TECHNICAL COMMENTARY

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Positive symptoms

Introduction

Positive symptoms (or reality distortion symptoms) of schizophrenia are a well-documented feature of the disorder and are arguably the most recognisable and conspicuous symptoms of the illness. Positive symptoms refer to hallucinations, paranoia, and delusions.

Hallucinations are defined as a perceptual experience that occurs in the absence of any corresponding external sensory input, and are most commonly auditory, but can occur in any modality. For example, hallucinations may be heard as voices speaking in the second or third person.

Delusions are fixed, false beliefs that persist regardless of contradictory evidence, but are not explained by cultural beliefs. Persecutory delusions and paranoia involve the belief that people are attempting to harm or even kill the individual, for example being under surveillance or being tricked. Delusion of reference refers to the belief that neutral events are directed specifically towards the individual, for example the people on the television are referring to the individual directly. Somatic delusions involve the belief that the individual has a serious physical disease or alteration of the body. Delusions of grandeur are characterised by an exaggerated belief that the individual has extraordinary powers, abilities, or fame.

Positive symptoms cause extreme distress for the sufferer. The severity of positive symptoms can significantly affect a person's day-to-day function, quality of life, and may also be associated with impaired cognitive ability. However, positive symptoms have been shown to be more responsive to antipsychotic treatment than other symptom dimensions.

Method

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

Results

We found 12 systematic reviews that met our inclusion criteria[3-14].

- Moderate to high quality evidence shows a small concordance of reality distortion symptoms in siblings with schizophrenia. There were no differences in positive symptom severity between patients with or without a family history of psychosis.
- Moderate quality evidence suggests features of hallucinations are similar across psychiatric conditions, apart from age of onset of hallucinations, which is earlier in non-clinical and dissociative disorder groups (<12 years) than in schizophrenia (late teens to early 20s), and is later in affective disorders, neurological disorders, and alcohol-related conditions (middle or older age). There is less negative content and more controllability of hallucinations in non-clinical groups.
- Moderate to high quality evidence finds medium-sized associations between increased maladaptive appraisals and beliefs about voices and increased voice-related and emotional distress. Maladaptive appraisals and beliefs include perceived power, intrusiveness, dominance,

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malevolence, lack of control, and metaphysical beliefs. Positive appraisals and beliefs about voices showed a small association with reduced distress.

- Moderate quality evidence suggests the prevalence of visual hallucinations in people with schizophrenia is around 27%, and the prevalence of auditory hallucinations is around 59%. These rates are higher than in affective psychosis (visual = 15%, auditory = 28%). They are higher than general population rates (7%), and lower than in Parkinson's disease (15-40%), dementia with Lewy bodies (60-90%), age-related eye disease (10-60%), and death-bed visions (50%). In schizophrenia, visual hallucinations are associated with more severe psychopathological profile and less favourable outcomes, are complex, negative in content, and are interpreted to have personal relevance.
- Moderate to high quality evidence finds small to medium-sized relationships between increased paranoia and lower self-esteem and increased externalising attributional bias (incorrectly holding others responsible for negative events). Increased paranoia was also associated with seeing others as controlling, dangerous, and rejecting.
- Compared to controls, people with psychosis and persecutory delusions showed a medium-sized effect of more externalising attributional bias, a large effect of lower explicit self-esteem, and a small to medium-sized effect of lower implicit self-esteem.
- Compared to people with depression, people with psychosis and persecutory delusions showed a large effect of more externalising attributional bias, a large effect of higher explicit self-esteem, and no differences in implicit self-esteem. There was a medium-sized effect of greater discrepancy between implicit and explicit self-esteem in people with persecutory delusions compared to people with depression.
- Compared to people with psychosis without persecutory delusions, people with psychosis with persecutory delusions showed a medium-sized effect of more externalising attributional bias, with no differences in explicit or implicit self-esteem.
- Moderate to high quality evidence finds small effects that people with psychosis and delusions require less information to form conclusions and display more extreme responding than people with psychosis without delusions.
- High quality evidence finds a medium-sized association between more severe delusions and more belief inflexibility.
- Moderate to high quality evidence finds medium to large effects of more jumping to conclusions (JTC), bias against disconfirmatory or confirmatory evidence (BADE/BACE), and more liberal acceptance (LA) in people with schizophrenia with current delusions than in controls. In people with schizophrenia without delusions there were small to medium-sized effects of more BADE and LA, with no differences in JTC or BACE.
- When directly comparing people with schizophrenia with or without delusions, high quality evidence finds small to medium-sized effects of more JTC, BADE, BACE, and LA in those with delusions.
- There were no differences in JTC, BADE, BACE, and LA between people with schizophrenia with delusions or people with other psychiatric disorders with delusions, however when compared to people with other psychiatric disorders without delusions, there were medium to large effects of more JTC, BADE, BACE and LA in people with schizophrenia with delusions.
- Moderate quality evidence finds a medium-sized association between poor insight (overall unawareness of having a mental disorder) and increased reality distortion.

