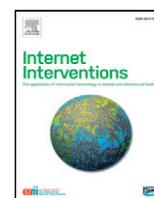


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# Internet Interventions

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## Online physical activity interventions for mental disorders: A systematic review

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### ARTICLE INFO

#### Article history:

Received 18 January 2015

Received in revised form 15 April 2015

Accepted 20 April 2015

Available online 25 April 2015

#### Keywords:

Online

Internet

Physical activity

Mental disorders

Depression

Exercise

### ABSTRACT

**Background:** Accumulating evidence indicates that face-to-face physical activity interventions improve the physical and mental health of people with mental disorders. However, it is unclear whether internet-delivered physical activity interventions are also efficacious.

**Objective:** Our aim was to determine the effect of online physical activity interventions on the severity of symptoms of mental illness among people experiencing mental disorders.

**Methods:** A systematic review of major electronic databases was conducted from inception to January 2015. Randomised controlled trials of internet-delivered interventions to increase physical activity participation in adults (> 18 years) with a DSM, ICD, clinician-confirmed diagnosis, and/or those receiving specialist mental health treatment were eligible for inclusion. Outcome data for symptom severity (depression) and physical activity participation was extracted.

**Results:** Two trials ( $N = 95$  participants) met the inclusion criteria, which investigated online clinician-guided interventions of 9–10 week duration. Results were discrepant across studies. One study found a moderate between-groups effect size compared to wait-list control on depression outcomes ( $d = .67$ ) but no differences in physical activity participation. In the other study, there were no significant differences between an online physical activity intervention versus treatment-as-usual in a university counselling service.

**Conclusion:** The preliminary findings suggest that online physical activity interventions may have positive effects on depression symptoms, but the size of the effects and mechanism of change remain unclear. Further research is critically needed to explore the efficacy and acceptability of online physical interventions for people with mental disorders.

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## 1. Introduction

The effectiveness of internet-delivered cognitive behavioural treatment for those experiencing common mental disorders has been previously demonstrated (Andrews et al., 2010). A large body of clinical evidence from randomised controlled trials (RCTs), effectiveness studies, and meta-analyses of internet-delivered CBT (iCBT) programmes demonstrate that iCBT is feasible and efficacious for treating depression (Perini et al., 2009; Ruwaard et al., 2009), a range of specific anxiety

disorders (Hedman et al., 2011; Klein et al., 2010; Paxling et al., 2011; Titov et al., 2008; Wims et al., 2010), mixed anxiety diagnoses (Carlbring et al., 2011; Johnston et al., 2011) as well as comorbid anxiety and depression (Johansson et al., 2012; Newby et al., 2013; Titov et al., 2011). Adherence rates are high in clinical trials (70–90%: e.g., Titov et al., 2011), clinically significant reductions are observed in symptoms, disability and distress, with medium to large effect pre- to post-treatment effect sizes (0.88,  $NNT = 2.13$ ) (Andrews et al., 2010; Spek et al., 2007), and the positive effects are sustained post-treatment (Andersson et al., 2013; Hedman et al., 2011). Together, the evidence provides strong support for the efficacy and cost-effectiveness of iCBT programmes in the treatment of mental disorders.

To-date, out of the available evidence-based treatments for common mental disorders that have been adapted for delivery over the internet, CBT protocols are the most common and widely available. CBT lends itself to online delivery because of its' structured nature, and its' focus

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on psychoeducation and skills-practice. However, not all patients recover during iCBT, and drop-out rates are not trivial (up to 45%), especially when iCBT is delivered in routine clinical care (Newby et al., 2014). Therefore, increasing efforts have been made in the field to develop and evaluate a range of additional internet-delivered treatment options, beyond the CBT approach. These include diagnosis-specific interventions from therapeutic modalities other than CBT, such as behavioural activation, and acceptance and commitment therapy, as well as more general programmes that teach certain skills (e.g., mindfulness-based interventions, behavioural stress management) to reduce emotional distress across disorders.

The focus of this review is to examine the literature on online physical activity interventions for people with common mental disorders, including depression and anxiety. Why investigate the impact of general physical activity interventions for mental disorders, and why look at online delivery? First, there is evidence that common mental disorders are associated with increased sedentary behaviour, the development of comorbid chronic physical diseases (e.g., type 2 diabetes, obesity, cardiovascular disease, chronic pain), and even premature mortality (Gan et al., 2014; Holt et al., 2014; Smith et al., 2013). Sedentary behaviour is recognised as a key modifiable risk factor contributing to the premature mortality experienced by those with serious mental disorders (De Hert et al., 2009; Scott and Happell, 2011; Vancampfort et al., 2012a).

