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The impact of exercise on the mental health and quality of life of people with severe mental illness: a critical review

Abstract

Introduction: Physical exercise has been proven to benefit the general population in terms of mental health and wellbeing. However, there is little research investigating the impact of exercise on mental health and quality of life for people who experience a severe and enduring mental illness.

Method: This review aims to describe the effect of physical exercise intervention on the mental health and quality of life of people with severe mental illness. Quantitative and qualitative articles published between 1998-2009 were sourced using electronic databases. Articles were included if the study intervention involved exercise and the outcome measure included mental health or quality of life. Sixteen articles were analysed for common themes and appraised critically.

Findings: The findings show that exercise can contribute to improvements in symptoms, including mood, alertness, concentration, sleep patterns and psychotic symptoms. Exercise can also contribute to improved quality of life through social interaction, meaningful use of time, purposeful activity and empowerment.

Implications: Future research is warranted to describe the way exercise can meet the unique needs of this population. Studies with a focus on psychological outcome measures would provide greater evidence for its use in therapy.

Introduction

Exercise has long been proven to benefit the general population in terms of mental health and wellbeing (Stathopoulou et al 2006). Many studies have examined its effect on anxiety disorders, minor depression and substance abuse (Stathopoulou et al 2006). In comparison, very little research has investigated the use of exercise in people who experience more severe and enduring mental illnesses. This systematic review adopts this focus and examines the impact that exercise can have on mental health and quality of life (QOL) for people with a severe mental illness. For the purposes of this review, the term 'severe mental illness' (SMI) encompasses severe and enduring illnesses, such as severe depression, bipolar disorder, schizophrenia, schizoaffective disorder and psychosis.

Observational studies of people with SMI have highlighted a link between reported regular levels of exercise and physical activity and improved mood and QOL (McCormick et al 2008). Researchers, however, have emphasised the limited number of intervention studies regarding the effect of exercise on mental health and QOL in this population group (Fogarty et al 2004, Richardson et al 2005).

Two main factors support the need for more research on the use of exercise intervention in this population. First, people with SMI are typically prescribed with antipsychotic medications. The risks and side effects of these medications and polypharmacy warrant a need to explore safer treatment approaches, such as exercise (Trivedi et al 2006). Secondly, people with SMI experience greater rates of obesity and risky health behaviours, and poorer levels of fitness, compared with the general

population (Smith et al 2007a). There is already an extensive body of research on the need for exercise interventions to address the physical health issues in people with SMI (Faulkner et al 2007). Confirmation of the benefits of exercise interventions for improving QOL could potentially add secondary benefits beyond the recognised improvements in physical health parameters.

The World Health Organization describes quality of life as a 'broad ranging concept affected in a complex way by the person's physical health, psychological state, level of independence, social relationships, personal beliefs and their relationship to salient features of the environment' (World Health Organization 1997, p1). Occupational therapy researchers theorise that QOL can be obtained through engagement and participation in personally meaningful occupations (Hammell 2004). Occupational therapists use meaningful activity as a medium through which people can engage in doing, being, becoming and belonging; these concepts have been described as core aspects in the meaning of occupation (Wilcock 1998, Hammell 2004). Exercise has been defined by the American College of Sports Medicine (2006) as '... planned, structured, and repetitive bodily movement done to improve or maintain one or more components of physical fitness' (p3). Exercise as a purposeful activity therefore may be able to provide people with the opportunity to 'do' exercise, to 'be' and 'become' exercisers, and to 'belong' to an exercise group or culture. The related term 'physical activity' extends not only to exercise, but also to '... activities which involve bodily movement and are done as part of playing, working, active transportation, house chores and recreational activities' (World Health Organization 2011).

Method

Aim of review

The aim of this review was to describe the effect of exercise intervention on the mental health and QOL of people with SMI. To gain a broad understanding of these issues, both quantitative and qualitative studies were included in the review.

Search strategy

A search was conducted using CINAHL, PsycInfo, the Cochrane Library, Scopus and Medline. The key words were 'physical exercise', 'exercise', 'exercise therapy', 'physical activity' and 'exercise movement therapies'. In the mental health category, literature searches were prefaced with 'severe', 'serious', 'enduring' and 'persistent' in relation to the degree of mental illness. In addition, 'schizophrenia' and 'psychosis' (and appropriate truncations) were used as key search words. The word 'depression' alone presented articles with mild and moderate depression. In order to keep with the focus on SMI, only 'major' or 'severe' or 'bipolar' were included in the literature search. Alzheimer's disease and dementia were listed under SMI in some databases; consequently, these articles were excluded because they did not meet the definition of SMI for the purposes of this review. Two systematic reviews from the Cochrane Library (Campbell and Foxcroft 2003, Faulkner et al 2007) were examined to provide an understanding of current knowledge and research. Reference lists were searched for any additional articles.

In total, 68 articles relevant for this study were sourced, 37 of which were quantitative and 16 qualitative in design. The remaining articles included six systematic reviews, five literature reviews, two of mixed-method design and two opinion pieces.

Inclusion criteria

The following inclusion criteria were placed on all studies:

- Published in a peer-reviewed journal
- Published in English between 1998 and 2009
- Relevant background literature reviewed
- Intervention involved exercise or physical activity (either independently or as part of a programme involving multiple intervention approaches).

