Introduction
Schizophrenia is characterised by positive, negative and disorganised symptoms. Positive symptoms are a well-documented feature of the disorder and are arguably the most recognizable symptoms. Positive symptoms refer to experiences additional to what would be considered normal experience, such as hallucinations and delusions. Hallucinations are sensory perceptions which may be auditory or visual; delusions are false beliefs. Negative symptoms refer to processes featuring an absence of normal function, and include blunted affect, impoverished thinking, alogia, asociality, avolition and anhedonia. Alogia is often manifested as poverty of speech, asociality involves reduced social interaction, avolition refers to poor hygiene and reduced motivation, while anhedonia is defined as an inability to experience pleasure. Symptoms of disorganisation involve bizarre behavior and disorganized thought and speech. Depressive symptoms are also common, with many individuals experiencing depression after the psychotic episode.

Cognitive deficits are also a core feature of schizophrenia. These deficits may be present in chronic patients, as well as prior to onset of the disorder and during its early and acute stages. Cognitive deficits may be associated with specific symptoms as well as functional impairment.

Method
We have included only systematic reviews (systematic literature search, detailed methodology with inclusion/exclusion criteria) published in full text, in English, from the year 2000 that report results separately for people with a diagnosis of schizophrenia, schizoaffective disorder, schizophreniform disorder or first episode schizophrenia. Reviews were identified by searching the databases MEDLINE, EMBASE, CINAHL, Current Contents, PsycINFO and the Cochrane library. Hand searching reference lists of identified reviews was also conducted. When multiple copies of reviews were found, only the most recent version was included. Reviews with pooled data are prioritised for inclusion.

Review reporting assessment was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist that describes a preferred way to present a meta-analysis. Reviews were assigned a low, medium or high possibility of reporting bias depending on how many items were checked. For instance, a low possibility of bias would be assigned to reviews checking over 66% of items, a medium possibility between 33 and 66% and a high possibility would be given to reviews checking less than 33%. Reviews rated as having less than 50% of items checked have been excluded from the library. The PRISMA flow diagram is a suggested way of providing information about studies included and excluded with reasons for exclusion. Where no flow diagram has been presented by individual reviews, but identified studies have been described in the text, reviews have been checked for this item. Note that early reviews may have been guided by less stringent reporting checklists than the PRISMA, and that some reviews may have been limited by journal guidelines.

Evidence was graded using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group approach where high quality evidence such as that gained from randomised controlled trials (RCT) may be downgraded to moderate or low if review and study quality is limited, if there is inconsistency in results, indirect comparisons, imprecise or sparse data and high probability of reporting bias. It may also be downgraded if risks associated with the intervention or other matter under review are high. Conversely, low
quality evidence such as that gained from observational studies may be upgraded if effect sizes are large or if there is a dose dependent response. We have also taken into account sample size and whether results are consistent, precise and direct with low associated risks (see end of table for an explanation of these terms). The resulting table represents an objective summary of the available evidence, although the conclusions are solely the opinion of staff of the Schizophrenia Research Institute.

Results
We found 29 systematic reviews that met our inclusion criteria. See PRISMA checklists for assessment of reporting transparency.

Conclusions

Overall symptoms
• High quality evidence shows that more severe overall symptoms are associated with lower prospective memory performance.
• Moderate to high quality evidence suggests an association between overall symptom severity and lower levels of insight.
• Moderate quality evidence suggests an association with poor executive functioning, impaired facial emotion perception, social perception, Theory of Mind, facial recognition and emotion processing.

Positive symptoms
• Moderate to high quality evidence suggests an association between more severe positive symptoms and lower levels of insight, attention/vigilance, reasoning and problem solving.

Negative symptoms
• Moderate to high quality evidence suggests an association between more severe negative symptoms and lower verbal fluency, IQ, attention, memory, learning, speed of processing, reasoning, executive functioning, and insight.
• Moderate quality evidence shows an association with impaired facial emotion perception and Theory of Mind.
• Moderate to low quality evidence suggests an association with verbal fluency and social cognition.

Disorganisation symptoms
• High quality evidence suggests an association between more severe disorganised symptoms and lower IQ, attention, executive functioning, speed of processing, and memory (but not verbal working memory).
• Moderate to high quality evidence suggests an association with lower reasoning and problem solving ability.

Other symptoms
Signs and Symptoms – Cognitive functioning relating to symptoms

- Moderate to high quality evidence suggests increased depression may be associated with increased levels of insight.
- Moderate quality evidence suggests a small, decreased risk of aggression with better cognitive functioning. High quality evidence suggests this effect is apparent for global cognition and insight. There were no significant relationships with memory, attention, executive functioning or visual-spatial reasoning.
## 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. |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary of evidence</td>
<td>Moderate to low quality evidence (direct, unable to assess consistency or precision) suggests that people with schizophrenia with high levels of negative symptoms may show the greatest impairments in memory and executive functioning compared with people with schizoaffective disorder/affective psychosis. Patients with high levels of either positive or negative symptoms may show the greatest impairments in psychomotor speed.</td>
</tr>
</tbody>
</table>

### Memory

**Meta-regression shows that people with schizophrenia who had highest levels of negative symptoms showed the greatest executive functioning impairments compared with people with schizoaffective/affective psychosis;**  
5 studies, $B = 0.23$, $SE = 10$, $p = 0.02$

### Executive Functioning

**Meta-regression shows that people with schizophrenia who had highest levels of negative symptoms showed the greatest executive functioning impairments compared with people with schizoaffective/affective psychosis;**  
6 studies, $B = 0.41$, $SE = 0.09$, $p < 0.001$

### Psychomotor speed

**Meta-regression shows that people with schizophrenia who had highest levels of positive or negative symptoms showed the greatest psychomotor impairments compared with people with schizoaffective/affective psychosis;**
**Signs and Symptoms – Cognitive Functioning Relating to Symptoms**

<table>
<thead>
<tr>
<th></th>
<th>Positive symptoms: 20 studies, B = 0.59, SE = 0.29, p = 0.04</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative symptoms: 6 studies, B = 0.39, SE = 0.09, p &lt; 0.001</td>
</tr>
<tr>
<td><strong>Consistency in results</strong></td>
<td>Unable to assess</td>
</tr>
<tr>
<td><strong>Precision in results</strong></td>
<td>Unable to assess</td>
</tr>
<tr>
<td><strong>Directness of results</strong></td>
<td>Direct</td>
</tr>
</tbody>
</table>

*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](#)

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Facial emotional perception and non-emotional facial or age recognition (control task) in people with schizophrenia vs. healthy controls.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Summary of evidence</strong></td>
<td>Moderate quality evidence (inconsistent, precise, direct) with a medium to large effect size, suggests that poorer performance on facial emotion perception may be associated with severity of negative symptoms and performance on non-emotional recognition tasks may be associated with severity of positive symptoms.</td>
</tr>
<tr>
<td><strong>Facial emotional perception</strong></td>
<td></td>
</tr>
</tbody>
</table>

*Greater negative symptom severity (measured by PANSS) was significantly associated with poorer facial emotion perception, showing a large effect;*

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

No significant association was reported between facial emotion perception and negative symptoms (measured by SANS), and positive symptoms (measured by the PANSS or SAPS).

*Greater positive symptom severity (measured by PANSS) was significantly associated with poorer performance on facial recognition tasks, showing a medium to large effect;*

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

No association was reported with negative symptoms (measured by PANSS or SANS), or positive symptoms (measured by SAPS).
# TECHNICAL COMMENTARY

## Signs and Symptoms – Cognitive Functioning Relating to Symptoms

<table>
<thead>
<tr>
<th>Consistency</th>
<th>Inconsistent for group comparisons, unable to assess moderator analyses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precision</td>
<td>Precise</td>
</tr>
<tr>
<td>Directness</td>
<td>Direct</td>
</tr>
</tbody>
</table>

**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

Association between cognitive functioning and symptom dimensions in people with deficit schizophrenia (predominantly negative symptoms) vs. people with non-deficit schizophrenia.

### Summary of evidence

Moderate to low quality evidence (direct, unable to assess consistency or precision) suggests people with deficit schizophrenia may show greater neuropsychological impairment than people with non-deficit schizophrenia on; speeded and non-speeded tasks; tasks tapping language, global cognition and social cognition.

### Overall neuropsychological processes

*Authors state there was greater neuropsychological impairment in people with deficit schizophrenia compared with non-deficit schizophrenia;*

Sample sizes, Q and p-values are not reported

- **Language**
  - Mean weighted ES (unspecified) = 0.51, 95%CI -1.81 to 2.83

- **Global cognition**
  - Mean weighted ES (unspecified) = 0.52, 95%CI 0.23 to 0.82

- **Social cognition**
  - Mean weighted ES (unspecified) = 0.56, 95%CI -2.09 to 3.21

- **Olfactory discriminations**
Mean weighted ES (unspecified) = 1.11, 95%CI not reported

### Performance speed

*The greater impairment in people with deficit schizophrenia compared with non-deficit schizophrenia was evident for both speeded and non-speeded tasks, with no significant differences in results across tasks;*

<table>
<thead>
<tr>
<th>Q_B</th>
<th>p-value reported as non-significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.17</td>
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</tbody>
</table>

**Speeded tasks**

- 8 studies, N = 467, 19 measures
- Mean weighted ES (unspecified) = 0.46, 95%CI 0.26 to 0.67, Q_w = 4.95 p-value not reported

**Non-speeded tasks**

- 13 studies, N = 719, 90 measures
- Mean weighted ES (unspecified) = 0.42, 95%CI 0.26 to 0.57, Q_w = 13.03 p-value not reported

### Brain regions

*The greater impairment in people with deficit schizophrenia compared with non-deficit schizophrenia was evident in tasks thought to tap frontal, parietal, temporal and other, non-specific brain regions, with no significant differences in results across regions;*

<table>
<thead>
<tr>
<th>Q_B</th>
<th>p-value not reported</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.89</td>
<td></td>
</tr>
</tbody>
</table>

**Frontal lobe**

- 9 studies, N = 533, 31 measures, p-values not reported
- Mean weighted ES (unspecified) = 0.42, 95%CI 0.23 to 0.62, Q_w = 12.89

**Parietal lobe**

- 7 studies, N = 540, 16 measures p-values not reported
- Mean weighted ES (unspecified) = 0.22, 95%CI 0.01 to 0.44, Q_w = 1.30

**Temporal lobe**

- 9 studies, N = 533, 44 measures p-values not reported
- Mean weighted ES (unspecified) = 0.40, 95%CI 0.19 to 0.60, Q_w = 4.81

**Nonspecific brain regions**

- 7 studies, N = 463, 15 measures p-values not reported
- Mean weighted ES (unspecified) = 0.42, 95%CI 0.21 to 0.64, Q_w = 5.53

### Consistency

Unable to assess

### Precision

Unable to assess
Signs and Symptoms – Cognitive Functioning Relating to Symptoms

### Directness

<table>
<thead>
<tr>
<th></th>
<th>Direct</th>
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**Directness**

<table>
<thead>
<tr>
<th>Cognitive performance in people with schizophrenia vs. bipolar disorder.</th>
</tr>
</thead>
</table>

**Summary of evidence**

<table>
<thead>
<tr>
<th>Cognitive deficits in bipolar disorder versus schizophrenia: A systematic review</th>
</tr>
</thead>
</table>

**Psychotherapy and Psychosomatics 2006; 75: 72-84**

View review abstract online

**Comparison**

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Cognitive performance in people with schizophrenia vs. bipolar disorder.</th>
</tr>
</thead>
</table>

**Moderate to low quality evidence (unable to assess consistency or precision, medium samples)** suggests increased positive or negative symptoms may be associated with decreased executive functioning. Increased negative symptoms may be associated with decreased verbal fluency.