Physical activity interventions directly address sedentary behaviour, and are a feasible, acceptable and efficacious co-treatment strategy for a range of mental disorders regardless of psychiatric diagnoses (Cooney et al., 2013; Rosenbaum et al., 2014a; Stanton et al., 2014). Positive effects of physical activity and exercise (a structured subset of physical activity) have been found across a broad range of mental disorders including depression (Cooney et al., 2013), anxiety (Jayakody et al., 2013), schizophrenia (Gorczyński and Faulkner, 2010; Vancampfort et al., 2012b, 2012c) and bipolar disorder (Wright et al., 2009) with effect sizes (SMD) ranging from 0.46 to 1.0. Examples of successful physical activity and lifestyle interventions for people experiencing mental illness are increasing (Bruins et al., 2014; Daumit et al., 2013), with growing interest in the role of physical therapists and exercise physiologists to facilitate the delivery of such interventions (Rosenbaum et al., 2014b; Stanton, 2013; Stubbs et al., 2014).

Despite the demonstrated benefits of physical activity and lifestyle interventions for people experiencing mental disorders, it is still unknown how generalist physical activity interventions compare in efficacy to specific programmes targeting specific mental disorders. In addition, the optimal method of implementation and integration of such interventions within existing services requires further research (Bartels, 2015; *The Lancet*, 2014). Physical activity interventions are traditionally delivered face-to-face, either individually or in groups. This mode of delivery may limit accessibility for key target groups, due to high transport costs or lack of access to qualified exercise specialists in particular settings (e.g., rural and remote communities) (Rosenbaum et al., 2015).

Delivering interventions for increasing physical activity among people with mental disorders over the internet presents a potentially useful implementation strategy, because of the low cost, and ability to reach a large number of people in the community. There has been extensive research in this area in the general adult population. Supporting the results of an earlier meta-analysis (Davies et al., 2012), a recent systematic review of 46 randomised controlled trials (RCTs) of internet-delivered physical activity interventions found that internet-based interventions were effective in increasing physical activity (Joseph et al., 2014). However, the question as to whether online physical activity interventions are effective for people with mental disorders has not yet been systematically reviewed or evaluated. To address this gap, the aim of this systematic review was to comprehensively summarise the literature to determine the effect of online physical activity interventions on the severity of symptoms of mental illness among people experiencing mental disorders.

## 2. Method

### 2.1. Design

The aims and methods of this systematic review and meta-analysis were registered with the PROSPERO database prior to conducting the review (#CRD42015015848). Reporting has been conducted as per the PRISMA statement (Moher et al., 2009).

### 2.2. Identification and selection of trials

An electronic database search was conducted from earliest record to January 2015 using MEDLINE, PsycInfo, Cochrane Central Register of Clinical Trials, and Google Scholar. The search strategy combined keywords for 'mental illness', 'mental health', 'mental disorders', 'depression' and 'anxiety' with 'physical activity' and 'exercise' in addition to 'online', 'internet' and 'web'. The full search strategy can be found in [Appendix A](#). The reference lists of relevant systematic reviews were also hand searched. Study eligibility was assessed by two reviewers (SR and JN), with disagreements resolved by a third reviewer (PW). The same reviewers extracted the outcome data and trial quality information. [Table 1](#) summarises the characteristics of included trials including diagnosis and intervention.

### 2.3. Assessment of trial characteristics and risk of bias

#### 2.3.1. Quality

The quality of included trials was rated according to the Physiotherapy Evidence Database (Maher et al., 2003) Scale (1–10), which assessed the internal validity of a randomised controlled trial (RCT) (de Morton, 2009). PEDro scale scores and key features of the study design including the concealed allocation of participants to groups and the blinding of assessors are reported in [Table 2](#).

### 2.4. Inclusion/eligibility criteria

#### 2.4.1. Participants

Eligible studies were those that included participants 18 years of age or older, in whom a DSM or ICD diagnosis of mental disorder was made, and/or receiving treatment from a specialist mental health service. No restriction was placed on the source of the participants; patients from primary care as well as community settings were eligible, and the source of recruitment was recorded. Gender, age and number of participants were extracted from eligible trials.