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- Moderate to high quality evidence found a small effect of increased positive symptoms in people with schizophrenia and current cannabis use compared to people with schizophrenia and no cannabis use. Moderate to high quality evidence found no differences in positive symptoms between people with schizophrenia who recently abstained from cannabis use compared to people with schizophrenia and no cannabis use.

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Dudley R, Taylor P, Wickham S, Hutton P

Psychosis, Delusions and the "Jumping to Conclusions" Reasoning Bias: A Systematic Review and Meta-analysis

Schizophrenia Bulletin 2016; 42: 652-65

View review abstract online

Comparison	**Reasoning bias in people with psychosis and delusions vs. people with psychosis without delusions.**
Summary of evidence	**Moderate to high quality evidence (medium to large samples, consistent, some imprecision, direct) finds small effects that people with psychosis and delusions require less information to form conclusions and display more extreme responding.**
Draws to decision	
A significant, small effect of less information required to form conclusions in people with psychosis and delusions; 8 studies, N = 456, *g* = -0.29, 95%CI -0.48 to -0.09, *p* < 0.05, I^2 = 0%, *p* = 0.72 *There was also a small correlation between increased delusion severity and less information required;* 18 studies, N = 794, *g* = -0.09, 95%CI -0.21 to 0.03, *p* < 0.10, I^2 = 54%, *p* = 0.03	
Extreme responding	
A significant, small effect of more extreme responding in people with psychosis and delusions; 14 studies, N = 770, OR = 1.52, 95%CI 1.12 to 2.05 *p* < 0.05, I^2 = 13%, *p* = 0.31	
Consistency	Consistent, apart from the correlation analysis.
Precision	Precise for draws to decision, imprecise for extreme responding.
Directness	Direct

Esterberg ML, Trotman HD, Holtzman C, Compton MT, Walker EF

The impact of a family history of psychosis on age-at-onset and positive

and negative symptoms of schizophrenia: A meta-analysis **Schizophrenia Research 2010; 120: 121-130** View review abstract online	
Comparison	**The impact of a family history of psychosis on severity of positive symptoms of schizophrenia.**
Summary of evidence	**Moderate to high quality evidence (large sample, unable to assess consistency, precise, direct) shows no differences in positive symptom severity between patients with or without a family history of psychosis.**
Positive symptoms	
The presence or absence of a family history of psychosis had no significant effect on positive symptom severity; 11 studies, N = 1,073, *d* = 0.11, 95%CI -0.01 to 0.24, *p* not reported, Q, *p* not reported	
Consistency in results	Unable to assess; no measure of consistency is reported.
Precision in results	Precise
Directness of results	Direct

Humphrey C, Bucci S, Varese F, Degnan A, Berry K **Paranoia and negative schema about the self and others: A systematic review and meta-analysis** **Clinical Psychology Review 2021; 90: 102081** View review abstract online	
Comparison	**The relationship between paranoia symptoms and negative schema about self and others in people with non-affective psychosis or at high-risk of psychotic disorders and in people with non-clinical paranoia symptoms.** **Negative schematic beliefs involve seeing the self as weak, vulnerable, ineffective, and worthless and seeing others as controlling, dangerous, and rejecting.**