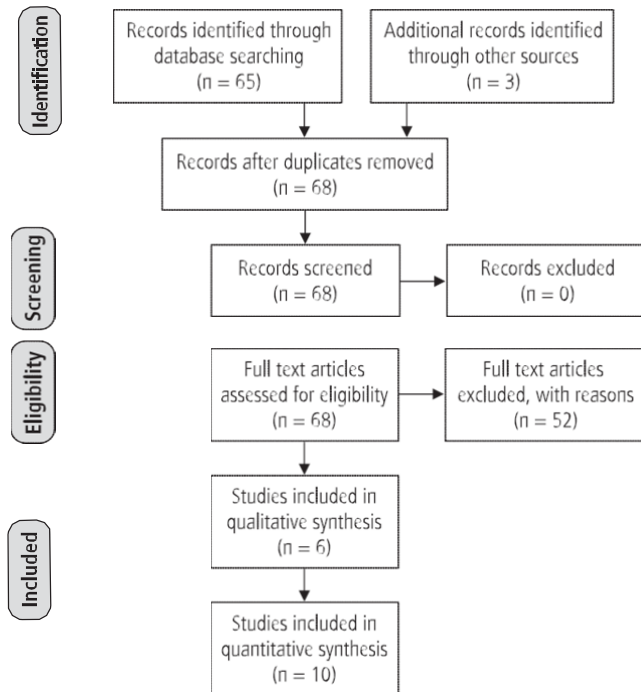
Quantitative studies were also required to meet the following criteria: (1) at least one outcome measure was used to assess the effect of exercise or physical activity on mental health, wellbeing or QOL; (2) study design was a randomised controlled trial (RCT), clinical trial or pre-post design; and (3) results were reported in terms of statistical significance. Qualitative studies were required to meet the following criteria: (1) outcome under study was either the perceived effect of exercise or physical activity on mental health, wellbeing or QOL, and (2) research question and methodology were clearly defined.

Articles dated prior to 1998 were excluded to restrict the review to literature published over the previous decade. A total of 16 studies met the inclusion criteria, including nine quantitative designs, six qualitative designs and one mixed-method design, although only the quantitative analysis in this study met the inclusion criteria. The PRISMA flowchart (Moher et al 2009) (Fig. 1) summarises the assessment and exclusion of articles.

Methodological quality assessment

Studies were analysed for methodological quality according to the guidelines developed by the McMaster University Occupational Therapy Evidence-Based Practice Research Group (Law et al 1998, Letts et al 2007). In order to illustrate the methodological quality of each study, the tool was modified by awarding a numerical score for criteria met under this quality assessment tool. The modified version of the tool was modelled on those used in systematic reviews by Barras (2005) and Deenadayalan et al (2010). Appendix 1 details the scoring method and the questions used to appraise the studies.

Fig. 1. PRISMA (Moher et al 2009) flowchart.



Analysis method

The heterogeneity of both interventions and outcome measures, as well as the consideration of qualitative studies in this review, rendered a meta-analysis unfeasible. Therefore, a narrative analysis approach was adopted for this systematic review.

Findings

All 16 articles reviewed are summarised under the headings of design, intervention, outcome measures, results and quality score in Table 1.

Methodological design

Quantitative studies

Of the quantitative studies, six were RCTs (Babyak et al 2000, Beebe et al 2005, Skrinar et al 2005, Brown and Chan 2006, Duraiswamy et al 2007, Melamed et al 2008) and three were a pre-post design (McDevitt et al 2005, Trivedi et al 2006, Smith et al 2007b). The mixed quantitative and qualitative study also adopted this latter approach (Pelletier et al 2005). Sample size ranged between 10 (Beebe et al 2005) and 966 participants (Smith et al 2007b). Four articles were pilot studies (Beebe et al 2005, McDevitt et al 2005, Pelletier et al 2005, Trivedi et al 2006). Mean age ranges were between 32 (Duraiswamy et al 2007) and 46 years (Pelletier et al 2005). Gender distribution in proportion of female participants ranged from 85% (Brown and Chan 2006) to 20% (Beebe et al 2005).

In terms of validity of the RCTs, one control group had significantly different baseline characteristics for gender and subjective scores of health and fitness to the intervention group (Brown and Chan 2006), and two control groups had issues with contamination (Babyak et al 2000, Melamed et al 2008). Four trials used single-blind designs whereby the assessors were blinded (Babyak et al 2000, Beebe et al 2005, Brown and Chan 2006, Duraiswamy et al 2007), while two trials did not specify if blinding procedures were in place (Skrinar et al 2005, Melamed et al 2008). Dropout rates ranged between 13% (McDevitt et al 2005) and 53% (Trivedi et al 2006). Intention-to-treat analysis was performed on four studies (Beebe et al 2005, McDevitt et al 2005, Brown and Chan 2006, Melamed et al 2008). However, two of these trials also used analysis by compliers ('per protocol') only at the 12-month follow-up period (Melamed et al 2008) and to calculate measures of change (McDevitt et al 2005).

Qualitative studies

All of the qualitative studies were conducted in the United Kingdom, with the exception of one Australian study (Fogarty and Happell 2005). Two studies adopted a case study design (Carless and Douglas 2008, Carless and Sparkes 2008), while the remainder consisted of one grounded theory (Crone and Guy 2008), one ethnography (Faulkner and Sparkes 1999), one not stated (Fogarty and Happell 2005) and one study that described itself as descriptive qualitative (Crone 2007).

Sample sizes ranged between 2 (Carless and Douglas 2008) and 12 participants (Fogarty and Happell 2005). One study had an equal gender ratio (Crone 2007) and another had one female to two male participants (Faulkner and Sparkes 1999). The remaining qualitative studies had a majority of male participants. Only two studies reported briefly on participant age, with one implying that the participants were in their forties (Carless and Douglas 2008) and the other stating an age range of 20-42 years (Fogarty and Happell 2005). The remaining studies did not report on participant age.