#### 2.4.2. Interventions

Eligible studies evaluated an online intervention (delivered predominantly over the internet without significant face-to-face contact) that included 2 or more modules or lessons, and were designed to target people experiencing mental disorders, aiming to increase physical activity or exercise participation. The terms 'physical activity' and 'exercise' were defined according to the American College of Sports Medicine (ACSM) definitions; 'physical activity' is 'any body movement that is produced by the contraction of skeletal muscles that increases energy expenditure' (Garber et al., 2011), whilst 'exercise' is 'a subset of physical activity that is planned, structured and deliberate' (Thompson et al., 2003). We included all forms of physical activity that met these definitions, such as aerobic, resistance-based or mixed-type interventions, and interventions designed to increase incidental physical activity. The American College of Sports Medicine guidelines state that adults should engage in aerobic exercise for at least 20 to 30 min per day, three to five days per week depending on intensity. The guidelines also recommend that adults should perform resistance exercises for each of the major muscle groups (eight to 10 exercises, eight to 15 repetitions per exercise) on two to three days per week (Garber et al., 2011). We aimed

**Table 1**  
Description of included trials (n = 2).

Trial	Age mean (SD)		Physical activity intervention and number of modules	Diagnosis; diagnostic criteria	Control	Sample	Outcome(s)
	Exp	Con					
Mailey et al. (2010) N = 47	25 (18–52); Exp n = 23; Con n = 24		10-week access to Internet Activity for College Students (IPACS) website + pedometers. 4 modules ( <i>Getting Started, Planning for Success, Beating the Odds, Sticking With It</i> ). Two monthly face-to-face meetings with PA counsellor.	Registered and receiving mental health counselling	10-weeks mental health counselling	College students	BDI; Physical activity participation
Ström et al. (2013) N = 48	48.8 (12.7); n = 24	49.6 (8.7); n = 24	9-week clinician-guided self-help intervention. The intervention comprised 9 modules consisting self-help texts about how to become more physically active. Three to five essay questions per module. All participants were provided with a pedometer.	DSM-IV Major Depressive Disorder	Wait-list	Community	BDI-II; Physical activity participation

Note. SD = standard deviation. Exp = experimental (treatment) group, Con = control group. DSM-IV = Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, BDI = Beck Depression Inventory; BDI-II = Beck Depression Inventory, second edition. PA = physical activity.

to extract information to evaluate whether included trials recommended physical activity levels in accordance with these guidelines.

Both self-guided and clinician-guided online programmes were eligible for inclusion. Interventions that solely consisted of self-monitoring tools, mobile phone applications, or email/SMS based interventions were excluded. Interventions where the exercise or physical activity component comprised less than approximately 50% of the total intervention were excluded. The reason for this exclusion criterion was because we sought to investigate the impact of online interventions where physical activity formed the major component, rather than interventions that include only brief discussion about the importance of physical activity in managing psychiatric symptoms (e.g., CBT) or combined lifestyle interventions.

#### 2.4.3. Comparisons

Trials were included if they compared online physical activity programmes to either a usual care, wait-list, or no-treatment control group. Trials that compared two different forms of physical activity intervention were excluded.

#### 2.4.4. Outcome measures

Trials were included in the review if they provided outcome data at pre- and post-treatment on at least one validated standardised self-report measure of the severity any mental disorder (e.g., depression severity). The primary outcome was changes in severity of the mental disorder from baseline to post-treatment on standardised self-report outcome measures. Secondary outcomes included changes between pre- and post-treatment on anthropometry (e.g., weight, waist circumference or body mass index) outcome measures. If multiple data points following treatment were provided, the scores obtained as close to the completion of the intervention as possible were extracted.

**Table 2**  
Methodological quality of included trials (n = 2).

Trial	PEDro score	Eligibility criteria specified	Random allocation	Concealed allocation to groups	Groups similar at baseline	Blinding of all subjects	Blinding of therapists who administered therapy	Blinding assessment of outcome measures	Measures obtained from more than 85% of subjects	Intention to treat analysis	Between-group statistical comparisons reported	Both point measures and measures of variability reported
Mailey et al. (2010) N = 47	5	Yes	Yes	No	Yes	No	No	No	Yes	No	Yes	Yes
Ström et al. (2013) N = 48	6	Yes	Yes	No	Yes	No	No	No	Yes	Yes	Yes	Yes

#### 2.4.5. Study design

Studies were included that were published in a peer-reviewed journal up to January 7, 2015. We included all randomised controlled trials comparing online physical activity programmes to a control condition. Studies that comprised case series or used a pre-post open trial design were excluded.