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#### Attention

<table>
<thead>
<tr>
<th>Attention</th>
<th>2 studies (N = 279) reported no difference between people with schizophrenia or bipolar disorder without psychotic symptoms.</th>
</tr>
</thead>
</table>

#### Executive functioning

<table>
<thead>
<tr>
<th>Executive functioning</th>
<th>1 study (N = 107) reported an association between increased negative symptoms and poorer executive functioning.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 study (N = 108) reported that people with psychotic symptoms performed more poorly than those without psychotic symptoms.</td>
</tr>
</tbody>
</table>

#### Language

<table>
<thead>
<tr>
<th>Language</th>
<th>1 study (N = 94) reported an association between increased negative symptoms and worse verbal fluency.</th>
</tr>
</thead>
</table>

**Consistency**

<table>
<thead>
<tr>
<th>Consistency</th>
<th>Unable to assess</th>
</tr>
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</table>

**Precision**

<table>
<thead>
<tr>
<th>Precision</th>
<th>Unable to assess</th>
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</thead>
</table>
Are psychotic psychopathology and neurocognition orthogonal? A systematic review of their associations


Comparison
Association between cognitive functioning and symptom dimensions in people with non-affective psychosis.

Summary of evidence
High quality evidence (direct, consistent, precise) shows a small to medium size association between more severe negative symptoms and lower verbal fluency, IQ, attention, memory (but not verbal working memory), speed of processing and reasoning ability.

High quality evidence suggests a small to medium size association between more severe disorganised symptoms and lower IQ, attention, memory (but not verbal working memory), and speed of processing. Moderate quality evidence (inconsistent) also suggests an association with lower reasoning ability.

Moderate quality evidence suggests a very weak association between more severe positive symptoms and lower speed of processing.

Executive functioning and verbal fluency
A significant medium association between increased negative symptoms and lower verbal fluency;

- 23 studies, \( \mu_p = -0.291 \), 95%CI -0.356 to -0.224, \( p = 0.00 \), \( I^2 = 42\% \)

No association between negative symptoms and executive control

- 10 studies, \( \mu_p = -0.131 \), 95%CI -0.265 to 0.008, \( p = 0.063 \), \( I^2 = 56\% \)

No association with positive or disorganised symptoms;

Positive symptoms and executive control: 9 studies, \( \mu_p = 0.082 \), 95%CI -0.017 to 0.179, \( p = 0.10 \)

\( I^2 = 7\% \)

Positive symptoms and verbal fluency: 20 studies, \( \mu_p = -0.035 \), 95%CI -0.101 to 0.031, \( p = 0.29 \)
## Signs and Symptoms – Cognitive Functioning Relating to Symptoms

<table>
<thead>
<tr>
<th>Cognitive Functioning</th>
<th>Relating to Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>IQ</td>
<td></td>
</tr>
<tr>
<td><strong>Disorganised symptoms and executive control:</strong> 7 studies, $\mu_p = -0.089$, 95%CI -0.202 to -0.026, $p = 0.13$, $I^2 = 20%$</td>
<td></td>
</tr>
<tr>
<td>Disorganised symptoms and verbal fluency: 13 studies, $\mu_p = -0.092$, 95%CI -0.208 to 0.027, $p = 0.13$, $I^2 = 61%$</td>
<td></td>
</tr>
<tr>
<td><strong>IQ</strong></td>
<td></td>
</tr>
<tr>
<td>A significant medium association between increased <strong>negative symptoms</strong> and lower IQ; 13 studies, $\mu_p = -0.244$, 95%CI -0.333 to -0.151, $p = 0.00$, $I^2 = 52%$</td>
<td></td>
</tr>
<tr>
<td>A significant medium association between increased <strong>disorganised symptoms</strong> and lower IQ; 6 studies, $\mu_p = -0.205$, 95%CI -0.327 to -0.076, $p = 0.002$, $I^2 = 45%$</td>
<td></td>
</tr>
<tr>
<td>No association with <strong>positive symptoms</strong>; 10 studies, $\mu_p = 0.024$, 95%CI -0.063 to 0.111, $p = 0.591$, $I^2 = 26%$</td>
<td></td>
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<tr>
<td><strong>Attention / vigilance</strong></td>
<td></td>
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<tr>
<td>A significant weak association between increased <strong>negative symptoms</strong> and worse attention; 15 studies, $\mu_p = -0.134$, 95%CI -0.191 to -0.076, $p = 0.00$, $I^2 = 26%$</td>
<td></td>
</tr>
<tr>
<td>A significant medium association between increased <strong>disorganised symptoms</strong> and worse attention; 6 studies, $\mu_p = -0.277$, 95%CI -0.392 to -0.154, $p = 0.00$, $I^2 = 34%$</td>
<td></td>
</tr>
<tr>
<td>No association with <strong>positive symptoms</strong>; 11 studies, $\mu_p = -0.012$, 95%CI -0.054 to 0.003, $p = 0.969$, $I^2 = 0%$</td>
<td></td>
</tr>
<tr>
<td><strong>Memory</strong></td>
<td></td>
</tr>
<tr>
<td>A significant small to medium association between increased <strong>negative symptoms</strong> and lower:</td>
<td></td>
</tr>
<tr>
<td>Verbal learning and memory; 20 studies, $\mu_p = -0.214$, 95%CI -0.279 to -0.146, $p = 0.00$, $I^2 = 54%$</td>
<td></td>
</tr>
<tr>
<td>Visual learning and memory; 13 studies, $\mu_p = -0.126$, 95%CI -0.202 to -0.047, $p = 0.001$, $I^2 = 29%$</td>
<td></td>
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<tr>
<td>No association with verbal working memory; 10 studies, $\mu_p = -0.07$, 95%CI -0.174 to 0.036, $p = 0.194$, $I^2 = 19%$</td>
<td></td>
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<tr>
<td>A significant small to medium association between increased <strong>disorganised symptoms</strong> and lower:</td>
<td></td>
</tr>
<tr>
<td>Visual learning and memory;</td>
<td></td>
</tr>
</tbody>
</table>
### Signs and Symptoms – Cognitive Functioning Relating to Symptoms

<table>
<thead>
<tr>
<th>Cognitive Functioning</th>
<th>Studies</th>
<th>Effect Size</th>
<th>95% CI</th>
<th>p Value</th>
<th>I²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal learning and memory</td>
<td>6</td>
<td>$\mu_p = -0.206, 95% CI -0.331$ to $-0.074$</td>
<td>$p = 0.002, I^2 = 42%$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No association with verbal working memory</td>
<td>13</td>
<td>$\mu_p = -0.169, 95% CI -0.27$ to $-0.064$</td>
<td>$p = 0.001, I^2 = 59%$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verbal working memory</td>
<td>5</td>
<td>$\mu_p = -0.177, 95% CI -0.247$ to $0.018$</td>
<td>$p = 0.09, I^2 = 0%$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual learning and memory</td>
<td>9</td>
<td>$\mu_p = -0.171, 95% CI -0.275$ to $-0.062$</td>
<td>$p = 0.002, I^2 = 56%$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information processing</td>
<td>13</td>
<td>$\mu_p = -0.171, 95% CI -0.275$ to $-0.062$</td>
<td>$p = 0.002, I^2 = 56%$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive symptoms</td>
<td>20</td>
<td>$\mu_p = -0.089, 95% CI -0.164$ to $-0.012$</td>
<td>$p = 0.023, I^2 = 46%$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reasoning ability</td>
<td>33</td>
<td>$\mu_p = -0.140, 95% CI -0.197$ to $-0.081$</td>
<td>$p = 0.00, I^2 = 58%$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disorganised symptoms</td>
<td>15</td>
<td>$\mu_p = -0.197, 95% CI -0.336$ to $-0.048$</td>
<td>$p &lt; 0.009, I^2 = 81%$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No association with positive symptoms</td>
<td>27</td>
<td>$\mu_p = -0.013, 95% CI -0.066$ to $0.041$</td>
<td>$p = 0.639, I^2 = 37%$</td>
<td></td>
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</tr>
</tbody>
</table>

**Consistency**: Consistent apart from reasoning and problem solving with disorganised symptoms.

**Precision**: Precise
**Dibben CR, Rice C, Laws K, McKenna PJ**

Is executive impairment associated with schizophrenic syndromes? A meta-analysis


<table>
<thead>
<tr>
<th>Comparison</th>
<th>Association between executive impairment and negative symptoms in people with schizophrenia.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary of evidence</td>
<td>High quality evidence (consistent in overall analysis, precise, direct) shows a weak association of more impaired executive function in people with schizophrenia and increased negative symptoms. This association was increased in patients who were untreated or who were chronically hospitalized. Verbal fluency tasks report the strongest association. Moderate quality evidence (unable to assess consistency, precise, direct) shows a weak association of lower IQ in people with schizophrenia with increased negative symptoms.</td>
</tr>
</tbody>
</table>

**Executive impairment and negative symptoms**

*Overall executive impairment*

Small effect size suggests an association of reduced executive function with negative symptoms in people with schizophrenia;

83 studies, N not reported, \( r = -0.21 \), 95%CI -0.24 to -0.18, p-value not reported, \( Q_w = 321.84, p < 0.0001 \)

Excluding 21 outliers gave a similar effect, with homogenous results:

\( r = -0.20 \), 95%CI -0.23 to -0.17, \( Q_w = NS \)

*Subgroup analyses*

Greater association of executive dysfunction and negative symptoms were reported for antipsychotic treated patients vs. patients who were not receiving treatment;

Treated: 58 studies, \( r = -0.19 \), Untreated: 7 studies, \( r = -0.29 \)
Greater association of executive dysfunction and negative symptoms were reported for chronically hospitalized (persistent) patients vs. acutely ill patients;

Acutely ill: 19 studies, $r = -0.13$, Chronically ill: 35 studies, $r = -0.24$

$Q_B = 20.93, p = 0.0001$

No moderating effect of age: 80 studies, N not reported, $p = 0.71$

No moderating effect of duration of illness: 72 studies, N not reported, $p = 0.28$

All tasks showed a small to medium size association with negative symptoms:

Verbal fluency: 40 studies, $r = -0.27$, 95%CI -0.31 to -0.23

Trail-making tasks B: 24 studies, $r = -0.24$, 95%CI -0.29 to -0.18

WCST, set-switching: 43 studies, $r = -0.16$, 95%CI -0.20 to -0.13

Executive working memory: 13 studies, $r = -0.14$, 95%CI -0.22 to -0.07

Stroop/Hayling: 16 studies, $r = -0.13$, 95%CI -0.21 to -0.05

Significant between-group differences in effect sizes were reported between the cognitive tasks, with the association between negative symptoms and verbal fluency being the strongest and between negative symptoms and STROOP being the weakest.