Findings

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Methodological design

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Table 1. Study design, characteristics and findings

Study and design	Intervention	Outcome measures*	Results	Quality score
Quantitative				
Babiyak et al (2000) Randomised controlled trial. Study duration 10 months (4 months plus 6 months post-treatment follow-up), n = 156.	Setting: Not stated. Exercise group (study): Three supervised sessions per week for 16 weeks. Ten minutes warm-up, 30 minutes walking/cycle ergometry/jogging, 5 minutes cool down. Training range 70-85% maximum heart rate reserve. Medication group (control): 'Zoloft' Sertraline (Selective serotonin-reuptake inhibitor). Combined exercise and medication group: As above.	Diagnostic Interview Schedule; Hamilton Rating Scale for Depression (HRSD); Becks Depression Inventory (BDI); and Interview: self-reported measures of number of sessions per week, duration of sessions and type of physical activity.	Non-significant difference in self-reported symptoms (BDI scores) between groups. HRSD and Diagnostic Interview Schedule scores showed exercise group had significantly lower rates of depression than other groups (30% study compared with 52% control and 55% combined group). Participants in exercise group more likely to be partially or fully recovered at 6-month follow-up when compared with control or combination group. Participants who self-reported that they continued to engage in physical activity after the study period were less likely to be classified as 'depressed' at a follow-up 6 months later (statistically significant).	10/15
Beebe et al (2005) Randomised controlled trial. Study duration 16 weeks, n = 10.	Setting: Outpatients. Walking group (study): Supervised treadmill programme. Three times per week. Ten minutes warm-up, 30 minutes walking (graded from 5 minutes initially over first 3 weeks of programme), 10 minutes cool down. Walking at target heart rate. Control group: Nil exercise.	Positive and Negative Syndrome Scale (PANSS).	Non-significant reduction in PANSS score for study group. Non-significant increase in mean PANSS score differences between groups.	14/15
Brown and Chan (2006) Randomised controlled trial. Study duration 6 weeks, n = 28.	Setting: Community. Health promotion package (study): Follows pre-developed programme: Lilly Meaningful Day Manual. Programme includes health education; activity diaries; access to community facilities. Six by 50-minute one-on-one health promotion sessions. Subjects covered include weight control, healthy eating, exercise, structured daily activity and substance misuse. Standard control group.	Initial basic health questionnaire; Hospital Anxiety and Depression Scale (HAD); and Likert scale for self-reported measure of current physical health, physical fitness and mental health.	Study group had non-significant reductions in HAD scores. Study group had non-significant improvements in subjective views of mental health.	11/15
Duraiswamy et al (2007) Randomised controlled trial. Study duration 4 months, n = 61.	Setting: Inpatient and outpatient. Yoga therapy (study): Yoga positions, breathing practice, relaxation techniques. Physical exercise therapy (control): Brisk walking, jogging, exercises in standing/sitting postures, relaxation. Both interventions involved 3-week training period followed by 3 months continued participation (reviewed by therapist monthly). One hour per day, 5 days per week.	Positive and Negative Syndrome Scale for Schizophrenia (PANSS); Social and Occupational Functioning Scale (SOFS); and WHO Quality of Life BREF Version (WHOQOL-BREF).	Both study and control group had statistically significant drop in total PANSS score. Study group scored significantly lower in total PANSS score than control. Study group scored significantly lower in PANSS sub-scores for Negative, Depression Score, Anergia Score than control (no significant difference for Positive sub-scores). Study group scored significantly better in QOL scores. Study group scored significantly better in SOFS scores.	10/15

*Where study focus also included physical health outcome measures, only mental health outcome measures are listed here.

Table 1 (continued)

Study and design	Intervention	Outcome measures*	Results	Quality score
<p>McDevitt et al (2005) Pre-post design. Study duration 12 weeks, n = 15.</p>	<p>Setting: Community (outpatient). Study: Supervised group walking programme. Individualised prescription at orientation. Four times a week. Warm-up and cool-down periods. Between 10 and 30 minutes walking. Intensity between 60 and 79% of predicted maximal heart rate. Health workshops on problem solving, goal setting, overcoming barriers and planning. Ongoing problem solving and support.</p>	<p>Short-Form Health Survey (SF-12); Profile of Mood States (POMS); Multnomah Community Ability Scale; Outcomes Expectancies for Exercise Scale; and Decisional Balance Scale.</p>	<p>No change in SF-12 scores. Significant improvement in mood score (POMS) and psychosocial functioning (Multnomah Community Ability Scale).</p>	11/15
<p>Melamed et al (2008) Randomised controlled trial. Study duration 3 months plus review 12 months follow-up post completion of study, n = 59.</p>	<p>Setting: Inpatient (hospital). Study: Supervised 30-minute walks five times per week. Warm-up period, quick pace, cool-down period. Aerobic exercise via video when rain prevented walking outdoors. Weekly structured nutrition counselling in small groups. Group-based behaviour therapy.</p>	<p>Positive and Negative Syndrome Scale (PANSS); and abbreviated version of Quality of Life Enjoyment and Satisfaction Questionnaire (Q-LES-Q).</p>	<p>Significantly better quality of life scores for study group than control post-intervention (3 months). Non-significant relationship between PANSS scores and involvement in the intervention (3 months). (Twelve-month review only reported outcome measures in physical health.)</p>	9/15
<p>Pelletier et al (2005) Mixed method: only quantitative pre-post design component met inclusion criteria. Study duration 16 weeks, n = 25.</p>	<p>Setting: Supported community setting (ICCD Clubhouse). Study: Three by 90 minutes sessions per week. Thirty-minute warm up (aerobics and flexibility). Individually customised weight machines programme. Bottled water provided. Shirts provided with team appointed logo printed on it for group cohesiveness.</p>	<p>Medical Outcomes Study (MOS) 36-Item Short Form (SF-36) Version 2.</p>	<p>Significant improvement in mean SF-36 mental health subscale score (from 52.14 to 64.51). Non-significant improvements in all other aspects of SF-36 scores.</p>	11/15
<p>Skrinar et al (2005) Randomised controlled trial. Study duration 12 weeks, n = 30.</p>	<p>Setting: Inpatient, outpatient and community. Health education and exercise programme (study): Four sessions per week. Warm up, cardiovascular training, cool down and strength training (two out of every four sessions only). Graded duration – starting at 15 minutes and progressing up to 45 minutes. Exercise intensity at 70 to 85% of predicted maximal heart rate. Weekly health seminar session on healthy eating, weight management, exercise levels, stress relief, spirituality and wellness, individual planning to incorporate wellness activities into one's life.</p>	<p>Symptom checklist 90R (SCL-90); Lehman Quality of Life Questionnaire; Boston University Making Decisions Questionnaire; and Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36).</p>	<p>SF-36 revealed significant improvement in subjective scores of general health sub-score for study group compared with control. Significant improvement in subjective ratings of empowerment for study group compared with control. Non-significant improvements for the study group in most aspects of SCL-90, SF-36 and quality of life scale.</p>	10/15

