(PowerPoint Presentation)

Resource attached

Prior to beginning work on this interactive assignment, it is recommended that you review the recommended resources for this week as they will assist you in the creation of an effective presentation of your Research Design.

This interactive assignment will provide you with an opportunity to create a dynamic presentation of some of the materials you are creating for your Research Proposal. This type of presentation would be used in the professional world to request Institutional Review Board (IRB) approval, and potentially elicit funding, for your research.

In your presentation, summarize the main points and ideas for your Research Design. Over the course of the week, you will have the opportunity to share feedback and suggestions with your classmates and instructor, which may assist you in improving your research proposal before submitting the Research Proposal.

For this interactive assignment, create a presentation file using PowerPoint and then create a three- to five-minute screencast video of your presentation with pertinent audio that includes important points about the content of each slide. In order to make sure your video remains within the 3-5 minute time requirement, create a script for your screencast video. You must attach your script to your initial post. It is recommended you rehearse your presentation using your script to ensure that you are within the time limit and that all pertinent information is presented in a manner that is easy to understand. You may use any screencasting software of your choice (e.g., Screencast-O-Matic, Jing, etc.). A quick-start guide is available for Screencast-O-Matic (Links to an external site.) for your convenience.

The content of the presentation must include the following:

- A brief introduction
- Devise a specific research question related to the topic you chose in Week One.
- Explain the importance of the topic and research question.
- A brief literature review
- Evaluate published research studies on your topic found during your work on the Weeks One, Two, and Four assignments and identify two relevant published studies.
- A description of potential methods
- Based on what you have learned about research design options and requirements in this course, create an appropriate research approach and design to investigate your research question.
- Provide a rationale for your design choices.
- A discussion on ethical issues
- Apply ethical standards to the proposed research and identify potential ethical issues that would apply. Explain how you plan to address these issues.
- A conclusion
- Summarize the main points of the presentation and reiterate why the proposed research is important and why it should be carried out.

In your initial discussion post, introduce your presentation and provide a link to the screencast URL.

Be sure to attach your PowerPoint presentation and script documents to your initial post. Please do not include the question prompt in your initial post.

Note to Students: This assignment requires that you produce a visual presentation, supply a spoken audio narrative, and to listen the audio narrative of others. Note you are also asked to provide a transcript of your presentation. If you have a documented disability accommodation that might interfere with your ability to complete this assignment you may contact your instructor to develop a comparable alternative assignment. If you have other issues that you feel may be a barrier to your ability to complete this course or this assignment please contact the Office of Access and Wellness at: access@ashford.edu.

Guided Response: Review several of your colleagues' posts and respond to at least two of your peers by 11:59 p.m. on Day 7 of the week. You are encouraged to post your required replies earlier in the week to promote more meaningful interactive discourse in this discussion.

Apply the scientific method to the research problem(s) presented and comment on the appropriateness of the research question devised. If the question devised does not seem appropriate and researchable, suggest another research question that would apply to this topic. Compare the characteristics of various appropriate research paradigms related to your colleague's chosen topic and suggest another research method that could be applied to this research question. Provide a rationale that explains how this method may be equally or more appropriate for the research question. Evaluate the ethical implications of the proposed research and suggest other issues your colleague has not mentioned. Provide any other comments to your colleague that may assist him or her in creating a more effective research proposal.

PowerPoint Presentation "Resource" Please use for Final Paper as well

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ORIGINAL ARTICLE

Exercise can seriously improve your mental health: Fact or fiction?

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Abstract

The World Health Organization predicts that depression will create the second greatest burden of disease by 2020, requiring cost-effective prevention and intervention strategies. The evidence to support the benefits of exercise in offering protection from depression and as an intervention in the treatment of mental illness is growing. The literature is reviewed with 11 prospective longitudinal studies that include measures of physical activity and depression at two or more time points showing a protective effect from physical activity. Fifteen randomized controlled trials (RCTs) and three meta-analyses provide evidence that exercise can reduce depression and that it can be as effective as cognitive therapy. Four RCTs report exercise as an intervention in alcohol addiction and two RCTs in the use of illicit drugs. While many of the studies reviewed have methodological weaknesses, including lack of concealment in randomization, limited use of intention to treat and blinding, the benefits of exercise far outweigh the risks. Neurobiological and psychological explanations as to why exercise should work are discussed. There is evidence that exercise protects against depression and is an effective intervention and adjunctive intervention for the treatment of mild to moderate depression. Exercise provides some health and psychological benefits as an adjunct to treatment in complex mental health problems such as alcohol and drug rehabilitation.

Key words: *Alcohol abuse, cognitive–behavioural techniques, depression, drug abuse, physical activity*

Introduction

Depression affects 121 million people worldwide; however, under-reporting is common and only 25% receive treatment (1,2). Lack of access to treatment, particularly in developing countries, is linked to the increased risk of suicide, which claims 850 million lives every year and is one of the three highest causes of death in young adults aged 15–35 years (3). Depression is more common in women and more prevalent in developing countries (4). The World Health Organization highlights mental illness as a public health issue, predicting that depression will create the second highest burden of disease by 2020 (1). Exercise is a low-cost intervention, which has the potential, if effective, to play a significant role in both developed and developing countries in the prevention and treatment of depression.

The rise in mental illness is also associated with the global increase in the abuse of alcohol and illegal drugs (5). It is estimated that 76.3 million people are addicted to alcohol causing 60 types of disease and 195,000 deaths per year in Europe. The impact of alcohol abuse on disability is high accounting for 4.5 million disability-adjusted life-years (6). Global mortality figures for injecting drug users are estimated to be 13 million; however, mortality figures for drug misuse are difficult to assess with many deaths recorded as suicide, accidents or HIV related (7). This paper will not attempt to cover all areas of mental health in which exercise can play a role but will focus on the globally important areas of depression and addiction.

What is causing this global pandemic of mental health problems? There are many indicators that have been associated with the rise in mental health problems. Mental health is associated with the economy of the country, employment levels and quality of housing. War, political conflict and natural disasters have specific effects on the mental health of societies. At a family and community level, mental health is associated with social support, and

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an environment with manageable levels of stress. At an individual level, mental health is linked to individual coping strategies, lifestyle and life satisfaction.

Definitions

Defining mental health is complex the terminology is viewed negatively in the context of mental illness and positively in the context of mental well-being. Mental health is defined by WHO as a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully and is able to make a contribution to his or her community (8). Clinical depression is diagnosed by a cluster of symptoms that persist for more than 2 weeks. Symptoms include feelings of unbearable sadness and loss of pleasure in association with four or more of the following: sleep disturbance, lack of energy, inability to concentrate, feelings of worthlessness and thoughts of suicide (9). Addiction to alcohol or illicit substances can be described as an individual who experiences multiple serious life problems as a result of prolonged and heavy drinking or illicit drug use (7). Physical activity is any movement of the body that results in energy expenditure rising above resting level and includes activities of daily living, domestic chores, gardening and walking (10). Exercise is a subset of PA and is undertaken to improve health or for leisure-time activities including activities such as swimming, jogging, brisk walking, going to the gym and sports such as tennis and football.

Is exercise important for mental well-being?

There are three critical reasons why exercise is important for mental well-being. The literature reviewed by a panel of experts to produce the UK National Consensus Statements (11) provides support for; exercise and decreased depression, the stress reduction effects of exercise, the association of exercise and positive mood, improvement in cognitive function in fit older adults, and positive effects of exercise on physical self-perceptions and body image. Research has also found that people who experience mental health benefits from exercise are more motivated to continue exercising (12). In addition, exercise and regular physical activity is known to offer protection in the prevention of obesity, cardiovascular disease, hypertension and diabetes. The promotion of exercise thus benefits both physical and mental health and can be seen as a "win–win" situation (13).

Is there sufficient evidence to support the premise that exercise can seriously improve your mental health?

In order to address this question, the literature on depression was reviewed and is discussed alongside commentary from a published review by the author on the use of exercise in drug and alcohol rehabilitation (14).

All studies from 1970 onwards were located by standard search methods Firstsearch, MEDLINE, PsychInfo Embase, SPORTDiscuss, Cinahl, Bandolier, Cochrane Database of Systematic Reviews (CDSR) and the Social Citation Index. The search words "depression", "dysthymia", "depressive disorder", "mild depression", "moderate depression" and "severe depression" were combined with "exercise", "physical activity" and "running". To be included in the review, a study had to be published between 1970 and 2006. The studies had to be longitudinal studies with measures at two or more time points, a randomized controlled exercise intervention for a clinically defined population of people with depression, or a meta-analysis of exercise and depression. Studies that looked only at the effect of exercise on anxiety or neurotic disorders were excluded.

There are numerous quasi-experimental exercise intervention studies and the numbers of those have grown exponentially over the last decade; however, these have not been included in this review. In total, 12 prospective longitudinal studies were included, 11 with positive outcomes supporting the links between regular physical activity, exercise and reduced risk of mental health problems. Fifteen RCTs provide evidence of exercise in the treatment of depression alongside three meta-analyses. In addition, key policy documents in the UK and NICE guidelines relating to exercise and mental health published between 2000 and 2006 were reviewed in order to consider the impact of the evidence on policy and practice in the UK.

Evidence for prevention

Eleven prospective longitudinal studies that include measures of exercise and depression at two or more time points have demonstrated a positive association between physical activity and the reduced risk of depression (Table I). This research has been carried out by research teams in the USA, Netherlands and Finland using different populations of community dwellers, workers, adults, adolescents and older people. The findings show that people who are physically active and exercise regularly are less likely to be diagnosed with depression in the period

Table I. Prospective longitudinal studies that include measures of physical activity and depression at two or more time points demonstrating a protective effect.

Authors (ref.)	Participants	Physical activity	Follow-up	Results
Farmer et al., 1988, USA (15)	1497	Recreational activity	8 years	Women not engaged in regular activity twice as likely to develop depression (95% CI 1.1–3.2)
Camacho et al., 1991, USA (16)	8023	Low active and high active	9 and 18 years	At 9 years, increased risk of depression for men and women who are low active (RR 1.8 men, 1.7 women) compared with high active. At 18 years, ↓activity increases risk of depression (OR = 2.02)
Paffenbarger et al., 1994, USA (17)	10,201 men only	Self-report of physical activity exercise and sport	23–27 years	Men taking 3 h of sport a week at baseline had 27% ↓ risk of depression compared with men who played less than 1 h a week. Evidence of dose–response
Mobily et al., 1996, USA (18)	2084 older adults	Self-reported walking	3 years	Those that walked daily and reported more depression at baseline were a third less likely to report depression at follow-up (OR = 0.38)
Strawbridge et al., 2002, USA (19)	1947 (age 50–94)	Physical activity, 8-point scale	5 years	Increased levels of physical activity provided protection from depression at 5-year follow-up (OR = 0.83)
Van Gool et al., 2003, Netherlands (20)	1280 older adults	Change from active to sedentary lifestyle	6 years	From baseline to follow-up, 155 people reported depression associated with decreased amount of minutes in physical activity and changing from an active to a sedentary lifestyle (RR = 1.62)
Motl et al., 2004, USA (24)	4594 adolescents	Self-reported physical activity- after school	3 time points over 2 years	Decrease (1 SD) in physical activity inversely related to increase in depression (0.25 SD)
Motl et al., 2005, USA (22)	174 sedentary older adults	Walking or low-intensity resistance/flexibility training	1 year and 5 years	Depressive symptoms scores decreased after the 6-month intervention, followed by a sustained reduction for 12 and 60 months. Findings similar for both types of physical activity
Bernaards et al., 2006, Netherlands (23)	1747 workers	Strenuous physical activity 1–2 times a week	3 years	Strenuous leisure-time activity 1–2 times a week reduced risk of depression and emotional exhaustion. Activity at greater frequencies did not show this relationship
Lampinen et al., 2006, Finland (21)	1124 older adults	Leisure-time physical activity	8 years	Mental well-being in later life is associated with activity, better health and mobility
Harris et al., 2006, Netherlands (25)	424 depressed adults	Walking and leisure-time physical activity	1, 4, 10 years	More physical activity was associated with less concurrent depression with physical activity countering the effects of negative life events on depression

between baseline and follow-up. The findings of the first prospective study (15) suggest that women who had engaged in little or no recreational activity were twice as likely to develop depression when compared with women who had engaged in moderate or high levels of activity. The same protective effect for men was not evident. However, for men who were depressed at baseline, inactivity was a predictor of depression at follow-up. The protective factor of physical activity for both men and women was demonstrated in a study reported 3 years later (16). The Harvard Alumini (17), one of the largest longitudinal studies of its kind, confirms the protective effects of physical activity and the risk reduction of developing depression for men.

The evidence for prevention has also been demonstrated in studies of older people. Adults over the age of 65 were followed up for 3 years providing evidence that daily walking reduced risk of depression (18). A further study in the USA with middle-aged and older adults found similar protective factors (19). This is further supported by the work of researchers in the Netherlands (20), who found that study participants who became depressed from baseline to follow-up had changed from an active to a sedentary lifestyle, and research undertaken in Finland (21) with evidence that mental well-being in later life is associated with activity, better health and mobility.

A study to determine if changing to a more active lifestyle would impact on vulnerability to depression was undertaken with formerly sedentary, older adults. Study participants were randomly assigned into 6-month conditions of either walking or low-intensity resistance/flexibility training. Depressive symptoms scores decreased after the 6-month intervention, followed by a sustained reduction for 12 and 60 months. The effect was similar for both types of physical activity (22). A study in the Netherlands looking at how much exercise was needed to offer protection found that those with sedentary jobs only needed to engage in strenuous physical activity once

or twice a week to reduce the risk of depression and emotional exhaustion (23). Interestingly, higher levels of activity three or more times a week did not offer this protection.

Protective factors of physical activity have also been found in adolescents (24). The findings indicate that a decrease in the frequency of leisure-time activity was inversely related to an increase in depressive symptoms. All of these studies have been undertaken in communities and the workplace. In a recent study, the relationship between physical activity and depression was investigated in a clinical sample of 424 initially depressed patients with a 1-, 4- and 10-year follow-up (25). More physical activity was associated with less concurrent depression, with physical activity countering the effects of negative life events on depression. One further longitudinal study following up 973 medical school students from 1978 until 1993 did not find a link between levels of physical activity and associated risk of depression (26).

Evidence for intervention

Sixteen randomized clinical trials (Table II), and three meta-analyses demonstrate the effectiveness of exercise as a treatment or as an adjunct to treatment for people with mild to moderate depression. The most recent of these meta-regression analyses (27) included a systematic review of 14 RCTs; the findings are similar to previous meta-analyses (28,29). The results demonstrate that exercise reduces symptoms of depression, standardized mean difference in effect size of −1.1 (95% confidence interval, CI −1.5 to −0.6) when compared with a no treatment group. This is a large effect size (30). The effect size was found to be significantly greater for studies with a shorter follow-up period and for studies only reported in scientific conferences. Exercise was also found to be as effective as cognitive–behavioural therapy in reducing depression, standardized mean difference in effect −0.3 (95% CI −0.7 to 0.1). While these are convincing findings of the efficacy of exercise, the authors concluded that the effectiveness of exercise in reducing symptoms of depression could not be determined because of the lack of good-quality research. The methodological weaknesses in the studies include lack of information regarding treatment allocation, only three studies appeared to have appropriate concealment, and intention-to-treat analysis was only undertaken in two studies. In 12 of the studies, the main outcome was measured by self-assessment using a questionnaire. Nine of the studies included non-clinical populations with most participants being recruited through the media and assessed by a cut-off point on the Beck Depression Inventory (31); only four of these studies used additional clinical interview to confirm the presence of depression. Generalizing these studies, which include non-clinical participants, to populations with a clinical diagnosis of depression may be difficult. The most robust indicator of the clinical effectiveness of exercise is whether at follow-up the participants are still depressed. The lack of follow-up data a year post-intervention is missing in these studies. Undoubtedly there are weaknesses in the methodology to date. While this challenges the evidence, the effect size is large and consistent across the studies, and this should not be ignored. In considering whether exercise can be an effective intervention for depression, the potential benefits are far greater than the potential risks. In addition to the likelihood of the mental health benefits, considering intervention alongside the evidence for prevention the additional physical benefits to health are an added value from this approach.

The RCTs reviewed to inform this paper are outlined in Table II (32–48); this includes studies published after the most recent meta-regression analysis (27), including two studies with older adults (46,47) and a further study reporting dose–response (48). This area of investigation is still relatively new with the earliest of these studies undertaken in 1979 in the USA (32). The findings indicate that running three times a week for 30–45 min over 10 weeks was as effective as time-limited or non-time-limited psychotherapy. Researchers in Norway were the first to demonstrate the effectiveness of a 9-week programme of aerobic exercise to reduce the symptoms of depression in people hospitalized with depression (36). All of the studies demonstrated a positive effect, whether looking at the effectiveness of exercise versus standard treatment or where compared with psychotherapy or medication. Exercise appears to be effective whether it is undertaken with adults or older adults. The mode of exercise does not seem to be important with studies including weight training, aerobic exercise, mixed games and exercise. The length of treatment has varied with periods of 8–12 weeks being most prominent.

Recent work from researchers in the USA informs us that exercise has to be equivalent to the public health dose to be effective in reducing depression but that frequency does not matter (48). This study compared frequency of exercise [3 or 5 days per week] and total energy expenditure per week [7 kcal/kg/week "low dose" versus 17.5 kcal/kg/week "public health dose"] in a 12-week protocol. Four aerobic exercise conditions allowed these comparisons; two groups exercised on 3 days a week – one expended 7 kcal/kg/week and the other 17 kcal/kg/week; two

other groups exercised on 5 days a week but expended the same totals of either 7 or 17.5 kcal/kg/week. Participants were randomly assigned to one of these four groups or to a placebo exercise condition, which involved stretching exercises on 3 days of the week.

Exercise has been shown to be as effective as antidepressants or exercise plus anti-depressants in reducing depression with the benefits sustained at 6 months (44). In this study, participants ($n=156$; 113 women, mean age 57 years) who were assessed as clinically depressed according to DSM-IV criteria or HDRS >7 were randomized into one of three groups. The 16-week exercise intervention comprised of three 45-min aerobic sessions a week. All three groups reduced depression scores at 16 weeks and maintained the reduction at 6 months; at 10 months depression rates were lower for the exercise group. The participants self-selected to join the study and motivation may have been a factor influencing these findings.

RCTs undertaken with home-dwelling older people who were not self-selecting also show a reduction in depression from exercise. A 10-week exercise programme was found to be as effective as an adjunct to antidepressant therapy in reducing depressive symptoms in older people (46). Patients (aged 53–78 years) were randomized to attend either exercise classes or health education talks for 10 weeks. Results showed that at 10 weeks, a significantly higher proportion of the exercise group (55% compared with 33%) experienced a greater than 30% decline in depression. Two studies looked at unsupervised exercise as a long-term treatment for clinical depression in elderly people (42,43). The authors studied 32 older adults (aged 60–84 years) in a 20-week, randomized, controlled trial, with follow-up at 26 months. Exercisers engaged in 10 weeks of supervised weight-lifting exercise followed by 10 weeks of unsupervised exercise. Depression was significantly reduced at both 20 weeks and 26 months of follow-up in exercisers compared with controls. In a further study of 60 older adults, high-intensity progressive resistance training (80%) was found to be more effective than low-intensity progressive resistance training or general practitioner (GP) care (47). These studies provide some clinical evidence for group exercise lowering depression in home-dwelling older people. Like the studies in adults, the mode of exercise appears to be flexible with both weight training and aerobic exercise providing sustainable benefits; these studies vary in frequency.

Undoubtedly further research, which highlights longer periods of follow-up, is required before we can confirm the causal link between exercise and depression. A well-funded investigation into the effectiveness and cost-effectiveness of exercise on prescription for people with depression is currently being undertaken at the University of Bristol (49) and the team will report their findings in 2011.