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Summary of evidence	**Moderate quality evidence (unclear sample size, inconsistent, precise, direct) shows medium-sized associations between more negative other or self-schema and more paranoia symptoms both in clinical and non-clinical samples.**
Paranoia and negative self-schema	
Medium-sized associations between negative self-schema and paranoia both in clinical and non-clinical samples; Clinical: 14 studies, N not reported, r = 0.39, 95%CI 0.28 to 0.49, $p < 0.001$, I^2 = 86%, $p < 0.001$ Non-clinical: 16 studies, N not reported, r = 0.52, 95%CI 0.42 to 0.60, $p < 0.001$, I^2 = 96%, $p < 0.001$	
Paranoia and negative other schema	
Medium-sized associations between negative other schema and paranoia both in clinical and non-clinical samples; Clinical: 9 studies, N not reported, r = 0.51, 95%CI 0.34 to 0.65, $p < 0.001$, I^2 = 87%, $p < 0.001$ Non-clinical: 8 studies, N not reported, r = 0.48, 95%CI 0.04 to 0.55, $p < 0.001$, I^2 = 63%, p = 0.008	
Consistency in results	Inconsistent
Precision in results	Precise
Directness of results	Direct

McLean BF, Mattiske JK, Balzan RP

Association of the Jumping to Conclusions and Evidence Integration Biases With Delusions in Psychosis: A Detailed Meta-analysis

Schizophrenia Bulletin 2017; 43: 344-54

View review abstract online

Comparison 1	**Reasoning bias in people with schizophrenia with current delusions vs. controls.**
Summary of evidence	**Moderate to high quality evidence (medium to large sample size, some inconsistency, precise, direct) finds medium to large effects that people with schizophrenia display more JTC, BADE, BACE and LA than controls.**

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Jumping to conclusions (JTC)	
A medium to large effect of more JTC in people with schizophrenia; 21 studies, N = 1,131, *g* = 0.71, 95%CI 0.51 to 0.90, *p* < 0.05, I^2 = 58%, *p* < 0.0001	
Bias against disconfirmatory evidence (BADE)	
A medium to large effect of more BADE in people with schizophrenia; 7 studies, N = 369, *g* = 0.56, 95%CI 0.28 to 0.83, *p* < 0.05, I^2 = 38%, *p* = 0.14	
Bias against confirmatory evidence (BACE)	
A medium to large effect of more BACE in people with schizophrenia; 7 studies, N = 369, *g* = 0.53, 95%CI 0.32 to 0.78, *p* < 0.05, I^2 = 0%, *p* = 0.49	
Liberal acceptance (LA)	
A medium to large effect of more LA in people with schizophrenia; 6 studies, N = 338, *g* = 0.79, 95%CI 0.45 to 1.11, *p* < 0.05, I^2 = 51%, *p* = 0.07	
Consistency	Inconsistent for JTC, consistent for BADE, BACE, and LA.
Precision	Precise
Directness	Direct
Comparison 2	**Reasoning bias in people with schizophrenia without current delusions vs. controls.**
Summary of evidence	**High quality evidence (medium to large samples, consistent, precise, direct) finds small to medium-sized effects that people with schizophrenia without delusions display more BADE and LA than controls, with no differences in JTC and BACE.**
Jumping to conclusions (JTC)	
No significant differences between groups; 7 studies, N = 385, *g* = 0.12, 95%CI -0.17 to 0.41, *p* > 0.05, I^2 = 47%, *p* = 0.08	
Bias against disconfirmatory evidence (BADE)	