*Where study focus also included physical health outcome measures, only mental health outcome measures are listed here.

Table 1 (continued)

Study and design	Intervention	Outcome measures*	Results	Quality score
Smith et al (2007b) Pre-post design. Study duration 2 years, n = 966.	Setting: Community. Intervention (study): Physical health screening and referral to either weight management and physical activity groups and/or healthy living group. Group structure varied; physical activity group included swimming, aqua aerobics, walking groups, cycle riding, cinema trips and sightseeing. Healthy living group included sessions on eating, exercise, smoking cessation and alcohol consumption.	Liverpool University Side Effect Rating Scale (LUNERS); and Likert scale for subjective report of self-esteem ranging from poor to good.	Significant improvement in self-reported measures of self-esteem. Significantly higher prevalence of moderate to high self-esteem (from 9.5% of participants at baseline to 23% of participants at final follow-up).	10/15
Trivedi et al (2006) Pre-post design (pilot study). Study duration 12 weeks, n = 17.	Setting: Community. Study: Combination supervised and home-based sessions. Six supervised sessions at exercise laboratory during initial 3 weeks. Home-based programme of three to five sessions per week during weeks 4 to 12. Choice of treadmills, stationary cycles, combination of the two or overground walking. Exercise intensity at self-selected level.	Structured Clinical Interview for DSM-IV Axis I Disorders – Clinician Version (SCID-CV) (for initial diagnosis); Hamilton Rating Scale for Depression (HRSD); 30 Item Inventory of Depressive Symptomatology – Self Report (IDS-SR); and General Activities Form of the Quality of Life Enjoyment and Satisfaction Scale (Q-LES-Q general).	Significant changes in both clinician scored and self-report measures. Intention-to-treat analysis: Significant mean HRSD score decrease of 5.8 points. Significant mean IDS-SR score decrease of 13.9 points. Twenty-nine per cent of participants met HRSD criteria for remission post-treatment. Analysis of completing participants: Significant mean HRSD score decrease of 10.4 points. Significant mean IDS-SR score decrease of 18.8 points. Significant improvement in mean Q-LES-Q general score. Sixty-three per cent of completing participants met HRSD criteria for remission post-treatment.	9/15
Qualitative				
Carless and Douglas (2008) Case studies. Study duration 18 months, n = 2.	Setting: Rehabilitation day centre. Exercise: Not described in detail. Group sport and exercise activities. Football, swimming, cycling, badminton, walking group.	Researcher immersed in field; participated in exercise sessions; participant observation and informal interviews (conversation); document review of medical records; single semi-structured interview with participant; and single semi-structured interview with mental health professional in close contact with participant (care coordinator, physio-therapist, exercise leader).	Emerging themes include: Sense of achievement and satisfaction; exercise provided social support networks; increased level of control over own life; improvements in interpersonal skills; constructive use of time; satisfaction from contributing to a 'team'; mental health professionals believe exercise contributed to recovery.	15/23
Carless and Sparkes (2008) Case studies. Study duration at least 6 months in the programme; 18 months full study duration, n = 3.	Setting: Rehabilitation day centre. Exercise: Not described in detail. Group sport and exercise activities. Football, swimming, cycling, badminton, walking group.	In-depth semi-structured interview (45-90 minutes); one participant had two follow-up open-ended interviews of 45 minutes each.	In their stories, all three men described: Positive experiences of physical activity during childhood; 'valued physical activity' (Carless and Sparkes 2008, p206); enjoyed the social aspect of exercising; no longer experienced psychotic symptoms; and increased level of alertness and concentration.	15/23

*Where study focus also included physical health outcome measures, only mental health outcome measures are listed here.

Table 1 (continued)