However, the benefits of exercise are not limited to the treatment of depression

A systematic review undertaken by the author highlights the emerging evidence of the impact of exercise in the treatment of people with mental health problems such as alcohol and drug addictions (14). Four RCTs (50–53) provide some evidence for the use of exercise as an adjunct in the rehabilitation of problem drinkers and two RCTs (57,58) provide evidence for exercise as an adjunct to the rehabilitation from substance misuse (Table III). Of the four RCTs relating to problem drinkers, only two (52,53) had a sufficient sample size to provide conclusive findings. Both of these studies had a high dropout rate and only one (53) used intention-to-treat analysis. Both of these studies followed the American College Sports Medicine guidelines (ACSM) (54) on the frequency, duration and intensity of exercise required in order to develop and maintain aerobic and strength fitness. Estimated oxygen uptake was the most commonly used measure of fitness. Various measures were used for psychological outcome, depression, perceived body image and self-esteem. One study found benefits that included improvements in fitness and strength, physical activity levels, physical self-perceptions and self-worth (53). The perceptions of the study participants in regard to how their physical fitness and strength had changed were in line with actual changes. These physical changes and mental awareness of these changes impact on physical self-worth with a significant improvement noted at 1 month and 2 months in this study. Physical self-worth has a direct influence on self-esteem. Enhancing self-esteem is critical when people are attempting to change behaviour. For some, the exercise programme enabled them to change their lifestyle and get back to doing activities they used to enjoy, e.g. cycling, hill walking, and for one teenager boxing. An interesting outcome was that the study participants did not link the benefits from exercise to their addiction problem. There were many quotes similar to this one "Feeling fitter is great I feel less like drinking but that doesn't mean I go to the gym instead of drinking, they are very different things" (53).

In the treatment of substance misuse, two studies using an RCT design have been published (Table III). One of these studies (55) had an insufficient sample size ($n=15$ in each group) to have a realistic

Table II. Characteristics of randomized controlled studies of exercise for clinically defined depression.

Authors and country of study (ref.)	Study participants	Criteria for depression	Length of training	Comparison groups	Outcome measures	Results
Greist et al., 1979, USA (32)	$n=28$, M, F, outpatient clinic	RDC criteria for depression	10 weeks, 1- and 3-month follow-up	(i) Time-limited psychotherapy; (ii) Time-unlimited psychotherapy; (iii) Running 3 × 30–45 min/week	SCL	Running as effective as the two psychotherapy treatments
Reuter et al. 1982, USA (33)	$n=18$, M, F	BDI criteria for depression	10 weeks	(i) Running 3 × 30–45min/week and counselling; (ii) Counselling alone	BDI	The running and counselling group was more effective
McCann and Holmes, 1984, USA (34)	$n=43$, F	BDI criteria for depression	10 weeks	(i) Aerobic exercise 2 × 60 min/week; (ii) Relaxation training; (iii) Waiting list control	BDI	Depression scores lowered in all groups
Klein et al., 1985, USA (35)	$n=74$, mean age 30, M, F, outpatient psychiatric clinic	RDC criteria for depression	12 weeks, 1-, 3- and 9-month follow-up	(i) Running with a leader, 2 × 45 min/week; (ii) Group meditation 2 h/week; (iii) Group therapy 2 h/week	SCL and psychiatric interview	Running as effective as the other two treatments
Martinsen et al. 1985, Norway (36)	$n=43$, mean age 40 years, M, F, psychiatric inpatients	Clinical assessment by DSM-III	9 weeks of treatment	(i) Aerobic training 50–70% max. VO_2 1 h, 3 × week; (ii) Control group occupational therapy 1 h, 3 × week	BDI; predicted max. VO_2	Depression scores lowered and increased fitness in exercise group
Doyne et al., 1987, USA (37)	$n=40$, mean age 29 years, F, recruited via media	Clinical assessment by RDC	8 weeks, 1-, 7- and 12-month follow-up	(i) Running 4 × week; (ii) Weight-lifting 4 × week; (iii) Waiting list control group	BDI; HRSD; predicted max. VO_2	Running and weight training reduced depression more than control. Remained lower at 1 year
Fremont & Craighead, 1987, USA (38)	$n=49$, M, F, recruited via media	BDI criteria for depression	10 weeks and 2-month follow-up	(i) Cognitive therapy 1 h/week; (ii) Running with a leader, 3 × 20 min/week; (iii) Both cognitive therapy and running	BDI	All three groups lowered depression Improvements maintained at 2-month follow-up
Martinsen et al., 1989, Norway (39)	$n=99$, mean age 41 years, M, F, inpatients with depression	Clinical assessment by RDC	8 weeks	(i) Aerobic training, 3 × 1 h/week; (ii) Strength and flexibility training, 3 × 1 h/week	Montgomery-Asberg predicted VO_2 max.	Both groups decreased depression scores. The aerobic group made gains on max. VO_2

Bosscher, 1993, Netherlands (41)	$n=24$, mean age 34 years, M, F, inpatient hospitalized depressives	RDC classification, SDS >40	8 weeks of treatment	(i) Standard movement therapy of mixed games and exercises, 50 min, 3 × week; (ii) Running 45 min, 3 × week	SDS	Only the running group showed significant decreases in depression. No fitness measures taken
Singh et al., 1997, USA (42); Singh et al., 2001 (43)	$n=32$, mean age 71 years, M, F	Clinical assessment by DSM-IV criteria	10 weeks treatment follow-up at 20 weeks; 26-month follow-up	(i) Progressive resistance training (PRT) 3 × week; (ii) Attention–control group meeting 2 × week	BDI, HRSD, SF-36, strength (1 repetition max.).	At 10 weeks depression, strength pain and social functioning showing improvements in exercisers. Depression lower at 20 weeks and 26 months in exercisers. 33% exercisers still weight lifting at 26 months
Blumenthal et al., 1999 (44) and Babyak et al., 2000, USA (45)	$n=156$, mean age 57 years, M, F, media and local physician recruitment	Clinical assessment by DSM-IV criteria.	16 weeks of treatment, and follow-up 6 months later	(i) Aerobic exercise 3 × week supervised; (ii) Antidepressant medication; (iii) A combination of (i) and (ii)	HRSD, BDI, peak aerobic capacity (Balke protocol)	All groups reduced depression at 16 weeks maintained at 6 months. Exercise groups increased aerobic fitness. At 6 months, fewer in exercise group only had relapsed or used medication.
Mather et al., 2002, UK (46)	Older adults aged over 53 years	Clinical interview with ICD-10 classification	10 weeks of treatment and follow-up at 34 weeks	(i) Exercise classes; (ii) Health education talks	HRSD	A higher proportion of participants in exercise classes experienced greater than 30% decline in HRSD scores at 10 weeks
Singh et al., 2005, USA (47)	$n=60$, M, F, older adults aged over 60 years	Clinical assessment by DSM-IV criteria	8 weeks	(i) High-intensity (80% max) PRT 3 days per week; (ii) Low-intensity (20% max) PRT (iii) 3 days per week; Standard care by GP	HRSD, response rate and various quality of life indices including sleep.	High-intensity PRT was more effective than low-intensity PRT or GP care. A 50% reduction in HRSD score in 61% of the high-intensity, 29% of the low-intensity, and 21% of the GP care group
Dunn et al., 2005, USA (48)	$n=80$, age range 20–45, M, F, recruited in a medical centre	Clinical assessment by DSM-IV criteria	12 weeks of supervised exercise in laboratory. Public health dose defined as 17.5 kcal/kg/week	(i) Placebo exercise control (stretching); (ii) 7 kcal/kg/week achieved in 3 days aerobic exercise; (iii) 7 kcal/kg/week achieved in 5 days aerobic exercise; (iv) 17.5 kcal/kg/week achieved in 3 days aerobic exercise (public health dose); (v) 17.5 kcal/kg/week achieved in 5 days	HRSD, response and remission rates	The public health dose of exercise was more effective in reducing depression scores to a clinically acceptable level than the lower dose or the control condition. Frequency was not important

BDI, Beck Depression Inventory; CES, Center for Epidemiological Studies Depression Scale; CIS, Clinical Interview Schedule; DSM-III or IV, Diagnostic and Statistical Manual of Mental Disorders; HRSD, Hamilton Rating Scale; POMS, Profile of Mood States; RDC, Research Diagnostic Criteria; SCL, Symptom Checklist; SDS, Zung Depression Scale; SF-36, Medical Outcomes Survey Short Form.

Table III. Characteristics of randomized controlled studies on exercise interventions with problem drinkers or other substance abuse.

Authors and country of study	Study participants	Problem drinkers or substance misuse	Length of training	Comparison groups	Outcome measures	Results
Gary & Guthrie 1972, USA (50)	$n=20$, Male only, inpatient alcohol clinic	Problem drinkers	4 weeks	(i) Usual treatment plus running 5 ×week; (ii) Usual treatment	Schneider fitness, Jourard body Cathexis	↑ Fitness and self-esteem in exercise group only
Donaghy et al., 1991, Scotland (5)	$n=37$, Male only, outpatient alcohol clinic	Problem drinkers	8 weeks	(i) Aerobic 3 ×week, 30 min; (ii) Weight training 3 ×week, 30 min; ACSM guidelines followed for both exercise programmes	Est. max. VO_2, BDI Depression Inventory, Leeds Scale, strength and flexibility	↓ Anxiety and depression, and ↑ strength in both exercise groups change in fitness in aerobic group only
Anstiss, 1991, UK (52)	$n=166$, M, F, inpatient alcohol clinic	Problem drinkers	4 weeks	(i) Aerobic high-intensity 5 ×week; (ii) Aerobic low-intensity below training zone, 5 ×week	Unspecified fitness test, BDI Depression Inventory, STAI	↓ Depression in both groups; ↑ fitness in both groups, no between-group difference on VO_2 max, BDI, STAI, relapse rate, drinking behaviour or psychosocial functioning. Increased dropout in high-intensity exercise group
Donaghy M.E 1997, Scotland (53)	$n=117$, M, F, Outpatient and inpatient alcohol clinics Multi-site with four sites across Scotland 2 inpatient and 2 outpatient	Problem drinkers	3 weeks, + 12-week home-based programme	(i) Aerobic and strength exercise; group 3 ×week, 30 min; (ii) Stretching exercise group 3 ×week, 30 min	Est. max. VO_2, strength and flexibility, PSPP, BDI, Zung anxiety, 7-day, recall physical activity, Serum CDT, 1-, 2- and 5-month follow-up	At 1 month, ↑ strength, fitness, body condition, strength and self-worth in exercise group only; ↓ anxiety and depression both groups. At 2 months, ↑ fitness, strength, physical activity levels, body condition and strength in exercise group only ↓ anxiety and depression both groups, no between-group difference in abstinence levels; At 5 months, ↑ fitness maintained
Li et al., 2002, China (56)	$n=86$, Inpatients	Heroin Substance misuse	10 days	(i) Usual treatment; (ii) Qigong group-based, 25–30 min 4–5 times a day	Urine morphine, SESWS, HAS	For Qigong group versus both controls: ↓ withdrawal, anxiety, morphine
Palmer et al., 1995, North America (55)	$n=45$	Range of Substance misuse	4 weeks	(i) Weight strength training 30–40 min, 3 ×week; (ii) Aerobic exercise 30–40 min, 3 ×week; (iii) Circuit training 30–40 min, 3 ×week	Aerobic power, CES-D, skin-folds, resting pulse rate, blood pressure, strength	↓ Depression in strength group only

BP, blood pressure; Est. max. VO_2, estimated maximum oxygen consumption; LOC, locus of control; BDI, Beck Depression Inventory; STAI, Speilberger State and Trait anxiety inventory; CDT, Carbohydrate deficiency transferrin blood analysis; PSPP, Physical self-perception profile; CES-D, Centre of Epidemiological Studies – Depression; SESWS, Standard Evaluation Scale of Withdrawal Symptoms; HAS, Hamilton Anxiety Scale.

chance of showing any significant effects from the exercise, neither were the findings analysed on an intention-to-treat basis, with 35 participants excluded from analysis as they did not complete the programme. The other study used an intensive programme of Qigong over 10 days, although the analysis indicate a reduction in withdrawal and morphine use, the transferability of this type of programme outside of China may be limited (56). While these results are interesting the lack of consistency in the use of outcome measures and the small number of well designed RCTs limit the conclusions. However, we can say that there is unequivocal support that physical exercise regimens have a positive effect on aerobic fitness and strength if used as an adjunct in alcohol rehabilitation. The link between improvements in self-esteem and exercise with alcohol and drug rehabilitation is at this time equivocal. The evidence for exercise improving abstinence levels or controlled drinking levels is equivocal. The fitness benefits may be important for people attempting to change behaviour.

There are no longitudinal studies supporting the use of exercise as prevention in alcohol and drug addiction. Some large cross-sectional studies of adolescents have found a negative association between substance use and physical activity, whereas others have found no relationship, or have shown a negative relationship only in females or only in males. From this evidence, there appears to be a complex relationship between substance abuse and exercise, which is mediated by gender, personality, mode of activity and type of drug used (14).

Clinical guidelines and policy documents

In addition to the scientific literature key reports, clinical guidelines and policy documents promote the use of exercise for mental health. The United States Department of Health and Human Services and the Department of Health (57–60) highlight the links between exercise and mental health promotion. The National Institute for Clinical Effectiveness (NICE) guidelines for Depression (61,62) highlights exercise as an adjunctive treatment for mild and moderate depression. The recent Scottish Executive policy document Delivering for Mental Health (63) highlights exercise within its self-care management programme.

Do people with mental health problems want to exercise?

A survey by the charity Mind (64) found that 83% of people with mental health problems looked to exercise to lift their mood or to reduce stress with two-thirds indicating that it helped to relieve their depression; however, 58% did not know that some GPs can prescribe exercise. The GP exercise-referral schemes introduced in the late 1990s in the UK allow people with mental health problems to access exercise facilities in their local community. The commissioned report, "Up and Running" Treatment for Mild and Moderate Depression (65), came out strongly in favour of advocating exercise as a first-line treatment for depression and led to the production of posters and leaflets for distribution through GP surgeries. The findings outlined in the report, however, suggest that only 5% of the GPs surveyed consider exercise as one of their three most common treatment responses compared with 92% who would consider using medication.

How does exercise help in preventing and alleviating mental health problems?

The association between exercise and positive mood can be explained by physiological and psychological explanations. The increased blood flow to the brain stimulates the release of naturally occurring mood-enhancing chemicals known as endorphins; these natural opiates are similar to morphine and have been linked to the "runners high". Studies have demonstrated their presence in blood samples of people following exercise (13). This explanation, however, remains speculative, as we don't know if endorphins can cross over the blood–brain barrier. Animal studies have found that chemicals known to be depleted during depression – norepinephrine, dopamine and serotonin – are released during exercise (66). These neurotransmitters have been associated with elevating mood. Antidepressant medication such as Prozac works by boosting these chemicals. This may partially explain why exercise offers protection to depression and is effective as a treatment intervention. Exercise is known to increase levels of brain-derived neurotrophic factor (BDNF); this substance is associated with enhancing mood and helping the brain cells survive longer. This may also be linked to improved cognitive function (66). It has also been suggested that increased levels of phenylethylamine, a known stimulant in the brain occurring during exercise, is linked to the release of dopamine and endorphins, acting as a natural antidepressant. This has been evidenced by a rise in phenylacetic acid found in urine samples following exercise (67).

Explanations from psychology suggest links between exercise and physical self-perceptions such as body image, physical self-worth and self-esteem (12). The findings from the Mind survey support this explanation, with 50% stating that exercise

boosted their self-esteem. Planning and undertaking exercise allows setting and achieving goals, skill development, building self-confidence and it may also provide a mechanism for social support if exercising with others. The anxiety reduction effects of exercise have been linked to improved cardiovascular fitness reducing reactivity to and recovery from psychosocial stressors (11).

It has recently been suggested that exercise can influence brain plasticity and bring about changes by facilitating neurogenerative, neuroadaptive and neuroprotective processes (68). Currently the mechanism for this is not well understood but metabolic and chemical pathways among the brain, spinal cord and muscles offer plausible testable mechanisms. While agreeing with this, the author would argue that we have ignored the importance of emotions and feelings and their role in neuroadaptation. The human genome (the totality of our chromosomes) cannot account for the entire structure of the brain but it helps set the circuits in the older part of the brain (69). This part of the brain, which includes the brain stem, hypothalamus, limbic system and amygdala, is pre-set for survival ensuring we continue breathing, regulating our heartbeat and balancing our metabolism. Although pre-set, these circuits adapt with experience, ensuring that we can adjust to different environments across our lifespan. From early childhood, we learn about social conventions and ethical rules. These layers of new facts and experiences shape our behaviour leading to desirable decision-making strategies, increasing our chances of survival.

Studies have shown that we have reward circuits in the brain linked to the limbic system. Rewarding experiences release dopamine telling the brain "to do it again" (70). Memories associated with rewarding experiences are laid down in the cerebral cortex and are triggered by certain cues, which stimulate the recurrence of the behaviour. Thus the brain adapts over time to new experiences that are repeated. The sub-cortex or evolutionary part of the brain keeps us alive and helps us shape and change our behaviour as and when required (69). The cerebral cortex enables us to reason, make decisions, build and store knowledge. Our emotions and feelings are like a river with information continually flowing to ensure a concerted effort.

Recent research highlights how repeated abuse of illicit drugs or alcohol lays down memories that are difficult to diminish (70). These memories are triggered by cues associated with drug taking or drinking, increasing risk of relapse in addicts. Changing behaviour requires new pleasurable experiences to be repeated over time in order to rewire the circuits. Exercise has the potential to play a key role in this rewiring.

In summing up, exercise increases the blood flow to the brain. It stimulates the circuits in the sub-cortex resulting in increased heart rate, increased levels of cortisol and adrenaline. Regular exercise changes these pre-set circuits modifying the response to stress. This in turn lays down new associations in the cerebral cortex, which influences our thoughts, how we interpret situations, how we interact with our environment and the people within it. Through this mechanism of adaptation, regular exercise has the potential to influence other health behaviours such as alcohol and drug addiction, smoking and diet.

It has been argued that the benefits of exercise and mental health are likely to be best explained by an integrated theory that takes account of the biochemical physiological, psychological explanations (71). In doing so, the importance of the brain circuitry involved in emotions and feelings should not be ignored. The mind–body link is important in all of these explanations.

So are we really taking this evidence on board and what can we do to influence change?

Firstly, GPs need to shift their views about choosing exercise as a treatment option. In the UK, only 5% prescribed exercise as one of their three most common treatments for depression, compared with 92% who would prescribe anti-depressants (64). Why is this? Perhaps the idea that something as complex as the "mind" can be treated by something as simple as "exercise" is difficult for GPs, healthcare professionals and the public to accept. The 17th-century Cartesian view that the mind and body are separate entities may still pervade medicine today (69), resulting in the psychological consequences of disease being disregarded. There is a need to consider how exercise and the associated changes in the body relating to fitness and strength influence our emotions and feelings the somatopsychic response. By considering this response alongside the psychosomatic response, knowledge of how exercise can seriously impact on mental health may become evident.

What we need to do

There is a need to heighten awareness of GPs, physiotherapists, occupational therapists and exercise specialists on the benefits of exercise for people with mental health problems. We need to consider the training needs of those who deliver exercise programmes in the community at outpatients clinics and exercise-referral schemes. At this time, we do not know the optimum strategy to engage people

with depression or addiction problems into exercise. Research from exercise psychology with other populations (12) indicates that incorporating cognitive–behavioural techniques such as motivational interviewing, identification of barriers to exercise, goal setting, self-monitoring, contracting, social support and reinforcement are all likely to be beneficial if included into programmes. This needs to be evaluated with people with mental health problems to see whether it does increase adherence and maintenance to exercise and physical activity. Likewise, we do not know whether involving spouse or family in exercise will increase motivation and participation. The dose–response relationship is still not clearly defined, and while any type of exercise or physical activity undertaken regularly seems to be beneficial, using the public health dose as a guide and following the ACSM recommendations should be encouraged.

Conclusion

There is substantial evidence from longitudinal studies that physical activity and exercise offers protection from depression in adolescents, adults and older adults. This evidence has been gathered from different countries and with different populations. The preventative role in regard to alcohol and drug use appears to be more complex and less well established at this time. There is support for the use of exercise in the treatment of mild to moderate depression. The effect size is large and while this has to be tempered by the limitations of the methodologies one could argue that the findings across the studies are consistent in demonstrating a reduction in depression. In the context of alcohol and drug rehabilitation, exercise has the potential to encourage a healthy lifestyle, which is incompatible with substance misuse. It can provide valuable social support, and can enhance psychological well-being and coping skills. In both the treatment of depression and addiction, the benefits for mental health improvement and general health benefits are far greater than the health risks associated with remaining sedentary.

