then started on clozapine/olanzapine/risperidone/loxapine, measured performance on a hinting task.</p> <p>ToM performance improved with antipsychotic use, particularly during the first 2 weeks of treatment.</p> <p>No relationship between change in theory of mind and change in symptoms.</p>	
Consistency	Unable to assess; no measure of consistency is reported.
Precision	Unable to assess; no measure of precision is reported.
Directness	Direct

Sprong M, Schothorst P, Vos E, Hox J, van Engeland H

Theory of mind in schizophrenia. Meta-analysis

British Journal of Psychiatry 2007; 191: 5-13



Social cognition

View review abstract online	
Comparison	Assessing performance on theory of mind tasks in patients with a diagnosis of schizophrenia spectrum disorder vs. controls.
Summary of evidence	High quality evidence (large sample, consistent, precise, direct) shows people with schizophrenia have impairment on theory of mind tasks regardless of IQ, sex or age. Patients with disorganised symptoms are particularly impaired on these tasks.
Combined theory of mind score	
<p><i>Large effect shows impaired performance on combined theory of mind tasks in people with schizophrenia compared to controls;</i></p> <p>29 observational studies, N = 831, $d = -1.25$, 95%CI = -1.441 to -1.069, $p < 0.0001$, $Q = 29.13$, $p < 0.41$, $I^2 = 3\%$</p> <p>There were no differences in results when IQ, sex and age were added to the analysis.</p> <p><i>Larger effect shows more impaired performance on combined theory of mind tasks in people with disorganised symptoms compared to controls;</i></p> <p>9 studies, $d = -2.231$, 95%CI = -2.565 to -1.897, p, Q not reported, authors state data homogenous</p> <p><i>Medium effect shows impaired performance on combined theory of mind tasks in people with schizophrenia who are in remission compared to controls;</i></p> <p>5 studies, $d = -0.693$, 95%CI = -1.017 to -0.367, $p < 0.01$, $Q = 7.3816$, $p < 0.05$, $I^2 = 45.8\%$</p>	
Consistency	Consistent, except for patients in remission
Precision	All results precise
Directness	Direct

Subotnik KL, Ventura J, Helleman GS, Zito MF, Agee ER, Nuechterlein KH

Relationship of poor insight to neurocognition, social cognition, and psychiatric symptoms in schizophrenia: A meta-analysis

Schizophrenia Research 2020; 220: 164-71

[View review abstract online](#)

Comparison	The relationship between insight and positive symptoms in people with schizophrenia.
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Summary of evidence	Moderate quality evidence (large sample, some inconsistency, unable to assess precision, direct) finds small associations between poor insight (overall unawareness of having the disorder) and poor theory of mind and emotion processing.
Theory of mind and emotion processing	
<p><i>Small effects showed more unawareness (insight) was associated with poorer;</i> Theory of mind: 12 studies, N = 1,069, $r = -0.23$, 95%CI not reported, $p < 0.01$, $Qp < 0.01$ Emotion processing: 6 studies, N = 2,328, $r = -0.12$, 95%CI not reported, $p < 0.01$, $Qp = 0.60$</p>	
Consistency	Inconsistent for theory of mind, consistent for emotion processing.
Precision	Unable to assess; no CIs reported
Directness	Direct

Thibaudeau E, Achim AM, Parent C, Turcotte M, Cellard C

A meta-analysis of the associations between theory of mind and neurocognition in schizophrenia

Schizophrenia Research 2019; 216: 118-128

[View review abstract online](#)

Comparison	Associations between theory of mind and neurocognition in people with schizophrenia.
Summary of evidence	High quality evidence (large sample, consistent, precise, direct) shows theory of mind scores are associated with neurocognition scores in people with schizophrenia.
Theory of mind and neurocognition	
<p><i>A significant, medium-sized association between theory of mind tasks and overall neurocognition;</i> 91 studies, N = 5,462, $r = 0.32$, 95%CI 0.30 to 0.35, $p < 0.01$ Similar sized associations were observed for individual cognitive domains (attention, memory, language, visuospatial, perception, executive functioning), apart from abstraction which showed a significantly stronger association with theory of mind ($r = 0.52$).</p>	
Consistency	Authors report data are consistent for overall neurocognition and



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	subdomains apart from executive functioning.
Precision	Precise
Directness	Direct