$Q_B = 42.27, p < 0.001$

Small effect size suggests an association of reduced intellectual function with negative symptoms;

30 studies, N not reported, $r = -0.21$, 95%CI -0.26 to -0.17, $Q_w = $ not reported

Excluding 6 outliers did not change results: $r = -0.23$, 95%CI -0.28 to -0.17, $Q_w = $ not reported

<table>
<thead>
<tr>
<th>Consistency</th>
<th>Inconsistent where reported, apart from reduced overall analysis.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precision</td>
<td>Precise</td>
</tr>
<tr>
<td>Directness</td>
<td>Direct</td>
</tr>
<tr>
<td>Comparison 2</td>
<td>Association between executive impairment and disorganised symptoms in people with schizophrenia.</td>
</tr>
<tr>
<td>Summary of evidence</td>
<td>High quality evidence (consistent in overall analysis, precise, direct) shows a medium association of more impaired executive function in people with schizophrenia with increased</td>
</tr>
</tbody>
</table>
Signs and Symptoms – Cognitive Functioning Relating to Symptoms

disorganised symptoms. This association was increased in patients who were older, who had a longer duration of illness, who were untreated or who were chronically hospitalized. TMT-B task reports the strongest association.

Moderate quality evidence (unable to assess consistency, precise, direct) shows a weak association of lower IQ in people with schizophrenia with increased disorganised symptoms.

### Executive impairment and disorganised symptoms

**Overall executive impairment**

Small effect size suggests an association of reduced executive function with disorganised symptoms in people with schizophrenia;

40 studies, N not reported, \( r = -0.17 \), 95%CI -0.21 to -0.13, p-value not reported, \( Q_w = 148.14 \), \( p < 0.0001 \)

Excluding 8 outliers resulted in a medium effect with homogenous results:

\( r = -0.28 \), 95%CI -0.33 to -0.23, \( Q_w = \text{NS} \)

---

**Subgroup analyses**

Greater association of executive impairment with disorganised symptoms in older people with schizophrenia;

40 studies, N not reported, \( p = 0.05 \)

Greater association of executive impairment with disorganised symptoms in people with schizophrenia with a longer duration of illness;

36 studies, N not reported, \( p = 0.0006 \)

Greater association of executive dysfunction and disorganised symptoms were reported for neuroleptic treated patients;

Treated: 27 studies, \( r = -0.22 \), Untreated: 5 studies, \( r = -0.14 \)

\( Q_B = 4.09 \), \( p = 0.04 \)

Greater association of executive dysfunction and disorganised symptoms were reported for chronically hospitalized (persistent) patients;

Acutely ill: 11 studies, \( r = -0.12 \), Chronically ill: 16 studies, \( r = -0.28 \)

\( Q_B = 18.46 \), \( p = 0.0001 \)

---

**Task specific executive impairment**

All tasks showed a small to medium size association with disorganised symptoms;

Trail-making task B: 10 studies, \( r = -0.31 \), 95%CI -0.40 to -0.22
Signs and Symptoms – Cognitive Functioning Relating to Symptoms

Stroop/Hayling: 10 studies, $r = -0.29$, 95%CI -0.38 to -0.21  
WCST, set-shifting: 19 studies, $r = -0.19$, 95%CI -0.24 to -0.14  
Executive working memory: 6 studies, $r = -0.12$, 95%CI -0.23 to -0.00  
Verbal fluency: 18 studies, $r = -0.11$ 95%CI -0.17 to -0.05

Significant between-group differences in effect sizes were reported between the cognitive tasks, with the association between disorganised symptoms and trail-making B being the strongest and between disorganised symptoms and verbal fluency being the weakest.  
$Q_B = 33.71$, $p < 0.001$

**General intellectual impairment: IQ**

Small effect size suggests an association of reduced intellectual function with disorganised symptoms;  
N not reported, $r = -0.21$, 95%CI -0.28 to -0.14, $Q_w$ = not reported  
Excluding 2 outliers, $r = -0.28$, 95%CI -0.35 to -0.19, $Q_w$ = not reported

<table>
<thead>
<tr>
<th>Consistency</th>
<th>Consistent</th>
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</thead>
<tbody>
<tr>
<td>Precision</td>
<td>Precise</td>
</tr>
<tr>
<td>Directness</td>
<td>Direct</td>
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</table>

**Comparison 3**  
Association between executive impairment and positive symptoms in people with schizophrenia.

**Summary of evidence**  
Moderate quality evidence (inconsistent, precise, direct) suggests no association between executive functioning and positive symptoms.

**Executive impairment and positive symptoms**

**Overall executive impairment**

No association of reduced executive function with positive symptoms in people with schizophrenia;  
34 studies, N not reported, $r = -0.01$, 95%CI -0.04 to 0.05, p-value not reported, $Q_w = 321.84$, $p < 0.0001$  
Excluding 4 outliers did not change results  
$r = -0.02$, 95%CI -0.03 to 0.07, $Q_w$ = not reported

<table>
<thead>
<tr>
<th>Consistency</th>
<th>Inconsistent</th>
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<tbody>
<tr>
<td>Precision</td>
<td>Precise</td>
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</tbody>
</table>
Is semantic memory impaired in schizophrenia? A systematic review and meta-analysis of 91 studies

Doughty OJ, Done DJ

Cognitive Neuropsychiatry 2009; 14(6): 473-509

Semantic memory and symptom dimensions in people with schizophrenia.

Moderate to low quality evidence (direct, imprecise, unable to assess consistency) suggests more impaired performance in people with schizophrenia with formal thought disorder compared with people with schizophrenia without thought disorder on verbal fluency and naming tasks, with no consistent differences for semantic associations, categorisation or priming tasks.

The evidence also suggests more impaired performance in verbal fluency in people with schizophrenia with negative symptoms compared with people with schizophrenia without negative symptoms.

Semantic memory tasks

More impairment in people with thought disorder compared with people without thought disorder for:

- Verbal fluency: 3 studies reported a difference, $d = -1.12$, 95%CI -1.72 to -0.72, $p$ not reported
- Naming tests: 4 studies reported a difference, $d = -1.195$ vs. -0.73 (CIs not reported), $p = 0.046$

Inconsistent findings for:

- Semantic association: 1 study reported a difference, 1 study reported no difference (no statistics)
- Categorisation: 1 study reported a difference, 1 study reported no difference (no statistics)

No difference for:

- Semantic priming: 1 study reported no difference: $d = 0.126$ vs. $d = 0.202$, $p = 0.12$

More impairment in people with negative symptoms compared with people without negative symptoms in:
Verbal fluency: 2 studies, \( d = -1.006 \), 95%CI -1.43 to -0.58, \( p \) not reported

<table>
<thead>
<tr>
<th>Consistency</th>
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<tbody>
<tr>
<td>Precision</td>
<td>Imprecise</td>
</tr>
<tr>
<td>Directness</td>
<td>Direct</td>
</tr>
</tbody>
</table>

Fine C, Gardner M, Graigie J, Gold I

Hopping, skipping or jumping to conclusions? Clarifying the role of the JTC bias in delusions

Cognitive Neuropsychiatry 2007; 12(1): 46-77

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Comparison

Association between delusions and reasoning bias (jumping to conclusions – JTC) in people with schizophrenia with and without delusions.

Summary of evidence

Low quality evidence (direct, unable to assess consistency or precision) is unable to determine differences in reasoning bias between patients with schizophrenia with or without delusions.

Reasoning bias

1 study reported an association between JTC “extreme responding” and the presence of delusions in patients with schizophrenia. 3 studies reported no significant differences on “draws to decision”.

<table>
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</tr>
<tr>
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</tbody>
</table>

Forbes NF, Carrick LA, McIntosh AM, Lawrie SM

Working memory in schizophrenia: a meta-analysis
Signs and Symptoms – Cognitive Functioning Relating to Symptoms

**Psychological Medicine 2009; 39: 889-905**
*View review abstract online*

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Association between working memory and symptom dimensions in people with schizophrenia vs. controls.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary of evidence</td>
<td>Moderate to low quality evidence (direct, unable to assess consistency or precision) suggests that increased positive and negative symptoms may be associated with poorer performance on verbal list learning and digit span forwards and backwards tasks.</td>
</tr>
</tbody>
</table>

**Association between memory and symptoms**

Meta-regression suggests lower verbal list learning (list 1) was associated with increased **positive** ($b = 0.09$, $p = 0.035$) and **negative symptoms** ($b = 0.13$, $p = 0.019$). Digit span forwards and backwards combined was also associated with both increased positive ($b = 0.154$, $p < 0.001$) and negative symptoms ($b = 0.139$, $Z = 3.75$, $p < 0.001$). Number of studies and number of participants not reported.