Study and design	Intervention	Outcome measures*	Results	Quality score
Crone (2007) Descriptive. Study duration not stated, n = 4.	Setting: Not stated; participants recruited from supported living residence or day centres; referred from primary or secondary care agencies. Exercise: Walking programme in bird parks, gardens, historic places, trails in woods, lakes and coastlines. Walks included educational talks on wildlife, herbal plants, fauna and flora. Transport provided.	Individual interviews (20-45 minutes); open-ended questions.	Participants liked the opportunity to be involved in something. Perceived benefits and outcomes included: Enjoyment – in the intervention itself; opportunity to meet people and for social interaction; purposeful activity and sense of achievement; ‘help with sleeping’ (p177); researcher suggests walking programme may provide mental health benefits and positive emotional experiences.	21/23
Crone and Guy (2008) Grounded theory. Study duration: participants had taken part in sports therapy between 2 months and 4 years, n = 11.	Setting: Inpatient and outpatient. Exercise: Group sessions two times a week. Badminton, gym, water aerobics, 10-pin bowling. Participants paid for sessions at community facilities.	Two focus groups (50-60 minutes); open-ended questions; focus groups facilitated by previous service user who used experience to empathise and gain rich data.	Conceptual framework developed to explain experiences of sports therapy. Core theme of framework was ‘taking part’ – being involved in the exercise programme. Perceived benefits include: Social interaction; accomplishment – doing something purposeful; wellbeing; self-esteem; positivity; improved mood; reduced feelings of anger; mental alertness; increased energy; and distraction from illness.	21/23
Faulkner and Sparkes (1999) Ethnography. Study duration 10 weeks, n = 3.	Setting: Shared supported housing. Exercise: Thirty minutes continuous moderate activity twice weekly. Walking in parks. Swimming. Activities chosen by participants.	Participant observations; interview with participants; interview with workers; and field diary.	Effects of exercise include: Identified as coping strategy for symptom control (for example, hearing voices); improved sleep patterns; and increased social behaviours. Possible explanations for effects include: Increased individual control; offered distraction from hallucinations; improved self-esteem (body image and autonomy); and benefits of social interactions.	16/23
Fogarty and Happell (2005) Qualitative (not specified). Study duration 3 months, n = 12 (six participants with SMI; six mental health staff).	Setting: Residential community care unit. Exercise: Individual exercise programmes prescribed and conducted by qualified exercise physiologists. No details given on form or intensity of exercise.	One semi-structured, informal focus group with participants, exercise physiologists and nursing staff involved in facilitating programme.	Themes surrounding psychological impacts include: Participants enjoyed the group dynamics, offering a team environment and partners for support and encouragement; and participants viewed their involvement in the programme positively.	14/23

*Where study focus also included physical health outcome measures, only mental health outcome measures are listed here; SMI = severe mental illness.

In terms of validity of the RCTs, one control group had significantly different baseline characteristics for gender and subjective scores of health and fitness to the intervention group (Brown and Chan 2006), and two control groups had issues with contamination (Babyak et al 2000, Melamed et al 2008). Four trials used single-blind designs whereby the assessors were blinded (Babyak et al 2000, Beebe et al 2005, Brown and Chan 2006, Duraiswamy et al 2007), while their forties (Carless and Douglas 2008) and the other stating an age range of 20-42 years (Fogarty and Happell 2005). The remaining studies did not report on participant age.

Characteristics of interventions and associated outcomes

Quantitative studies Interventions were delivered to participants in a range of settings. Five interventions were delivered in community or outpatient facilities (Beebe et al 2005, McDevitt et al 2005, Brown and Chan 2006, Trivedi et al 2006, Smith et al 2007b), one was in a supported community living centre (Pelletier et al 2005), one was in an inpatient setting (Melamed et al 2008), two were in combination inpatient and outpatient settings (Skrinar et al 2005, Duraiswamy et al 2007) and one was not stated (Babyak et al 2000).

Interventions varied in the type of exercise offered. Three studies used solely walking groups as the intervention (Beebe et al 2005, McDevitt et al 2005, Melamed et al 2008), two used walking in combination with stationary cycles and jogging (Babyak et al 2000, Trivedi et al 2006), and a further two used a mixture of walking, other cardiovascular exercise forms and weights training (Pelletier et al 2005, Skrinar et al 2005). One intervention used yoga therapy (Duraiswamy et al 2007); one used a range of group-based activities, for example, swimming, aqua aerobics, cycling and physical activity, such as sightseeing and cinema trips (Smith et al 2007b); and one used a pre-developed health promotion programme with an integrated exercise component (Brown and Chan 2006). The majority of studies used supervised exercise programmes, except for one that used six supervised sessions prior to a home exercise programme (Trivedi et al 2006) and another that included advice and counselling on structured exercise and facilitated access to local facilities (Brown and Chan 2006).

The majority of studies measured the effect on mental health and QOL in combination with measures of physical health, with only three focusing solely on psychological outcomes (Babyak et al 2000, Trivedi et al 2006, Duraiswamy et al 2007). Tools used to measure outcomes varied across the range of studies. Some trends were noted in the number of studies that used the measures of Positive and Negative Syndrome Scale for Schizophrenia (PANSS) (n = 3) (Beebe et al 2005, Duraiswamy et al 2007, Melamed et al 2008); Hamilton Rating Scale for Depression (n = 2) (Babyak et al 2000, Trivedi et al 2006); and Medical Outcomes Study 36 Item Short Form questionnaire version 2 (n = 2) (Pelletier et al 2005, Skrinar et al 2005).

Qualitative studies

Findings of the qualitative studies fell under one of two main concepts. The first concept was the effect of exercise on mental health symptoms. In terms of the effect on symptoms, two studies described improvements in illness management and symptom levels, including mood and feelings of anger, as well as offering a distraction from psychotic symptoms, such as hallucinations (Faulkner and Sparkes 1999, Crone and Guy 2008). In one study the participants reported no longer experiencing psychotic symptoms, and in another study mental health professionals believed that the

exercise intervention had contributed to the recovery of their patients (Carless and Douglas 2008, Carless and Sparkes 2008). Additionally, two studies revealed an improvement in sleep patterns as a result (Faulkner and Sparkes 1999, Crone 2007), and another two noted improvements in concentration levels and alertness (Carless and Sparkes 2008, Crone and Guy 2008).

The second concept explored the perceived effect of exercise on QOL. Most significantly, in four of the studies, the participants described the positive social interactions that the exercise intervention offered (Faulkner and Sparkes 1999, Fogarty and Happell 2005, Crone 2007, Carless and Douglas 2008). Secondly, three studies revealed that a perceived benefit of exercise was doing something purposeful and using their time constructively (Crone 2007, Carless and Douglas 2008, Crone and Guy 2008). Thirdly, participants from two separate studies described the way in which the exercise intervention had helped them to increase the level of control they had over their own life (Faulkner and Sparkes 1999, Carless and Douglas 2008). Lastly, improvements in self-esteem were described in two studies (Faulkner and Sparkes 1999, Crone and Guy 2008).