### 3. Results

#### 3.1. Flow of trials through the review

A total of 230 records (excluding duplicates) were identified. After screening of abstracts and titles, 20 eligible randomised trials were identified. After reviewing full-text manuscripts, two trials were included that met the full eligibility criteria (Mailey et al., 2010; Ström et al., 2013). Fig. 1 presents the study flow chart.

#### 3.2. Characteristics of included trials

Table 1 summarises the characteristics of included trials, including participant primary diagnosis, diagnostic criteria, summary of the online physical activity intervention, and control group protocol. Two trials involving a total of 95 participants were included. The methodological quality of included trials is summarised in Table 2. Both studies were of good methodological quality according to the PEDro scale, with the main difference being that Ström et al. (2013) utilised an intention-to-treat analysis. The mean age of participants in Mailey et al. (2010) study was 25 (range 18–52) years, whilst participants in Ström et al. tended to be older (mean age 49, range 24–67 years).

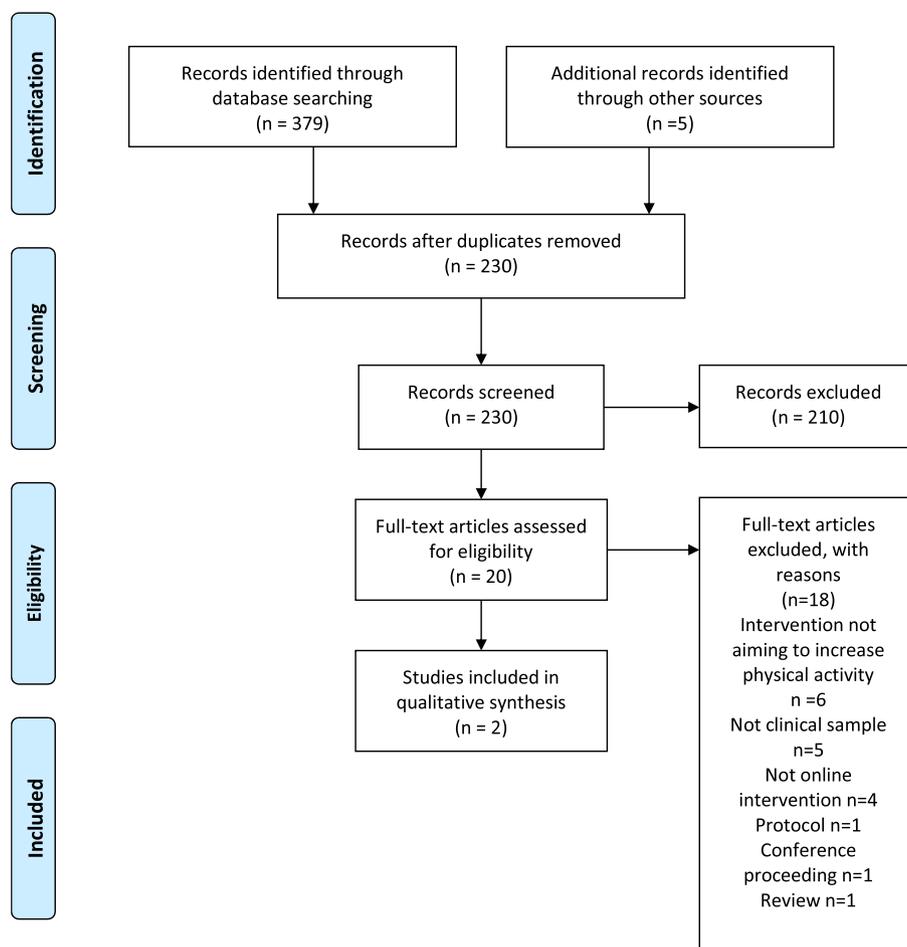


Fig. 1. PRISMA flow diagram.

Neither study reported baseline or follow-up anthropometric data (e.g., weight, waist circumference or body mass index).