<table>
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<td>Directness</td>
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</tbody>
</table>

**Henry JD, Crawford JR**

*A meta-analytic review of verbal fluency deficits in schizophrenia relative to other neurocognitive deficits*

*Cognitive Neuropsychiatry 2005; 10(1): 1-33*
*View review abstract online*

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Association between phonemic and semantic fluency and symptom dimensions in people with schizophrenia.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary of evidence</td>
<td>Moderate to low quality evidence (direct, unable to assess consistency or precision) suggests people with schizophrenia may show an association between greater phonemic fluency and reduced negative symptoms. No association was reported between symptoms and semantic fluency.</td>
</tr>
</tbody>
</table>
Phonemic fluency

A significant association is reported between better phonemic fluency and reduced overall symptoms (BPRS, 18 studies, $r = 0.57$, $p = 0.013$) and negative symptoms (SANS, 12 studies, $r = 0.70$, $p = 0.011$) but not positive symptoms (SAPS, 11 studies, $r = 0.17$, $p = 0.626$).

Semantic fluency

No association was reported between semantic fluency and overall symptoms on BPRS (10 studies, $r = 0.23$, $p = 0.531$) or negative symptoms on SANS (5 studies, $r = 0.54$, $p = 0.347$).

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</tr>
<tr>
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<td>Direct</td>
</tr>
</tbody>
</table>

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; 37(6): 1318-1326

View review abstract online

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Association between cognitive functioning and symptom dimensions in older people with schizophrenia (mean age 64 years).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary of evidence</td>
<td>Moderate quality evidence (unable to assess consistency or precision, direct) suggests that older people with schizophrenia may show an association between poorer global cognition and increased positive and negative symptoms.</td>
</tr>
</tbody>
</table>

Global cognition

Greater global cognitive impairment was significantly associated with both increased severity of positive and negative symptoms (measured by PANSS) in older people with schizophrenia;

Positive symptoms: 7 studies, $p < 0.01$
Negative symptoms: 7 studies, $p < 0.01$
Signs and Symptoms – Cognitive Functioning Relating to Symptoms

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<tr>
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<td>Direct</td>
</tr>
</tbody>
</table>

**Johnson-Selfridge M, Zalewski C**

**Moderator variables of executive functioning in schizophrenia: meta-analytic findings**

*Schizophrenia Bulletin* 2001; 27(2): 305-316

[View review abstract online](#)

**Comparison**

Association between executive functioning and symptom severity in people with schizophrenia vs. controls.

**Summary of evidence**

Moderate quality evidence (direct, unable to assess consistency or precision, large sample) suggests that poorer executive functioning may be associated with greater symptom severity.

**Executive functioning**

*Meta-regression reports a significant, medium size effect of increased symptom severity on increased effect sizes between schizophrenia and controls;*

Higher **negative and positive symptom** ratings on the SANS (10 studies, $r = -0.69$) and SAPS (9 studies, $r = -0.67$) was associated with greater impairment in people with schizophrenia compared with controls; $p < 0.05$. No significant association was reported between effect sizes and BPRS scores (15 studies, $r = -0.11$).

<table>
<thead>
<tr>
<th>Consistency</th>
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<tbody>
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<td>Precision</td>
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</tr>
<tr>
<td>Directness</td>
<td>Direct</td>
</tr>
</tbody>
</table>

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

**Face emotion perception in schizophrenia: A meta-analytic review**
Signs and Symptoms – Cognitive Functioning Relating to Symptoms

Schizophrenia Bulletin 2010; 36(5): 1009-1019
View review abstract online

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Association between facial emotion perception and symptom severity in people with schizophrenia vs. controls.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary of evidence</td>
<td>Moderate quality evidence (direct, precise, inconsistent) suggests impaired facial emotion perception in people with schizophrenia compared with controls. The results also suggest that impairment in facial emotion perception may be associated with greater symptom severity (but not PANSS).</td>
</tr>
</tbody>
</table>

Facial emotion processing

A large effect size suggests overall impaired facial emotion identification and differentiation in people with schizophrenia compared with controls;

Number of studies is unclear, N = 3822, $d = -0.91$, 95%CI -0.97 to -0.84, $Q_B = 275.7$, $p < 0.001$

A significant association was reported between impaired facial emotion perception and greater overall symptom severity (BPRS), negative symptoms (SANS) and positive symptoms (SAPS):

- SANS: 20 studies, Z = -4.13, $p < 0.001$
- SAPS: 18 studies, Z = -4.48, $p < 0.001$
- BPRS: 6 studies, Z = -3.08, $p = 0.002$

No association was found for PANSS positive, negative or total symptom scores

Consistency | Inconsistent for overall comparison, unable to assess subgroups

Precision | Precise

Directness | Direct

Lincoln TM, Lüllmann E, Rief W

Correlates and long-term consequences of poor insight in patients with schizophrenia. A systematic review

View review abstract online
## Signs and Symptoms – Cognitive Functioning Relating to Symptoms

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Association between insight and symptoms in people with schizophrenia.</th>
</tr>
</thead>
</table>

### Summary of evidence

Moderate to low quality evidence (direct, unable to assess consistency or precision) suggests that people with schizophrenia may show an association between increased insight and reduced symptom severity, but worse depressive symptoms.

### Insight, symptoms and hospitalisation

- **8 studies (N = 1157)** reported a significant association between poorer insight and increased symptom severity (general psychopathology, BPRS scores, positive, negative and depressive symptoms and anxiety).
- **1 study (N = 74)** reported an association between poorer insight regarding treatment and increased rehospitalisation, but no association between insight regarding mental health status and rehospitalisation.
- **3 studies (N = 175)** reported no association between insight, symptoms and rehospitalisation.

### Insight and depression

- **4 studies (N = 512)** reported an association between increased insight and increased depressive symptoms, lower self-esteem (2 studies, N = 362) and positive and negative symptoms (1 study, N = 100).
- **1 study (N = 101)** first-episode schizophrenia/ schizoaffective reported an association between greater insight and increased depression and suicide at follow-up when using the Birchwood Scale, but no association using the PANSS.
- **1 study (N = 980)** reported an association between increased insight and increased suicide events, but no association with depression. Increased insight as a function of treatment was associated with decreased risk of suicide.
- **1 study (N = 33)** reported an association between lower insight/awareness of symptoms and increased depression ($r = -0.46 \text{ to } -0.58$).
- **1 study (N = 74)** reported no association between insight and suicidal tendency during a 1 year follow-up.

### Consistency

Unable to assess

### Precision

Unable to assess

### Directness

Direct
## Signs and Symptoms – Cognitive Functioning Relating to Symptoms

*Mintz A, Dobson K, Romney D*

**Insight in schizophrenia: a meta-analysis**

*Schizophrenia Research* 2003; 61: 75-88

View review abstract online

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Association between insight (patient’s awareness of the disorder) and symptom dimensions in people with schizophrenia.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary of evidence</td>
<td>Moderate to high quality evidence (some inconsistency, some imprecision, direct) suggests increased global, positive and negative symptoms may be related to lower levels of insight of the disorder and its consequences. Conversely, increased depression is related to increased levels of insight.</td>
</tr>
</tbody>
</table>

### Global symptoms

*A medium negative association suggests that as global symptoms increase in patients with schizophrenia, they may demonstrate less overall insight;*

19 studies, N = 1361: $r = -0.27$, $p < 0.001$, 95%CI -0.41 to -0.13, $Q_w$ = not reported, $p > 0.05$

*And less insight for the following components;*

- **Awareness of mental disorder:** 8 studies, N = 742, $r = -0.20$, $p < 0.001$, 95%CI -0.54 to 0.13, $Q_w$ = 31.24, $p < 0.001$

- **Awareness of social consequences:** 2 studies, N = 251, $r = -0.27$, $p < 0.001$, 95%CI -0.27 to -0.27, $Q_w$ = non-significant

- **Awareness of need for treatment:** 4 studies, N = 323, $r = -0.25$, $p < 0.001$, 95%CI -0.25 to -0.25, $Q_w$ = non-significant

- **Awareness of symptoms:** 2 studies, N = 108, $r = -0.41$, $p < 0.001$, 95%CI -0.61 to -0.22, $Q_w$ = non-significant

- **Attribution of symptoms:** 2 studies, N = 108, $r = -0.21$, $p < 0.05$, 95%CI -0.43 to 0.01, $Q_w$ = non-significant

- **Composite of awareness of mental disorder, awareness of social consequences of disorder and awareness of need for treatment:** 14 studies, N = 926, $r = -0.24$, $p < 0.001$, 95%CI -0.54 to 0.06, $Q_w$ = 38.01, $p < 0.001$

### Positive symptoms

*A medium negative association suggests that as positive symptoms increase in patients with schizophrenia, they demonstrate less overall insight;*
Signs and Symptoms – Cognitive Functioning Relating to Symptoms

**schizophrenia, they may demonstrate less overall insight;**

22 studies, N = 1616,  \( r = -0.25, \ p < 0.001, 95\% \text{CI} -0.64 \text{ to } 0.13, Q_w = 92.32, p < 0.001 \\

Note: Subgroup analysis suggests that this relationship was strongest in samples that were comprised of a large percentage of acutely psychotic patients.

**And less insight for the following components:**

- **Awareness of mental disorder:** 9 studies, N = 686,  \( r = -0.32, \ p < 0.001, 95\% \text{CI} -0.68 \text{ to } 0.04, Q_w = 37.59, p < 0.001 \\

- **Awareness of social consequences:** 3 studies, N = 191,  \( r = -0.33, \ p < 0.001, 95\% \text{CI} -0.33 \text{ to } -0.33, Q_w = \text{non-significant} \\

- **Awareness of the need for treatment:** 2 studies, N =136,  \( r = -0.31, \ p < 0.001, 95\% \text{CI} -0.31 \text{ to } -0.31, Q_w = \text{non-significant} \\

- **Awareness of symptoms:** 3 studies, N = 100,  \( r = -0.23, \ p < 0.01, 95\% \text{CI} -0.23 \text{ to } -0.23, Q_w = \text{non-significant} \\

- **Attribution of symptoms to disorder:** 3 studies, N = 146,  \( r = -0.16, \ p < 0.05, 95\% \text{CI} -0.39 \text{ to } 0.15, Q_w = 15.28, p < 0.001 \\

Composite of awareness of mental disorder, awareness of social consequences of disorder and awareness of need for treatment: 9 studies, N = 807,  \( r = -0.18, \ p < 0.001, 95\% \text{CI} -0.35 \text{ to } 0.00, Q_w = 16.02, p < 0.05 \\

**Negative symptoms**

A medium negative association suggests that as negative symptoms increase in patients with schizophrenia, they may demonstrate less overall insight;

20 studies, N = 1487,  \( r = -0.23, \ p < 0.001, 95\% \text{CI} -0.48 \text{ to } 0.02, Q_w = 47.69, p < 0.001 \\

Note: Subgroup analysis suggests that this relationship was strongest in patients with an older age of onset of the disorder.