Thibaudeau E, Cellard C, Turcotte M, Achim AM

Functional Impairments and Theory of Mind Deficits in Schizophrenia: A Meta-analysis of the Associations

Schizophrenia Bulletin 2021; 47(3): 695-711

[View review abstract online](#)

Comparison	Associations between theory of mind and neurocognition in people with schizophrenia.
Summary of evidence	High quality evidence (large sample, consistent, precise, direct) shows theory of mind deficits are associated with functioning deficits.
Theory of mind and neurocognition	
<i>A significant, medium-sized association between theory of mind tasks and overall functioning; 53 studies, N = 4,205, r = 0.24, 95%CI 0.21 to 0.27, p < 0.05, Qp = 0.07</i>	
Consistency	Consistent
Precision	Precise
Directness	Direct

Ventura J, Wood RC, Helleman GS

Symptom Domains and Neurocognitive Functioning Can Help Differentiate Social Cognitive Processes in Schizophrenia: A Meta-Analysis

Schizophrenia Bulletin 2013; 39(1): 102-111

[View review abstract online](#)



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<p>Comparison</p>	<p>Association between social cognition, symptom domains and cognitive functioning in people with schizophrenia.</p>
<p>Summary of evidence</p>	<p>Moderate to high quality evidence (large samples, consistent, unable to assess precision, direct) suggests small to medium size associations between poor performance on emotion perception, social perception and theory of mind tasks and increased symptoms and decreased performance on cognitive measures.</p>
<p>Associations between social cognition and symptom domains</p>	
<p><i>Small to medium size associations between poor emotion perception and increased;</i></p> <p>Reality distortion: 18 studies, N = 757, $r = -0.22$, $Q_w = 44.22$, $p < 0.001$ Omitting 2 studies gave homogenous results and $r = -0.21$</p> <p>Disorganisation: 22 studies, N = 987, $r = -0.32$, $Q_w = 42.33$, $p = 0.01$ Omitting 2 studies gave homogenous results and $r = -0.34$</p> <p>Negative symptoms: 53 studies, N = 2,303, $r = -0.26$, $Q_w = 109.70$, $p < 0.001$ Omitting 8 studies gave homogenous results and $r = -0.30$</p> <p>Combined reality distortion/disorganisation: 17 studies, N = 771, $r = -0.17$, $Q_w = 6.99$, $p = 0.98$</p> <p><i>Small to medium size associations between poor social perception and increased;</i></p> <p>Reality distortion: 6 studies, N = 182, $r = -0.21$, $Q_w = 13.34$, $p = 0.04$ Omitting 1 study gave homogenous results and $r = -0.37$</p> <p>Disorganisation: 7 studies, N = 228, $r = -0.22$, $Q_w = 10.55$, $p = 0.16$</p> <p>Negative symptoms: 18 studies, N = 952, $r = -0.20$, $Q_w = 37.64$, $p < 0.001$ Omitting 1 study gave homogenous results and $r = -0.22$</p> <p>Combined reality distortion/disorganisation: 11 studies, N = 684, $r = -0.11$, $Q_w = 33.49$, $p < 0.001$ Omitting 1 study gave homogenous results and $r = -0.16$</p> <p><i>Small association between poor attribution bias and increased;</i></p> <p>Reality distortion: 6 studies, N = 250, $r = -0.07$, $Q_w = 25.87$, $p = 0.01$ Omitting 2 studies gave homogenous results and $r = -0.06$</p> <p><i>Small to medium size associations between poor theory of mind and increased;</i></p> <p>Reality distortion: 14 studies, N = 624, $r = -0.08$, $Q_w = 15.50$, $p = 0.34$</p> <p>Disorganisation: 16 studies, N = 684, $r = -0.32$, $Q_w = 19.14$, $p = 0.26$</p> <p>Negative symptoms: 38 studies, N = 1,869, $r = -0.25$, $Q_w = 43.43$, $p = 0.25$</p> <p>Combined reality distortion/disorganisation: 15 studies, N = 583, $r = -0.22$, $Q_w = 13.28$, $p = 0.58$</p>	



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Associations between social cognition and cognitive functioning

Medium size associations between poor emotion perception and poor;

