TECHNICAL COMMENTARY

Metabolic syndrome

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BIPOLAR DISORDERS LIBRARY

Introduction

People with bipolar disorder often have increased rates of co-occurring disorders, including metabolic syndrome. Metabolic syndrome is defined by a clustering of at least three interrelated abnormalities including abdominal obesity, hyperglycemia, hypertension, high triglycerides, or low high-density lipoprotein (HDL) cholesterol levels. Metabolic syndrome increases the risk of diabetes and heart disease.

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 2010 that report results separately for people with bipolar or related disorders. Reviews were identified by searching the databases MEDLINE, and PsycINFO. Hand searching reference lists of identified reviews was also conducted. When multiple copies of review topics were found, only the most recent and/or comprehensive review 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[1]. Reviews rated as having less than 50% or 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 (RCTs) 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, there is a dose dependent response or if results are reasonably consistent, precise and direct with low associated risks (see end of table for an explanation of these terms)[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 three systematic reviews that met our inclusion criteria[3-5].

- Moderate to high quality evidence suggests the overall prevalence of metabolic syndrome in people with bipolar disorder is around 37%. Rates were highest in New Zealand, Australia and North America, in people treated with antipsychotics, and in older people. Compared to people without bipolar disorder matched for age and sex, there was a small increased risk of metabolic syndrome in people with bipolar disorder. Moderate to high quality evidence also shows a small increased risk of hypertension.
- Moderate quality evidence suggests no significant differences in the rates of metabolic syndrome between people with bipolar disorder and people with schizophrenia or major depression.

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Ayerbe L, Forgnone I, Addo J, Siguero A, Gelati S, Ayis S

Hypertension risk and clinical care in patients with bipolar disorder or schizophrenia; a systematic review and meta-analysis

Journal of Affective Disorders 2018; 225: 665-70

View review abstract online

Comparison	**Hypertension in people with bipolar disorder vs. people without bipolar disorder.**
Summary of evidence	**Moderate to high quality evidence (large samples, some consistency, precise, direct) suggests a small increased risk of hypertension in people with bipolar disorder compared to people without bipolar disorder.**
Hypertension	
A small, significant increased risk of hypertension in people with bipolar disorder; 4 studies, N = 1,529,130, IRR = 1.19, 95%CI 1.01 to 1.37 $p < 0.05$, $I^2 = 71.4\%$, $p = 0.015$ *Heterogeneity reduced with one study removed;* 3 studies, N = 1,430,416, IRR = 1.27, 95%CI 1.15 to 1.40, $p < 0.05$, $I^2 = 32.6\%$, $p = 0.227$ Lower rates of screening, prescription, and adherence were reported in two studies of people with bipolar disorder.	
Consistency in results‡	Inconsistent for overall analysis, consistent with one study removed.
Precision in results§	Precise
Directness of results‖	Direct

Vancampfort D, Vansteelandt K, Correll CU, Mitchell AJ, De Herdt A, Sienaert P, Probst M, De Hert M

Metabolic syndrome and metabolic abnormalities in bipolar disorder: a meta-analysis of prevalence rates and moderators

American Journal of Psychiatry 2013; 170: 265-74

View review abstract online

Comparison	**Rates of metabolic syndrome in people with bipolar disorder.**

Summary of evidence	**Moderate to high quality evidence (large samples, inconsistent, precise) suggests the overall prevalence of metabolic syndrome in people with bipolar disorder is around 37%. Rates were highest in New Zealand, Australia and North America, in people treated with antipsychotics and in older people. Compared to people without bipolar disorder who were matched for age and sex, there was a small increased risk of metabolic syndrome in people with bipolar disorder.**
Metabolic syndrome	
Overall prevalence in people with bipolar disorder; 37 studies, N = 6,983, 37.3%, 95%CI 36.1% to 39.0%, Q*p* < 0.0001 Prevalence differed according to region; New Zealand and Australia (64.2%), North America (49.3%), Asia (39.6%), South America (38.2%), Europe (32.4%), Tunisia (30.0%). Metabolic syndrome was significantly more prevalent in patients currently treated with antipsychotics than those who were antipsychotic free (45.3% vs. 32.4%, OR = 1.72). Older age had a small effect on increasing metabolic syndrome rate in patients. *A small, significant increased risk of metabolic syndrome in people with bipolar disorder compared to age and gender-matched controls;* 6 studies, N = 1,252, OR = 1.98, 95%CI 1.74 to 2.25, *p* < 0.0001	
Consistency in results	Inconsistent
Precision in results	Precise
Directness of results	Direct

Vancampfort D, Stubbs B, Mitchell AJ, Wampers M, Ward PB, Rosenbaum S, Correll CU

Risk of metabolic syndrome and its components in people with schizophrenia and related psychotic disorders, bipolar disorder and major depressive disorder: a systematic review and meta-analysis

World Psychiatry 2015; 14: 339-347

View review abstract online

Comparison	**Rates of metabolic syndrome in people with bipolar disorder vs. schizophrenia vs. major depression.**
Summary of evidence	**Moderate quality evidence (large samples, inconsistent, some**

	imprecision, direct) suggests no differences in the rates of metabolic syndrome between people with bipolar disorder and people with schizophrenia or major depression.
Metabolic syndrome	
There was no significant differences between bipolar disorder and schizophrenia; Bipolar disorder: N = 2,077, 35.5%, 95%CI 27.0% to 44.3% Schizophrenia: N = 2,338, 39.2%, 95%CI 30.5% to 48.3% 10 studies, RR = 0.92, 95%CI 0.79 to 1.06, *p* = 0.24, Q*p* < 0.011 *There was no significant differences between bipolar disorder and major depression;* Bipolar disorder: N = 137, 29.2%, 95%CI 14.5% to 46.2% Major depression: N = 176, 34%, 95%CI 19.4% to 50.3% 4 studies, RR = 0.87, 95%CI 0.48 to 1.55, *p* = 0.64, Q*p* = 0.05	
Consistency in results	Inconsistent
Precision in results	Precise for bipolar vs. schizophrenia, imprecise for bipolar vs. depression.
Directness of results	Direct

Explanation of acronyms

CI = confidence interval, IRR = incidence rate ratio, N = number of participants, OR = odds ratio, *p* = statistical probability of obtaining that result (*p* < 0.05 generally regarded as significant), Q = test for heterogeneity, RR = relative risk, 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; 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[6].

† 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 randomized 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 moderate effect, and 0.8 and over represents a large effect[6].

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[7]. 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

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indirect indication of prediction, but do not confirm causality due to possible and often unforseen confounding variables. An r of 0.10 represents a weak association, 0.25 a medium association and 0.40 and over represents a strong association. Unstandardized (*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. Standardized 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[6];

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

§ 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[8].

‖ 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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