**And less insight for the following components:**

- **Awareness of mental disorder:** 8 studies, N = 619,  \( r = -0.20, \ p < 0.001, 95\% \text{CI} -0.45 \text{ to } 0.04, Q_w = 18.63, p < 0.01 \\

- **Awareness of social consequences:** 2 studies, N = 125,  \( r = -0.40, \ p < 0.001, 95\% \text{CI} -0.40 \text{ to } -0.40, Q_w = \text{non-significant} \\

- **Awareness of need for treatment:** 2 studies, N = 136,  \( r = -0.40, \ p < 0.001, 95\% \text{CI} -0.40 \text{ to } -0.40, Q_w = \text{non-significant} \\

- **Attribution of symptoms:** 3 studies, N = 146,  \( r = -0.33, \ p < 0.001, 95\% \text{CI} -0.33 \text{ to } -0.33, Q_w = \text{non-significant} \\

**No significant association was reported between awareness of symptoms and negative symptoms:**

2 studies, N = 71,  \( r = -0.16, \ p > 0.05, 95\% \text{CI} -0.16 \text{ to } -0.16, Q_w = \text{non-significant}
Signs and Symptoms – Cognitive Functioning Relating to Symptoms

<table>
<thead>
<tr>
<th>Composite of awareness of mental disorder, awareness of social consequences of disorder and awareness of need for treatment: 11 studies, N = 800, r = -0.29, p &lt; 0.001, 95%CI -0.63 to 0.04, Q_w = 38.68, p &lt; 0.001</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Depressive symptoms</strong></td>
</tr>
<tr>
<td>A weak positive association suggests that as depressive symptoms increase in patients with schizophrenia, they may demonstrate more overall insight; 15 studies, N = 1218, r = 0.18, p &lt; 0.001, 95%CI -0.14 to 0.49, Q_w = 48.63, p &lt; 0.001</td>
</tr>
<tr>
<td>And less insight for the following components;</td>
</tr>
<tr>
<td>Awareness of mental disorder: 7 studies, N = 579, r = 0.11, p &lt; 0.01, 95%CI -0.24 to 0.46, Q_w = 26.14, p &lt; 0.001</td>
</tr>
<tr>
<td>Awareness of social consequences: 2 studies, N = 121, r = 0.21, p &lt; 0.01, 95%CI -0.09 to 0.52, Q_w = 5.14, p &lt; 0.05</td>
</tr>
<tr>
<td>Awareness of need for treatment: 3 studies, N = 236, r = 0.16, p &lt; 0.01, 95%CI 0.16 to 0.16, Q_w = non-significant</td>
</tr>
<tr>
<td>Awareness of symptoms: 4 studies, N = 215, r = 0.39, p &lt; 0.001, 95%CI 0.39 to 0.39, Q_w = non-significant</td>
</tr>
<tr>
<td>Attribution of symptoms to disorder: 4 studies, N = 175, r = 0.21, p &lt; 0.01, 95%CI -0.16 to 0.60, Q_w = 11.26, p &lt; 0.05</td>
</tr>
<tr>
<td>Composite of awareness of mental disorder, awareness of social consequences of disorder and awareness of need for treatment: 6 studies, N = 545, r = 0.20, p &lt; 0.001, 95%CI 0.01 to 0.40, Q_w = 12.25, p &lt; 0.01</td>
</tr>
</tbody>
</table>

**Consistency**
Inconsistent for all measures except for awareness of social consequences for global, positive and negative symptoms; awareness of the need for treatment for all symptoms; awareness of symptoms for all symptoms; and attribution of symptoms for global and negative symptoms.

**Precision**
Precise for all measures except the composite measure for global and negative symptoms; overall insight for positive and depressive symptoms; awareness of the mental disorder for positive and depressive symptoms; attribution of symptoms to the disorder for positive and depressive symptoms; and awareness of social consequences for depressive symptoms.

**Directness**
Direct

*Nieuwenstein M, Aleman A, de Haan E*
## Relationship between symptom dimensions and neurocognitive functioning in schizophrenia: a meta-analysis of WCST and CPT studies

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| Comparison | Association between executive functioning, sustained attention and symptom dimensions in people with schizophrenia.  
**Note:** For WCST-PE, positive correlations indicate an association between increased symptoms and worse performance, and for the CPT-\(d\)'s, positive correlations indicated increased symptoms were associated with better performance. |
|---|---|
| **Summary of evidence** | High quality evidence (direct, consistent, precise) shows a medium association between increased negative or disorganised symptoms and impaired executive functioning and a medium association between negative symptoms and impaired attention.  
No significant association is reported with positive symptoms or reality distortion or between attention and disorganised symptoms. |
| **Negative symptoms** | A medium positive association suggests that as negative symptoms increase in patients with schizophrenia, they may demonstrate more perseveration errors on the WCST-PE;  
15 studies, \(N = 699\), \(r = 0.27\), 95%CI 0.13 to 0.40, \(p < 0.01\), \(Q_w = 18.9\), \(p > 0.10\)  
A medium negative association suggests that as negative symptoms increase in patients with schizophrenia, they may also demonstrate worse performance on the CPT-\(d\);  
6 studies, \(N = 250\), \(r = -0.31\), 95%CI -0.41 to 0.21, \(p < 0.01\), \(Q_w = 6.8\), \(p > 0.10\) |
| **Disorganised symptoms** | A medium positive association suggests that as disorganised symptoms increase in patients with schizophrenia, they may demonstrate more perseveration errors on the WCST-PE;  
6 studies, \(N = 273\), \(r = 0.25\), 95%CI 0.24 to 0.26, \(p < 0.01\), \(Q_w = 6.0\), \(p > 0.10\)  
No significant association was reported between disorganised symptoms and attention on CPT-\(d\);  
2 studies, \(N = 98\), \(r = -0.06\), 95%CI -0.04 to 0.08, \(p > 0.05\), \(Q_w = 1.1\), \(p > 0.10\) |
| **Positive symptoms** | --- |
**Signs and Symptoms – Cognitive Functioning Relating to Symptoms**

<table>
<thead>
<tr>
<th>No association was reported between positive symptoms and executive functioning on the WCST-PE;</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 studies, N = 487, r = 0.06, 95%CI -0.15 to 0.27, p &gt; 0.05, Q_w = 13.3, p &gt; 0.10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No association was reported between positive symptoms and attention on the CPT-d;</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 studies, N = 188, r = -0.01, 95%CI -0.10 to 0.09, p &gt; 0.05, Q_w = 4.5, p &gt; 0.10</td>
</tr>
</tbody>
</table>

**Reality distortion**

<table>
<thead>
<tr>
<th>No significant association reported between reality distortion symptoms and executive functioning on the WCST-PE;</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 studies, N = 194, r = 0.04, 95%CI -0.22 to 0.30, p &gt; 0.05, Q_w = 7.4, p &gt; 0.10</td>
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</tbody>
</table>

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<thead>
<tr>
<th>No significant association was reported between reality distortion symptoms and attention on CPT-d;</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 studies, N = 98, r = 0.04, 95%CI 0.02 to 0.06, p &gt; 0.05, Q_w = 0.0, p &gt; 0.10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consistency</th>
<th>Consistent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precision</td>
<td>Precise</td>
</tr>
<tr>
<td>Directness</td>
<td>Direct</td>
</tr>
</tbody>
</table>

**Palmer BW, Savla GN**

**The association of specific neuropsychological deficits with capacity to consent to research or treatment**


**View review abstract online**

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Association between neuropsychological performance and capacity to consent to treatment and research in people with schizophrenia spectrum disorders, in terms of their understanding of the information; appreciation of the context; and reasoning of the consequences of their decision.</th>
</tr>
</thead>
</table>

| Summary of evidence | Moderate to low quality evidence (direct, unable to assess precision or consistency, mostly small samples) suggests that impaired understanding and appreciation were more consistently associated with more severe psychopathology, particularly negative symptoms, in people with schizophrenia |
### Neuropsychological performance

Five studies (N = 1680) examined the association between an individual’s capacity to consent, and their neuropsychological performance. Capacity to consent was assessed in terms of understanding, appreciation and reasoning, in the context of consent to either treatment or research.

**Understanding** was significantly associated with symptom severity;

- 3 of 5 studies reported a very small but significant negative association between understanding and severity of general psychopathology, N = 1542, $r = -0.06$ to $-0.48$, $p < 0.05$
- 3 of 4 studies reported a small, significant negative association between understanding and negative symptom severity, N = 1542, $r = -0.14$ to $-0.50$, $p < 0.05$
- 1 of 5 studies reported a medium-size significant negative association between understanding and positive symptom severity, N = 30, $r = -0.38$. $p < 0.05$

**Appreciation** was significantly associated with symptom severity;

- 2 of 5 studies reported a significant negative association between appreciation and severity of general psychopathology, N = 1472, $r = -0.06$ to $-0.47$, $p < 0.05$
- 1 of 4 studies reported a small but significant negative association between appreciation and negative symptom severity, N = 1447 schizophrenia, $r = -0.12$, $p < 0.01$
- 1 of 5 studies reported a medium-size significant negative association between appreciation and positive symptom severity, N = 30, $r = -0.37$. $p < 0.01$

**Reasoning** was significantly associated with symptom severity;

- 1 of 5 studies reported a significant large negative association between reasoning and general psychopathology, N = 30, $r = -0.47$, $p < 0.05$
- 1 of 4 studies reported a small but significant negative association between reasoning and negative symptom severity, N = 1447 schizophrenia, $r = -0.09$, $p < 0.001$
- 1 of 5 studies reported a significant large negative association between reasoning and positive symptom severity, N = 30, $r = -0.52$, $p < 0.05$

<table>
<thead>
<tr>
<th>Consistency</th>
<th>Unable to assess – authors report inconsistent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precision</td>
<td>Unable to assess</td>
</tr>
<tr>
<td>Directness</td>
<td>Direct</td>
</tr>
</tbody>
</table>

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Pelletier M, Achim AM, Montoya A, Lal S, Lepage M

**Cognitive and clinical moderators of recognition memory in schizophrenia:**
Signs and Symptoms – Cognitive Functioning Relating to Symptoms

**a meta-analysis**

*Schizophrenia Research* 2005; 74: 233-252

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Association between recognition memory and symptoms in people with schizophrenia vs. controls.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary of evidence</td>
<td>Moderate quality evidence (direct, unable to assess consistency or precision, large samples) suggests no association between performance on recognition tasks and symptoms.</td>
</tr>
</tbody>
</table>