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Final Paper

Research Question: Does Physical Exercise Improve Mental Health?

The written research proposal will be created based on a narrowly defined aspect of the topic selected in Week One. A research proposal is a detailed plan for a specific study to be conducted at a future time. It is the document which potential researchers typically submit to an institutional review board (IRB) for ethical review and approval, and/or to funding agencies to secure financial support for a research effort. Because it is a plan for research which has not yet been conducted, the Methods section should be written in the future tense and should not contain any hypothetical results. The paper must address all of the components required in the Methods section of a research proposal. The following actions must be completed.

- State the research question and/or hypothesis.
- Briefly compare the characteristics of the major research paradigms used in previous studies on the chosen topic. Introduce the specific approach (qualitative, quantitative, or mixed methods), research design, sampling strategy, data collection procedures, and data analysis techniques to be used in this study. Provide a short explanation as to why the selected procedures are more feasible than other alternatives for the research topic.
- Describe any relevant variables, measures, and statistical tests.
- Apply ethical principles and professional standards to the proposed psychological research. Provide an analysis of any ethical issues that may arise and explain how these issues will be resolved.

The following headings for the required sections and subsections must appear in the paper. In accordance with APA style, all references listed must be cited in the text of the paper.

- **Introduction**
    - Introduce the research topic, explain why it is important, and present an appropriately and narrowly defined research question and/or hypothesis.
- **Literature Review**
    - Evaluate the published research on the chosen topic including a minimum of three peer-reviewed articles. Summarize the current state of knowledge on the topic, making reference to the findings of previous research studies. Briefly mention the research methods that have previously been used to study the topic. State whether the proposed study is a replication of a previous study or a new approach employing methods that have not been used before. Be sure to properly cite all sources in APA style.
- **Methods**
    - **Design –** Create a feasible research design that incorporates appropriate methods to address the topic. Indicate whether the approach of the proposed study is qualitative, quantitative, or mixed methods. Identify the specific research

design, and indicate whether it is experimental or non-experimental. Evaluate the chosen design and explain why this design is feasible and appropriate for the topic and how it will provide the information needed to answer the research question. Cite sources on research methodology to support these choices. Include a minimum of two peer-reviewed sources.

- **Participants** – Identify and describe the sampling strategy to be used to recruit participants for the study. Estimate the number of participants needed, and explain why this sampling method is appropriate for the research design and approach.

- **Procedure/Measures** – Apply the scientific method by describing the steps to be taken in carrying out the study. Identify any test, questionnaire, or measurement instrument to be utilized. If an existing published instrument will be employed, briefly describe it and cite the source. If an original questionnaire, survey, or test will be created for the project, describe the types of information that will be collected with it and explain how the validity and reliability of the instrument will be established. If such an instrument will not be used, describe how the data will be collected for the study.

- **Data Analysis** – Describe the statistical techniques (if quantitative) or the analysis procedure (if qualitative) to be used to analyze the data. Cite at least one peer-reviewed source on the chosen analysis technique.
- **Ethical Issues** – Analyze the impact of ethical concerns on the proposed study, such as confidentiality, deception, informed consent, potential harm to participants, conflict of interest, IRB approval, etc. After analyzing the ethical issues that apply to the project, indicate what will be done to handle these concerns.

- **Conclusion**

  - Briefly summarize the major points of the paper and reiterate why the proposed study is needed.

Attention Students: The Masters of Arts in Psychology program is utilizing the Pathbrite portfolio tool as a repository for student scholarly work in the form of signature assignments completed within the program. After receiving feedback for this Research Proposal, please implement any changes recommended by the instructor, go to Pathbrite. (Links to an external site.) and upload the revised Research Proposal to the portfolio. Use the Pathbrite Quick-Start Guide to create an account if you do not already have one. The upload of signature assignments will take place after completing each course. Be certain to upload revised signature assignments throughout the program as the portfolio and its contents will be used in other courses and may be used by individual students as a professional resource tool. See the Pathbrite (Links to an external site.) website for information and further instructions on using this portfolio tool.

The Research Proposal

- Must be five to seven double-spaced pages (excluding title page and references page) in length and formatted according to APA style as outlined in the Ashford Writing Center (Links to an external site.).
- Must include a title page with the following:
  - Title of paper
  - Student's name
  - Course name and number
  - Instructor's name
  - Date submitted
- Must address the topic of the paper with critical thought and provide a thorough explanation of all required issues.
- Must utilize a minimum of six peer-reviewed sources from the Ashford University Library.
- Must document all sources in APA style as outlined in the Ashford Writing Center.
- Must include a separate references page that is formatted according to APA style as outlined in the Ashford Writing Center (Links to an external site.).

6 Papers attached * MUST BE 6 Sources From Ashford Library

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ORIGINAL ARTICLE

Adding an accredited exercise physiologist role to a new model of care at a secure extended care mental health service: a qualitative study

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Abstract

Background: Accredited exercise physiologists (AEPs) are emerging as essential members of allied health in the management of non-communicable chronic diseases. People diagnosed with severe mental illness (SMI) are at greater risk of cardiovascular diseases. Secure extended care units (SECUs) provide treatment, supervision and support for people with SMI whose needs cannot be met adequately in the community. However, the role of AEPs in SECUs has not been described.

Aim: Describe the processes and outcomes of adding an AEP to a new model of care at a SECU.

Methods: An exploratory study with emphasis on qualitative data. Interviews with a purposive sample of SECU staff.

Results: Participants articulated concern about poor physical health of which two themes emerged (1) the development of the AEP role; a calculated gamble and (2) the practical application of the role.

Conclusions: An AEP was identified as the role to best implement the organisations vision to improve physical health of people with SMI. Implementation and practical application of the role relied on an informed calculated gamble. Yet, once embedded in the service, the AEP role was able to capacity build among clinical staff, develop a treatment pathway, and implement consumer specific physical health interventions.

Keywords

severe mental illness, exercise, secure extended care, physical health

History

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Background

People diagnosed with severe mental illness (SMI) (i.e. schizophrenia, schizoaffective disorder, bipolar disorder and major depressive disorder) account for around 600 000 Australians (AIHW, 2014) and at least another 80 million people globally (WHO, 2014). Severe mental illness negatively affects morbidity and is associated with higher mortality compared with people without a diagnosis of SMI (Parks et al., 2006; Tiihonen et al., 2009). Factors attributing to increased morbidity include cardiovascular diseases (Robson & Gray, 2007), mental illness stigma (Gary, 2005; Thornicroft, 2008) and poor engagement with mental health services (Folsom et al., 2005; McKenna et al., 2014a).

Engagement with mental health services may include short- or medium- to long-term admissions to inpatient facilities that cater for consumers with unremitting and severe symptoms of mental illness (McKenna et al., 2014b) that preclude living in less restrictive locations (DHS, 2008). However, there are a group of people with SMI who require longer-term support due to their enduring symptoms in a secure environment because of an on-going risk to self and/or others. Secure extended care units (SECUs) provide treatment, supervision and support for consumers whose needs cannot be met adequately by other available programmes and services in less restrictive environments (McKenna et al., 2014b). Secure services may provide access to multidisciplinary teams, regular clinical review, care planning, education and support and promote links with community services (DHS, 2008). However, given the known poor physical health of consumers in inpatient services (Fowler et al., 2015; Jones et al., 2004; Robson & Gray, 2007), innovative and creative additions to existing models of care may be required to beneficially affect physical health outcomes for consumers in secure services.

The physical health of people with SMI remains a concern as the incidence of cardiovascular diseases (Tosh et al., 2014) and other coexisting conditions (Marder et al., 2004) remains higher within this cohort compared with the general population. Among multidisciplinary teams, monitoring and beneficially affecting physical health has been addressed through

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various combinations of clinicians and allied health involvement/intervention (Daumit et al., 2013; Wright et al., 2006). In Australia, university trained accredited exercise physiologists (AEPs) are emerging as essential members of allied health in the management of non-communicable chronic diseases such as cardiovascular diseases, diabetes mellitus and obesity (Cheema et al., 2014; Soan et al., 2014). During clinical practice, an AEP may prescribe interventions that focus on the acute or subacute management of chronic disease or injury to assist in restoring an individual's physical function, health, or wellness (ESSA, 2014). Interventions may include exercise, physical health education and supportive advice about healthy lifestyle choices (ESSA, 2014). A recent consensus statement endorses engagement of AEPs within the treatment of mental disorders (Lederman et al., 2016) and this is supported by an emerging body of literature across multiple mental health service delivery areas. Specifically, AEP roles have been involved with forensic (Wynaden et al., 2012), community, (Rosenbaum et al., 2014), and inpatient (Stanton et al., 2015a) mental health settings.

Although the role of AEPs to increase long-term adherence to interventions that may enhance physical function, health or wellness is still to be thoroughly determined (Stanton et al., 2015a), recent meta-analyses identified reduced dropout among cohorts with depression (Stubbs et al., 2016a) and schizophrenia (Vancampfort et al., 2016a). Furthermore, as the beneficial outcomes of cardiovascular/respiratory exercise training continue to be articulated for people with SMI (Stanton et al., 2015b; Vancampfort et al., 2015), there is potential to add AEP roles to SECUs. The evaluation of such roles may add to the growing evidence of the effects of AEPs across mental health service delivery areas and contexts. Therefore, the aim of this study was to describe the processes and outcomes of adding an AEP role to a new model of care at a SECU with focus among the conceptualisation, implementation and practical application of the role.

Methods

Research design

This research was conducted as exploratory research using qualitative research guidelines (Malterud, 2001). Exploratory research can be undertaken when a problem has not been clearly defined (Stebbins, 2001). In the current study, the problem was the lack of knowledge of an AEP role to a new model of care at a SECU. This research was approved by the Monash Health Human Research Ethics Committee (Ref: 14310L). Data were collected in October 2014, 9-months after the establishment of the role.

Participants

A purposive sample of managerial, clinical and allied health staff employed at the SECU provided written informed voluntary consent to participant in a one-to-one interview of approximately 30-min duration. A purposive sample can be used to learn issues of central importance to a research problem as the process seeks to recruit information-rich cases (Patton, 2002). Therefore, inclusion criteria was (1) direct involvement in the processes that allowed the conception, development, implementation of the AEP role, or (2) ability to describe first-hand experiences of the AEP role or (3) ability to describe the practical application of the role. A total of eight staff were identified by one of the research team (JB). Another researcher (JH) then contacted participants with information about the study. Seven people were invited to participate as one person was no longer at the SECU.

Secure extended care unit (SECU)

The unit is a 50-bed secure extended care facility adjoining a large metropolitan hospital. The SECU program is designed to provide an extended period of sustained treatment and rehabilitation or treatment and care in a contained environment, with a large proportion of consumers receiving compulsorily treatment under the Victorian Mental Health Act (2014). The 50 beds are separated to three service delivery areas (SDAs) that provide specialist mental health care for medium to longer-term admission, typically 12 to 24 months. The SECU is staffed by over 80 employees across the multidisciplinary spectrum and at varying levels of a full-time equivalent (FTE) workload. Each of the three SDAs are equipped with a communal kitchen, a designated space with gym equipment, separate male and female lounge areas and various communal living areas. The SECU has several courtyards for outdoor recreation, quiet spaces and sensory areas. Accessible to consumers within the SECU is an outdoor basketball court and an indoor multipurpose area with a table tennis and billiards table, and opportunity for ad hoc activities. Depending upon legal and leave status, consumers have the potential to access the general hospital gym (with aerobic conditioning and resistance training equipment), the local YMCA indoor pool and community-based sporting teams.

Data collection

One researcher (TF), external and unattached to the SECU, undertook all one-to-one interviews with participants in a quiet uninterrupted space within the service with emphasis on narrative inquiry (Denzin & Lincoln, 2011). Narrative inquiry relies on generating construct narrative of past events or specific cases (Giacomini, 2011). There were two interview schedules. The first interview was for participants that met inclusion criterion 1 and 2. The second interview was for the participant that met inclusion criterion 3. The first literature informed interview schedule was based on the conceptualisation and development of the AEP role, perception of how the role assisted in the provision of physical health and mental health care for consumers, views on changes in service provision since the establishment of the role, and perceived enablers, barriers and future of the AEP role. For example, participants were asked to discuss "how were the day-to-day activities of the AEP devised prior to employment of the AEP?" and "can you describe the nature of changes in service provision after the commencement of the AEP role?" The second interview schedule was based on the day-to-day activities of the AEP with a focus of how the AEP-assisted consumers on their journey through the SECU, and the organisational systems that supported the role. For example, the participant was asked "can you describe a typical day at

work?'' (with prompts – meetings, phone calls, and interactions with consumers and staff) and ''how do you assist consumers on their journey through the SECU?'' (with prompts – assistance/role in care planning, negotiation or support through multiple departments inside the hospital and outside the SECU and negotiations/involvement with family members/significant others). Participants were encouraged to relate stories that exemplified the items asked. All interviews were recorded on an audio-digital recorder application (Apple iPhone 6 MG472X/A). Field notes were also taken and integrated into the data analysis.

Data analysis

A thematic analysis of the qualitative data was undertaken using a general inductive approach around the development and practical application of the role within the SECU. A thematic analysis enables defensible analysis of qualitative data that may initially be varied raw text and allows it to be condensed into brief summaries (Thomas, 2006). Data were analysed with the processes of immersion, coding, creating categories and identifying themes (Green et al., 2007). Interview data were transcribed verbatim, integrated with field notes, and independently read repeatedly by three researchers (TF, BMcK, & CJ). Colour codes were developed though agreement among the researchers and categories were formed. Categories were collapsed to themes and examined for supporting quotes from the data (Guba & Linclon, 2005; Mays & Pope, 1995).

Results

A total of seven key stakeholders provided written informed voluntary consent to participate in the study. The participants represented the voice of; (1) disciplines of management or senior clinical staff ($n = 4$) and (2) allied health staff ($n = 3$, a consumer advisor, a senior occupational therapist, and an AEP). The participants had been employed at the SECU for a minimum of 9 months at FTE workloads between 0.5 FTE and 1.0 FTE. The participants had experience of working in mental health services between 9 months and more than 15 years. The participants had various levels of involvement with the role including (1) management level decisions about conceptualisation, development, and implementation, (2) clinical oversight and (3) interdisciplinary support and knowledge of the practical application of the role.

Findings and themes

Participants (of the first interview) articulated a persistent concern about physical health of consumers and that mental health nurses had ''not been good at'' concurrently providing mental and physical health care. The complexities of secure inpatient services, such as enduring SMI and the potential of risk contributed to such concerns. Participants also described concerns about mental health consumers' sedentary lifestyle, amotivation and harmful history of drug and alcohol consumption. The concerns were founded in past clinical experience at ''old inpatient units'' and as such, two themes emerged about a process to address those concerns. The first theme was about the development of the AEP role; a calculated gamble. The second theme was about the practical application of the AEP role which included; (1) the role in practice, (2) perceived benefits and outcomes of the role and (3) perceived challenges.

The development of the AEP role

The potential of the role arose from the development of new and expanded facilities within the health organisation. The construction of a brand new 50-bed environment created the opportunity to review and revise the model of care to the new SECU. The model of care at the new service was created by all professional leads at the organisation including the Directors of Medicine, Mental Health Nursing, Psychology, Allied Health and Consumer Relations. The multistakeholder input allowed discussion and confirmation of the disciplines required to deliver the organisation's vision for physical health specific to the context of the new SECU:

> ''We wanted this to be about health promotion and specifically targeted to what the literature said were the physical health issues in this [consumer] population and that's better suited to an AEP than a physiotherapist.'' (voice of allied health management)

A calculated gamble. Despite a literature informed process that identified the AEP discipline and the identified limitations in the current ability to provide safe and appropriate exercise interventions, adding such a role was a calculated gamble:

> ''I suppose, to tell you the truth, we didn't know fully how it was going to turn out.'' (voice of senior clinical staff)

An AEP can screen, assess and apply clinical reasoning to ensure safe and appropriate health education and exercise interventions to improve exercise capacity of consumers (ESSA, 2014). As such, there was a realisation that previously, mental health clinicians were limited to provide such clinical practice:

> ''I realised that some of the things we were doing was risky behaviour. For example, people were just traditionally going down to the gym without any checks and balances.'' (voice of senior allied health staff)

Furthermore, management identified the need to prepare clinical staff for the introduction of an AEP, which was a step into the unknown for the SECU. In particular, clinical staff were provided with online resources (e.g. videos and information from ESSA – Exercise and Sports Science Australia. See: https://www.essa.org.au/and http://www.abc.net.au/catalyst/stories/3515000.htm) to support and detail how the role of the AEP may be conducted within the SECU and benefit consumers.

Practical application of the AEP role

The role in practice. As the role had not previously existed in the mental health service, it took six to eight months for a pragmatic operational procedure to evolve (Figure 1). In time, adding an AEP to all SDAs of the SECU was discussed as an

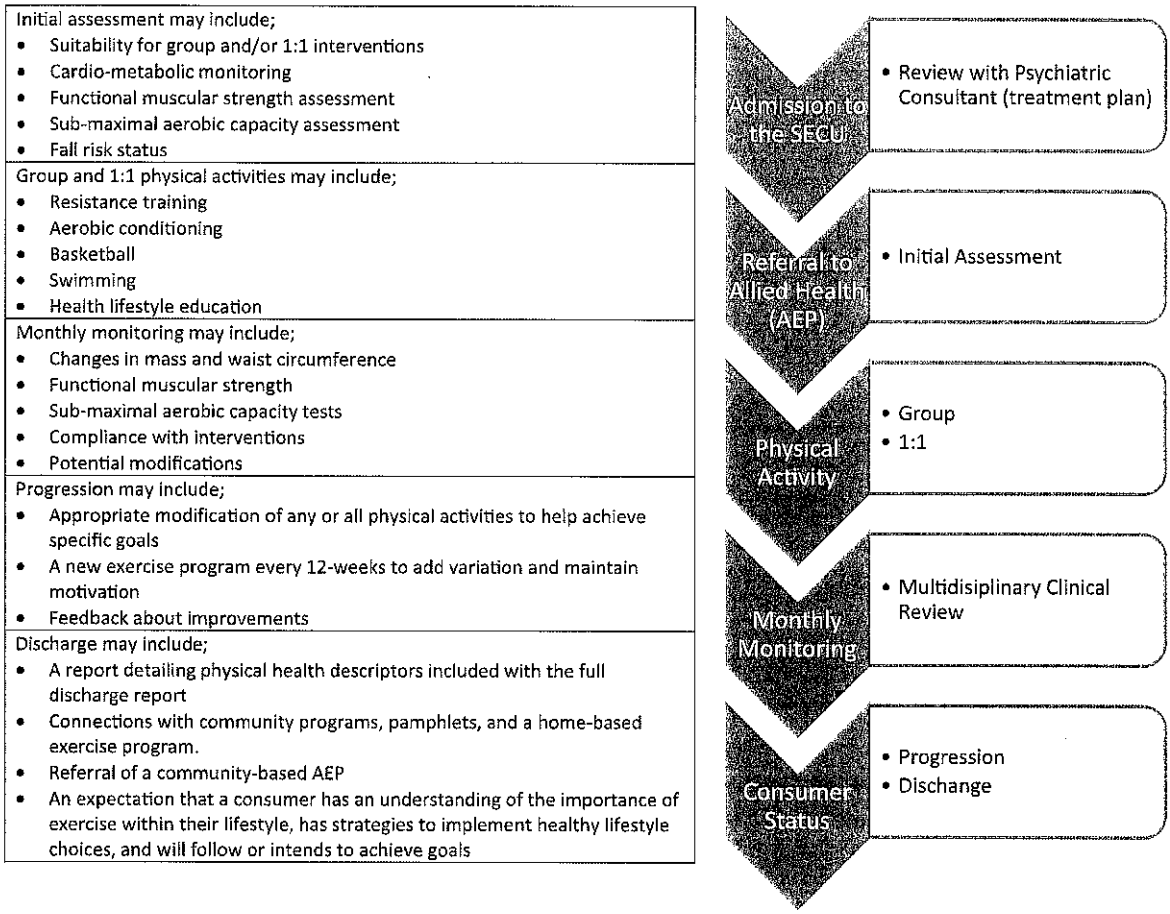

Figure 1. Treatment pathway of a consumer at the SECU specific to the AEP role.