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A small to medium-sized effect of more BADE in people with schizophrenia without delusions; 7 studies, N = 455, *g* = 0.35, 95%CI 0.15 to 0.55, *p* < 0.05, I^2 = 0%, *p* = 0.69	
Bias against confirmatory evidence (BACE)	
No significant differences between groups; 7 studies, N = 455, *g* = 0.22, 95%CI -0.01 to 0.44, *p* > 0.05, I^2 = 9%, *p* = 0.28	
Liberal acceptance (LA)	
A medium-sized effect of more LA in people with schizophrenia without delusions; 6 studies, N = 409, *g* = 0.48, 95%CI 0.17 to 0.78, *p* < 0.05, I^2 = 49%, *p* = 0.08	
Consistency	Consistent
Precision	Precise
Directness	Direct
Comparison 3	**Reasoning bias in people with schizophrenia with current delusions vs. people with schizophrenia without current delusions.**
Summary of evidence	**High quality evidence (medium to large samples, consistent, precise, direct) finds small to medium-sized effects that people with schizophrenia with delusions display more JTC, BADE, BACE and LA than people with schizophrenia without delusions.**
Jumping to conclusions (JTC)	
A small to medium-sized effect of more JTC in people with schizophrenia with delusions; 20 studies, N = 834, *g* = 0.33, 95%CI 0.19 to 0.46, *p* < 0.05, I^2 = 0%, *p* = 0.53	
Bias against disconfirmatory evidence (BADE)	
A small to medium-sized effect of more BADE in people with schizophrenia with delusions; 8 studies, N = 466, *g* = 0.31, 95%CI 0.02 to 0.60, *p* < 0.05, I^2 = 50%, *p* = 0.05	
Bias against confirmatory evidence (BACE)	
A small to medium-sized effect of more BACE in people with schizophrenia with delusions; 7 studies, N = 426, *g* = 0.39, 95%CI 0.12 to 0.54, *p* < 0.05, I^2 = 0%, *p* = 0.55	

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Liberal acceptance (LA)	
A small to medium-sized effect of more LA in people with schizophrenia with delusions; 6 studies, N = 383, *g* = 0.38, 95%CI 0.15 to 0.62, *p* < 0.05, I^2 = 9%, *p* = 0.36	
Consistency	Consistent
Precision	Precise
Directness	Direct
Comparison 4	**Reasoning bias in people with schizophrenia with current delusions vs. people with other psychiatric disorders with current delusions.**
Summary of evidence	**Moderate quality evidence (small sample, consistent, precise, direct) finds no significant differences in JTC.**
Jumping to conclusions (JTC)	
No significant differences between groups; 2 studies, N = 86, *g* = 0.20, 95%CI -0.23 to 0.63, *p* > 0.05, I^2 = 0%, *p* = 0.95	
Consistency	Consistent
Precision	Precise
Directness	Direct
Comparison 5	**Reasoning bias in people with schizophrenia with current delusions vs. people with other psychiatric disorders without current delusions.**
Summary of evidence	**Moderate to high quality evidence (small to medium-sized samples, consistent, precise, direct) finds a large effect of more JTC, and medium-sized effects of more BADE, BACE and LA in people with schizophrenia with delusions.**
Jumping to conclusions (JTC)	
A large effect of more JTC in people with schizophrenia with delusions; 10 studies, N = 409, *g* = 0.84, 95%CI 0.64 to 1.04, *p* < 0.05, I^2 = 0%, *p* = 0.67	
Bias against disconfirmatory evidence (BADE)	

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A medium-sized effect of more BADE in people with schizophrenia with delusions; 4 studies, N = 221, g = 0.68, 95%CI 0.34 to 1.01, $p < 0.05$, I^2 = 20%, p = 0.29	
Bias against confirmatory evidence (BACE)	
A medium-sized effect of more BACE in people with schizophrenia with delusions; 4 studies, N = 221, g = 0.48, 95%CI 0.19 to 0.78, $p < 0.05$, I^2 = 0%, p = 0.47	
Liberal acceptance (LA)	
A medium-sized effect of more LA in people with schizophrenia with delusions; 4 studies, N = 221, g = 0.50, 95%CI 0.20 to 0.79, $p < 0.05$, I^2 = 0%, p = 0.51	
Consistency	Consistent
Precision	Precise
Directness	Direct

Murphy P, Bentall RP, Freeman D, O'Rourke S, Hutton P

The paranoia as defence model of persecutory delusions: a systematic review and meta-analysis

The Lancet Psychiatry 2018; 5: 913-29

View review abstract online

Comparison	**Relationships between persecutory delusions and externalising attributional bias (incorrectly holding others responsible for negative events) or self-esteem in people with psychosis vs. controls or people with depression.**
Summary of evidence	**Moderate to high quality evidence (mostly large samples, inconsistent, precise, direct) finds small relationships between increased paranoia and increased externalising attributional bias and lower self-esteem.** **Compared to controls, people with psychosis and persecutory delusions showed a medium-sized effect of more externalising attributional bias, a large effect of lower explicit self-esteem, and a small to medium-sized effect of lower implicit self-esteem.**