Verbal memory: 14 studies, N = 915, $r = 0.28$, $Q_w = 28.10$, $p = 0.01$

Omitting 1 study gave homogenous results and $r = 0.24$

Visual memory: 10 studies, N = 469, $r = 0.30$, $Q_w = 2.61$, $p = 0.99$

Working memory: 7 studies, N = 424, $r = 0.22$, $Q_w = 12.20$, $p = 0.09$

Reasoning and problem solving: 15 studies, N = 870, $r = 0.30$, $Q_w = 17.38$, $p = 0.30$

Speed of processing: 16 studies, N = 943, $r = 0.29$, $Q_w = 18.28$, $p = 0.31$

Attention/vigilance: 16 studies, N = 828, $r = 0.26$, $Q_w = 20.00$, $p = 0.22$

Small to medium size associations between poor social perception and poor;

Verbal memory: 12 studies, N = 867, $r = 0.37$, $Q_w = 25.87$, $p = 0.01$

Omitting 1 study gave homogenous results and $r = 0.31$

Visual memory: 2 studies, N = 181, $r = 0.30$, $Q_w = 1.68$, $p = 0.43$

Working memory: 4 studies, N = 323, $r = 0.17$, $Q_w = 16.15$, $p < 0.001$

Omitting 1 study gave homogenous results and $r = 0.22$

Reasoning and problem solving: 8 studies, N = 540, $r = 0.33$, $Q_w = 4.98$, $p = 0.76$

Speed of processing: 7 studies, N = 478, $r = 0.24$, $Q_w = 3.83$, $p = 0.80$

Attention/vigilance: 7 studies, N = 424, $r = 0.17$, $Q_w = 12.18$, $p = 0.09$

Small to medium size associations between poor theory of mind and poor;

Verbal memory: 9 studies, N = 572, $r = 0.31$, $Q_w = 15.46$, $p = 0.08$

Visual memory: 3 studies, N = 198, $r = 0.22$, $Q_w = 0.22$, $p = 0.97$

Working memory: 6 studies, N = 352, $r = 0.33$, $Q_w = 5.04$, $p = 0.54$

Reasoning and problem solving: 17 studies, N = 747, $r = 0.34$, $Q_w = 15.58$, $p = 0.48$

Speed of processing: 11 studies, N = 683, $r = 0.18$, $Q_w = 8.18$, $p = 0.70$

Attention/vigilance: 5 studies, N = 279, $r = 0.24$, $Q_w = 6.48$, $p = 0.26$

Consistency	Consistent
Precision	Unable to assess (no CIs reported)
Directness	Direct

Ventura J, Wood RC, Jimenez AM, Helleman GS



Social cognition

Neurocognition and symptoms identify links between facial recognition and emotion processing in schizophrenia: Meta-analytic findings

Schizophrenia Research 2013; 151: 78-84

[View review abstract online](#)

Comparison	Association between social cognition, symptom domains and cognitive functioning in people with schizophrenia.
Summary of evidence	Moderate to high quality evidence (mixed samples, consistent, unable to assess precision, direct) suggests small to medium associations between poor facial recognition and emotion processing and increased symptoms and decreased performance on cognitive measures.

Associations between social cognition and symptom domains

Small to medium size associations between poor facial recognition and increased;

Reality distortion: 4 studies, N = 203, $r = -0.02$, $Q_w = 1.99$, $p = 0.74$

Disorganisation: 5 studies, N = 240, $r = -0.25$, $Q_w = 3.49$, $p = 0.62$

Negative symptoms: 12 studies, N = 487, $r = -0.22$, $Q_w = 20.44$, $p = 0.06$

Combined reality distortion/disorganisation: 3 studies, N = 138, $r = -0.25$, $Q_w = 0.80$, $p = 0.85$

Small to medium size associations between poor emotion processing (facial stimuli) and increased;

Reality distortion: 18 studies, N = 757, $r = -0.21$, $Q_w = 45.70$, $p < 0.001$

Omitting 2 studies gave homogenous results and $r = -0.20$

Disorganisation: 22 studies, N = 987, $r = -0.32$, $Q_w = 39.21$, $p = 0.01$

Omitting 1 study gave homogenous results and $r = -0.33$

Negative symptoms: 53 studies, N = 2,825, $r = -0.25$, $Q_w = 132.35$, $p < 0.001$

Omitting 10 studies gave homogenous results and $r = -0.28$

Combined reality distortion/disorganisation: 22 studies, N = 1076, $r = -0.18$, $Q_w = 34.23$, $p = 0.05$

Omitting 1 study gave homogenous results and $r = -0.16$

Small to medium size associations between poor emotion processing (voice prosody) and increased;