Discussion Methodological design Quantitative studies

First, the studies revealed a trend in relatively small sample sizes. A number of these smaller studies were pilot studies. Although these present important data of their own, they serve to remind us that it is a relatively underexplored topic for which researchers are still trialling the most effective means of testing (Beebe 2007). It can also be said that the difficult nature of recruiting participants with a SMI may have contributed to the small sample sizes in the studies (Beebe 2007).

Secondly, with regard to methodological quality, more than half of the RCTs employed single blinding techniques. The use of blinded assessors in these studies improved the quality of their evidence by avoiding issues of measurement bias (Glasziou et al 2001). Thirdly, half of the RCTs had methodological concerns with their control groups. Control groups were either not matched for characteristics; had received aspects of the intervention; or had participants self-enrol in similar interventions outside the study. More methodologically sound control groups would greatly support the associated reports of effectiveness (Law et al 1998) of the exercise interventions. Furthermore, the pre-post trials may have provided significant results, but the research design limits the power to claim that positive outcomes were a result of the treatment alone and not due to other factors (Law et al 1998).

Fourthly, less than half of the quantitative studies employed intention-to-treat analysis, and half of these did not do so for all their outcomes. Intention-to-treat analysis would have provided a more realistic representation of the intervention effect as it would occur in real life (Riegelman 2005) and, given the high dropout rate in the studies, it could be more confidently assumed that the same phenomena would occur in clinical practice. Those studies that accounted for dropouts in their analysis may provide practitioners with a more accurate picture of the clinical significance of exercise interventions. Lastly, all studies used a volunteer method of sampling, except for one that used a sampling method of convenience by using participants already enrolled in a wellbeing support programme (Smith et al 2007b). This method of sampling could have potentially caused an overestimation of the effect (Law et al 1998) of exercise, because participants may have been more motivated and interested in exercise. However, volunteer sampling is common practice in RCTs due to the requirement for informed consent (Riegelman 2005). Given the high dropout rates and small sample sizes, it would appear at this stage that volunteer sampling would be a required means

for this population group. Beebe (2007) indicated that the difficulties in obtaining people with SMI for research may, in fact, call for more creative recruitment methods.

It is important to note that only three studies explored the effect specifically on mental health and QOL (Babyak et al 2000, Trivedi et al 2006, Duraiswamy et al 2007). The remainder of the quantitative evidence comes from studies that explored both the physical and mental health benefits of exercise. Studies with a sole focus on mental health and QOL would provide greater evidence for the use of exercise in therapy, because they would offer a deeper insight and more detailed analysis of these benefits. Although it may prove difficult, there is certainly a need for larger RCTs using solely psychological outcome measures and sound research methodology.

Qualitative studies

The purpose and nature of qualitative research is different to that relying on quantitative methods and, as such, cannot be either compared or evaluated by the same means. When it comes to issues of bias in qualitative research, confirmability aims to ensure that the findings presented are neutral (Letts et al 2007). In one study, the experience of one researcher as a previous SMI service user certainly added a level of insight and trustworthiness that could not be ignored (Crone and Guy 2008). However, half of the studies did not address strategies used to combat bias, making it difficult to rely on the evidence these produce when evaluating the effects of exercise intervention.

When approaching qualitative research, one important factor is to ensure that results are interpreted in context (Taylor 2007). It is mainly the responsibility of the reader to make certain that he or she does not misinterpret the intentions of the study; however, researchers must provide sufficient information for the reader to be able to do so (Taylor 2007). The majority of the studies described in this report had difficulty achieving transferability, that is, the researchers did not provide a detailed description of the participants, setting and /or intervention (Letts et al 2007). In all of these cases, it was due to a poor or absent description of the participants or intervention settings. Many studies did not describe the exercise intervention used adequately and, as demonstrated by the quantitative studies, the form of exercise can potentially affect the outcome. The absence of participant diagnosis in half the studies creates difficulties when attempting to apply findings to the target population. Furthermore, the over-representation of male participants in the studies restricts the degree to which results can be applied to the wide population of people with SMI, particularly given that research suggests that women with SMI have different experiences of exercise intervention to men (McDevitt et al 2006).

Research findings

The results of the studies suggest that exercise can lead to improvements in QOL by offering an avenue for social interaction and goal-directed activity. It can also contribute towards a sense of empowerment and improved self-confidence for people who experience SMI. In addition, the study results indicate that exercise can improve some symptoms of SMI.

Quantitative findings

Cardiovascular: walking exercise

When extrapolating the evidence for exercise to improve the mental health and QOL of people with SMI, a variety of outcomes emerged. The results of the walking interventions suggested that it is not an effective form of exercise to improve the symptoms of mental illness. Results did suggest that walking could have a positive effect on QOL; however, as only one study used this outcome measure (Melamed et al 2008), the evidence base to support its use is limited. Mood and psychosocial functioning were also found to improve after the walking intervention but, again, only one study examined this area (McDevitt et al 2005). All the walking studies explored the effect on physical health as well, and it could be seen that this style of intervention was chosen specifically for its physical health benefits without much consideration for its psychological effect. Stronger evidence would be required to support the use of walking as an effective means of improving mental health and wellbeing.

Weights training and mixed cardiovascular: walking, cycling and jogging

The studies that used a variety of cardiovascular exercises, including walking, cycling and jogging, were more successful than the interventions that used walking alone. Results demonstrated the effectiveness in reducing the severity of major depression when measured using clinical scales. However, subjective reports of symptom control were not as positive, with only one study recording significant improvements (Trivedi et al 2006). Given the subjectivity of QOL, it is just as important to consider these self-reported measures when weighing up the evidence. Cardiovascular exercise combined with mixed weights training provided some degree of evidence for the positive effect on QOL, but with significant changes in only some components of self-reported measures.