	Compared to people with depression, people with psychosis and persecutory delusions showed a large effect of more externalising attributional bias, a large effect of higher explicit self-esteem, and no differences in implicit self-esteem. There was a medium-sized effect of greater discrepancy between implicit and explicit self-esteem in people with persecutory delusions compared to people with depression. **Compared to people with psychosis without persecutory delusions, people with psychosis with persecutory delusions showed a medium-sized effect of more externalising attributional bias, with no differences in explicit or implicit self-esteem.**
Externalising attributional bias	
A medium-sized effect of more externalising attributional bias in people with psychosis and persecutory delusions than in controls; 27 studies, N = 1,442, g = 0.48, 95%CI 0.23 to 0.73, I^2 = 80%, p < 0.001 *A large effect of more externalising attributional bias in people with psychosis and persecutory delusions than in depressed individuals;* 10 studies, N = 421, g = 1.06, 95%CI 0.48 to 1.63, I^2 = 86%, p < 0.001 *A medium-sized effect of more externalising attributional bias in people with psychosis and persecutory delusions than in people with psychosis without persecutory delusions;* 11 studies, N = 480, g = 0.40, 95%CI 0.12 to 0.68, I^2 = 53%, p = 0.018 *A small overall relationship between increased externalising attributional bias and increased paranoia;* 21 studies, N = 1,128, r = 0.18, 95%CI 0.08 to 0.27, I^2 = 58%, p = 0.001	
Self-esteem	
<u>Explicit self-esteem</u> *A large effect of lower explicit self-esteem in people with psychosis and persecutory delusions than in controls;* 22 studies, N = 1,256, g = -0.88, 95%CI -1.10 to -0.66, I^2 = 68%, p < 0.001 *A large effect of higher explicit self-esteem in people with psychosis and persecutory delusions than in depressed individuals;* 13 studies, N = 647, g = 0.89, 95%CI 0.51 to 1.28, I^2 = 80%, p < 0.001 *No differences in explicit self-esteem between people with psychosis with or without persecutory delusions;*	

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11 studies, N = 644, *g* = -0.26, 95%CI -0.54 to 0.02, I^2 = 58%, *p* = 0.01 *A small overall relationship between lower explicit self-esteem and increased paranoia;* 23 studies, N = 1,866, *r* = -0.26, 95% CI -0.34 to -0.17, I^2 = 74%, *p* < 0.001 <u>Implicit self-esteem</u> *A small to medium-sized effect of lower implicit self-esteem in people with psychosis and persecutory delusions than in controls;* 11 studies, N = 683, *g* = -0.37, 95%CI -0.65 to -0.08, I^2 = 66%, *p* = 0.001 *No differences in implicit self-esteem between people with persecutory delusions and depressed individuals;* 7 studies, N = 398, *g* = -0.19, 95%CI -0.45 to 0.07, I^2 = 34%, *p* = 0.165 *No differences in implicit self-esteem between people with psychosis with or without persecutory delusions;* 4 studies, N = 167, *g* = -0.24, 95%CI -0.77 to 0.30, I^2 = 61%, *p* = 0.054 *No relationship between implicit self-esteem and paranoia;* 4 studies, N = 167, *r* = -0.13, 95% CI -0.38 to 0.15, I^2 = 62%, *p* = 0.049 <u>Discrepancy between explicit and implicit self-esteem</u> *No differences in discrepancy between people with psychosis and persecutory delusions and controls;* 10 studies, N = 592, *g* = -0.17, 95%CI -0.45 to 0.12, I^2 = 61%, *p* = 0.006 *A medium-sized effect of greater discrepancy in people with persecutory delusions than depressed individuals;* 7 studies, N = 398, *g* = 0.61, 95%CI 0.37 to 0.85, I^2 = 22%, *p* = 0.258 *No differences in discrepancy between people with psychosis with or without persecutory delusions;* 4 studies, N = 165, *g* = 0.17, 95%CI -0.19 to 0.53, I^2 = 20%, *p* = 0.287	
Consistency in results	Mostly inconsistent
Precision in results	Mostly precise
Directness of results	Direct