enabling process to potentially alleviate staff concerns about how to address poor physical health of consumers. Furthermore, the perception of tailored or personalised physical activity, created by the AEP, and based on the consumer's current health status was described to address this:

> "I've worked in the community so I've case managed people who have been in hospital [mental health related] and my experience is that when they go into hospital they lay around and they do nothing so to actually have that opportunity to go out and do physical exercise based on their abilities is huge." (voice of senior allied health staff)

The process and interventions that enabled such perception were (1) the provision of consumer specific aerobic conditioning and resistance training interventions with assessment, reassessment, and progression/modification, (2) tailored exercise-based rehabilitation exercise for chronic physical conditions such as lower back pain with a focus on muscular strength, postural assessment and core stability, (3) use of the SECU outdoor spaces to deliver activity programs including group walking, running, and basketball and (4) a healthy living education program about the risks and benefits of seemingly 'unhealthy' lifestyle choices with specific consideration of the impact of SMI. There was also evidence that along with usual care, the AEP role could transcend beyond just physical health because of the established group activities that had not previously existed in the SECU:

> "There's a young guy in one of the service delivery areas (SDAs) and I see him constantly and he's so much more engaging than he was when he first admitted. He's constantly saying 'hi' to me and he's so proud of the fact that he's playing a team sport [football] ... For his self-esteem, it's just phenomenal." (voice of management)

Perceived benefits and outcomes of the role. The AEP was able to (1) advise staff about physical activity interventions, (2) accompany staff and participate in off-campus therapeutic activities and (3) assess physical health risk, develop a treatment pathway (Figure 1) and implement consumer specific physical health interventions. Those benefits were expressed relative to how staff responded to the role rather than quantifiable changes in physical health status of consumers:

> "So if I've got a [consumer] who wants to get involved in some form of exercise, well, I'm no exercise person so I can go to the AEP and go 'where should we start? Can you come and assess this person and tell me where they're at?'" (voice of consumer advisor)

After the pragmatic operational procedure of the AEP emerged (at least six months after role commencement), the

role extended beyond the SECU and a focus just on physical health of consumers in the service. At the organisation level, interest in what an AEP could provide to an acute inpatient mental health unit and a community care unit (CCU) was identified and discussed. Furthermore, the AEP participated in falls prevention initiatives and committee meetings, opened avenues of access to the general hospital gym and hydrotherapy pool, created links within the community to local sporting clubs, and created a SECU-wide, all inclusive sports day:

> ''Well I think there's a lot more understanding that it's about a more of a holistic, collaborative thing that the AEP does and I think it was highlighted when he did a sports day here. They called it the 'Olympics' or something and he had all these different activities organised for all the clients [consumers] and the day just went amazingly well; there was nursing staff involved in that and other allied staff involved in it. The clients were clearly highlighting how much fun they were having. It also took away the focus on 'I need to have leave. I need to go and smoke'. All these things that the clients get so caught up in, they forgot it and left it all behind and I think the nursing staff were able to see the greater effect that that AEP role had on the clients in that instance because they weren't having to deal with some other issues they normally deal with around agitation and that sort of thing.'' (voice of senior clinical staff)

Perceived challenges. The conduct of the AEP role in the service was not without challenges. Participants described challenges from when the AEP commenced at the service through to the current status of the role. The challenges were evident and while not insurmountable, may need careful consideration in future iterations of an AEP in SECUs. Firstly, in the resource limited mental health service, clinical staff could benefit from understanding the need for and role of an AEP:

> ''It also brings challenges in terms of people understanding what the role is and, you know, nurses not knowing who to refer or why. People are going 'well why are we spending money on that role as opposed to more nurses?''' (voice of senior allied health staff)

The aim of interventions an AEP may prescribe focuses on the acute or subacute management of chronic disease or injury to assist in restoring an individual's physical function, health or wellness (ESSA, 2014). Interventions may include exercise, physical health education and supportive lifestyle modifications (ESSA, 2014). An AEP is an allied health provider, yet despite a growing literature base describing involvement of AEPs in mental health services, the translation of such information to clinicians currently working in the SECU may not be optimal:

> ''I think there's a lack of knowledge and maybe there's a need for more of an understanding of what the AEP does rather than to just sort of think 'yeah, he's a personal trainer and he just goes away and shows somebody how to lift some weights''' (voice of senior clinical staff)

Secondly, given the largely unknown role of the discipline in the current mental health setting, challenges about managing risk were described. Despite mandatory organisation and service level orientation and initiation, given a lack of experience in SECUs, the AEP needed other staff to support and educate for the identification of risk, determination of acceptable risk and awareness of situations that may negatively affect safety. This dedication by staff added workload to their day-to-day duties that had previously not existed, yet was not perceived negatively:

> ''Basically there are things that you can do to upskill someone in terms of their safety. It's really, I think, the exercise physiologist's safety [AEP's] for themselves on the unit that was much more of a concern'' (voice of senior allied health staff)

Discussion

A multidisciplinary managerial-level group of clinical experts informed with the assistance of literature, were able to identify the discipline they perceived best to assist improve the physical health of consumers at the SECU. Once the discipline was identified and the role implemented within the service, scope for other mental health areas across the organisation was identified as possibilities for an AEP role. The findings of the current study also show how an AEP role can be embedded in the model of care for consumers with the development of a treatment pathway, practical exercises and structured health-related activities.

A lack of structured activities has been systematic to inpatient units (Sharac et al., 2010) and mental health nurses have perceived physical health of consumers to be poor (Happell et al., 2015). The articulated concerns about physical health in the current study support such perceptions. Mental health nurses have been limited by a lack of training in exercise prescription (Torrey et al., 2001) and have expressed desire for formal training (Stanton et al., 2015a). A similar perception was identified in the current study as participants became aware of the role an AEP can play in providing specialist physical health care and how their previous practice was limited and potentially unsafe in comparison.

However, the positioning of mental health nurses to take a more direct role in physical health care may risk excessive workload (Happell et al., 2011). One option is for referral to AEPs working as allied health professionals in satellite services (Stanton et al., 2015a). Yet, despite the scope of practice of AEPs, referral rates have been low (Happell et al., 2014; Stanton, 2013). The findings of the current study may partly explain low referral rates as the role an AEP can play was perceived to be largely unknown. Furthermore, in the setting of the current study, referral to satellite services was unavailable given the legal and leave status of many consumers. As such, embedding an AEP in SECUs may be one method to increase referral and access to specialist exercise prescription and structured health-related activities.

Access to specialist exercise prescription and structured supervised health-related activities are known to improve cognitive function (Firth et al., 2016a) and reduce dropout for people with SMI (Vancampfort et al., 2015). As people with SMI are highly sedentary (Vancampfort et al., 2016b) and subsequently less engaged with moderate and vigorous physical activity (Stubbs et al., 2016b), the nature of SECUs may exacerbate such behaviours along with depression, stress, and fatigue (Firth et al., 2016b). Therefore, there is a need for specialist supervised exercise in SECU settings to reduce sedentary behaviour, potential improve mental health status, and reduce risk of cardiovascular diseases. The results of the current study indicated that the process to achieve such beneficial outcomes in a SECU is possible and beginning to emerge.

As mental health nurses have expressed limited ability to prescribe exercise for consumers, the ability of AEPs to understand the complexities of inpatient mental health services including signs and symptoms of SMI, effects of psychotropic medication, behavioural escalation, risk of violence and aggression, the use of restrictive interventions, and recovery-oriented care needs to be explored. To our knowledge, the AEP role created in the current study is the first of its kind introduced to a SECU. The theme "a calculated gamble" may have emerged because the role of an AEP in secure services is barely known. The method of education for AEPs about, for example, the Victorian Mental Health Act (2014), use of de-escalation techniques (e.g. sensory modulation and limit setting) and current State mental health space initiatives (e.g. framework for reducing restrictive interventions (DoH, 2011) and Safewards (Bowers et al., 2014)) may need to be defined to potentially ease the transition of AEPs from satellite services to SECUs.

An AEP is well positioned to deliver a holistic approach to care enhancing both physical and mental health outcomes (Lederman et al., 2016). Although beyond the scope of the current study, the AEP role may dovetail with existing recovery-oriented care (i.e. holistic) domains such as (1) building collaborative partnerships and meaningful engagement and (2) enhancing community participation and citizenship (DoH, 2011). The "Olympics" sports day and engagement of one consumer in the local football team are pragmatic examples. However, prior to AEP roles becoming more prevalent in inpatient mental health settings, the role an AEP can play in a consumer's recovery journey and the effectiveness of an AEP role to beneficially affect physical health needs to be explored with both objective and subjective measures. The justification of resource allocation to establish, maintain and expand AEP roles will likely depend upon such evidence in the first instance.

Limitations

This study was limited to a purposive sample of participants who could articulate how the AEP role was conceptualised and how the AEP role interfaced with consumers and clinicians at the SECU. Therefore, data may not be representative of the entire service, nor how similar AEP roles may function in other secure extended care mental health services and organisations. This study was also limited because the perceptions of the role by current consumers were not profiled, rather voiced by a consumer advisor employed at the SECU. Another limitation was that changes in, for example, cardiovascular diseases risk factors were not profiled. As such, the effectiveness of the role on physical health of consumers remains to be quantified.

Conclusions

For the SECU in the current study, an AEP was identified as the key role to best implement the organisations vision to improve physical health of people with SMI. The impact of adding an AEP role to a new model of care at a SECU was established. Yet, implementation and practical application of the role relied on an informed calculated gamble. Once embedded in the service, the AEP role was able to capacity build among clinical staff, develop a treatment pathway, and implement consumer specific physical health interventions. Further work is needed to quantify effects of AEP roles in SECUs to assist in describing potential beneficial changes in physical health status of people with SMI.

Declaration of interests

The authors report no conflicts of interests. The authors alone are responsible for the content and writing of this article.

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Improving cognition by adherence to physical or mental exercise: A moderated mediation analysis

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Background: The role of adherence to an intervention is examined to further understand the relationship between performing new challenging activities (either mental or physical ones) and their putative cognitive benefits.
Method: Healthy older women ($N = 229$, age range: 70–93 years) took part in a six-month randomised controlled trial, covering either a physical or mental activity (three × weekly). They completed five tests, measuring episodic and working memory pre- and post-intervention. A moderated mediation model was specified to test the strength of the indirect effect of the activity mode (i.e. physical vs. mental) through adherence (i.e. time spent on course attendance) on levels of baseline cognitive performance.
Results: Both physical and mental activity groups performed better over time than the control group ($p < 0.001$). Adherence predicted cognitive performance ($p = 0.011$). The indirect effect of the activity mode on cognitive performance through adherence was especially seen when levels of baseline composite scores were low ($p = 0.023$).
Conclusion: Older healthy women can improve episodic and working memory through spending time on a challenging physical or mental activity. Results are most promising for cognitively less fit women. Time spent on course attendance can be interpreted as an adherence indicator that makes a difference for various cognitive outcomes of the intervention.

Keywords: older women; cognitive improvement; adherence; spending time; intervention

Background

Physically or mentally demanding activities are found to counteract a decline in cognitive performance (Hogan, 2005; Mackinnon, Christensen, Hofer, Korten, & Jorm, 2003), which occurs with increasing age especially with regard to episodic and working memory (Craik & Salthouse, 2000). Controlled intervention studies have shown a positive effect of these activities on mental status in older adults (Colcombe & Kramer, 2003; Willis et al., 2006). However, training characteristics of the intervention programmes such as intensity, frequency and duration vary considerably (Heyn, Abreu, & Ottenbacher, 2004). Due to length, frequency and complexity of the performed activities, remarkable adjustments of the daily schedule of the participants are required. As a consequence, variability in adherence to those activity programmes exists.

Although inadequate adherence is presumed to reduce the effectiveness of interventions, the mechanisms of the adherence–outcome relationship remain unclear (Flegal, Kishiyama, Zajdel, Haas, & Oken, 2007; Spirduso & Cronin, 2001). For example, in a meta-analysis of 30 randomised controlled trials (RCT), positive treatment effects of exercise on cognitive outcome measure are suggested, but no significant marker of training characteristic, i.e. intensity, frequency or duration, was found on large effects as compared with medium to small effects (Heyn et al., 2004), whereas an intensity of less than 30 minutes and short programme duration (<6 months) had little impact on cognition (Colcombe & Kramer, 2003). A Swedish study reports on light to moderate levels of exercise several times a week to be most beneficial for cognitive function compared to strenuous exercise levels (Lindwall, Rennemark, & Berggren, 2008).

Explanatory variables are needed to clarify the positive relationship between physical activity and cognitive performance (Etnier, Nowell, Landers, & Sibley, 2006). Furthermore, adherence should be measured and assessed specifically according to the studied behaviour to provide accurate data on the dose–response relationship and of treatment consequences (Vitolins, Rand, Rapp, Ribisl, & Sevick, 2000). According to a meta-analysis by DiMatteo, Giordani, Lepper, and Croghan (2002), strong relations between adherence and medical treatment outcomes were found if measures of adherence were continuous instead of dichotomous. However, no method of measuring adherence is considered to be the gold standard (Osterberg & Blaschke, 2005; Vermeire, Hearnshaw, van Royen, & Denekens, 2001).

Besides the importance of adherence to training, baseline memory, speed of processing and education have been found to be predictors of cognitive response patterns after memory training (Langbaum, Rebok, Bandeen-Roche, & Carlson, 2009). Initial cognitive function may be important for treatment effects. A review on cognitive decline in older adults showed that

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baseline cognitive function and cognitive decline are negatively related; however, high intra-individual variation is described (Park, O'Connell, & Thomson, 2003). Behavioural brain reserve, which is also referred to as cognitive reserve (Scarmeas & Stern, 2003), could be increased by interventions to protect against this latter stated cognitive decline (Valenzuela & Sachdev, 2006).

In this article, we examine data of a previously reported RCTs to improve cognitive fitness (Klusmann et al., 2010). Healthy older women were randomised to a six-month standardised physical activity (i.e. an exercise course), mental activity (i.e. a computer course), or a passive control group. Participants in both intervention groups showed comparably better cognitive performance change over six months than the controls.

According to Hansen and McNeal (1996), who argue that interventions work by means of mediating variables, we explore the question of how the intervention was effective by assuming adherence to be the mediating variable. We further, address the question of whom this effect was especially seen by testing the moderating role of baseline cognitive performance. Thereby, we use a composite score of cognitive performance as the primary outcome measure. Figure 1 illustrates the three mechanisms, mediation, moderation and the integrated model of moderated mediation to be tested:

(i) testing the influence of the activity mode on cognitive change through adherence (Figure 1, Panel A, hypothesis on mediation),
(ii) examining the moderating role of cognitive baseline performance on the follow-up performance (Figure 1, Panel B, hypothesis on moderation),
(iii) testing the two assumptions simultaneously: (1) the activity mode has an indirect effect on cognition through adherence, and (2) the strength of the adherence–cognition association depends on the level of cognitive baseline performance (Figure 1, Panel C, hypothesis on moderated mediation). In other words, the hypothesised indirect effect (activity – adherence – cognitive outcome) would emerge at a certain level of baseline performance.

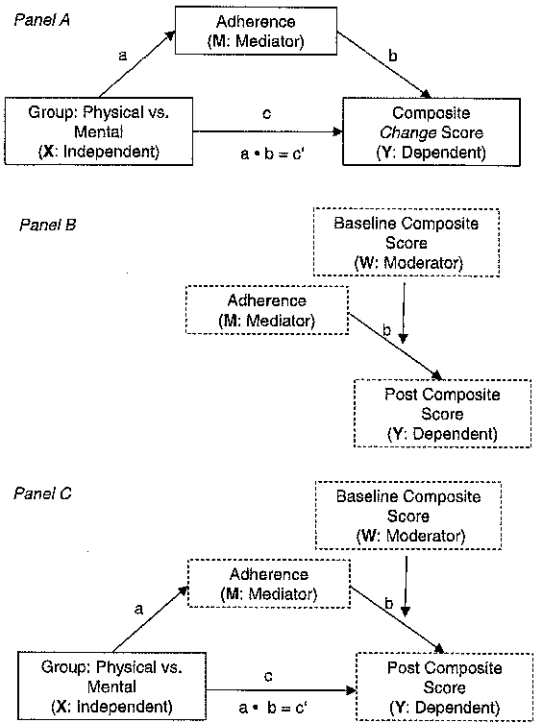

Figure 1. Assumed hierarchical structure of the moderated mediation model. Panel A addresses the question of how the intervention was effective (mediation). Panel B shows the assumed moderating role of cognitive baseline performance. Panel C depicts the hypothesised indirect effect of the activity mode through adherence depending on cognitive baseline performance. The simple effect c is the effect X has on Y without the intervening variable M.

Methods

Participants and procedure

German-speaking women from Berlin, aged 70 years or older, were recruited by advertisements in newspapers, public transport systems and flyer distribution. Prior to randomisation, participants were screened to rule out a presence of cognitive impairment, depression or other neurological or medical diseases that would interfere with cognitive performance or course participation. Further, eligibility criteria were exercising less than one hour/week and being unfamiliar with a computer.

A total of 259 women aged 70 years and older were randomised to a six-month standardised physical activity (i.e. an exercise course, $n = 86$), mental activity (i.e. a computer course, $n = 85$), or control group ($n = 76$). Twelve women withdrew consent after being informed about group assignment, leaving 247 women who started the intervention. Both intervention programmes of physical or mental activities consisted of 90-minute standardised training sessions, three times weekly for six months. Participants were trained in groups of 12 by a certified exercise trainer or a qualified computer trainer in different locations throughout Berlin that were accessible by public transportation.

The exercise course started with 30 minutes of endurance training on bicycle ergometers or treadmills. Heart rate monitors were used to avoid exceeding the individually detected heart rate maximum. The endurance training was followed by 60 minutes of strength, flexibility, balance and coordination training. The computer course comprised learning how to operate with the common software and hardware (writing, playing, calculating, surfing the Internet, emailing, drawing, image editing and video taping).

On average, 73 training classes (range 70–74 sessions) were offered to a total of seven groups (physical and mental) that started interventions

successively. A total of 230 women, i.e. 80 women on the physical exercise course, 81 women on the computer course and 69 women in the control group, returned for follow-up assessments at the end of the 6 month training session. The data of this sample were used for all analyses in this article.

Cognitive assessment

As reported elsewhere (Klusmann et al., 2010), baseline and follow-up assessments covered neuropsychological tests measuring episodic memory, working memory, executive attention and semantic verbal fluency. Significant differences between the activity groups and the controls were found in five validated tests that were measuring episodic and working memory: the Free and Cued Selective Reminding Test (FCSRT; Buschke, 1984; Grober, Lipton, Hall, & Crystal, 2000), short- and long-delayed recall, measuring episodic memory in a classical laboratory condition, the Rivermead Behavioural Memory Test, immediate and delayed recall (Wilson, Cockburn, & Baddely, 1985), measuring episodic memory in a more naturalistic way, and the Reitan Trail Making Test (TMT; A & B; Reitan, 1955) measuring speed and executive function. All these tests represent well-known standard inventories in neuropsychological assessment.

Participants in our study were healthy and well-educated, and, therefore, ceiling effects are likely to play a role. To minimise ceiling artefacts and other sources of measurement errors and to test training effects at the level of one overall outcome rather than at the level of one single test, a composite score was calculated for women who completed all measures of those five tests at baseline (pre-score) and follow-up (post-score). Pre-scores of each single test were standardised (z-score) using the mean and standard deviation (SD) of the total sample and then averaged into one single score. Post-scores were standardised using the baseline mean and SD to facilitate interpretation of change. Averaging the standardised scores provided a *composite score* of cognitive performance for both measurement points with higher scores indicating higher cognitive performance.

To assess differences in cognitive performance from baseline to follow-up in the cited tests, change scores were computed (raw post-scores minus raw pre-scores for each single test). These change scores were then converted to z-scores and these standardised scores were averaged into a composite measure of *change* of cognitive performance, with greater absolute values indicating greater change.