Low intensity exercise and physical activity

The broad lower intensity interventions appeared more successful in improving QOL and reducing symptoms in comparison to other forms of exercise. Notably, the yoga therapy intervention was the most successful intervention of all studies, with positive improvements in measures of symptoms, wellbeing and QOL (Duraiswamy et al 2007). However, given that the intervention also included aspects of relaxation and breathing exercises, it could be possible that these contributed to the positive effects as well and that it was not solely the exercise itself. The community-based exercise groups that used swimming, aqua aerobics and recreation-based physical activity, such as sightseeing and educational walks, gained significant improvements in subjective ratings of self-esteem (Smith et al 2007b). However, as this was the only outcome measure used, it is impossible to comment on its effect on other psychological parameters.

Intervention settings

The majority of interventions were delivered in community or outpatient settings, and this dictates the degree to which these results can be generalised to the population with SMI. The research highlighted the effective use of exercise with consumers in community settings. It can be assumed that the participants in these studies would have been managing their illness at a high functional level, which could have aided positive outcomes. Very little evidence exists to support the use of exercise or physical activity to improve QOL for people with SMI in acute inpatient settings, and

there is room for investigation into its feasibility. The main difference between interventions delivered in a supervised setting compared with those offering advice and home-based exercise programmes was evident in the dropout rates. The two studies that used unsupervised and self-directed exercise programmes had the highest dropout rates of all studies (Brown and Chan 2006, Trivedi et al 2006). This phenomenon suggests that adherence to exercise programmes in people with SMI is greater with the external motivation and reinforcement provided by supervised programmes.

Long-term feasibility

Most of the interventions were short-term programmes, with limited follow-up. Although some of these studies proved effective in demonstrating immediate short-term gains in mental health and QOL, many were not able to report on the sustainability of such improvements. While this provides some degree of evidence for the use of exercise as a therapeutic medium, it does not offer practitioners the confidence that it will provide long-term benefits for their clients. Only one study measured the maintenance of mental health improvements, because it reviewed participants 6 months after the completion of the exercise intervention (Babyak et al 2000). Further research is necessary into the long-term effects of exercise on the wellbeing of people with SMI. The short duration of most of the studies may also have contributed to the statistical non-significance of results.

When considering long-term benefits, one cannot ignore the high dropout rate in the studies and, as such, the feasibility of long-term programmes. While the dropout rate could, in part, have been attributed to the nature of SMI, researchers have also identified a number of barriers to participation, such as fatigue, illness, symptoms of mental illness, side effects of medications and weight gain (McDevitt et al 2006, Usher et al 2007). Drawing on meaningful and personally motivated mediums of exercise and physical activity may help to address the high dropout rates.

Qualitative findings

The qualitative studies focused directly on mental health and QOL outcomes, with only one study that assessed subjective reports of physical health as well (Fogarty and Happell 2005). The restricted range of diagnostic groups makes it difficult to determine the impact of exercise intervention in all people with SMI. Of the studies that specified participant diagnosis, all investigated the effect of exercise on people with a diagnosis of schizophrenia. Although these studies provide a good deal of evidence for the use of exercise in this group, they do not provide any evidence for its use in people with other illnesses, such as major depression and bipolar disorder. Future qualitative studies are required to explore the effects of exercise intervention on SMIs collectively and separately.

Mental illness symptoms

In terms of symptoms, the research suggested that exercise can contribute to subjective improvements in mood, alertness, concentration and sleep patterns. Research suggests that exercise can have a positive effect on sleep patterns for the general population (Youngstedt 2005). It could be possible that improvements in the sleep patterns of people with SMI are due more to this general exercise benefit than to actual reductions in symptoms themselves. Additionally, the

exercise interventions appeared to have improved psychotic symptoms, such as hallucinations, in some cases simply by providing a distraction. In one study, health professionals suggested that exercise had contributed to the recovery of patients with SMI (Carless and Douglas 2008); however, stronger evidence would be required to support this concept.

Quality of life

Quality of life improvements were similar across the studies. The research suggested that, most notably, exercise can improve QOL by providing people with SMI a medium through which to foster social interaction. However, without sufficient details on the interventions, it cannot be determined whether this occurred through group interventions, connection with community facilities or involvement in the study process itself, and warrants further research. Indeed, researchers have recognised the need to investigate the role of physical activity in reducing social isolation for this population further (Richardson et al 2005). The studies also suggested that exercise intervention can contribute to improved QOL by providing people with SMI an avenue through which to spend their time meaningfully. It could be seen that it was the process of being involved in something purposeful, rather than the exercise itself, that contributed to these improvements.

It appears to be the perception of some mental health staff that improvements are attributable solely to the distraction from daily life and structure that exercise provides (Faulkner and Biddle 2001, 2002). However, it is possible that the occupation of exercise itself, being a purposeful and goal-directed activity, has a much more direct effect than these studies suggest. Further research into the mechanism responsible for QOL improvements would help to shed light on this issue.

Empowerment

Participants described the way in which the exercise intervention empowered them and increased their level of personal control and self-confidence. The mechanism through which this confidence improvement occurs is unclear. Some researchers believe that it is secondary to the effect of exercise, linked to improvements in, and control over, their own body image (Faulkner and Sparkes 1999). Other research has described the way in which improved self-confidence from the exercise intervention transferred into other domains of life (Shiner et al 2008). Certainly, there is room for researchers to explore the role of exercise to provide a medium through which people can develop the skills, attitude and identity to improve their QOL in all areas.