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Positive symptoms

Rietkerk T, Boks MPM, Sommer IE, Liddle PF, Ophoff RA, Kahn RS

The genetics and symptom dimensions of schizophrenia: review and meta-analysis

Schizophrenia Research 2008; 102: 197-205

View review abstract online

Comparison	**The heritability of reality distortion symptoms, assessed through the concordance of symptoms in twins and siblings with schizophrenia.**
Summary of evidence	**Moderate to high quality evidence (large sample, inconsistent, precise, direct) suggests a small effect of concordance of reality distortion symptoms in siblings with schizophrenia.** **Lower quality evidence (unable to assess precision) shows unclear concordance in twins.**

Symptom heritability

A small significant effect of concordance of reality distortion symptoms between siblings with schizophrenia;

4 studies, N = 753, r = 0.18, 95%CI 0.12 to 0.24, $p < 0.0001$, $I^2 = 80.92$, $p = 0.001$

2 studies assessed reality distortion in twins;

1 study of twins discordant for schizophrenia (N = 47 pairs) reported that monozygotic co-twins of people with schizophrenia had reality distortion scores twice as high as those of discordant dizygotic co-twins, indicating a genetic effect for non-clinical reality distortion (symptoms were measured by the Schedule for Schizotypal Personalities).

The other study of twins concordant for schizophrenia (N = 57 pairs) found no genetic effect of reality distortion in clinical samples of monozygotic twins (r = 0.19) or dizygotic twins (r = 0.27). Symptoms were measured by the Operational Criteria checklist for psychotic disorders, and the sample included schizophrenia, schizoaffective disorder, affective psychosis, and unspecified psychosis.

Consistency in results	Inconsistent
Precision in results	Precise for siblings, unable to assess for twin studies (no CIs reported).
Directness of results	Direct

Positive symptoms

Sabe M, Zhao N, Kaiser S

Cannabis, nicotine and the negative symptoms of schizophrenia: Systematic review and meta-analysis of observational studies

Neuroscience and Biobehavioral Reviews 2020; 116: 415-25

View review abstract online

Comparison 1	**Positive symptoms in people with schizophrenia with current cannabis use vs. positive symptoms in people with schizophrenia with no cannabis use.**
Summary of evidence	**Moderate to high quality evidence (large samples, some inconsistency, precise, direct) suggests a small effect of increased positive symptoms in people with schizophrenia and current cannabis use.**
Current cannabis use	
A small effect showed increased positive symptoms in people with cannabis use; 12 studies, N = 1,932, SMD = 0.11, 95%CI -0.00 to 0.23, p = 0.05, I^2 = 10% There were no moderating effects of comorbid nicotine use.	
Consistency	Consistent
Precision	Precise
Directness	Direct
Comparison 2	**Positive symptoms in people with schizophrenia with recent abstinence of cannabis use vs. positive symptoms in people with schizophrenia with no cannabis use.**
Summary of evidence	**Moderate to high quality evidence (large sample, inconsistent, precise, direct) found no differences in positive symptoms in people with schizophrenia who recently abstained from cannabis use.**
Recent abstinence of cannabis use	
No significant differences between groups; 7 studies, N = 760, SMD = 0.17, 95%CI -0.11 to 0.45, p = 0.24, I^2 = 58%	

Excluding one study decreased the heterogeneity to 0% and decreased the effect size to 0.08.	
Consistency	Inconsistent
Precision	Precise
Directness	Direct

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

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

Schizophrenia Research 2020; 220: 164-71

View review abstract online

Comparison	**The relationship between insight and positive symptoms in people with schizophrenia.**
Summary of evidence	**Moderate quality evidence (large sample, inconsistent, unable to assess precision, direct) finds a medium-sized association between poor insight (overall unawareness) and increased reality distortion.**
Insight and reality distortion	
A medium-sized association between poor insight (overall unawareness) and increased reality distortion; 32 studies, N = 5,012, r = 0.28, 95%CI not reported, $p < 0.01$, Q$p < 0.01$ Removing five studies reduced heterogeneity and gave similar results (r = 0.29).	
Consistency in results	Inconsistent
Precision in results	Unable to assess; no CIs reported
Directness of results	Direct

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Tsang A, Bucci S, Branitsky A, Kaptan S, Rafiq S, Wong S, Berry K, Varese F