Adherence assessment

Course attendance in the activity classes was recorded by all trainers for each participant and intervention unit. Adherence was defined as the amount of time spent on participation in the courses plus the individual average travel time to course locations. Adherence (A) was calculated by multiplying course attendance (CA) with the sum of 90 minutes (i.e. duration of one intervention unit) plus travel time in minutes to and from course locations (TT):

$$A = \text{CA} \bullet (90 \text{ minutes} + \text{TT})$$

For reasons of convenience, the result was converted into units of hours. The average course attendance is the ratio of attended to offered course units in per cent.

Statistical analyses

Primary analysis on cognitive outcome

A 3×2 mixed ANCOVA was conducted for the cognitive composite score to test the main effect of all three experimental groups, the main effect of time and whether the change in composite scores was different for the three experimental groups (time $\times$ group interaction). Baseline measures for educational level (Lector Test; Reischies, Wertenauer, & Kühl, 2005) and general fluid intelligence (LPS-3/50+, Leistungs-Prüf-System/Performance Test System; Sturm, Willmes, & Horn, 1993) were included as covariates as done in the primary analyses described in Klusmann et al. (2010). Additionally, dependent sample t-tests on composite scores from pre- to post-testing were conducted to examine changes within each experimental group.

(i) *Hypothesis on mediation*

Given a significant change on cognitive outcome in both intervention groups compared to controls, a simple mediation model (Figure 1, Panel A) was conducted by Sobel Z using an SPSS macro provided by Preacher and Hayes (2004) to examine the mechanism of the intervention through adherence.

The term 'mediation' implies that a significant simple effect (c; $X \rightarrow Y$) is initially present (Holmbeck, 1997; Preacher & Hayes, 2004). If X and Y are not associated directly, they may be related indirectly through the intervening variable M; this would be termed an *indirect effect* (Mathieu & Taylor, 2006).

The applied Sobel test is based on the assumption that this indirect effect ($a \cdot b$ or $c - c'$) is normally distributed which is the case only in large samples (Preacher & Hayes, 2008). Thus, we additionally used a product-of-coefficients strategy with bootstrapping, a non-parametric method for assessing indirect effects, to test and estimate the indirect effect (Hayes, 2009; Preacher, Rucker, & Hayes, 2007; Shrout & Bolger, 2002).

(ii) *Hypothesis on moderation*

We predicted that the baseline composite score would moderate the relationship between adherence and outcome composite score (Figure 1, Panel B). We tested this moderator model in a multiple regression

Table 1. Sample characteristics of intervention groups with complete follow-up data.

	Exercise group ($n=80$)	Computer group ($n=80$)	Control group ($n=69$)
Age (year)	73.5 ± 4.0	73.4 ± 4.2	73.7 ± 4.4
Marital status			
Widowed (*n*)	26 (33%)	28 (35%)	28 (41%)
Married (*n*)	23 (29%)	13 (16%)	17 (25%)
Divorced (*n*)	22 (28%)	24 (30%)	16 (23%)
Other (*n*)	9 (11%)	15 (19%)	8 (12%)
Years of education	11.8 ± 2.5	12.1 ± 2.6	12.0 ± 2.8
Mini-Mental States Examination	28.84 ± 0.91	28.82 ± 0.91	28.70 ± 0.43
Fluid intelligence (LPS-3/50+)	19.0 ± 3.9	19.0 ± 4.5	18.7 ± 4.5
Educational level (Lector test)	40.5 ± 3.9	40.4 ± 5.0	40.6 ± 3.6
Self-reported exercise level (min/week)	0.40 ± 0.48	0.35 ± 0.45	0.27 ± 0.43
Travel time to courses, single way (min)	43.1 ± 16.3	40.9 ± 16.8	–
Adherence (including travel activity, h)	146.5 ± 62.5	176.9 ± 53.3	–
Average course attendance (%)	69.1 ± 26.0	85.3 ± 18.9	–

Notes: Means ± SDs. Self-reported exercise levels were defined as minutes per week spent on sports implying quickened pulse and perspiration. Scores of the Mini-Mental State Examination (Folstein, Folstein, & McHugh, 1975) above 26 indicate no cognitive impairment (range 0–30). Higher scores of LPS-3/50+ (range 0–40) and Lector test (range 0–48) indicate better performance.

procedure using an SPSS macro (MODPROBE) provided by Hayes and Matthes (2009) with baseline composite score, adherence and their interaction as independent variables predicting the outcome composite score. Educational level and general fluid intelligence were added as covariates.

(iii) *Hypothesis on moderated mediation*

Finally, assuming that the hypothesised moderation is supported, we pieced together mediation and moderation. We tested whether the strength of the hypothesised indirect effect is conditional on the value of the baseline composite score (Figure 1, Panel C). Therefore, a moderated mediation (termed alternatively *conditional indirect effect*) was conducted using an SPSS macro (MODMED macro Model 3) provided by Preacher et al. (2007). Here, coefficients were estimated in two regression analyses using centred variables. Firstly, adherence (time spent; M) was regressed on activity mode (physical vs. mental activity, X), educational level and fluid intelligence included as covariates. Secondly, the outcome measure (post-composite score, Y) was regressed on activity mode (X), adherence (M), the baseline composite score (W) and the interaction between adherence and baseline composite score. Again, educational level and general fluid intelligence were included as covariates.

If a significant effect of activity mode (X) on the mediator adherence (M) occurs, the moderated mediation would be expressed by a significant interaction between adherence (M) and baseline composite score (W) on the composite outcome measure (Y), which then would affect the indirect effect process. Subsequently, regression analyses were conducted on the mean ± 1 SD of the moderator to define the degree to which mediation varies depending on the level of the moderator. Bias-corrected (BC) bootstrapping (5000 bootstrap samples) was applied as it produces more accurate confidence intervals (CIs) (MacKinnon, Lockwood, & Williams, 2004).

For testing the hypotheses, variables were standardised to attain a common metric, and B coefficients were interpreted.

Results

Analyses were computed with complete valid data of all five tests from baseline and follow-up, not imputing missing data. In the computer condition, one woman had to be excluded due to incorrect test assessment. Thus, data on cognition and adherence were used of 80 women in the exercise condition and 80 women in the computer condition ($n=160$), and for mixed ANCOVA, 69 women of the control group were included ($N=229$). Data of the sample characteristics are summarised in Table 1.

There were no apparent group differences regarding demographics, educational level, years of education and fluid intelligence. Regarding baseline cognitive function, the three groups did not differ significantly. Pearson correlation coefficients of adherence, composite scores of cognition and covariates are presented for all groups in Table 2.

Composite score of cognition: 3 × 2 mixed ANCOVA

Distribution of each variable was normal with the exception that the educational level for the intervention groups was negatively skewed. Assumption of homogeneity for composite scores was met at baseline and after six months. Covariates were not different across all three experimental groups and the assumption of homogeneity for regression slopes was met, i.e. the

Table 2. Intercorrelations of experimental groups with complete follow-up data.

	Exercise group ($n=80$)				Computer group ($n=80$)				Control group ($n=69$)			
	1	2	3	4	1	2	3	4	1	2	3	4
1. Pre-composite score	–	–	–	–	–	–	–	–	–	–	–	–
2. Post-composite score	0.51***	–	–	–	0.60***	–	–	–	0.38**	–	–	–
3. General fluid intelligence	0.12	0.24*	–	–	0.16	0.12	–	–	0.31**	0.36**	–	–
4. Educational level	0.27*	0.40***	0.18	–	0.22	0.28*	0.30**	–	0.18	0.20	0.31*	–
5. Adherence	−0.01	0.13	0.14	−0.06	0.12	0.23*	−0.08	0.17	–	–	–	–

Note: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

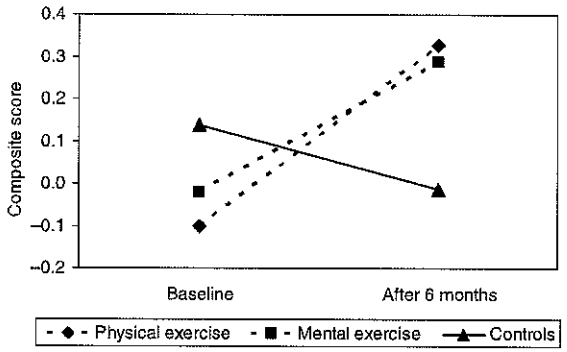

Figure 2. Result of 3 × 2 mixed ANCOVA: comparing composite scores at baseline and after 6-month intervention of all three groups, controlling for educational level and general fluid intelligence.

overall relationship between pre- and post-composite scores and the covariates were equal in all groups.

Results of the 3 × 2 mixed ANCOVA, controlling for educational level and general fluid general intelligence, showed that change of composite score from baseline to follow-up was significantly different in the intervention groups (time × group interaction, $F(2, 224) = 15.89$, $p < 0.001$). The interaction graph in Figure 2 depicts increased scores for the experimental groups and a score decline for the controls. Results of dependent t-tests on pre- and post-composite scores (Table 3) showed a significant increase from pre- to post-testing for both experimental groups (all p's < 0.001), whereas the decline of the control group was statistically significant ($p = 0.07$).

Adherence data

Both experimental groups did not differ in their average travel time (one way) to course locations: the physical exercise course reported on average 43 minutes (SD = 16) and the computer course 41 minutes (SD = 17), $t(158) = 0.85$, $p > 0.05$. However, the average course attendance was significantly higher in the computer course (85%, SD = 19) than in the physical exercise course (69%, SD = 26), with heterogeneous variances (Levene's test $p < 0.01$). The variable adherence, defined as time spent on course participation, was homogeneous in variance for both groups, with significant differences in both groups, $F(1, 158) = 10.9$, $p = 0.001$). The computer course spent, on average, an additional 30 hours on participation as compared to the physical exercise course (exercise group: 146.5 h, SD = 63; computer group: 177 h, SD = 53).

(i) *Test of mediation*

Findings fit the criterion for an indirect effect but not for mediation, which is a special case of an indirect effect, as there was no significant relationship between activity mode (exercise vs. computer group) and the outcome ($B = -0.20$, $p > 0.05$). The standardised estimate of regressing adherence on the activity mode was significant ($B = 0.51$, $p = 0.001$). Adherence, controlling for activity mode, predicted cognitive change ($B = 0.21$, $p = 0.009$). Results yielded a significant indirect effect of activity mode on the cognitive composite change score through adherence (Sobel $Z = 2.01$, $p = 0.044$). Bootstrapped 95% CIs ranging from 0.02 to 0.24 corroborated the results of a mean indirect effect of $B = 0.11$, SE = 0.06.

(ii) *Test of moderation*

Results indicated that the baseline composite score moderated the relationship between adherence and the post-composite score ($B = -0.12$, $t = -1.84$, $p = 0.068$). This model, including the moderator and covariates, accounted for approximately 38% of the variance in the post-composite score ($R^2 = 0.38$, $p < 0.001$). We plotted the interaction at one SD above and below the mean of the post-composite score to facilitate interpretation. Women with a low-baseline composite score but high adherence are predicted to outperform women with the same baseline score but low adherence (Figure 3).

(iii) *Test of moderated mediation*

As the above-mentioned results suggest a moderating effect of the baseline composite score on the adherence–outcome relationship, a BC bootstrapped moderated mediation analysis was conducted to investigate the utility of the overall model. Results of the first regression analysis showed that activity mode (X)

Table 3. Comparison of change in composite scores within all three experimental groups.

	Composite score						
	M (SD)		Dependent *t*-tests				
Group	Pre	Post	Change ΔM (SD)	*t*	df	*p*	*r*
Exercise group ($n=80$)	−0.10 (0.60)	0.33 (0.68)	0.43 (0.64)	5.99	79	<0.001	0.56
Computer group ($n=80$)	−0.02 (0.63)	0.29 (0.77)	0.31 (0.64)	4.27	79	<0.001	0.43
Control group ($n=69$)	0.14 (0.62)	−0.01 (0.62)	−0.15 (0.69)	−1.83	68	0.07	0.22

Notes: ΔM = mean of post-test minus pre-test scores, SD = standard deviation, *r* = effect size ($r=0.10$ = small effect; $r=0.30$ = medium effect; $r=0.50$ = large effect, Cohen, 1992).

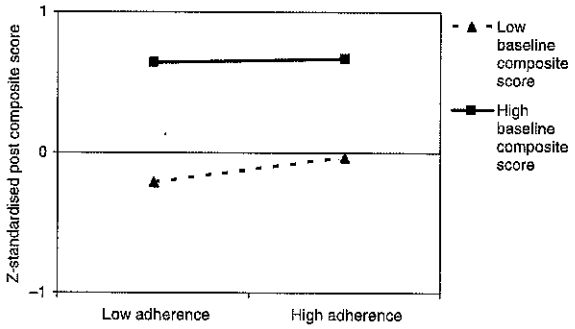

Figure 3. Post-composite score predicted by adherence and moderated by baseline composite score; high baseline = 1 SD above the mean, low baseline = 1 SD below the mean.

predicted adherence (*M*; $B=0.51$, $p=0.001$; Table 4, mediator variable model).

The second regression analysis provided a statistical trend for the interaction between baseline composite score and adherence (*W*•*M*; $B=-0.11$, $p=0.072$), suggesting that the indirect effect of activity mode (*X*) on the cognitive outcome measure (*Y*) through adherence (*M*) was moderated by the baseline composite score (*W*). It further demonstrated that the post-composite score (*Y*) was significantly predicted by adherence (*M*; $B=0.17$, $p=0.011$) and educational level ($B=0.19$, $p=0.006$), but not by activity mode (*X*; $B=-0.20$, $p>0.05$) and general fluid intelligence ($B=0.05$, $p>0.05$; Table 4, dependent variable model). Given the statistical trend for the interaction term, significance tests were conducted on values of the mean ± 1 SD (0.0 ± 1.0) of the moderator. Thereby, the indirect effect of activity mode on post-composite score of cognition through adherence was seen when levels of baseline composite score on cognitive performance were low (−1 SD, $p=0.023$) to moderate (mean, $p=0.057$), but not when this level was high (+1 SD, $p=0.543$). BC bootstrapped CIs corroborated the results as neither of the CIs of low and mean levels of the moderator contained zero. Table 4 provides results on the bootstrapped indirect effect at the three selected levels.

The SPSS macro provided bootstrapped conditional indirect effects at different values of the moderator that fall within the range of the data using an extension of the Johnson–Neyman technique. Results showed that the conditional indirect effect was significant at $\alpha=0.05$ for any value of the centred baseline composite score smaller than −0.13 (*z*-standardised scores, assessed on the total sample, $N=229$, were standardised for the intervention group, $n=160$). As the baseline composite score decreased, the indirect effect became stronger. The given values of the moderator for which the indirect effect was significant delineate the region of significance, here with a lower limit of the standardised value of the baseline composite score of −2.98 and the higher limit of −0.13.

Discussion

We asked the questions of how and for whom two different intervention programmes are effective with regard to cognition. We found that spending time on a physical or mental activity is a prerequisite for cognitive improvement and that spending a high amount of time is most beneficial for participants with low-baseline cognitive performance.

We studied the relationship between adherence and cognitive performance, i.e. a composite measure of five different neuropsychological tests which allowed for distinct conclusions on the effectiveness of adherence. Composite scores are widely used in research on cognition (Helzner, Scarmeas, Cosentino, Portet, & Stern, 2007; Sturman et al., 2005; Weuve et al., 2004; Willis et al., 2006). They minimise possible ceiling effects which are likely to have played a role in our healthy and well-educated sample. The positive intervention effect on one composite measure of five cognitive tests is in line with primary analyses, where all neuropsychological tests were analysed separately (Klusmann et al., 2010); both intervention groups improved in this composite measure over the 6 months compared to the controls who declined slightly.

It was found that the activity mode (physical vs. mental activity) predicted adherence. More specifically, the exercise group spent significantly less time for the intervention during the six months than the computer group. We conclude that physical activity is a more demanding, challenging and exhausting behaviour to perform than a mental activity with the same training characteristics. Reasons may be the most highly rated barriers to exercise reported by Newson and Kemps

Table 4. Regression results for conditional indirect effect of intervention groups.

Predictor	*B*	SE	*t*	*p*
	Mediator variable model (DV: adherence)			
Constant	−0.25	0.11	−2.33	−0.021
Activity mode[a]	0.51	0.15	3.29	0.001
Educational level[b]	0.05	0.08	0.68	0.501
General fluid intelligence[b]	0.01	0.08	0.14	0.885
	Dependent variable model (DV: post-composite score)			
Constant	0.10	0.09	1.13	0.260
Activity mode[a]	−0.20	0.13	−1.54	0.125
Adherence[b]	0.17	0.07	2.57	0.011
Baseline composite score[b]	0.49	0.07	7.42	0.000
Adherence × baseline composite score	−0.11	0.06	−1.81	0.072
Educational level	0.19	0.07	2.79	0.006
General fluid intelligence	0.05	0.07	0.75	0.455

Conditional indirect effect at baseline composite score = Mean ± 1 SD (DV: post-composite score)

Baseline composite score	Boot indirect effect	Boot SE	Boot *z*	Boot *p*	95% BC CIs
−1 SD (−1.0)	0.14	0.06	2.27	0.023	LL = 0.0530, UL = 0.3179
Mean (0.00)	0.09	0.05	1.90	0.057	LL = 0.0178, UL = 0.1990
+1 SD (1.0)	0.03	0.05	0.61	0.543	LL = −0.0628, UL = 0.1617

Notes: $n = 160$. Standardised regression coefficients are reported; Bootstrap sample size = 5.000.
BC, bias-corrected; CIs, confidence intervals; LL, lower limit; UL, upper limit.
[a]Activity mode is coded: physical (0), mental (1); [b]variables were standardised prior to analyses.

(2007, p. 474): physical ailment, painful joints, adverse weather conditions and lack of energy. These barriers seemed to be much more likely to prevent participants from engaging in exercise than in mental activities. We assume that initial physical fitness had no influence due to our randomisation procedure, but painful joints or minor injuries, for example, did not preclude women from participating in their computer course. Nevertheless, compared to other studies (McAuley, Courneya, Rudolph, & Lox, 1994; Ruscheweyh et al., 2009) adherence levels were very high in our study, especially given our sample of 70-year-old and older women and the intense training characteristics.

Cognitive improvement was significantly influenced by adherence to the intervention. Results permit the conclusion that a person can achieve cognitive improvement through spending a large amount of time on a challenging mental activity, but less amount of time is needed to achieve the same improvement by engaging in a more demanding and physically exhausting behaviour. One explanation for those different pathways to achieving similar cognitive benefits is the assumption that improvements in cardiovascular fitness will lead to cognitive benefits as well, although this hypothesis is controversial (Brown et al., 2010; McAuley, Kramer, & Colcombe, 2004; Smiley-Oyen, Lowry, Francois, Kohut, & Ekkekakis, 2008).

As the computer course provided novel intellectually challenging stimulation, cognitive gains are likely to be achieved through this second pathway (Kramer, Bherer, Colcombe, Dong, & Greenough, 2004). This aspect of novelty was given especially in the computer course, as all women were unfamiliar with computer work.

Further, we asked for whom the hypothesised mediation effect occurs. The indirect effect of activity mode on cognitive performance was seen only when baseline cognitive performance was low to moderate, but not when participants performed very well (1 SD above the mean). Compared to the already high-functioning sample at baseline, low-baseline women seemed to have more room to improve or reach gains. These results are consistent with recent findings of Langbaum and collaborators (Langbaum et al., 2009), who found individuals with lower baseline memory ability to improve most in verbal learning tests.

The cognitive reserve hypothesis postulates that individuals have 'the ability to optimize or maximize performance through differential recruitment of brain networks, which perhaps reflect the use of alternate cognitive strategies' (Stern, 2002, p. 451). Low-baseline women in our study might have been stimulated and might have learned to use their cognitive reserve due to their enriched environment, whereas high-baseline women possibly have exploited this potential already in the beginning. For them, adherence (low or high) had the function of stabilisation and protection against cognitive decline. The decision to use an overall measure of adherence and not only the frequency with which one engages in a specific activity (Newson & Kemps, 2006) is justified by our results. We reran the performed analyses by replacing adherence with a limited measurement of adherence, i.e. the average course attendance. Interestingly, none of the results remained significant. We assume that adherence, as defined here, is an overall measure of the environmental stimulation for it includes travelling activity. For example, due to a long journey to course locations,

a woman might have had an average course attendance of only 60%. But, adding travelling time for those 60%, this would possibly compensate for lower course attendance; this woman may spend the same amount of time on participation than another woman who lives 'around the corner' from the location and attends almost 100% of the courses. Their cognitive improvement would be predicted to be the same. If this person had been defined as a non-adherer using a certain threshold (for details see Shields, Brawley, & Lindover, 2005), analyses on effects of an intervention would have been misleading.