**Recall memory and symptoms**

*No association between symptoms and effect sizes of recognition memory performance by schizophrenia vs. controls;*

- **Positive symptoms**
  - SAPS global ratings: 10 studies, N = 918, p = 0.12
  - SAPS total items: 7 studies, N = 370, p = 0.44
  - PANSS positive scale: 6 studies, N = 395, p = 0.052

- **Negative symptoms**
  - SANS global ratings: 10 studies, N = 918, p = 0.07
  - SANS total items: 8 studies, N = 374, p = 0.34
  - PANSS negative scale: 6 studies, N = 395, p = 0.17

- **Overall symptoms**
  - BRPS: 16 studies, N = 1158, p = 0.13
  - PANSS overall: 8 studies, N = 549, p = 0.06

<table>
<thead>
<tr>
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<tr>
<td>Directness</td>
<td>Direct</td>
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</tbody>
</table>

*Pickup GJ*

**Relationship between Theory of Mind and executive functioning in**
### Signs and Symptoms – Cognitive Functioning Relating to Symptoms

<table>
<thead>
<tr>
<th>Comparison</th>
<th>The association between Theory of Mind (ToM), executive functioning and symptoms in people with schizophrenia vs. controls (healthy and various control groups).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary of evidence</td>
<td>Moderate to low quality evidence (unable to assess consistency or precision) suggests impaired performance on various Theory of Mind and executive functioning tasks may be associated with greater overall symptoms severity.</td>
</tr>
</tbody>
</table>

### Association with symptoms

Poorer ToM 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).

However, two studies reported that ToM 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).

Poorer executive function was associated with increased negative thought disorder (1 study, N = 45). No association between executive functioning and symptom severity (2 studies, N = 93).

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</tr>
</tbody>
</table>

**Pomarol-Clotet E, Oh TM, Laws KR, McKenna PJ**

**Semantic priming in schizophrenia: systematic review and meta-analysis**
### Comparison

Semantic priming in people with schizophrenia with or without thought disorder vs. controls.

| Summary of evidence | High quality evidence (direct, consistent, precise) shows no effect of overall priming in schizophrenia. Moderate quality evidence (inconsistent) suggests a small effect of increased semantic priming, but only in patients with thought disorder. |

### Priming

**No difference in overall priming in people with schizophrenia (with or without thought disorder) compared with controls:**

- 36 studies, $d = 0.07$, 95%CI -0.02 to 0.16, $Q_w = 59.92$, $p = 0.008$

Authors state that excluding two outliers gave similar results but reduced heterogeneity to NS

**A small effect size suggests significantly increased semantic priming in people with schizophrenia with thought disorder compared with controls:**

- 18 studies, $d = 0.16$, 95%CI 0.01 to 0.31, $Q_w = 52.31$, $p < 0.001$

**People with schizophrenia without thought disorder vs. controls:**

- 14 studies, $d = 0.00$, 95%CI -0.15 to 0.16, $Q_w = 21.29$, $p = 0.07$

**People with schizophrenia with thought disorder vs. people with schizophrenia without thought disorder:**

- 13 studies, $d = 0.06$, 95%CI -0.12 to 0.24, $Q_w = 28.79$, $p = 0.004$

**A small effect size suggests significantly increased indirect semantic priming in people with schizophrenia (with or without thought disorder) compared with controls:**

- 9 studies, $d = 0.19$, 95%CI 0.03 to 0.36, $Q_w = 4.67$, $p = 0.80$

**A medium effect size suggests significantly increased indirect semantic priming in people with schizophrenia with thought disorder compared with controls:**

- 6 studies, $d = 0.56$, 95%CI 0.31 to 0.80, $Q_w = 7.74$, $p = 0.17$

A significant difference was reported between patients with thought disorder compared with controls for short Stimulus Onset Asynchronicity (SOA) (10 studies, $d = 0.25$) and long SOA (7 studies, $d = -0.14$), $Q_B = 6.33$, $p = 0.01$.

A trend difference between patients with thought disorder compared with patients without thought disorder for short SOA (8 studies, $d = 0.15$) and long SOA (6 studies, $d = -0.17$), $Q_B = 3.39$, $p = 0.06$.  

Signs and Symptoms – Cognitive Functioning Relating to Symptoms

Age and duration of illness showed no effect.

<table>
<thead>
<tr>
<th>Consistency</th>
<th>Consistent for overall priming (without outliers) and indirect semantic priming.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precision</td>
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<tr>
<td>Directness</td>
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</table>

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

Association between cognitive functioning and symptoms dimensions in people with schizophrenia aged over 50 years (late-life schizophrenia, LLS).

Summary of evidence

Low quality evidence (1 observational study, unable to assess consistency or precision, direct) is unclear about associations between cognitive deficits and positive and negative symptoms in late-life schizophrenia.

Negative symptoms

One study (N = 330) reported that people with LLS performed more poorly than ethnic and premorbid functioning matched controls and that increased negative symptoms in patients correlated with poor performance on all measures of the CERAD (animal fluency, BNT, Praxis, word-list learning, recall and recognition).

Positive symptoms

One study (N = 330) reported that people with LLS performed more poorly than ethnic and premorbid functioning matched controls and that increased positive symptoms in patients correlated with poor performance on praxis (practicing).

<table>
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<tr>
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<tbody>
<tr>
<td>Precision</td>
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</tbody>
</table>
Reinharth J, Reynolds G, Dill C, Serper M

Cognitive predictors of violence in schizophrenia: a meta-analytic review

Schizophrenia Research, Cognition 2014; 1: 1101-111

View review abstract online

Comparison

Association between aggression and cognition in people with a psychotic disorder (inpatients or outpatients). 85.9% of the sample had a diagnosis of a psychotic disorder; ~70% had schizophrenia or schizoaffective disorder.

Summary of evidence

Moderate quality evidence (inconsistent, precise, direct, large samples) suggests a small, decreased risk of aggression with better cognitive performance. High quality evidence (consistent) suggests this effect is apparent for global cognition and insight. There were no significant relationships with memory, attention, executive functioning or visual-spatial reasoning (trend effect).

Aggression

Small, decreased risk of aggression with better cognitive performance;
29 studies, N = 4,764, OR 0.59, 95%CI 0.51 to 0.67, p < 0.05, I² = 63.72, p < 0.05

Subgroup analyses showed similar effect sizes according to;
Combined measures of insight, general cognition, attention, visual-spatial reasoning, memory, motor functioning and processing speed: 19 studies, N = 3,507, OR 0.72, 95%CI 0.63 to 0.82, p < 0.05, I² < 25%, p > 0.05
Global cognition: 11 studies, N = 732, OR 0.61, 95%CI 0.47 to 0.80, p < 0.05, I² < 25%, p > 0.05
Insight: 5 studies, N = 2,422, OR 0.72, 95%CI 0.61 to 0.86, p < 0.05, I² < 50%, p > 0.05

Small, increased risk of aggression with better motor functioning;
Motor functioning: 4 studies, N = 370, OR 1.52, 95%CI 1.03 to 2.24, p < 0.05, I² < 25%, p > 0.05
Authors report no significant relationships between aggression and executive functioning (r = 0.01, p > 0.05) visual-spatial reasoning (r = -0.13, p = 0.06), memory (r = -0.09, p > 0.05) or attention (r = -0.08, p > 0.05).

Authors report no publication bias
Consistency in results | Consistent for subgroup analyses only
---|---
Precision in results | Precise apart from motor functioning
Directness of results | 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 | Association between performance on Theory of Mind (ToM) and reasoning bias tasks and symptoms in people with schizophrenia.
---|---
Summary of evidence | Moderate quality evidence (direct, unable to assess precision, appears consistent) suggests performance on Theory of Mind tasks may be associated with negative and total scores on the PANSS and SANS, with positive symptoms showing a weaker association.

Moderate to low quality evidence (direct, unable to assess precision, appears inconsistent) suggests performance on Theory of Mind stories may be related to delusional outcome (preoccupation and distress).

Moderate quality evidence (direct, unable to access precision, mostly consistent, large samples) suggests an associated between more severe positive symptoms (usually delusions) and greater belief inflexibility, internalizing, externalizing and personalizing attribution bias.

Low quality evidence (direct, unable to access precision, appears inconsistent, small samples) is unable to determine any clear relationships between JTC or evidence evaluation and schizophrenia, nor the effects of antipsychotics on JTC or attribution style.

Theory of Mind and symptom severity
1 observational study, N = 128 (medication not reported), measured performance on a hinting task. ToM 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 computerised mental inference task. Affective ToM was associated with negative symptoms (SANS alogia, SANS attention and SANS total symptoms), whereas cognitive ToM was associated with positive symptoms (PANSS). The authors concluded that ToM 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. ToM performance correlated with PANSS negative symptoms, general and total score, but not positive score on the PANSS.

1 observational study, N = 128 (39 currently paranoid, 29 remitted paranoid, 27 non-psychotic depressed, 33 healthy controls), measured performance on ToM stories. Patients with persecutory delusions scored lower on the ToM task. Performance on ToM stories correlated significantly with delusional preoccupation and distress, but the picture-sequencing task did not and there was no correlation with antipsychotic dosage.

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 ToM questionnaire. No group differences, authors concluded that ToM performance was not related to severity of delusions, which could be due to the small sample.

**Jumping to conclusions, attributional style, belief flexibility and evidence evaluation**

**Jumping to conclusions (JTC)**

1 longitudinal study (N = 19 with current hallucinations or delusions) reported that greater delusion symptom scores were associated with poorer performance on the fish task with earlier termination of information gathering.

1 observational study (N = 81: 23 with delusions, 22 psychiatric controls, 36 healthy controls) reported that greater positive and delusional symptoms were associated with fewer beads drawn, and anxiety disorder was associated with a greater number of beads drawn on the Beads task.

1 observational study (N = 100 with current delusions) reported a trend effect of greater positive and delusional symptoms (measured by PANSS) being associated with poorer performance on the Beads task.

No association was reported between severity of delusional symptoms and change in number of beads drawn.
Signs and Symptoms – Cognitive Functioning Relating to Symptoms

‘draws to decision’ (1 observational study, N = 19), or JTC performance (1 observational study, N = 128 with schizophrenia, and 1 longitudinal study N = 55: 17 with delusions, 18 psychiatric controls, 20 controls).