The relationship between appraisals of voices (auditory verbal hallucinations) and distress in voice-hearers with schizophrenia-spectrum diagnoses: A meta-analytic review

Schizophrenia Research 2021; 230: 38-47

View review abstract online

Comparison	**The relationship between distress and appraisal of voices in people with schizophrenia.**
Summary of evidence	**Moderate to high quality evidence (large overall sample, mostly inconsistent, precise, direct) finds medium-sized associations between increased maladaptive appraisals and beliefs about voices and increased distress. Positive appraisals and beliefs about voices showed a small association with less distress.**
Any distress (voice related and emotional)	
28 studies, N = 1,497 *Medium-sized associations between increased maladaptive appraisals and beliefs about voices and increased distress;* Voice malevolence: 17 studies, N not reported, r = 0.46, 95%CI 0.33 to 0.57, $p < 0.001$, I^2 = 88% Voice power: 21 studies, N not reported, r = 0.36, 95%CI 0.28 to 0.44, $p < 0.001$, I^2 = 67% Voice dominance: 3 studies, N not reported, r = 0.58, 95%CI 0.43 to 0.69, $p < 0.001$, I^2 = 29% Voice intrusiveness: 3 studies, N not reported, r = 0.40, 95%CI 0.27 to 0.52, $p < 0.001$, I^2 = 0% Metaphysical beliefs: 2 studies, N not reported, r = 0.38, 95%CI 0.23 to 0.51, $p < 0.001$, I^2 NR Loss of control: 2 studies, N not reported, r = 0.33, 95%CI 0.17 to 0.47, $p < 0.001$, I^2 NR *Positive appraisals and beliefs showed a small association with less distress;* Voice malevolence: 12 studies, N not reported, r = -0.25, 95%CI -0.45 to -0.04, p = 0.021, I^2 = 92% Positive beliefs: 2 studies, N not reported, r = -0.11, 95%CI -0.28 to -0.05, p = 0.18, I^2 NR The magnitude of the observed effects was similar across subgroup analyses considering measures of voice-related distress, anxiety, and depression.	
Consistency in results	Inconsistent, apart from voice dominance and intrusiveness.
Precision in results	Precise

Directness of results	Direct

Waters F, Fernyhough C

Hallucinations: A systematic review of points of similarity and difference across diagnostic classes

Schizophrenia Bulletin 2017; 43(1): 32-43

View review abstract online

Comparison	**Features of hallucinations in people with schizophrenia vs. other psychiatric disorders, medical conditions, or nonclinical.**
Summary of evidence	**Moderate quality evidence (large sample, unable to assess consistency or precision, direct) suggests features of hallucinations are similar across diagnostic groups, apart from age on onset which is earlier in non-clinical and dissociative disorder groups (<12 years) than in schizophrenia (late teens to early 20s), and later in affective disorders, neurological disorders, and alcohol-related conditions (middle or older age). Non-clinical groups reported more control and less negative content.**

Hallucination features

43 studies, N = 6,321

Authors report that age of onset of hallucinations in late teens to early 20s is uniquely associated with schizophrenia compared to an early age of onset of hallucinations (< 12 years) in dissociative identity disorder and non-clinical groups, and a later age of onset (middle or older age) in affective disorders, neurological disorders, and alcohol-related conditions.

Non-clinical groups reported more control and less negative content.

There were no clear differences across groups according to whether voices were; persisting, interfering, commanding, commenting or conversing, expected to be heard by others, or their attribution characteristics. There were also no differences in various risk factors across groups, such as negative life events or family history of psychiatric disorder.

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

Positive symptoms

Waters F, Collerton D, Ffytche DH, Jardri R, Pins D, Dudley R, Blom J, Mosimann U, Eperjesi F, Ford S, Larøi F

Visual hallucinations in the psychosis spectrum and comparative information from neurodegenerative disorders and eye disease