Description of control groups and treatments: Both trials utilised an online-delivered physical activity intervention. In terms of control groups, Ström et al. (2013) used a wait-list control group, whereas Mailey et al. (2010) utilised a treatment-as-usual control group (mental health counselling). With regard to the interventions, Ström et al. (2013) investigated the efficacy of a 9-week clinician-guided self-help intervention. The intervention comprised 9 self-help text-based modules (72 pages total), that were released weekly. Modules included psychoeducation about depression and how it can be treated with physical activity; the influence of sedentary behaviour on health outcomes and optimal physical activity levels for positive health outcomes; common barriers to physical activity and how to overcome them; the stages of change model and motivational balance exercise (pros and cons of increasing exercise); goal setting using SMART principles; activity scheduling; handling setbacks and relapses during behaviour change; nutritional advice, as well as how to achieve sufficient rest and recovery after physical activity; acceptance and commitment theory and values exercise; mindful walking and incorporating acceptance in the struggle to increase physical activity. Each module had corresponding homework assignments, consisting of three to five essay questions per module. Therapists provided written feedback on homework assignments, and exchanged messages with participants. All participants were also provided with a pedometer for motivational purposes and to encourage participants to track their physical activity.

The intervention evaluated in Mailey et al. (2010) consisted of a 10-week intervention. Participants were paid (\$60) for completing the outcome questionnaires. The intervention comprised access to a secure website: Internet Physical Activity for College Students (IPACS) which featured four modules, each of which became available bi-weekly. The first module included education about the benefits of exercise, how to exercise safely, and monitor activity. The second module taught about self-efficacy, outcome expectations and goal setting. The third module discussed barriers to physical activity and strategies to overcome barriers, with an emphasis on utilising social support. The final module provided advice for maintaining a physically active lifestyle. Participants were provided a pedometer to wear daily throughout the study. Participants were promoted to submit an activity log each week electronically, and downloaded data from their pedometers at the end of each month for feedback. Finally, all participants attended two monthly face-to-face meetings with a counsellor to provide feedback on the activity logs and pedometer readings, to set goals, and address barriers to achieving goals. Counsellors emailed participants following the face-to-face meetings to encourage participants with progress.

Both studies used a measure of depression as their primary outcome. Mailey et al. (2010) reported a small, positive effect (Cohen's  $d = 0.12$  for the within-group pre-to-post treatment effect) of the intervention on depression severity between baseline (pre-treatment) and 10-week follow-up (post-treatment) (intervention BDI pre-treatment:  $M = 15.7$ ,  $SD = 11.1$ ; post-treatment:  $M = 14.2$ ,  $SD = 12.1$ , control group BDI pre-treatment:  $M = 16.0$ ,  $SD = 6.3$ ; post-treatment,  $M = 15.6$ ,  $SD =$

7.2, Cohen's  $d = 0.07$  for the within-group effect). There was a small, but non-significant difference between the intervention group and the treatment-as-usual control group at follow-up (Cohen's  $d = 0.15$ ,  $p = 0.6$ ). Mailey et al. (2010) also reported significantly increased physical activity in both the intervention condition (Cohen's  $d$  for the within-group effect = 0.68) and the control condition (Cohen's  $d$  for the within-group effect = 0.05). In contrast to Mailey et al. (2010), Ström et al. (2013) found a large, significant reduction in depression symptoms between pre and post-treatment (treatment: pre-treatment:  $M = 26.92$ ,  $SD = 9.3$ , post-treatment:  $M = 17.88$ ,  $SD = 11.3$ ), corresponding to a large ( $d = .89$ ) within-group effect size. They also found a moderate between-groups effect size difference between the treatment and control groups at post-treatment (Cohen's  $d = 0.67$ ; control: pre:  $M = 28.25$ ,  $SD = 7.08$ , post:  $M = 24.04$ ,  $SD = 6.86$ ). No significant interaction effect between group and time was found for self-reported physical activity.

With regard to adherence rates and participant retention, the two studies used different metrics for participant adherence. Mailey et al. (2010) reported that 3 out of 26 participants dropped out in the intervention group (88% adherence). In contrast, Ström et al. (2013) found that 14/24 (58%) of the participants in the treatment group completed all treatment modules, although they reported post-treatment data for all participants.

#### 4. Discussion

In the current study, we systematically reviewed the existing literature on online physical activity interventions for people with common mental disorders. We identified only two RCTs of online physical activity interventions that met our inclusion criteria, which studied a total of 95 participants. Both of the included studies examined the effects of online physical activity interventions on depression severity and physical activity participation. The included RCTs were of reasonable methodological quality based on the PEDro risk of bias measure. The first trial, conducted by Mailey et al. (2010) evaluated an online physical activity programme that targeted college students receiving treatment at a university mental health counselling clinic, whilst the second trial conducted by Ström et al. (2013) examined an online physical activity intervention specifically designed for people with DSM-IV major depressive disorder (MDD).