**Attribution style**

1 observational study (N = 81: 23 with delusions, 22 psychiatric controls, 36 healthy controls) reported that deluded patients made significantly more internalizing attributions than healthy controls. Patients with “bad me” delusions showed the greatest self-serving bias and patients with “poor me” delusions showed a depressive attributional style. No association was reported between attribution style and clinical measures at baseline.

1 observational study (N = 136: 40 with acute delusions, 25 with remitted delusions, 35 depressed, 36 healthy controls) reported that people with acute delusions showed significantly greater personalizing bias than patients with remitted delusional symptoms. All patients with delusions (acute or remitted) showed externalizing bias for negative events. Greater attribution bias was significantly associated with increased symptom severity.

1 observational study (N = 71 with schizophrenia) reported that people with increased persecutory and grandiose beliefs showed greater externalizing attribution for negative events.

1 longitudinal study (N = 55: 17 with delusions, 18 psychiatric controls, 20 healthy controls) reported an increase in self-serving bias at follow-up across all groups.

1 observational study (N = 86 with schizophrenia) reported that greater overall psychopathology was associated with less externalizing bias, however no association was reported between externalizing or internalizing bias and delusions specifically.

**Belief flexibility**

1 observational study (N = 100 with current delusions) reported that poorer belief flexibility was associated with greater delusional symptoms. No association was reported between belief flexibility and severity of psychosis.

1 observational study (N = 100 with current delusions) reported that poorer belief flexibility was associated with greater delusional symptoms and hallucinations (measured by PANSS). No association was reported between belief flexibility and negative or general symptoms.

1 observational study (N = 76: 36 with active delusions, 16 with remitted delusions, 24 healthy controls) reported that patients with active delusions were less responsive to disconfirmatory evidence than remitted patients.

1 observational study (N = 69: 17 with delusions, 17 without delusions, 35 healthy controls) reported that the deluded and non-deluded groups showed poorer belief flexibility compared with controls, with only the comparison between non-deluded and controls reaching significance. No association was reported between groups on personally meaningful beliefs.

**Evidence evaluation**

1 longitudinal study (N = 95: 29 schizophrenia, 31 anxious, 35 healthy controls) reported no association between individual psychiatric symptom severity and performance on a probability judgment task, however the effect of confirmatory and disconfirmatory evidence on probability judgment was stronger in remitted patients than non-remitted patients.
### Consistency
Unable to assess

### Precision
Unable to assess

### Directness
Direct

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**Ventura J, Helleman GS, Thames AD, Koellner V, Nuechterlein KH**

**Symptoms as mediators of the relationship between neurocognition and functional outcome in schizophrenia: a meta-analysis.**

*Schizophrenia Research* 2009; 113(2-3): 189-99

[View review abstract online](#)

### Comparison
Association between positive, negative symptoms and cognitive functioning in people with schizophrenia.

### Summary of evidence
Moderate quality evidence (large samples, direct, inconsistent, unable to assess precision) suggests that increased negative symptoms (but not positive symptoms) are significantly associated with reduced global cognitive functioning, working memory, speed of processing, verbal learning and memory, reasoning and problem solving, attention, and visual learning and memory.

### Positive Symptoms

*No significant association was reported between positive symptom severity and overall cognitive functioning;*

- 25 studies, N = 1297, $r = -0.00$, $p = 0.97$

*Individual domains of cognitive function also failed to show any significant association with positive symptom severity;*

- Working memory: 8 studies, N = 357, $r = -0.03$, $p = 0.54$
- Speed of processing: 18 studies, N = 1040, $r = 0.04$, $p = 0.21$
- Verbal learning and memory: 10 studies, N = 531, $r = 0.00$, $p = 0.93$
- Reasoning and problem solving: 16 studies, N = 797, $r = 0.00$, $p = 0.94$
- Attention / vigilance: 4 studies, N = 199, $r = -0.10$, $p = 0.15$
- Visual learning and memory: 4 studies, N = 197, $r = -0.10$, $p = 0.20
**Negative Symptoms**

*Medium effect size suggests a significant association between increased negative symptom severity and reduced overall cognitive functioning;*

<table>
<thead>
<tr>
<th>Consistency</th>
<th>Authors report all results are inconsistent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precision</td>
<td>Unable to assess</td>
</tr>
<tr>
<td>Directness</td>
<td>Direct</td>
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</table>

53 studies, $N = 4929$, $r = -0.24$, $p < 0.01$

*Small effect sizes suggest a significant relationship between increased negative symptoms and poorer cognitive performance in;*

| Working memory: 17 studies, $N = 2230$, $r = -0.21$, $p < 0.01$ |
| Speed of processing: 33 studies, $N = 3899$, $r = -0.26$, $p < 0.01$ |
| Verbal learning and memory: 23 studies, $N = 2978$, $r = -0.21$, $p < 0.01$ |
| Reasoning and problem solving: 27 studies, $N = 3039$, $r = -0.13$, $p < 0.01$ |
| Attention/vigilance: 10 studies, $N = 2138$, $r = -0.17$, $p < 0.01$ |
| Visual learning and memory: 8 studies, $N = 454$, $r = -0.16$, $p < 0.01$ |

*Ventura J, Thames AD, Wood RC, Guzik LH, Hellemann G*

**Disorganisation and reality distortion in schizophrenia: a meta-analysis of the relationship between positive symptoms and neurocognitive deficits**

_Schizophrenia Bulletin 2010; 121(1-3): 1-14_  
[View review abstract online](#)

**Comparison**  
Association between reality distortion, disorganised symptoms and cognitive functioning in people with schizophrenia.

**Summary of evidence**  
Moderate to high quality evidence (direct, large sample, inconsistent, precise) suggests a small effect that overall reduced cognitive functioning may be associated with both disorganised and reality distortion symptoms. Disorganised symptoms may be specifically associated with reductions in attention/vigilance, reasoning and problem solving, speed of processing, verbal memory, working memory and visual memory. Reality distortion may be specifically associated with
Signs and Symptoms – Cognitive Functioning Relating to Symptoms

<table>
<thead>
<tr>
<th>Disorganised symptoms and reality distortion combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small effect size suggests a significant relationship between increased disorganised symptoms and reality distortion combined, and reduced cognitive functioning;</td>
</tr>
<tr>
<td>40 studies, N = 4654, ( r = -0.05 ), ( p &lt; 0.01 ), CI not reported</td>
</tr>
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<table>
<thead>
<tr>
<th>Disorganised symptoms</th>
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</thead>
<tbody>
<tr>
<td>Medium effect size suggests a significant association between increased disorganised symptoms and reduced overall cognitive functioning;</td>
</tr>
<tr>
<td>69 studies, N = 4002, ( r = -0.23 ), 95%CI -0.26 to -0.20, ( p &lt; 0.01 )</td>
</tr>
<tr>
<td>Medium effect sizes suggests a significant association between increased disorganised symptoms and reduction in the following cognitive functions;</td>
</tr>
<tr>
<td>Attention/ vigilance: 19 studies, N = 1404, ( r = -0.25 ), 95%CI -0.31 to -0.20, ( p &lt; 0.01 )</td>
</tr>
<tr>
<td>Reasoning and problem solving: 38 studies, N = 2300, ( r = -0.24 ), 95%CI -0.28 to -0.19, ( p &lt; 0.01 )</td>
</tr>
<tr>
<td>Speed of processing: 42 studies, N = 2473, ( r = -0.26 ), 95%CI -0.30 to -0.22, ( p &lt; 0.01 )</td>
</tr>
<tr>
<td>Verbal memory: 22 studies, N = 1532, ( r = -0.20 ), 95%CI -0.24 to -0.15, ( p &lt; 0.01 )</td>
</tr>
<tr>
<td>Working memory: 20 studies, N = 945, ( r = -0.20 ), 95%CI -0.26 to -0.13, ( p &lt; 0.01 )</td>
</tr>
<tr>
<td>Visual memory: 14 studies, N = 978, ( r = -0.20 ), 95%CI -0.27 to -0.14, ( p &lt; 0.01 )</td>
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</table>

<table>
<thead>
<tr>
<th>Reality distortion</th>
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</thead>
<tbody>
<tr>
<td>Very small effect size suggests a significant association between increased reality distortion and reduced overall cognitive functioning;</td>
</tr>
<tr>
<td>50 studies, N = 2722, ( r = -0.04 ), 95%CI -0.08 to -0.01, ( p = 0.03 )</td>
</tr>
<tr>
<td>Very small effect sizes suggests a significant association between increased reality distortion and reduced cognitive functions in;</td>
</tr>
<tr>
<td>Attention/ vigilance: 10 studies, N = 743, ( r = -0.12 ), 95%CI -0.19 to -0.05, ( p &lt; 0.01 )</td>
</tr>
<tr>
<td>Reasoning and problem solving: 27 studies, N = 1427, ( r = -0.06 ), 95%CI -0.11 to -0.05, ( p = 0.03 )</td>
</tr>
<tr>
<td>No significant relationship between reality distortion and;</td>
</tr>
<tr>
<td>Speed of processing: 33 studies, N = 1870, ( r = -0.03 ), 95%CI -0.07 to 0.02, ( p = \text{non-significant} )</td>
</tr>
<tr>
<td>Verbal memory: 16 studies, N = 927, ( r = 0.01 ), 95%CI -0.07 to 0.06, ( p = \text{non-significant} )</td>
</tr>
<tr>
<td>Working memory: 18 studies, N = 855, ( r = -0.00 ), 95%CI -0.07 to 0.07, ( p = \text{non-significant} )</td>
</tr>
<tr>
<td>Visual memory: 10 studies, N = 630, ( r = 0.01 ), 95%CI -0.07 to 0.09, ( p = \text{non-significant} )</td>
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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Authors report results are inconsistent</td>
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</tbody>
</table>
Signs and Symptoms – Cognitive Functioning Relating to Symptoms

<table>
<thead>
<tr>
<th>Precision</th>
<th>Precise, unable to assess for combined positive symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directness</td>
<td>Direct</td>
</tr>
</tbody>
</table>

**Ventura J, Wood RC, Hellemann GS**


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

[View review abstract online](#)

**Comparison**

Association between social cognition, symptom domains and cognitive functioning in people with schizophrenia.

**Summary of evidence**

Moderate quality evidence (consistent, direct, unable to assess precision) suggests small to medium size associations between poor performance on emotion perception, social perception and Theory of Mind tasks and increased symptoms.