We can assume that the stimulating effects continued beyond the actual intervention units: participants might have been physically stimulated while being 'en-route' by an additional, albeit unspecific, travel activity (Wener & Evans, 2007), because all but three participants were public transit commuters. They might as well be mentally stimulated by preparing for the ongoing courses, reworking previous course units or reflecting on various experiences and impressions which were made before, during and after the courses.

As both activity groups improved their cognitive performance compared to a control group, obviously both intervention types provided a similar 'nutrient' for counteracting cognitive decline. Motivation, measured by intention to participate in the courses, was high and equally strong in both courses. Translating this intention into adherence is addressed by the concept of volition (Schwarzer, 2008). Judging an individual's effort solely in a mathematical way on course attendance is difficult, because both activity programmes are qualitatively distinct. We can only pronounce a judgement from the individual's motivational and volitional effort and that is expressed by spending time on these activities including travel time. Future research may explore the influence of travel activity in an active control group.

Limitations

We found a linear relationship of adherence on cognitive change. A classic dose–response effect could not be calculated, because participants were not randomised to different groups of training intensity, and adherence in our study turned out to be high. In addition to the objectively measured course attendance, we used self-reported data on travel time, which may have been misjudged. Pedometers (Wener & Evans, 2007) could be used in future research to measure additional physical travelling activity. Nevertheless, this would not allow for a calculation of the temporal engagement in intervention content, such as reworking previous course units.

Conclusion

Older healthy women are able to adhere to challenging physical or mental training over an extended period of time. This enables them to improve their cognitive abilities. Results are most promising for cognitively less fit persons; they will benefit most if they invest time and effort in an intervention. The introduced adherence measure including travelling time is advantageous: it illustrates the importance of accounting for the amount of time a person is willing to spend on implementing a new challenging physical or mental activity. This temporal engagement marks a breakthrough of a person's daily routine, which is supposed to be a prerequisite for cognitive improvement.

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The effects and determinants of exercise participation in first-episode psychosis: a qualitative study

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Abstract

Background: Previous qualitative studies have found that exercise may facilitate symptomatic and functional recovery in people with long-term schizophrenia. This study examined the perceived effects of exercise as experienced by people in the early stages of psychosis, and explored which aspects of an exercise intervention facilitated or hindered their engagement.

Methods: Nineteen semi-structured interviews were conducted with early intervention service users who had participated in a 10-week exercise intervention. Interviews discussed people's incentives and barriers to exercise, short- and long-term effects, and opinions on optimal interventions. A thematic analysis was applied to determine the prevailing themes.

Results: The intervention was perceived as beneficial and engaging for participants. The main themes were (a) exercise alleviating psychiatric symptoms, (b) improved self-perceptions following exercise, and (c) factors determining exercise participation, with three respective sub-themes for each.

Conclusions: Participants explained how exercise had improved their mental health, improved their confidence and given them a sense of achievement. Autonomy and social support were identified as critical factors for effectively engaging people with first-episode psychosis in moderate-to-vigorous exercise. Implementing such programs in early intervention services may lead to better physical health, symptom management and social functioning among service users.

Trial registration: Current Controlled Trials ISRCTN09150095. Registered 10 December 2013.

Keywords: Physical activity, Early intervention, Aerobic exercise, Resistance training, Recovery, Early psychosis, Community mental health, Rehabilitation

Background

People with schizophrenia typically have poor physical fitness and lower levels of physical activity than general population [1, 2]. This is linked to the elevated rates of obesity, cardio-metabolic diseases and premature mortality observed within this patient group [3]. Furthermore, physical inactivity and poor fitness bears particularly strong relationships with negative symptoms and cognitive deficits in schizophrenia [1, 4], which strongly impair functional recovery and yet often remain untreated.

Exercise offers a possible adjunctive intervention which may improve both physical and mental health outcomes in schizophrenia. A recent systematic review and meta-analysis found that 90 min of moderate-to-vigorous activity per week can increase fitness, reduce positive and negative symptoms and improve cognition [5]. The qualitative literature has also shed light on how exercise may have these effects. Two separate reviews, each including between 11 and 13 qualitative studies, found that vigorous exercise can draw attention away from auditory hallucinations and/or adverse beliefs that people with long-term schizophrenia may have, and help

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them to 'reconnect with reality' by focusing on physical exertion [6, 7]. Furthermore, exercise may improve negative symptoms and real-world functioning through providing a valued, sociable activity with achievable and rewarding goals [6, 7].

Despite the clear benefits, adherence to exercise among people with schizophrenia is lower than other patient groups [8]. However, interventions which use supervised exercise have better rates of retention [8]. Additionally, interventions which accommodate individual preferences, through offering different types of exercise, have previously resulted in higher rates of exercise adherence among long-term schizophrenia patients [9, 10].

This is congruent with qualitative research which shows that patients feel that individualised support can overcome many of the barriers faced by people with schizophrenia, and facilitate exercise engagement [6, 7]. The qualitative literature has also provided insight into why people with schizophrenia often fail to achieve adequate amounts of exercise. For example, symptoms of paranoia and anxiety are barriers to attending exercise facilities, while amotivation and body-image issues can deter people from physically engaging [6].

However, all previous qualitative research has sampled patients who are receiving treatment for long-term schizophrenia. The experiences of exercise among younger patients within an 'Early Intervention for Psychosis' (EIP) service has yet to be explored. This is a pertinent area of enquiry, since early psychosis is a time when interventions which target negative and cognitive symptoms may maximize functional recovery [11]. It is also a 'critical period' for physical health interventions to prevent cardio-metabolic disorders from arising [12]. Patients themselves may feel more able to engage with exercise when they are at a younger age, with a lower BMI and in the absence of metabolic disorders [13].

Preliminary research has indicated that increasing physical activity and fitness during the first-episode of psychosis (FEP) can improve physical health and support functional recovery [14–16]. In a recent feasibility trial (the "iBeep" study) of an exercise intervention delivered through EIP services for patients with FEP, significant improvements were observed in cardio-metabolic health, positive and negative symptoms and cognitive functioning after just 10 weeks [17]. Additionally, adherence and retention rates were substantially higher than in previous exercise trials in schizophrenia [8, 17], perhaps due to the nature of the intervention applied, or certain characteristics of the first-episode sample.

We conducted a qualitative study of patients who had participated in the iBeep trial. The aim of this investigation was to explore the perceived benefits of exercise as experienced by people with FEP, and to establish the barriers and facilitating factors for increasing physical activity in this patient group. These findings could inform the development of future studies, and the implementation of exercise interventions within EIP services.

Methods

Ethics, consent and permissions

This study was conducted as the qualitative section of the iBeep ('Investigating the Benefits of Exercise in Early Psychosis') feasibility trial [17], which was approved by the North West Research Ethics Committee on 18/12/2013 (REC# 13/NW/0784) and registered with the current clinical trials database (ISRCTN: 09150095). Participants were recruited from EIP services in Greater Manchester, UK. In the United Kingdom, EIP services are currently offered to any individual aged 14–35 who are experiencing FEP, defined as full threshold psychotic symptoms for a period of greater than 7 consecutive days, regardless of formal diagnostic status. Additionally, diagnoses given during the early stages of illness are susceptible to change [18]. Therefore, no restrictions were placed on patients' diagnosis in this study, in order to assess exercise as an intervention for FEP more broadly, and inform its implementation within EIP services. Inclusion criteria were: (1) currently receiving care for FEP as a service user of EIP services; (2) aged 18 – 35; (3) experiencing some psychological difficulties, defined as having either a score of ≥2 on the WHO Disability Assessment Schedule 2.0 [19] or ≥21 on the Beck Depression Inventory 2.0 [20]. Exclusion criteria were inability to provide informed consent, pregnancy, physical health issues which are a contraindication to exercise (as assessed by the referring clinician), and/or insufficient command of English to complete baseline assessments. All referrals were screened against inclusion criteria using a telephone interview. Eligible service users were then met in person to provide written informed consent.

Intervention

Each participant received a 10-week individualised exercise training programme, which aimed to achieve ≥90 min of moderate-to-vigorous activity each week [17]. All interventions were delivered through 'community leisure schemes' within service users' localities. Such schemes are now commonplace throughout the UK and offer highly discounted gym memberships and sports facilities to anyone referred by health services.

During the intervention period, participants were offered gym training sessions twice per week at their local leisure centres. These were supervised by research assistants, either on a 1-to-1 basis or in small groups of 2–3 participants. Research assistants had no formal exercise qualifications but did have several years of exercise

experience. Their role was to facilitate exercise adherence through arranging gym memberships, accompanying participants to gym sessions and recording their training. A standardised training plan was developed in line with recommendations from exercise physiologist JM, and used as a guide for exercise sessions, consisting of combination of aerobic and resistance exercise activities (See Additional file 1; Aerobic-resistance training plan for IBEEP). However, the specific content of each session was tailored toward participant preference. Mandatory gym inductions were also provided by the personal trainers at community leisure centres (who were available for further support throughout the duration of the intervention).

Qualitative interviews

Informants for the qualitative section were selected on the basis of availability while aiming to obtain a "maximum variation sample" [21] of men and women, older and younger participants, full compliers and non-adherers. Participants were interviewed on a one-to-one basis. Interviews took place either immediately after the intervention, or 6-months after the supervised training period had subsided. These two time-points were used in order to obtain additional perspectives from participants following the withdrawal of supervised training, thus providing a more complete understanding of exercise adherence, benefits, and barriers experienced by patients over time.

All interviews used topic guides which contained open ended questions about participant experiences and opinions of exercise, and were conducted between June 2014 and March 2015. To minimize response bias, interviews were conducted by different research assistants to those who supervised the exercise sessions. However, due to unavailability of research assistants at follow-up, some interviews were conducted by the same person who had previously supervised participants' exercise. Nonetheless, this only occurred for five of 19 total interviews, each of which was conducted 6 months after the intervention had finished, thus limiting potential impact on findings.

Data analysis

The current study pre-specified several areas of interest for analysis, determined on basis of existing qualitative literature around exercise and schizophrenia [6, 7]. These areas included; possible reasons for exercising; short- and long-term effects of exercise; barriers/facilitating factors towards exercise participation. A thematic analysis was used to determine the key themes from participants' dialogue on these topics, through applying the five stages of qualitative analysis [22]:

(i) transcripts were read and re-read to familiarize the researcher with the data
(ii) a range of codes were generated to index common features across interviewees
(iii) these initial codes were examined to determine prevalent themes
(iv) themes were reviewed for internal homogeneity and external heterogeneity, to combine similar themes into overarching themes and draw coherent links or distinctions between them [21]
(v) the overarching themes were firmly defined, organized in relation to their collated data extracts, and then analysed for sub-themes.

Interpretive rigor

To reduce the risk of bias, the prominence of overarching themes and their respective sub-themes was determined through discussion between three of the authors, who had transcribed the interviews and reviewed all coded quotations for each theme. To validate the findings, first hand quotes are presented word-for-word within the Results and Table 1, following removal of non-specific interjections [23].

Results

The clinical and demographic characteristics of participants are displayed in Table 1, which shows that interviewees were broadly representative of the entire 'iBeep' sample. A total of 19 interviews were conducted; nine immediately after the 10-week intervention and a further ten at 6-month follow-up. Six participants were interviewed at both time points. The mean level of exercise achieved by these participants during the intervention was 119 min of moderate-to-vigorous exercise per-week for 10 weeks (s.d. 74 mins), primarily in the form of individualised gym training. Three overarching themes emerged from the thematic analysis. These were: (a) exercise alleviating psychiatric symptoms (b) improved self-perceptions from exercise, and (c) factors determining exercise participation. To accurately represent the entirety of participants' dialogue, one exemplar quote for each theme has been featured in Results (selected through mutual agreement between authors), with three additional examples in Table 2.

(A) **Exercise alleviating psychiatric symptoms**
Participants generally felt that exercise was capable of providing acute relief for psychiatric symptoms. These effects varied across participants. Some reported relief from positive symptoms (i.e. auditory hallucinations and paranoia) and others for negative symptoms (amotivation and anhedonia). This seemed to depend on which aspects of psychosis characterised the individual's current condition.

Table 1 Baseline characteristics of participants

Characteristic	Interviewees (*n* = 13)	Total sample (*n* = 31)
Gender		
Male; n (%)	12 (92)	25 (81)
Female; n (%)	1 (8)	6 (19)
Age, years; mean (s.d.)	26.5 (4.5)	25.8 (4.6)
Time in EIS, years; mean (s.d.)	2.0 (1.3)	1.9 (1.4)
ICD-10 Diagnosis; n (%)		
Non organic psychosis	6 (46)	15 (48)
Schizophrenia	5 (38)	9 (29)
Schizoaffective disorder	1 (8)	3 (10)
Bipolar disorder	0 (0)	1 (3)
Other psychotic disorder	1 (8)	3 (10)
Physical and Mental Health		
BMI, kg/m2: mean (s.d.)	32.4 (7.2)	30.4 (6.9)
PANSS total; mean (s.d.)	76.7 (12.8)	79.0 (18.0)
PANSS positive; mean (s.d.)	19.8 (5.7)	18.9 (6.2)
PANSS negative; mean (s.d.)	17.5 (3.0)	19.0 (6.1)
BDI-II total; mean (s.d.)	25.1 (12.7)	21.7 (10.9)
SOFAS; mean (s.d.)	47.5 (9.0)	46.6 (8.0)

BDI-II beck depression inventory, *BMI* body mass index, *EIS* early intervention services, *ICD-10* International Classification of Diseases 10th Edition, *PANSS* positive and negative syndrome scale, *SOFAS* social and occupational functioning assessment scale

(A1) *Positive symptoms*
Participants described how the physical demands of exercise temporarily subdued positive symptoms, by helping them to direct their thoughts away from intrusive voices, delusions and/or paranoia:

P005: "Well with psychosis, which is partly what I suffer from, I hear the voices and stuff like that. But when I'm training, the voices are suppressed, cos I'm so concentrated on lifting that weight up, doing the next exercise, that everything else clears out of your head."

(A2) *Overcoming negative symptoms and depression*
Exercising was also beneficial for negative symptoms and depression, reportedly helping people to overcome feelings of low energy, low mood and amotivation.

P006: "it makes me more active, before I was lazy and couldn't be bothered doing things. But now it's like I'm more active and I just want to go out there and start going to the gym... Got my get up and go back!"

Furthermore, comments about this were often tied to feelings of exercise acting directly on one's mood state through stimulating the production of neurological chemicals or 'endorphins':

P002: "I always get them bad days but when I go the gym, like I said, physical exercise, it lets endorphins off in your brain doesn't it. So even if you are a bit depressed it can erm make you not depressed, [laughs] or make you slightly more happy."

(A3) *Supporting psychological well-being*
Participants explained how these immediate effects of exercise provided a sense of well-being and freedom from mental health problems. This could have an enduring impact on the rest of one's day, reducing usual feelings of disturbance, stress and/or despair.

P009: "...I'd notice, after I'd done the gym sessions, I felt really fresh. Like afterwards like my mind felt kind of washed, if you like."

(B) **Improved self-perceptions following exercise**

(B1) *Overall confidence*
While engaging in exercise was associated with transitory relief from mental health issues, the long-term benefits of exercise participation were more strongly related to improved self-perceptions. This was described as an increased confidence, stemming from greater self-efficacy and self-esteem.

P003: "I think people can benefit from it - to get fitter and healthier - Get more confidence and self-esteem."

(B2) *Benefits extending to other areas of life*
Improvements in confidence were often directly linked to physical changes, in terms of feeling fitter, healthier and/or obtaining a better body image. Others described exercise as providing a supportive platform for improving social confidence. In both cases, the increased confidence gained from exercising positively affected other areas.

P007: "if you can learn and do things in the gym, then you can do it anywhere outside and, you know, you can get other people involved as well. And er it definitely helps your lifestyle you know - it improves your lifestyle."

Table 2 Additional examples of content within each qualitative sub-theme

Theme (and subthemes)	Additional example quotes
(A) Exercise alleviating psychiatric symptoms	
(A1) Reducing positive symptoms	P011: "It's like, when I'm doing the weights or I'm running, I don't sit there and think about the voices or what they're saying, I just think 'yeah let's do it!"
	P006: "All your mental issues are going to go away because once you're concentrating on picking up weights and doing exercise. Then your mind goes somewhere else."
	P008: "It makes you calmer when exercising. It gives you a fresh mind. If you have got any worries then just it'll go away."
(A2) Overcoming negative symptoms and depression	P012: "I felt the change, emotional changes, you know what I mean, that I was like flooded with chemicals if you will, like made me feel good by myself"
	P007: "I think more energetic a bit more enthusiastic kind of thing. Yeah more up for doing things which I probably normally wouldn't do"
	P004: "More energetic, feeling happier, makes you feel a lot happier I think. Erm you feel motivated to do things - and energetic."
(A3) Supporting psychological well-being	P006: "Go and exercise you'll feel you'll feel your minds gone free. And you're stress free. You'll get all your worries to go away, cos you're concentrating on something else"
	P005: "A lot of people don't understand how much exercise helps. But if I didn't do exercise I'd be in a lot worse place than what I am right now cos at times when I feel like I'm just so angry, and stuff like that, I've gone training, I've done press ups and stuff at home and it's cleared my head, killed me anger and you feel better for it…"
	P003: "Yeah, makes you happier really. I don't know really, just when you've done it you're buzzing aren't you."
(B) Improved self-perceptions from exercise	
(B1) Overall confidence	P002: "Has a big err, a big big er, has a big effect on all of it. It makes me feel more happy in myself, you know, more confident, more self erm… [esteem], you know, believe in myself better, a lot more."
	P012: "once you once you go gym and that after a while you start feeling good about yourself. You start walking round like yeah I'm getting big and do you know what I mean type thing."
	P011: "I love it. It's just like, thinking yeah, I couldn't do this 4 months ago, now look at me doing it comfortably. Let's throw it up a gear!"
(B2) Benefits extending to other areas of life	P001: "I feel good knowing that I've lost weight. I'm really excited and proud of meself that I've lost weight…Erm I go out with my friends more and they are like proud of me because they know I've lost weight because they know about me wanting to lose it and they have been very supportive as well."
	P005: "it's a lot better when you start doing it and like I said you gain that confidence up and you think you just think to yourself I can do this. I'm training and, er give me another year year of doing this I think I'll be ready to go back to work…and you'll be nervous getting a job interview or anything, like anyone would, but you'll go in with your confidence that you gained from going from doing your exercise. And when er like people from interviews see that, you work hard in the gym or something like that they'll look at you and they'll think well this guy's got quite good confidence."
	P009: "My head felt a bit better after I'd done the exercise, like it was easier to do uni work and…. I dunno my head just felt a lot clearer."
(B3) Sense of achievement	P002:" Yeah I feel like I've achieved summat I feel like you know a lot better in myself I feel like, I should do this every day"
	P005: And you think yeah I feel good, and erm especially if you got somebody with you you know you'll have it all out that were a good session that and then you'll go you'll sit down or you go home you'll turn your xbox on or you do your house cleaning or something like that and then when you're going to bed you think I had a good day today
	P012: "For me…it's not so much as like putting weight on or losing weight or it was just that feel good factor that I enjoyed…I used to look forward to going to the gym for that particular reason you know to make me feel good and that."