Implications

The exercise experiences of people with SMI link closely with the concepts of the meaning of occupation: doing, being, becoming and belonging (Wilcock 1998, Hammell 2004). The concept of 'doing' is illustrated by the participants' engagement in purposeful activity, and meaningful and constructive use of their time. 'Being' and 'becoming' are seen where people with SMI reshape their identity and form perceptions of the self through the exercise experience. The strong emphasis on

the value of group exercise and partners for motivation shows that exercise provides a medium through which these people can experience 'belonging'.

There is an opportunity for occupational therapy to look towards embedding exercise and physical activity intervention into meaningful everyday occupations. Sorensen (2006) argued that the motivation to participate in exercise in people with SMI is similar to the general population, and that exercise needs to be self-determined and an enjoyable act in itself. If people with SMI were offered a range of ways to exercise, and were able to select those that are intrinsically motivating, it may improve the acceptance of such interventions and help to address the high dropout rate. A deeper insight into the experiences of exercise for people with SMI would help researchers to design more acceptable intervention strategies, and aid health professionals' understanding of their clients' needs.

This review raises several questions, warranting further research to explore the use of exercise as an augmentative treatment strategy. Further study is needed on the mechanism through which holistic improvements in psychosocial domains occur, as well as the most effective styles of exercise intervention. From an occupational therapy perspective, more research is needed to explore the role that purposeful activity, meaningful use of time, social interaction and empowerment play towards improving QOL and psychological wellbeing. There is a clear path for researchers to explore the unique way in which exercise is experienced by people with SMI and, as such, how this occupation affects QOL for this client group in comparison to the general population.

Furthermore, given the mixed results from the different interventions, further research is warranted into comparing the benefits of different mediums of exercise, as well as research into other types of exercise not previously explored. The high proportion of male participants in exercise studies also highlights a gap in the evidence from the perspective of women with SMI. Research into the exercise experiences of these women is needed in order to provide a more comprehensive understanding, because the experiences would most likely differ from those of their male counterparts.

Methodological limitations

The following limitations of this review should be acknowledged. First, restricting the initial search to English language articles only may have meant the exclusion of relevant research printed in other languages. Secondly, as the literature search was completed in December 2009, any relevant research published since then was not included. Lastly, because some exercise interventions were included as part of wider healthy living interventions, interventions such as behavioural therapy and nutrition education could have acted as potential confounders.

Conclusion

This systematic review highlights that existing research warrants the use of exercise intervention to relieve symptoms of SMI and to improve QOL. First, the research shows that exercise can contribute to improvements in mental illness symptoms, including mood, alertness, concentration and sleep patterns. It also suggests that it may reduce or provide a distraction from psychotic symptoms, such as hallucinations. Furthermore, findings suggest that exercise may lead to a reduction in the severity

of depression, and improvements in psychosocial functioning. Secondly, the research shows that exercise can contribute to improved QOL for people who experience SMI. These improvements appear to occur through exercise as it provides opportunity and avenues for social interaction, meaningful use of time and purposeful and goal-directed activity. The studies also describe how exercise can lead to empowerment and increased personal control.

The literature suggests that mixed styles of exercise, such as cardiovascular and weights training, yoga and swimming, possibly provide greater benefits than walking alone. In spite of this, the small number of studies limits the strength of this argument, and calls for research comparing the outcomes of different mediums of exercise. In addition, it is evident that further research is needed to determine the long-term effectiveness of any improvements and the mechanism through which these improvements occur.

Given the subjective nature of measuring QOL, there is an opportunity for qualitative researchers to explore the experiences of exercise for individuals with SMI. This would help to give depth and an interpretation of existing research from the experiences of people with SMI themselves. However, if qualitative approaches are to be used to add strength to the argument for exercise intervention in treating SMI, there is a need for a clearer picture of the context of the study and greater confirmability.

The positive effect of exercise on the mental health and wellbeing of the general population is already widely researched. This review suggests that exercise may be an effective complementary intervention strategy to reduce symptoms and to improve QOL for people experiencing SMI. The limited number of studies on people with SMI highlights that future studies are needed to describe the way in which exercise can meet the unique needs of this population.

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**Appendix 1. Criterion scoring system (yes = 1; no = 0; not applicable/
not stated = 0) Quantitative criteria**

Total quality score out of 15

1. Study purpose was stated clearly
 2. Relevant background literature was reviewed
 3. Research design was appropriate
 4. Sample was described in adequate detail
 5. Sample size was justified
 6. Outcome measures were valid
 7. Outcome measures were reliable
 8. Intervention was described in adequate detail
 9. Contamination was avoided
 10. Co-intervention was avoided
 11. Results were reported in statistical significance
 12. Analysis method used was appropriate
 13. Clinical significance of findings was reported
 14. Number of dropouts was reported
 15. Conclusions were appropriate to study findings
-

Qualitative criteria

Total quality score out of 23

1. Study purpose was stated clearly
2. Relevant background literature was reviewed
3. Study design was appropriate to study question
4. Theoretical perspective for study was identified
5. Study methods were congruent with study purpose
6. Selection process was described in detail
7. Selection occurred until data redundancy was reached
8. A clear site description was provided
9. A clear participant description was provided
10. Role of researcher was clearly described
11. Any assumptions and biases of researcher described
12. Procedural rigour used in data collection methods
13. Analysis of data was inductive
14. Findings were reflective of data
15. Decision trail was developed during analysis
16. Data analysis process was clearly described
17. A meaningful picture of phenomenon under study emerged
18. Methods used to ensure credibility were described
19. Methods used to ensure transferability were described
20. Methods used to ensure dependability were described
21. Methods used to ensure confirmability were described
22. Conclusions were appropriate to study findings
23. Findings contributed to future research and practice