Schizophrenia bulletin 2014; 40 Suppl 4: S233-S45

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Comparison	**Prevalence and features of hallucinations in people with schizophrenia vs. affective disorders, neurodegenerative and eye disorders and in non-clinical groups.**
Summary of evidence	**Moderate quality evidence (large samples, unable to assess consistency or precision, direct) suggests the prevalence of visual hallucinations in people with schizophrenia is around 27%, and the prevalence of auditory hallucinations is around 59%. These rates are higher than in affective psychosis (visual = 15%, auditory = 28%). They are higher than general population rates (7%), and lower than in Parkinson's disease (15-40%), dementia with Lewy bodies (60-90%), age-related eye disease (10-60%), and death-bed visions (50%). In schizophrenia, visual hallucinations are associated with more severe psychopathological profile and less favourable outcomes, are complex, negative in content, and are interpreted to have personal relevance.**

Prevalence and features of hallucinations

Schizophrenia

29 studies, N = 5,873, mean prevalence of visual hallucinations = 27%, mean prevalence of auditory hallucinations = 59%

Affective psychosis

12 studies, N = 2,892, mean prevalence of visual hallucinations = 15%, mean prevalence of auditory hallucinations = 28%

Parkinson's disease

Frequency rates range from 15-40%

Dementia with Lewy bodies

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Frequency rates range from 60-90% Age-related eye disease Frequency rates range from 10-60% Death-bed visions Frequency rates around 50% General population 6 studies, N = 26,458, mean prevalence of visual hallucinations = 7.3% Authors report that visual hallucinations are more common in younger individuals with schizophrenia, while the prevalence of visual hallucinations in non-clinical groups is most common during adolescence and late adulthood. Visual hallucinations were linked to a more severe psychopathological profile and less favourable outcome in schizophrenia and neurodegenerative conditions. In schizophrenia, they typically co-occur with auditory hallucinations, are complex, negative in content, and are interpreted to have personal relevance.	
Consistency in results	Unable to assess; no measure of consistency is reported.
Precision in results	Unable to assess; no measure of precision is reported.
Directness of results	Direct

Zhu C, Sun X, So SH

Associations between belief inflexibility and dimensions of delusions: A meta-analytic review of two approaches to assessing belief flexibility

British Journal of Clinical Psychology 2018; 57: 59-81

View review abstract online

Comparison	**Association between delusions and belief inflexibility in people with schizophrenia spectrum disorders vs. controls.**
Summary of evidence	**High quality evidence (large sample, consistent, precise, direct) finds a medium-sized association between more severe delusions and more belief inflexibility.**
Belief inflexibility and delusions	
A significant, medium-sized association between more severe delusions and more belief inflexibility; 4 studies, N = 849, g = 0.452, 95%CI 0.303 to 0.600, $p < 0.001$, I^2 = 0%, p = 0.940	

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The effect was similar in the analysis of patients with active delusions. In the analysis of delusion dimensions, the effect was largest for conviction (*g* = 0.678), then preoccupation (*g* = 0.274), then distress (*g* = 0.20).	
Consistency	Consistent
Precision	Precise
Directness	Direct

Explanation of acronyms

BADE/BACE = bias against disconfirmatory or confirmatory evidence, CBT = cognitive behavioural therapy, CI = confidence interval, *g* = Hedges' *g*, standardised mean difference, I^2 = the percentage of the variability in effect estimates that is due to heterogeneity rather than sampling error (chance), JTC = jumping to conclusions, LA = liberal acceptance, N = number of participants, NR = not reported, OPCRIT = operational criteria checklist for psychotic disorders, OR = odds ratio, *p* = statistical probability of obtaining that result ($p < 0.05$ generally regarded as significant), *r* = correlation coefficient, RCT = randomised controlled trial, SMD = standardised mean difference, vs. = versus

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Explanation of technical terms

* Bias has the potential to affect reviews of both RCT and observational studies. Forms of bias include; 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[15].

† 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. 0.2 represents a small effect, 0.5 a medium effect, and 0.8 and over represents a large effect[15].

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[16]. lnOR stands for logarithmic OR where a lnOR of 0 shows no difference between groups. Hazard ratios

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

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

‡ Inconsistency refers to differing estimates of effect across studies (i.e. heterogeneity or variability in results) that is not explained by subgroup analyses and therefore reduces confidence in the effect estimate. I^2 is the percentage of the variability in effect estimates that is due to heterogeneity rather than sampling error (chance) - 0% to 40%: heterogeneity might not be important, 30% to 60%: may represent moderate heterogeneity, 50% to 90%: may be 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[15];

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

§ 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[17].

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

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