Reality distortion: 2 studies, N = 81, $r = -0.31$, $Q_w = 0.64$, $p = 0.73$

Disorganisation: 3 studies, N = 124, $r = -0.47$, $Q_w = 8.90$, $p = 0.03$

Omitting 1 study gave homogenous results and $r = -0.60$

Negative symptoms: 7 studies, N = 312, $r = -0.25$, $Q_w = 8.52$, $p = 0.29$



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Combined reality distortion/disorganisation: 1 study, N = 36, $r = -0.13$, $Q_w = N/A$

Associations between social cognition and cognitive functioning

Medium size associations between poor facial recognition and poor;

Verbal memory: 4 studies, N = 194, $r = 0.21$, $Q_w = 1.31$, $p = 0.86$

Visual memory: 5 studies, N = 156, $r = 0.41$, $Q_w = 2.86$, $p = 0.75$

Working memory: 2 studies, N = 62, $r = 0.28$, $Q_w = 0.00$, $p = 1.00$

Reasoning and problem solving: 2 studies, N = 68, $r = 0.45$, $Q_w = 3.81$, $p = 0.15$

Speed of processing: 1 study, N = 35, $r = 0.24$, $Q_w = N/A$

Attention/vigilance: 3 studies, N = 108, $r = 0.28$, $Q_w = 1.19$, $p = 0.76$

Medium size associations between poor emotion processing (facial stimuli) and poor;

Verbal memory: 15 studies, N = 1,046, $r = 0.27$, $Q_w = 28.44$, $p = 0.02$

Omitting 1 study gave homogenous results and $r = 0.23$

Visual memory: 12 studies, N = 620, $r = 0.30$, $Q_w = 3.01$, $p = 1.00$

Working memory: 9 studies, N = 575, $r = 0.28$, $Q_w = 22.22$, $p = 0.01$

Omitting 1 study gave homogenous results and $r = 0.36$

Reasoning and problem solving: 15 studies, N = 972, $r = 0.28$, $Q_w = 17.71$, $p = 0.28$

Speed of processing: 17 studies, N = 1,037, $r = 0.29$, $Q_w = 15.97$, $p = 0.53$

Attention/vigilance: 17 studies, N = 922, $r = 0.29$, $Q_w = 31.06$, $p = 0.02$

Omitting 1 study gave homogenous results and $r = 0.25$

Medium size associations between poor emotion processing (voice prosody) and poor;

Verbal memory: 4 studies, N = 194, $r = 0.30$, $Q_w = 4.08$, $p = 0.40$

Visual memory: 5 studies, N = 156, $r = 0.43$, Q_w not reported

Working memory: 2 studies, N = 62, $r = 0.31$, $Q_w = 1.40$, $p = 0.71$

Reasoning and problem solving: 2 studies, N = 68, $r = 0.30$, $Q_w = 2.10$, $p = 0.35$

Speed of processing: 1 study, N = 35, $r = 0.34$, $Q_w = N/A$

Attention/vigilance: 3 studies, N = 108, $r = 0.29$, $Q_w = 2.43$, $p = 0.66$

Consistency	Consistent
Precision	Unable to assess (no CIs reported)
Directness	Direct



Social cognition

Explanation of acronyms

B = coefficient, BPRS = Brief Psychiatric Rating Scale, CI = Confidence Interval, d = Cohen's d and g = Hedges' g = standardised mean differences (see below for interpretation of effect size), Eggers test = test for asymmetry for detecting possible publication bias, EP = Emotional Perception, ES = effect size, FB = False Beliefs, FGA = first generation antipsychotics, 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), PANSS = Positive and Negative Symptom Scale, 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), r = correlation coefficient, SANS = Scale for the Assessment of Negative Symptoms, SAPS = Scale for the Assessment of Positive Symptoms, SCWT = Stroop colour word test, ToL = Tower of London, ToM = theory of mind, WCST = Wisconsin Card Sorting Task SGA = second generation antipsychotics, SP = Social Perception, vs = versus, Z = z-transformation



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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 small³⁸.

† 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 effect³⁸.

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 ³⁹. InOR stands for logarithmic OR where a InOR of 0 shows no difference between groups. Hazard ratios



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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 unforeseen 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;³⁸

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

§ 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 relaxed⁴⁰.

|| 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.



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Social cognition

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