Due to the small number of trials, it is difficult to draw definitive conclusions about the effects of online physical activity interventions, but the preliminary findings suggest that they may have positive effects on both physical activity participation and depression symptoms. However, it is unclear whether the improvements in symptoms constitute clinically meaningful and reliable change. Ström et al. (2013) found evidence of a large and significant reduction in depression symptoms on the BDI-II between pre- and post-treatment, and a moderate between-groups effect size favouring the intervention group over a wait-list control group (Cohen's  $d = 0.67$ ). In contrast, Mailey et al. (2010) found only a very small, but positive effect on depression severity on the BDI between baseline and post-intervention (Cohen's  $d = 0.12$ ), and a small but non-significant difference between the intervention group and the treatment-as-usual counselling control group. It remains unclear whether increases in physical activity were the causal mechanism underlying symptom improvements in both studies, as there were inconsistent evidence for the relationship between changes in physical activity and improvements in psychiatric symptoms in both studies. Including objective measures of cardiorespiratory fitness, and physical activity may help to determine the underlying causal mechanism and association between increased physical activity and reduced psychiatric symptoms.

The discrepancy in results across the two studies included in this review may be in part due to methodological differences, sample characteristics, features and quality of the physical activity interventions, and/or the nature of the therapist input, support and guidance. For

example, Mailey et al. (2010) included a sample of young college participants ( $M = 25$  years) receiving treatment from a counselling service, whereas Ström et al. (2013) included relatively older participants ( $M = 45$  years) who met DSM-IV criteria for a diagnosis of MDD. It is possible that the latter sample may have been more sedentary at the beginning of the intervention, or they may have been more motivated to adhere to the recommended activities. Alternatively, it is also possible that the quality, content and intensity of the interventions differed across studies in important ways, and that the intervention evaluated in the study by Ström et al. (2013) consisted of components that were more effective. Although the interventions were similar duration (9 and 10 weeks), the Mailey et al. (2010) intervention involved participants completing 4 modules over 10 weeks, whereas the physical activity intervention in Ström et al. (2013) consisted of 9 modules over 9 weeks and was more intensive in terms of the amount of education offered to participants. The latter intervention also taught a greater number of skills that spanned a range of therapeutic modalities including extensive psychoeducation, motivational change techniques, identifying cognitive errors, as well as mindfulness and acceptance techniques. In addition, Ström et al. (2013) incorporated specific homework tasks to assess participants' progress and understanding of key concepts, and provided therapist support and encouragement on a weekly basis. In contrast, Mailey et al. (2010) required participants to log their activity on a weekly basis, but participants appeared to have clinical contact with therapists (counsellors) only on two occasions throughout the 10 week period.

The most surprising finding of this review is the scarcity of studies evaluating online physical activity programmes for people with mental disorders. It is unclear why there are so few studies in this field, particularly in light of the large number of studies evaluating internet-delivered psychological therapies (e.g., CBT) for mental disorders, and the large number of studies of physical activity interventions in the general population. One possible explanation is that physical activity interventions are often thought of as an adjunctive treatment, rather than a stand-alone treatment. As a consequence, researchers and clinicians may be hesitant to treat participants with mental disorders solely with an online physical activity intervention, whilst restricting participants' access to other evidence-based treatments. Another possibility is that it is difficult to find clinicians with sufficient expertise in physical activity prescription in the context of mental disorders. It is possible that a multidisciplinary team (including exercise physiologists or physiotherapists as well as psychologists or psychiatrists) is needed to provide therapist input, but this may not be practical or feasible in existing settings that deliver online treatments.

More studies are needed to identify the nature, type, duration and intensity of online physical interventions that promote the largest positive changes in symptoms and physical activity, and the type of therapist support and homework tasks that promote sustained gains. More studies are also needed to explore how internet-delivered physical activity interventions compare to existing gold-standard treatment approaches (including internet-based treatment programmes) for common mental disorders. Interestingly, a RCT is currently underway comparing internet-delivered physical exercise to behavioural activation for depression, which will begin to examine this question (Carlbring et al., 2013) and begin to shed light on how generalist physical activity programmes compare to specific behavioural activation treatments for depression.