**Associations between social cognition and symptom domains**

*Small to medium size associations between poor emotion perception and increased;*

- Reality distortion: 18 studies, N = 757, $r = -0.22$, $Q_w = 44.22$, $p < 0.001$
  - Omitting 2 studies gave homogenous results and $r = -0.21$
- Disorganization: 22 studies, N = 987, $r = -0.32$, $Q_w = 42.33$, $p = 0.01$
  - Omitting 2 studies gave homogenous results and $r = -0.34$
- Negative symptoms: 53 studies, N = 2303, $r = -0.26$, $Q_w = 109.70$, $p < 0.001$
  - Omitting 8 studies gave homogenous results and $r = -0.30$
- Combined reality distortion/disorganization: 17 studies, N = 771, $r = -0.17$, $Q_w = 6.99$, $p = 0.98$

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

- Reality distortion: 6 studies, N = 182, $r = -0.21$, $Q_w = 13.34$, $p = 0.04$
  - Omitting 1 study gave homogenous results and $r = -0.37$
- Disorganization: 7 studies, N = 228, $r = -0.22$, $Q_w = 10.55$, $p = 0.16$
- Negative symptoms: 18 studies, N = 952, $r = -0.20$, $Q_w = 37.64$, $p < 0.001$
  - Omitting 1 study gave homogenous results and $r = -0.22$
Combined reality distortion/disorganization: 11 studies, N = 684, r = -0.11, Q_w = 33.49, p < 0.001
  Omitting 1 study gave homogenous results and r = -0.16

  Small association between poor attribution bias and increased;
  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

Small to medium size associations between poor Theory of Mind and increased;
  Reality distortion: 14 studies, N = 624, r = -0.08, Q_w = 15.50, p = 0.34
  Disorganization: 16 studies, N = 684, r = -0.32, Q_w = 19.14, p = 0.26
  Negative symptoms: 38 studies, N = 1869, r = -0.25, Q_w = 43.43, p = 0.25
  Combined reality distortion/disorganization: 15 studies, N = 583, r = -0.22, Q_w = 13.28, p = 0.58

Consistency in results | Consistent
---|---
Precision in results | Unable to assess (no CIs reported)
Directness of results | Direct

**Ventura J, Wood RC, Jimenez AM, Hellemann GS**

*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](#)

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Association between social cognition, symptom domains and cognitive functioning in people with schizophrenia.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary of evidence</td>
<td>Moderate quality evidence (consistent, unable to assess precision, direct) suggests small to medium size associations between poor facial recognition and emotion processing and increased symptoms.</td>
</tr>
</tbody>
</table>

**Associations between social cognition and symptom domains**

Small to medium size associations between poor facial recognition and increased;
Signs and Symptoms – Cognitive Functioning Relating to Symptoms

<table>
<thead>
<tr>
<th></th>
<th>Reality distortion: 4 studies, N = 203, ( r = -0.02, Q_w = 1.99, p = 0.74 )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Disorganization: 5 studies, N = 240, ( r = -0.25, Q_w = 3.49, p = 0.62 )</td>
</tr>
<tr>
<td></td>
<td>Negative symptoms: 12 studies, N = 487, ( r = -0.22, Q_w = 20.44, p = 0.06 )</td>
</tr>
<tr>
<td></td>
<td>Combined reality distortion/disorganization: 3 studies, N = 138, ( r = -0.25, Q_w = 0.80, p = 0.85 )</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>Reality distortion: 18 studies, N = 757, ( r = -0.21, Q_w = 45.70, p &lt; 0.001 )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Omitting 2 studies gave homogenous results and ( r = -0.20 )</td>
</tr>
<tr>
<td></td>
<td>Disorganization: 22 studies, N = 987, ( r = -0.32, Q_w = 39.21, p = 0.01 )</td>
</tr>
<tr>
<td></td>
<td>Omitting 1 study gave homogenous results and ( r = -0.33 )</td>
</tr>
<tr>
<td></td>
<td>Negative symptoms: 53 studies, N = 2825, ( r = -0.25, Q_w = 132.35, p &lt; 0.001 )</td>
</tr>
<tr>
<td></td>
<td>Omitting 10 studies gave homogenous results and ( r = -0.28 )</td>
</tr>
<tr>
<td></td>
<td>Combined reality distortion/disorganization: 22 studies, N = 1076, ( r = -0.18, Q_w = 34.23, p = 0.05 )</td>
</tr>
<tr>
<td></td>
<td>Omitting 1 study gave homogenous results and ( r = -0.16 )</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>Reality distortion: 2 studies, N = 81, ( r = -0.31, Q_w = 0.64, p = 0.73 )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Disorganization: 3 studies, N = 124, ( r = -0.47, Q_w = 8.90, p = 0.03 )</td>
</tr>
<tr>
<td></td>
<td>Omitting 1 study gave homogenous results and ( r = -0.60 )</td>
</tr>
<tr>
<td></td>
<td>Negative symptoms: 7 studies, N = 312, ( r = -0.25, Q_w = 8.52, p = 0.29 )</td>
</tr>
<tr>
<td></td>
<td>Combined reality distortion/disorganization: 1 study, N = 36, ( r = -0.13, Q_w = N/A )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consistency in results</th>
<th>Consistent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precision in results</td>
<td>Unable to assess (no CIs reported)</td>
</tr>
<tr>
<td>Directness of results</td>
<td>Direct</td>
</tr>
</tbody>
</table>

Wang Y, Cui J, Chan R, Deng Y, Shi H, Hong X, Li Z, Yu X, Gong QY, Shum D

Meta-analysis of prospective memory in schizophrenia: Nature, extend, and correlates

Schizophrenia Research 2009; 114: 64-70
### View review abstract online

**Comparison**

Prospective memory (time-based, event-based and activity-based prospective memory) in people with schizophrenia vs. controls.

**Note:** Prospective memory (PM) is the ability to remember to carry out an intended action in the future.

**Summary of evidence**

Moderate to high quality evidence (consistent, precise, direct, medium-sized sample) suggests a significant, small association between poorer prospective memory and increased general psychopathology. No association was reported between prospective memory and positive symptoms.

Moderate quality evidence (inconsistent) suggests a significant, small association between poorer prospective memory and increased negative symptoms.

### Prospective memory

A significant, small association was reported between impaired prospect memory and increased general psychopathology and negative symptoms;

**General psychopathology:** 4 studies, N = 146, \( r = -0.168, 95\% CI \) -0.326 to 0, \( p = 0.05, Q_w = 2.268, p = 0.519 \)

**Negative symptoms:** 8 studies, N = 400, \( r = -0.18, 95\% CI \) -0.276 to -0.081, \( p < 0.001, Q_w = 21.32, p = 0.003 \)

*No association was reported with positive symptoms;*

8 studies, N = 400, \( r = -0.094, 95\% CI \) -0.193 to 0.007, \( p = 0.067, Q_w = 7.512, p = 0.378 \)

**Consistency**

Consistent for all measures except negative symptoms

**Precision**

Precise

**Directness**

Direct
### Self-recognition deficits in schizophrenia patients with auditory hallucinations: a meta-analysis of the literature

Self-recognition deficits in people with schizophrenia with auditory hallucinations compared with people without auditory hallucinations. Moderate quality evidence (large samples, consistent, unable to assess precision, direct) suggests a medium effect of poorer self-recognition, but not new item recognition, in people with schizophrenia with auditory hallucinations compared with people with schizophrenia without auditory hallucinations.

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Self-recognition in people with schizophrenia with auditory hallucinations in the week prior to testing vs. those without auditory hallucinations in the week prior to testing.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary of evidence</td>
<td>Moderate quality evidence (large samples, consistent, unable to assess precision, direct) suggests a medium effect of poorer self-recognition, but not new item recognition, in people with schizophrenia with auditory hallucinations compared with people with schizophrenia without auditory hallucinations.</td>
</tr>
</tbody>
</table>

#### Self-recognition and new item recognition

Significant medium effect of poorer self-recognition, but not new item recognition, in people with schizophrenia with auditory hallucinations compared with people with schizophrenia without auditory hallucinations;

- Self-recognition accuracy: 9 studies, N = 315, $g = -0.58$, CI not reported, $p < 0.00001$, $I^2 = 17\%$
- New item recognition: 5 studies, N = 214, $g = -0.13$, CI not reported, $p = 0.352$, $I^2 = 71\%$

No evidence of publication bias

<table>
<thead>
<tr>
<th>Consistency in results</th>
<th>Consistent for self-recognition accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precision in results</td>
<td>Unable to assess</td>
</tr>
<tr>
<td>Directness of results</td>
<td>Direct</td>
</tr>
</tbody>
</table>
Signs and Symptoms – Cognitive Functioning Relating to Symptoms

Explanation of acronyms

B = estimated regression coefficient, BADE = Bias Against Disconfirmatory Evidence task, BNT = Boston Naming Test, BPRS = Brief Psychiatric Rating Scale, CERAD = Consortium to Establish Registry for Alzheimer’s Disease, CDR = Clinical Dementia Rating scale, CI = Confidence Interval, B = regression coefficient, CPT – d = Continuous Performance Task, measure of sensitivity, d = Cohen’s d = standardised mean differences (see below for interpretation of effect size), ES = effect size (unspecified), I² = the percentage of the variability in effect estimates that is due to heterogeneity rather than sampling error (chance), IQ = Intelligence Quotient, JTC = Jumping to Conclusions, LLS = late-life schizophrenia, MMSE = Mini-Mental Status Examination, N = number of participants, NS = non-significant, p = statistical probability of obtaining that result (p < 0.05 generally regarded as significant), PANSS = Positive and Negative Symptoms Scale, Q = Q statistic for the test of heterogeneity, Qw = test for within group differences (heterogeneity in study results within a group of studies – measure of study consistency), QB = test for between group differences (heterogeneity between groups of studies for an outcome of interest), r = correlation coefficient, RCT = randomised controlled trial, SAI-E = Schedule for Assessing the 3 components of insight – Expanded Version, SANS = Scale for the Assessment of Negative Symptoms, SAPS = Scale for the Assessment of Positive Symptoms, SE = standard error, SOA = Stimulus Onset Asynchrony, ToM = Theory of Mind, μp = estimated average correlation in the population, vs. = versus, WCST = Wisconsin Card Sorting Task, WCST-PE = Wisconsin Card Sorting Task, perseveration error
**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.

† 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.

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. lnOR stands for logarithmic OR where a lnOR of 0 shows no difference between groups. Hazard ratios
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:\[I^2 = \left(\frac{Q - df}{Q}\right) \times 100\%\]

§ 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.\[34\]

║ 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.

This topic is yet to be reviewed by a content expert
Signs and Symptoms – Cognitive Functioning Relating to Symptoms

References


