TECHNICAL COMMENTARY

Physical activity

Introduction

Increased physical activity has the potential to improve physical and mental health in people with bipolar disorder. Individuals with serious mental illnesses are more likely to be sedentary than the general population and are consequently at high risk for chronic medical conditions associated with inactivity. Positive psychological effects from physical activity in clinical populations have been reported, including improved quality of life.

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 a diagnosis of bipolar or related disorders. Reviews were identified by searching the databases MEDLINE, EMBASE, and PsycINFO. Hand searching reference lists of identified reviews was also conducted. When multiple copies of review topics were found, only the most recent or comprehensive review was included. Reviews with pooled data are given priority 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 with 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).[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

Three reviews met our inclusion criteria[3-5].

- Moderate quality evidence suggests people with a severe mental illness were less active and more sedentary than controls. However, in people with bipolar disorder specifically, no differences were found compared to controls, as they were more active than people with schizophrenia or major depression.
- Lower physical activity was associated with; living in North America, outpatients, antidepressant use, male sex, being single, unemployed, smoking, higher body mass index, lower cardio-respiratory fitness, medical comorbidity, older age, ethnic minority status, and low education.

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

Vancampfort D, Correll CU, Probst M, Sienaert P, Wyckaert S, De Herdt A, Knapen J, De Wachter D, De Hert M

A review of physical activity correlates in patients with bipolar disorder

Journal of Affective Disorders 2013; 145: 285-91

View review abstract online

Comparison	**Factors associated with increased or decreased physical activity in people with bipolar disorder.**
Summary of evidence	**Moderate quality evidence (large samples, consistent, unable to assess precision, direct) suggests predictors of low levels of activity include higher BMI, medical comorbidity, older age, ethnic minority status and low education. Low confidence and low social support may also be associated with lower physical activity, however samples sizes are small.**
Correlates of physical activity	
11 studies, N = 13,426 *The following variables were associated with lower physical activity in people with bipolar disorder;* Higher BMI: 4 studies (N = 11,016) found an association, 2 (N = 72) did not Medical comorbidity: 3 studies (N = 11,647) found an association, 1 (N = 148) did not Older age: 3 studies (N = 11,459) found an association, 2 (N = 37) did not Ethnic minority: 3 studies (N = 11,465) found an association, 1 (N = 12) did not Lower education: 4 studies (N = 11,513) found an association, 1 (N = 831) did not Low confidence: 2 of 2 studies (N = 37) found an association Low social support: 2 of 2 studies (N = 65) found an association	
Consistency in results	Appears consistent (large samples for the majority of associations).
Precision in results	Unable to assess; no measure of precision is reported.
Directness of results	Direct

Vancampfort D, Firth J, Schuch F, Rosenbaum S, De Hert M, Mugisha J, Probst M, Stubbs B

Physical activity and sedentary behavior in people with bipolar disorder: A

systematic review and meta-analysis

Journal of Affective Disorders 2016; 201: 145-52

View review abstract online

Comparison	**Physical activity in people with bipolar disorder vs. controls.** **There was insufficient data for meta-analysis of sedentary behaviour in people with bipolar disorder vs. controls.**
Summary of evidence	**Moderate to low quality evidence (small to medium-sized sample, inconsistent, imprecise, direct) suggests no significant differences in time spent per day in physical activity between people with bipolar disorder and controls.**
Physical activity	
No significant differences in total physical activity per day; 3 studies, N = 168, g = -0.62, 95%CI -1.55 to 0.31, $p > 0.05$, $I^2 = 88.5\%$ Subgroup analysis found that objective measures of physical activity were significantly lower levels than self-report. Meta-regression demonstrated that older age and a higher body mass index predicted lower physical activity levels.	
Consistency in results	Inconsistent
Precision in results	Imprecise
Directness of results	Direct

Vancampfort D, Firth J, Schuch FB, Rosenbaum S, Mugisha J, Hallgren M, Probst M, Ward PB, Gaughran F, De Hert M, Carvalho AF, Stubbs, B.

Sedentary behavior and physical activity levels in people with schizophrenia, bipolar disorder and major depressive disorder: a global systematic review and meta-analysis

World Psychiatry 2017; 16: 308-15

View review abstract online

Comparison	**Sedentary behaviour and physical activity in people with a severe mental illness vs. controls.**

	The sample included people with bipolar disorder, major depression and schizophrenia.
Summary of evidence	**Moderate quality evidence (large sample, some inconsistencies, precise, direct) suggests a small effect that people with a severe mental illness are less active and more sedentary than controls.** **People with bipolar disorder were both more active and more sedentary than people with schizophrenia or major depression.** **Lower physical activity levels were associated with patients in North America vs. Europe or Oceania, outpatients vs. inpatients, use of antidepressants, males, being single, being unemployed, smoking, a higher body mass index and a lower cardio-respiratory fitness.**
Physical activity	
A small effect that people with a severe mental illness were less active than controls; Moderate activity: 69 studies, N = 38,615, SMD = 0.35, 95%CI 0.10 to 0.60, $p = 0.002$, $I^2 = 77\%$ Mean difference = 10 minutes per day. Vigorous activity: 69 studies, N = 38,615, SMD = 0.20, 95%CI 0.10 to 0.30, $p < 0.001$, $I^2 = 53\%$ Mean difference = 3 minutes per day. People with bipolar disorder were more active than those with schizophrenia or major depressive disorder. People in Europe were more active than those in North America, or Oceania. Inpatients were more physically active than outpatients or while community patients. Lower levels of vigorous physical activity were reported with objective vs. subjective measures. Lower moderate or vigorous physical activity levels were associated with a higher percentage of people taking antidepressants, a lower percentage of male and single participants, a higher percentage of unemployment, a lower percentage of smokers, a higher body mass index and a lower cardio-respiratory fitness.	
Sedentary behaviour	
A small effect that people with a severe mental illness were more sedentary than controls; 69 studies, N = 38,615, SMD = 0.10, 95%CI 0.00 to 0.20, $p = 0.003$, $I^2 = 37\%$ Mean difference = 10 minutes per day. People with bipolar disorder were more sedentary than those with schizophrenia or major depressive disorder. People in Europe were less sedentary than those in North or South America, or Asia. Greater amounts of sedentary behaviour were found when assessed using objective rather than	

self-reported measures.	
Consistency in results	Inconsistent for physical activity, consistent for sedentary behaviour.
Precision in results	Precise
Directness of results	Direct

Explanation of acronyms

CI = confidence interval, *g* = Hedges *g*, standardised mean difference, I^2 = measure of heterogeneity across study results, N = number of participants, SMD = standardised mean difference, vs. = versus

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

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

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

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

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