Both studies assessed self-reported physical activity participation and self-reported symptom severity (e.g., depression). However, given the strong association between common mental disorders (e.g., depression) and the risk for chronic diseases such as type 2 diabetes, obesity and cardiovascular disease (e.g., Katon, 2011), future studies should examine the impact of online physical activity interventions on key physical health outcomes (e.g., waist circumference and other anthropometric outcomes), and the cluster of risk factors associated with metabolic syndrome (blood lipids, blood sugar levels, blood pressure). In addition,

future research studies utilising online-delivered physical activity interventions should at minimum cite the appropriate population-based guidelines and recommendations for physical activity, and state whether or not the physical activity intervention is consistent with these recommendations. We were unable to determine whether the physical activity interventions were consistent with population-based guidelines due to the limited description of the physical activity protocols.

Although there is a consistent body of research demonstrating that individualised physical activity and exercise interventions lead to increased adherence, the results of Ström et al. (2013) suggest that a standardised online physical activity intervention can lead to positive results, in line with the findings of the Joseph et al. review of internet-based physical activity interventions in the general population (Joseph et al., 2014). Further research is needed to examine and compare the impact of individualised versus tailored approaches, as well as self-guided versus clinician-guided online interventions for physical activity on symptom severity and adherence rates. Interventions developed by multidisciplinary teams incorporating expertise from exercise science and mental health clinicians will likely result in development of methods that will optimise clinical outcomes.

This review highlights the need for more high quality RCTs examining the effects of online physical activity interventions in people with mental disorders, to clarify the acceptability, feasibility, efficacy and effectiveness of online physical activity interventions in such groups and the extent to which these can be integrated with the growing availability of iCBT interventions. Whilst there is growing interest in traditional face-to-face physical activity interventions for common mental disorders, there are substantial barriers to the scalability of these interventions, which require clinicians with appropriate training and expertise. High costs, geographical barriers, and insufficient numbers of qualified clinicians present significant barriers that have the potential to limit access. In addition, because of ongoing funding constraints in the health sector, there is a growing need to develop and deliver low-cost and cost-effective interventions. In light of the positive effects of face-to-face physical activity interventions, more research is needed to determine whether these positive effects can be translated into the online delivery format, and whether online physical activity interventions are feasible and acceptable to patients. Given the high societal and economic burden of mental disorders, such novel interventional approaches provide an opportunity to improve outcomes for people living with mental disorders.

## 5. Conclusions

The potential to utilise online delivery of physical activity interventions for people with mental disorders is largely unrealised; given the ready scalability that the online delivery mode offers, it may be possible to greatly improve access to an intervention that has shown great promise as a co-treatment for reduction of psychiatric symptoms and improvement of physical health outcomes when delivered in-person. Based on past success in implementing iCBT interventions, there are grounds for optimism that similar positive outcomes can be achieved for physical activity interventions.

## Conflict of interest statement

All authors declare that they have no conflicts of interest.

## Acknowledgements

Financial funding for this study was provided by the Australian National Health and Medical Research Council (NHMRC) in the form of a Fellowship awarded to Jill Newby (1037787). The NHMRC had no involvement in any aspect of the study, nor in the preparation of this manuscript.

## Appendix A. MEDLINE search strategy

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1  exp exercise
2  exp exercise therapy
3  exp physical exertion
4  exp walking
5  exp running
6  exp swimming
7  exp jogging
8  exp bicycling
9  exp physical education/ and train.mp [mp = protocol supplementary concept,
rare disease supplementary concept, title, original title, abstract, name of
substance word, subject heading word, unique identifier]
10 exp resistance training
11 exp aerobic exercise
12 exp physical activity
13 exercise$.tw.
14 (physical adj1 activ$).mp.
15 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15
16 exp mental disorders
17 exp depression
18 exp anxiety disorder
19 exp bipolar disorder
20 exp post traumatic stress disorder
21 exp schizophrenia
22 exp eating disorder
23 exp mood disorder
24 exp obsessive compulsive disorder
25 exp panic disorder
26 mental health.tw.
27 mental illness.tw.
28 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27
29 randomized controlled trial.pt.
30 random.tw.
31 randomly.ab.
32 random$.tw.
33 29 or 30 or 31 or 32
34 15 and 28 and 33
35 web.mp
36 computer.mp
37 internet.mp
38 online.mp
39 35 or 36 or 37 or 38
37 34 and 39

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