Table 2 Additional examples of content within each qualitative sub-theme *(Continued)*

(C) Factors determining participation	
(C1) Acceptability of individualised routines	P003: "It was good that we got to choose something out of like a list. We could have done all different things… I thought the options were quite good. But I would have like to have done boxercise as well."
	P007: yeah let them try all the different er materials out there in the gym um different weights machines, definitely they will fit into something that they like yeah
	P004: "I think it's er finding what they enjoy what they love to do… And if you can maybe, er, assess what type of exercise would be desirable um then, er, I'm sure they they're more likely to exercise"
(C2) Importance of a training partner	P006: "It wasn't just him [the trainer] standing and shouting at you. He was like persuading us on like 'come on you can do it, you can do it!' when he says things like that it makes me more activate."
	P005: "[You've] got someone there also who's basically saying, 'it's alright I'm here. i'll show you what you need to learn' and once like the 6 months is over they've got that extra bit of confidence to say I'll give it a go on me own."
	P010: "Yeah definitely I think group work group exercising gets you more motivated than…Whereas if you're going on your own you don't really motivate yourself especially this time of year as well."
(C3) Overcoming anxiety and motivational barriers	P001: "…if you go on your own you like don't know somebody and you feel dead shy and timid and stuff like that, whereas if you go with somebody you're chatting as you're swimming or on bikes or at gym or something the time passes and stuff."
	P002: "They push you to do more than you would and if you're on your own you might just say oh well I'm not really bothered, but if someone's with you they'll they'll push you to do more they'll push you to go."
	P004: "What really gave me the confidence to go, because the err, we had to work in sort of a group, so we worked in a group and did some sets and stuff, so that was really good. It made me feel a lot secure."

(B3) *Sense of achievement*

People also received an immediate boost from a 'sense of achievement' associated with completing exercise sessions. This was a highly prevalent experience, reported by almost all.

P010: "Just lifts your spirits I think when you've done it and just makes you feel like you've achieved a goal in a day when you go to the gym and if you go swimming or…Definitely lifts it yeah, bit of exercise does."

(C) **Factors determining exercise participation**

(C1) *Acceptability of individualised exercise training*

Overall, participants' achieved more than satisfactory amounts of exercise during their 10-week programmes. We found that the exercise offered (most often personalised gym training) was acceptable and desirable among people with first-episode psychosis. From the interviews, it was apparent that flexible, individualised interventions ensure that exercise is enjoyed, and thus adhered to by participants.

P004: "…it's very important in drawing the individual towards making their own choice, because it is about choice. They can make a choice in what they want to do, and what they love to do, it motivates them to sort of do what they feel happy to do."

(C2) *Importance of a training partner*

Another emergent sub-theme was the perception of exercise as an inherently social activity. A central aspect of the 'iBeep' intervention was the provision of a research assistant to facilitate exercise on either an individual or small-groups basis (2–3 participants). This was found to be highly effective, perhaps essential, for encouraging attendance and promoting engagement with exercise.

The only recurrent criticism of 'iBeep' was the relatively short length of the intervention (10 weeks), with participants unanimously stating that a longer (or permanent) period of supervised exercise sessions would have been preferred. Furthermore, participants' suggestions for further and/or alternative exercise interventions all involved some level of social support, such as; personal trainers, 'service user friendly' exercise groups, or learning how to train with friends.

P001: "It's just summat' I want to do and it's just a bit of support and more encouragement to do it. And I got the encouragement and the support, so I did it.

(C3) *Barriers towards exercise*

Barriers towards exercise fell into two categories. The most frequently mentioned was anxiety within the exercise environment. This was often related to social anxiety, or a lack of exercise efficacy. The second was feelings of low motivation, which dissuaded some participants from initiating exercise alone. However, this was never described as apathy towards exercise itself, as they still perceived exercise as beneficial and congruent with personal goals. Instead, participants expressed how generalized amotivation could become a psychological obstacle towards initiating any activity, even those which they valued and enjoyed. Nevertheless, the feedback showed that having an experienced and enthusiastic trainer can overcome both amotivation and anxiety:

P012: "It's just good to have a partner you know mentally it's good having a partner. You know what I mean; when you go out there on your own you just feel like, you know, like you really need somebody to come with you I suppose."

Discussion

This study examined the experiences of exercise among people with first-episode psychosis who had recently participated in a 10-week intervention. A thematic analysis showed exercise could provide relief for participants' positive symptoms along with improving their energy levels and mood. Social aspects of exercise also emerged as overarching themes, in terms of (i) long-term benefits of exercise participation, and (ii) ideal types of support required. The findings are consistent with qualitative studies of exercise in people with long-term schizophrenia [6, 7]. They are also congruent with quantitative data from the 'iBeep' study, which found significant reductions in participants' positive and negative symptoms after the exercise intervention, as measured by the PANSS [17].

Exercise as an intervention for first-episode psychosis

The positive symptoms of psychosis can be indications of a 'loss of contact with reality' [24]. People with long-term schizophrenia have previously described how exercise provides a platform to reconnect with a reality, thus helping to detach from these symptoms [25–27]. Our study replicated these findings in the first-episode sample; participants similarly described how exercise can inhibit auditory hallucinations and intrusive thoughts, as a consequence of physical exertion demanding their full attention. Exercise was also perceived as energizing and uplifting, making participants feel more enthusiastic about other aspects of life. This may be linked to physiological responses to exercise, as participants reported a rush or 'feel good' effect immediately after their sessions. Therefore, exercise offer a destigmatising, empowering and natural method for overcoming negative symptoms in early psychosis, which are usually unresponsive to antipsychotic treatment [28].

As the benefits of exercise for psychiatric symptoms were often tied to the physical activity itself, rather than just the social aspects, it is important to provide activities which allow for sufficient levels of exercise-intensity. While low-intensity activities (e.g. walking, stretching) may have other therapeutic benefits, moderate-to-vigorous exercise may be optimal for people with psychosis, as it would occupy enough attentional resources to subdue voices/delusions, while also physiologically stimulating the body to release neurobiological chemicals known to enhance mood [29]. This is supported by a recent meta-analysis, which found that the symptoms of schizophrenia are only reduced significantly by exercise interventions which implement at least moderately intense exercise [5]. Future randomised trials should aim to specify the mechanisms of exercise as an intervention for FEP using time-and-attention control conditions, in order to separate the physiological effects of vigorous physical activity from the social support provided during the intervention.

Moderately difficult or 'challenging' exercise has the added benefit of providing an immediate sense of achievement. Participants experienced this upon completing their sessions, and described how this led to improved self-perceptions overtime. For instance, many participants explained how achieving their goals in the exercise setting had increased their self-efficacy and confidence for other areas of life, which may help to improve psychosocial functioning.

Overcoming barriers using individualised exercise training

Participants discussed how sufficient levels of exercise can be attained by tailoring programmes to individual needs, thus facilitating physical exertion through intrinsically rewarding activities. Early psychosis may be an ideal time to implement this, when patients are younger, fitter, and less likely to have cardio-metabolic diseases, which may act as a barrier towards exercise [13, 30]. Among our participants, barriers were mostly related to anxiety, rather than the physical health complaints often mentioned by long-term patients [30].

Additionally, motivational barriers were not attributed to reduced interest in exercise, but rather as generalized amotivation obstructing their engagement with positive activities. Crucially, these barriers were readily overcome through the intervention, with participants achieving 107 min of moderate-to-vigorous activity per week on average [17]. Thus, both the qualitative and quantitative data shows individualised exercise interventions can feasibly achieve sufficient moderate-to-vigorous activity for people with early psychosis.

Providing structured advice is insufficient for overcoming barriers towards exercise [31]. Instead, social support was consistently identified as the crucial facilitator of exercise engagement – as is found in long-term schizophrenia [32–34]. Participants described how the provision of a 'training partner' moved them from feeling willing but unable to exercise, to readily achieving substantial amounts of activity each week. This is likely because a training partner can effectively address both of the most prominent barriers towards exercise (anxiety and amotivation), through providing reassurance or prompting as required.

Research assistants who supervised exercise in this study were not qualified personal trainers, but were familiar with gym-based training. This suggests that such interventions could be delivered by any mental health support staff with personal exercise experience. Additional exercise support was available from the qualified exercise professionals based in community leisure centres. Thus future interventions could also take advantage of the expertise and facilities readily available through community facilities, to provide low cost and destigmatising interventions to this population.

Furthermore, due to the general alignment in exercise preferences expressed by participants [35], research assistants were often able to group participants and supervise 2–3 people per session. Administering individualised exercise within small group settings has also proved feasible in studies of long-term schizophrenia patients [9, 10]. Thus, implementing this approach within clinical practice would reduce the cost of exercise interventions, and may even improve long-term maintenance of exercise through enabling participants to act as each other's training partner after the supervised period subsides.

Limitations

One limitation is that our sample were mostly male (92 %) and had demonstrated an existing desire for exercise by opting into the study. Thus, findings may not generalise across whole first-episode population. However, the high referral-to-recruitment rates [17], along with the many benefits observed, suggest that a substantial portion of early intervention service users would value exercise as an adjunctive intervention. It should also be considered that the individualised nature of our intervention meant that each participant's preferences were flexibly accommodated for. Therefore, barriers which may typically prevent people from engaging (i.e. lack of interest in activities offered, inaccessibility of facilities) would be less likely to arise.

For this study, we conducted one round of interviews immediately following the intervention, and then another 6-month after, in order to assess patient opinions on exercise after the supervised training period had subsided. A limitation here is that, in order to obtain sufficient data, six of the original interviewees were also used in follow-up interviews, resulting in more qualitative data being available for the subgroup ($n = 6$) who were interviewed at both time-points. Nonetheless, the data was grouped by participant number throughout, and thematic analysis was applied to identify the common themes across interviewees (rather than just interviews) [21, 22], thus reducing the possibility of 'double counting'. Furthermore, each emergent sub-theme was supported by quotations from multiple participants.

Conclusions

The findings show that interventions which allocate support on an individual-needs basis, while also prioritising the amount/intensity of exercise (rather than the modality), are well-suited for people with early psychosis. Such interventions could be used in EIP services to provide patients with an additional tool to manage positive and/or negative symptoms, while also improving physical health and psychosocial functioning. Future research must establish sustainable systems for implementing exercise in clinical practice. Optimal systems could incorporate short-term 'introductory periods' with relatively high levels of supervision, followed by step-down periods or peer support, leading people to autonomy and social integration with their own exercise routines at local facilities.

Additional file

Additional file 1: Gym Training Guide used for IBEEP. (PDF 355 kb)

Competing interests

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Authors' contributions

JF, RC, RE, PF and AY conceived and developed the study. JF, RC and LJ designed the qualitative schedule. JF, RC and LJ designed the analysis strategy and carried out the data collection and transcription. JF and LJ carried out the data analysis under supervision of PF, RE and AY. All authors drafted and reviewed the manuscript and determined its final content. All authors read and approved the final manuscript.

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Improving Lifestyle Interventions for People With Serious Mental Illnesses: Qualitative Results From the STRIDE Study

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Objective: Individuals with serious mental illnesses are disproportionately affected by overweight and obesity. Understanding the factors that facilitate or hinder lifestyle change in this population could lead to better interventions and improved health outcomes. ***Methods:*** A subset of intervention and usual-care participants (n = 84) in the STRIDE randomized trial were interviewed at 3, 9, and 18 months, yielding 101 interviews (some were interviewed more than once). Participants had a mean age of 48.1 (SD = 10.1); 64% were female. Participants had diagnoses of schizophrenia or schizoaffective disorder (41%), bipolar disorder (20%), affective psychoses (37%), or PTSD (2%). Interviews were transcribed verbatim, coded using Atlas.ti, and analyzed for common themes. ***Results:*** Barriers to behavior change were similar to those described for the general population, including lack of support from significant others, the lure of unhealthy foods, and poor weather impeding exercise. Additional challenges included the effects of psychiatric symptoms, or consequences of symptoms (i.e., social isolation), on ability to make and sustain lifestyle changes. We found a strong preference for ongoing, group-based support to foster a sense of accountability which motivated and helped to sustain behavior changes. ***Conclusions and Implications for Practice:*** Individuals with serious mental illnesses encounter many of the same barriers to weight loss seen in the general population, but they may be more vulnerable to additional obstacles. Lifestyle change interventions for this population should help participants develop the ability to iteratively cope with fluctuating mood and subsequent changes in motivation to eat healthfully and exercise regularly.

Keywords: barriers, exercise, facilitators, lifestyle change, serious mental illness, weight loss

Overweight and obesity are widespread problems (May, Freedman, Sherry, Blanck, & CDC, 2013), but are disproportionately prevalent among individuals with serious mental illnesses (Allison et al., 2009). Lifestyle change interventions effectively facilitate weight loss, including among this group (Bartels et al., 2013; Daumit et al., 2013; Green et al., 2015; Hjorth, Davidsen, Kilian, & Skrubbeltrang, 2014). Such interventions are helpful because they address access to and affordability of healthy foods, safe places to exercise, and education and skills that support attempts to lose weight and improve and maintain health. This type of approach may be particularly important for individuals with serious mental illnesses who are more likely to have less access to healthy foods (Drewnowski, 2012), limited autonomy over food choices when living in controlled environments (Lowndes, Angus, & Peter, 2013), poorer nutrition and sedentary lifestyles (Casagrande et al., 2011; Janney et al., 2013; Kilbourne et al., 2009), unhealthy social environments (Aschbrenner et al., 2013), psychiatric medications that cause weight gain (Chaggar, Shaw, & Williams, 2011; Newcomer, 2005, 2007), and mental health symptoms (Aschbrenner, Mueser, Bartels, & Pratt, 2013; Pearsall, Hughes, Geddes, & Pelosi, 2014), and associated cognitive impairments (Vohringer et al., 2013) that may affect lifestyle change efforts.

Because lifestyle modification interventions have only recently been adapted for overweight people with mental illnesses, we have little information on the experiences of those participating in these interventions, including what motivates them to change their lifestyles, what enables adoption of healthier habits, which components of interventions are most valued, and what additional resources and supports are needed to further maximize benefit. Better understanding the factors that facilitate or hinder lifestyle change among individuals with serious mental illnesses could lead to improvements in these programs and to better health outcomes.

As part of a 24-month study of the STRIDE weight loss and lifestyle-change program for adults taking antipsychotic medications (Yarborough, Leo, Stumbo, Perrin, & Green, 2013), we interviewed a sample of study participants at three time points to assess lifestyle change barriers and facilitators across the first 18 months of study participation. Our objective was to identify modifiable factors associated with making and maintaining healthy lifestyle changes in order to inform clinicians and improve the development of future interventions for individuals with serious mental illnesses.

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Method

As part of a process evaluation of the STRIDE mixed-methods randomized control trial (Yarborough et al., 2013), we conducted qualitative interviews with intervention and control group participants at 3, 9, and 18 months (midway through the intensive phase of the intervention; midway through the maintenance phase; 6 months after the intervention ended). The STRIDE intervention was an adaptation of the PREMIER comprehensive lifestyle intervention (Appel et al., 2003; Funk et al., 2008) that promoted the DASH dietary eating pattern (Ard et al., 2004) and was tailored for individuals taking antipsychotic medications.

STRIDE participants were at least 18 years of age, stable on antipsychotic medications for at least 30 days, and had a BMI ≥27. An initial mailing to 1,866 potential participants yielded 739 refusals, 511 who screened ineligible, and 208 who we could not reach. Those interested in the study (n = 408) participated in a screening visit. We excluded anyone who was pregnant or planning a pregnancy during the study period, enrolled or planned to enroll in a weight-reduction program, planning or had completed bariatric surgery, or had cognitive impairment that prevented informed consent. Participants were recruited from Kaiser Permanente Northwest, an integrated health plan providing comprehensive medical and behavioral health care for nearly 500,000 members, and from three large, publicly funded community mental health clinics providing outpatient behavioral health services to more than 28,000 low income individuals in the Portland, Oregon metropolitan area.

Two hundred participants were randomized to intervention or control conditions. The intervention consisted of 24 weekly meetings that targeted readiness to change; included interactive, participant-centered delivery of lifestyle education information along with a 20-min walk; encouraged skills practice, self-monitoring and feedback; and facilitated group interactions and support. Intervention participants could consult with interventionists by telephone as needed. Participants were encouraged to keep detailed weekly logs of calories consumed, exercise, and sleep (materials available at: http://www.kpchr.org/research/public/stride/stride.htm). These were similar to food logs used in PREMIER (Appel et al., 2003; Funk et al., 2008). Interventionists reviewed logs with participants weekly and gave feedback. Six monthly group maintenance sessions followed the weekly meetings. All sessions were co-led by a mental health counselor and another interventionist familiar with nutrition interventions. All participants completed questionnaires, laboratory and anthropometric measures, and were weighed at baseline, 6, 12, and 24 months. The protocol (Yarborough et al., 2013) and main outcomes (Green et al., 2015) are described elsewhere. The study was approved by the Kaiser Permanente Northwest Institutional Review Board. All authors certify responsibility for the content of this article and declare that they have no known conflicts of interest.

Interviews addressed efforts to change eating habits, increase exercise, and lose weight, and explored barriers to and facilitators of those changes. Intervention arm participants were also asked specifically about engagement with the intervention. Control participants were interviewed to understand general (nonintervention related) lifestyle change barriers and facilitators.

The intervention was delivered in eight cohorts, and we attempted to select 10 intervention participants and three control participants from each cohort for interviews. We also oversampled minority group members at each time point and balanced the 3-month interview sample on BMI category (27–34.9, ≥35), the stratification criteria used for randomization. For the 9-month interviews, we calculated weight change from baseline to 6 months; at the 18-month interviews we calculated 12-month weight change, sampling from those who had lost or gained weight in order to gather information from people with differential experiences. We attempted to contact 91 participants and were unable to reach three, three more agreed to the interview but did not complete the interview despite efforts to reschedule. Table 1 summarizes the number of participants interviewed at each time point as well as the phase of the intervention during which the interview took place. We interviewed participants in the control arm once; 17 intervention participants were interviewed more than once to ensure that all cohorts were represented in each interview wave (some cohorts were small).

Master's- and doctoral-level research staff conducted the interviews, which were 30 to 60 minutes long and were audio-recorded

Table 1
Interview Time Points Throughout Study Period, Topics Covered, and Number Conducted, N = 101 Interviews

Interview time point	Intervention arm phase	Intervention interviews		Control interviews[a]
		#	Repeat[b]	#
3 months	Midway through the intensive 6-month active phase of the intervention. Study participants were attending weekly meetings to educate and support lifestyle changes. Major goals were use of weekly food logs to track calorie intake and increase physical activity.	31	—	8
9 months	Midway through the second, less-intensive 6-month phase of the intervention. Monthly meetings to maintain lifestyle skills developed during the intensive phase and monthly telephone support.	25	4	8
18 months	6 months after active phase of intervention ended. No structured interaction with intervention participants.	21	13	8
Total		77	17	24

[a] No participants in the control arm were interviewed more than once. [b] The number of interviewees in the intervention arm who were interviewed in a previous time point (e.g. 4 individuals were interviewed at 9 months who had been interviewed at 3 months).

and transcribed verbatim. Participants received $35 gift cards for completing interviews.

The research team read transcripts throughout data collection to ensure accuracy, then developed a general descriptive coding scheme. Code definitions included examples of text generated after careful reading of a subset of transcripts. Analyses for this report were based on text coded, using Atlas.ti (Friese, 2011), with the broad descriptor "barriers and facilitators." Coded text was further reviewed for subthemes and explanations of (a) how and why specific barriers and facilitators affected participants, and (b) circumstances under which barriers and facilitators were encountered. To ensure rigor, we completed check coding on 15% of the transcripts, achieving 79% agreement between primary and secondary coders. We also reviewed discrepancies, sought disconfirming cases, and involved investigators with different academic backgrounds in analyses and interpretation (Creswell, 1998).

Results

Participants

Table 2 describes characteristics of the 84 study participants we interviewed. Interviewees averaged 48 years old; 36% were men, and 21% were members of racial or ethnic minorities. Participants had diagnoses of schizophrenia or schizoaffective disorder (41%), bipolar disorder (20%), affective psychosis (37%) or PTSD (2%). Forty-six (55%) were from Kaiser Permanente cohorts and 38 (45%) were from community mental health centers. BASIS-24 depression subscale scores averaged 1.7 (SD = 1.0) and psychosis subscale scores averaged 0.84 (SD = 1.0). The demographics of the qualitative sample roughly matched the full sample (Yarborough et al., 2013) with the exception of having more males and non-Whites, both as a result of purposeful oversampling.

Table 2
STRIDE Interviewee Characteristics at Baseline, N = 84

Characteristic	Mean (*SD*)
Age	48.1 (10.1)
	n (%)
Male	30 (36%)
Ethnic or racial minority	18 (21%)
Recruitment site	
Kaiser Permanente Northwest	46 (55%)
Community mental health clinic	38 (45%)
Mental health diagnosis[a]	
Schizophrenia	34 (41%)
Bipolar disorder	17 (20%)
Affective psychoses	31 (37%)
PTSD	2 (2%)
Married or living with partner	34 (41%)
Smoked all of last year	20 (24%)
Income	
$0–$9,999[b]	25 (31%)
$10,000 to $29,999	28 (35%
$30,000 or higher	27 (34%)
High school grad/GED or lower	29 (35%)
Some college/technical	37 (44%)
College graduate or higher	18 (21%)
Working[c]	22 (26%)
Disabled	34 (41%)
Retired, unemployed, student, homemaker, temporarily laid off, other	28 (33%)
Colorado Symptom Index (CSI)[d]	19.1 (12.6)
BASIS-24[e]	1.4 (.78)
Depression/functioning subscale	1.72 (1.0)
Psychosis subscale	0.84 (1.0)
SF-12 general health[f]	43.0 (10.1)

[a] Diagnoses were pulled from electronic medical records. All other items in table are based on self-report on baseline questionnaires. [b] N = 80 for income (4 declined to answer). [c] Working, disabled and retired/other were mutually exclusive, self-reported categories in the baseline survey based on a single item "What is your current employment status?" Response options included: working, homemaker, retired, temporarily laid off, unemployed, disabled, student, other. [d] We used the modified version of the CSI. Possible scores range from 1 to 56 with higher scores indicating more symptoms. [e] BASIS-24 possible scores range from 0 to 4 with higher scores indicating more symptoms. [f] SF-12 general health measure can have possible scores ranging from 0 to 100 and are normed to achieve means of 50 and standard deviations of 10 in the general U.S. population.

Thematic Analyses

We identified 12 themes in our analyses of lifestyle change barriers and facilitators, described below. Barriers tended to be consistent across intervention and control arms, and stable across time. Facilitators related to participation in the intervention diminished over time as the intensity of the intervention waned.

Motivation for joining the study and making lifestyle changes.

Theme 1: People with serious mental illnesses are concerned about physical health, especially obesity-related adverse effects of psychiatric medications. Reasons for wanting to enroll and participate in STRIDE did not differ by study arm. The most commonly mentioned reasons for wanting to lose weight were current health (or perceived future health risk status) and perceived potential for weight gain, particularly as a result of taking psychiatric medications.

On the topic of health and health risks, one participant who was worried about her family history of diabetes, said:

> One of the reasons why I wanted to be part of this study was to be healthier. . . . My dad was a big guy and he developed diabetes, and he had to have surgeries and all kinds of stuff. I don't want to do that later in life. You know, I'm trying to avoid getting diabetes. I don't want to have to go through any weight loss surgery and stuff like that. That's stuff I worry about. (intervention arm, 9 months)

Recently receiving health news was also a motivator for another participant: "Finding out that I'm a borderline diabetic . . . about six months ago . . . was also a push too" (control arm, 3 months).

Some STRIDE participants felt that the intensity or rapidity of their weight gain on psychiatric medications necessitated action. "When I went on Zyprexa I gained a hundred pounds, very quickly. And that was really frustrating for me, because I had worked really hard to get me down to where I was" (control arm, 3 months). Another participant noted that she was

> hoping to get some kind of control over my weight. I have been on medications that have severely increased my weight. . . . And just hoping and praying that this will . . . work. Even if I don't necessarily

> lose so much weight, but just living healthier, eating healthier, being healthier is enough. (intervention arm, 3 months)

Themes in common with those who do not have mental health problems. Early in analyses, we noted that many participants' experiences with lifestyle change barriers and facilitators were similar to those reported in lifestyle change studies in other populations. We detail these common themes here:

Theme 2: Living with family members who did not support healthy lifestyle change was a significant barrier. Family members who did not support improved lifestyle were particularly problematic when it came to making dietary changes or managing tempting foods. Temptation to eat junk food and exposure to unhealthy eating among family members were commonly noted: "My husband verbally supports me but he eats whatever he wants to eat and has it in the house" (intervention arm, 9 months). Social gatherings also presented barriers:

> If I'm at my mom's place then she usually has some food out there . . . [and] my wife likes to go out to McDonald's quite a bit. Social situations where I'm encouraged to eat . . . restaurants often offer huge portions. Gatherings with relatives on any kind of holiday . . . It's easier for me not to eat at all than to eat moderately. (intervention arm, 9 months)

Theme 3: Unhealthy foods have enticing, pleasing flavors, even if healthy foods taste good too. Participants reported various ways that the pleasant flavors of unhealthy foods presented barriers to healthier eating choices. It is noteworthy that the desire for pleasant-tasting but unhealthy foods was distinct from the dislike of healthy foods. In fact, some participants said they enjoyed eating healthy foods as a result of their participation in the intervention: "I'm finding out that I like some things that I didn't think I'd like. You know, like . . . more vegetables, more fruit. Ever since the program, I think I've ate a lot more of that kind of stuff than I have in years" (intervention arm, 18 months). Nevertheless, many more interviewees mentioned the lure of unhealthy foods: "I'm not using anything [learned in the program] now . . . I decided I like eating badly" (intervention arm, 18 months).

Theme 4: Bad weather interferes with the best-laid plans for exercise. The most commonly named barrier to physical exercise was bad weather, mentioned by many participants, across all interview time points.

> I'm kind of an all or nothing person. And the weather holds me back. I count on walking outside a lot . . . in the spring it was so beautiful that I was out walking and focusing on my diet. And then I got sloppy with that. I don't like to walk in the mall, and I don't like to walk in the cold, the rain. (intervention arm, 3 months)

Theme 5: Positive attention related to weight loss reinforces lifestyle changes. Receiving positive attention for weight loss was a common facilitator that fortified change efforts. One woman said "My family is starting to notice that I'm losing weight. I like the positive comments . . . I feel like I've got more energy and more motivation to do stuff" (intervention arm, 3 months). For another participant, continued weight loss or maintaining weight during the less intensive phase of the intervention helped keep up momentum: "The reinforcement of coming in and having [group leader] weigh me, write it down. Once in a while we would get graphs of how much weight we lost, and mine was always going down" (intervention arm, 9 months).

Barriers that may carry more significance among people with serious mental illnesses than among others.

Theme 6: Depressive symptoms interfere with lifestyle change efforts. Certain barriers, while also commonly observed in the general population, appeared to be more detrimental to behavior change efforts in our sample of individuals with serious mental illnesses. In our sample, mental health symptoms were mentioned as barriers to both healthy eating and regular exercise. A link between depression and poor eating choices was typical: "I was just feeling really horrible. And I make bad food choices when I'm feeling really horrible, which gets me more depressed, you know? And it's kind of a cycle" (intervention arm, 3 months). Another said, "The more symptomatic I get, the harder it is to get myself out of the house to do stuff. . . . And I'm trying to exercise because it helps clear my head of stuff" (intervention arm, 9 months). Still another noted the difficulty of enacting lifestyle changes when depressed: "It's hard to make changes in your diet and follow the routine . . . when you're at a point where you just don't care" (intervention arm, 3 months).

Theme 7: Lack of motivation or weariness interferes with ability to consistently adhere to behavior change plans. Another common response across participants was what they called "laziness," generally described as a lack of motivation or a weariness that came with having to maintain the effort that dietary changes and regular exercise require. "Yeah, laziness. [Chuckles] You know what I mean? Sometimes I just don't feel like making something nutritional. So I'll have a bowl of cereal with sugar on it" (intervention arm, 3 months). Another participant said: "I just get lazy sometimes. I just don't want to do it, so I sit on the couch and watch TV" (intervention arm, 9 months). This feeling is not uncommon among those attempting to lose weight generally, nor is it unique to our sample. However, among people managing serious mental illnesses, this weariness might represent, be the result of, or be worsened by anhedonia, avolition, fatigue, or general emotional resource drain that can accompany chronic or recurrent mental illness.

Theme 8: Friends help facilitate exercise but loss of exercise buddies can inhibit exercise motivation. Several participants described how exercise motivation interacted with social support, and it was common for participants to mention loss of external exercise motivation when exercise partners were not available:

> having a buddy to walk with helps a lot. You can talk while you're walking and it doesn't seem like it is taking so long to do the walk. So that helps. That's one of the reasons why I do it with my friend. When I'm at home I don't have anybody to walk with. So there's not so much of a reason to do it. (intervention arm, 9 months)

To the extent that one's mental illness has resulted in social skills deficits or social isolation, accountability to a group and social support that make it easier to receive encouragement and reinforcement for healthy behavior may be particularly important. Another participant said,

> I used to exercise with a group of people, and we just always met at the gym all the time. We gave each other a lot of support and stuff, and had a really good time. That was when I lost quite a bit of weight

during the time. [Now] I don't have a friend that I like [to] exercise with. (control arm, 3 months)

Primary facilitators of lifestyle changes. As with many other themes found in these analyses, we found facilitators of lifestyle change in our sample that are also reported by individuals without mental health problems.

Theme 9: Active engagement in the intervention and accountability to the group are key facilitators of lifestyle change. The most important facilitator of dietary changes and increased exercise was active engagement in the intervention. Attendance at the weekly group sessions, along with turning in a weekly food and exercise log and being weighed, were important motivators for the majority of intervention participants. Several people noted that accountability to self, to other group members, and to group leaders is what led to behavior changes. For example, one participant reported: "Well, just knowing that I want to be accountable, because I don't want to disappoint the group or . . . myself, I guess" (intervention arm, 3 months). Another participant noted:

> The accountability of being part of the group is very important . . . I had pretty much given up on trying to get to a reasonable weight. And I looked at this as one last shot at trying to do that . . . The group has been very supportive, and I appreciate that . . . meeting once a week and comparing notes with people, and knowing that I'm not alone with all these obstacles, and that there are people that care. (intervention arm, 3 months)

Theme 10: Group walks support exercise motivation. Group facilitation of exercise was also important; participants liked the 20-min walk that was part of each intervention session. Several participants noted feeling accountable to exercising with the group:

> [T]he walking [is helpful]. The exercise portion of the group, that can get set on the back burner. And I don't think it should be. It's enjoyable just to get to talk to people and get the support of exercise. (intervention arm, 3 months)

Theme 11: Learning about nutrition and calories fills knowledge gaps; logging food, exercise, and sleep is instructive. Finally, the nutritional education and behavioral monitoring components of the intervention facilitated changes in eating habits for some participants.

> It was the food section [of the intervention], teaching me how to cook healthier. That helped. The rainbow helped. Shopping the perimeter helped. You learned different tricks of the trade to eat healthier. And what was helpful was label reading too, as far as eating healthier goes.

From another participant:

> I think the greatest help has just been the repetition and just kind of instilling that in my mind. Because before, I was raised where it was like meat and potatoes and chocolate cake for dessert. Vegetables were on the table at Thanksgiving and Christmas. So . . . I learned that when it's like that, it's really hard, at the store, to consciously say 'I need fruits and vegetables' because I'm not used to eating them. So it actually takes a big, conscious decision for me to go in to that area.

Though food logs were unpopular with some individuals, the participants who found them helpful described how the logs helped them to count calories and track their eating.

> As much as I do not like saying this, the weekly records really, really help . . . it's quick, it's easy. . . . I think a lot of problems that I had before with portion control and serving size [are] not happening now. And I really like that the weekly records are not just about food. I've got, on the same page, my sleep and my exercise. I think that really balances it. Instead of just being about food. (intervention arm, 3 months)

Another participant said,

> The food logs were helpful to me. . . . When you have to write it down on paper and you can see that one item has eight hundred or a thousand calories on it, and that is almost all of your calories in one meal, it kind of surprises you. (intervention arm, 3 months)

Theme 12: Without the facilitators of accountability, camaraderie, and structured support, maintaining healthy behavior is difficult. The waning intensity of the intervention itself—from weekly to monthly meetings to no meetings—commonly triggered backslides in eating and exercise habits. At 9 months, one participant noted

> It's not the same as when we were meeting weekly. . . . You know, after about two weeks I sort of fall off the horse and start going back to my old habits. And then a week later [as the monthly meeting approaches] I'll try to improve on it. (intervention arm)

Another, looking ahead to when even the monthly meetings would cease, said "I'm a little leery about this next year where there's basically nothing . . . It's kind of scary. It's kind of a big jump-off place, even though when we went to once a month it felt uncomfortable from every week" (intervention arm, 9 months). Several participants noted at the 9-month interview that meeting only once a month made it very difficult to keep up with changes they had made during the first six months of weekly meetings such as keeping up with food logs and recommended dietary changes. In particular, participants felt less accountable: "You know, when you're here every week you're more accountable. Once a month, it's tough" (intervention arm). By 18 months, accountability was even harder to maintain: "It's challenging. It was helpful when I had the group, especially when we met every week. It was good to get that interaction and reinforcement from the group. So now . . . it's a little difficult" (intervention arm).

For many, exercise decreased over time without the facilitation of group support. A participant, frustrated by gaining much of her weight back by 18 months, said "Less exercise. I don't know . . . I never really exercised an awful lot. I rode my bicycle and tried walking a little bit, but that was always my weakest part of the program. And now it's virtually nonexistent" (intervention arm). One participant noted that he had not kept up with the exercise regimen established during the group sessions: "I could be exercising. But it's hard to do by myself . . . I really liked the walks . . . when I attended group. Walks by yourself can kind of get . . . boring" (intervention arm, 18 months).

Participants reported more consistency in keeping food logs early in the study period and significantly less at 18 months. The perceived importance of the food logs to future weight loss re-

mained for some participants, however, even if their actual use had declined precipitously. At 9 months one man noted:

> Well, it wasn't until I started writing things down that I realized my intake was terrible. It was like two, three or four thousand [calories] every day. And, I haven't been journaling. I haven't written stuff down in the last few months. But, I know I'm eating too much still. And I know if I get back into writing everything down, it's going to help . . . the first thing on my list was keeping your food record, [it's] the biggest part of the whole thing. For me, that was very helpful. (intervention arm)

Discussion

Among individuals with serious mental illnesses enrolled in a study testing a comprehensive lifestyle change program, we found that lifestyle change efforts were motivated by current or future perceived health risks, often related to antipsychotic medication-induced weight gain. Our participants experienced many of the same barriers and facilitators of behavioral change as those identified by members of the general population (Hammarstrom, Wiklund, Lindahl, Larsson, & Ahlgren, 2014; Ruelaz et al., 2007; Shuval et al., 2013; Toscos, Consolvo, & McDonald, 2011), though we also identified barriers that appear more significant for individuals with serious mental illnesses or that may interact with psychiatric symptoms to make lifestyle changes more difficult to adopt or sustain.

STRIDE group facilitators reported that mental illnesses episodes disrupted engagement and participation in the study but few participants described specific psychotic symptoms that interfered with behavior change efforts despite reporting psychotic symptoms typical of individuals with serious mental illnesses in other day treatment and outpatient settings (Dickerson et al., 2013; Eisen, Normand, Belanger, Spiro, & Esch, 2004). In contrast, many described depression symptoms as important barriers to lifestyle improvements, consistent with a recent research report (Klingaman, Viverito, Medoff, Hoffmann, & Goldberg, 2014) indicating depression and stress were greater barriers to weight loss among those with schizophrenia than for those in the general population. Our participants commonly described how depressive symptoms negatively influenced their ability, motivation, and willingness to control eating choices and portions, and their ability to motivate themselves to exercise. Moreover, participants described how depressed mood co-occurred with disinhibited eating (i.e., the tendency to overeat without restraint, sometimes considered "opportunistic" eating) perpetuating a cycle of unhealthy behavior.

In addition, lack of desire to continue eating vegetables, easy availability of cheap fast food, and disinhibition (i.e., lack of control), combined with enjoyment of high fat, unhealthy foods known from previous research to correlate with stress, depression, and anxiety (Bryant, King, & Blundell, 2008), while barriers also experienced in the general population (Klingaman et al., 2014; Lundgren, Rempfer, Lent, & Foster, 2014), were particularly prevalent in our interview sample.

Cognitive impairments in this population may also limit opportunities for successful lifestyle changes. These include limited ability to think flexibly, estimate perceived effort and compare effort with its potential benefits (Gold et al., 2013), predict cues that lead to rewarding outcomes (Strauss, Waltz, & Gold, 2014), and make adaptive and goal-directed decisions (Brown et al., 2013; Heerey, Robinson, McMahon, & Gold, 2007; Mason, O'Sullivan, Montaldi, Bentall, & El-Deredy, 2014; Waltz, Frank, Wiecki, & Gold, 2011; Waltz & Gold, 2007). We did not measure cognitive impairment directly, nor ask specifically about it in the interviews but were struck by the frequency with which participants spontaneously mentioned these kinds of difficulties in their discussions of lifestyle change barriers. All-or-nothing thinking (a maladaptive thinking style, typically associated with depression, but not uncommon in schizophrenia) (Grant & Beck, 2009) was common among interview participants, negatively influencing dietary changes and exercise. Moreover, flexible cognitive restraint (having a less rigid and more relative approach to dietary self-regulation) was rare, limiting participants' ability to recover from dietary setbacks and maintain weight loss (Teixeira et al., 2010). Participants described how all-or-nothing thinking interacted with cost-effort analyses, leading many to avoid the perceived effort of adapting their exercise routine to accommodate bad weather or lack of exercise companions. Similarly, participants perceived that healthy eating was more costly and required more effort and cooking skills than unhealthy eating. Such assessments are not uncommon in socioeconomically disadvantaged groups, who are more likely than advantaged groups to believe that losing weight is expensive, not of high priority, and requires a lot of cooking skills (Siu, Giskes, & Turrell, 2011). These types of cognitive limitations may be important to address in future lifestyle interventions.

Limitations

Our sample was relatively small, though larger than similar qualitative studies (Jimenez et al., 2015). We purposely chose to look only at barriers and facilitators among people with serious mental illnesses enrolled in a lifestyle intervention, so results may not represent those who refused participation. Our study also only included individuals with mental illnesses, so we are unable to make direct comparisons to the general population. Finally, we did not directly measure behaviors like rigid thinking, or skills like cost-effort analysis, so our interpretations regarding the influence of these factors are based on our observations of study participants and analyses of interview text. They therefore suggest avenues for future research.

Conclusions and Implications for Practice

Our study revealed several areas where the effectiveness of lifestyle change programs tailored for individuals with serious mental illnesses may be improved. These include the following:

1. Assisting people to develop the ability to iteratively adapt to changes in mental health symptoms, particularly mood changes, and subsequent changes in motivation to eat healthfully and exercise regularly.

2. Enhancing estimation of effort and prediction of future health benefits. Participants described "laziness," as a lack of motivation resulting from the overwhelming effort required to make and then keep up with changes in eating and exercise habits. These issues may be a key factor in the limited success in producing long-term sustainable weight loss (Ramage, Farmer, Eccles, & McCa-

rgar, 2014). Future research should focus on the best ways to assist people with accurate cost/effort/benefit analyses and help them connect effort with immediate and long-term rewards.

3. Amplifying skills training related to developing flexible thinking, perhaps with a greater focus on the coping and planning necessary for successful health behavior change (Schwarzer, 2008). Other areas to explore include a heavier emphasis on cognitive restructuring focused on overcoming defeatist beliefs and negative expectancies (Couture, Blanchard, & Bennett, 2011) and reframing lapses as opportunities for improvement.

4. Developing meal preparation skills to enhance the palatability of healthy foods, particularly vegetables. As income and educational levels are relatively low in this population, low-cost cooking demonstrations may be particularly useful (Yarborough, Janoff, Stevens, Kohler, & Green, 2011).

5. Facilitating exercise to promote the social nature of activity. Exercise partners were important facilitators of exercise, while, conversely, not having an exercise partner was seen as a barrier by many. Other studies of the general population (Kruger, Blanck, & Gillespie, 2006) have shown the value of exercise partners, bolstering the idea that concurrent family or friend involvement in healthy lifestyle interventions would be beneficial to making changes in exercise and diet. In addition, peer health coaches have been shown to be effective in improving diabetes (Moskowitz, Thom, Hessler, Ghorob, & Bodenheimer, 2013; Thom et al., 2013) and other health outcomes (Druss et al., 2010), and could prove useful in this population where peer mentors and support are particularly valued.

6. Increasing options for exercise to accommodate variable weather. Because many people with serious mental illnesses have limited incomes, facilitating or supplying fitness-club memberships and training may be a cost-effective indoor alternative; results from the In Shape program support this approach (Bartels et al., 2013).

7. Establishing and maintaining active engagement in the lifestyle change program, including by the use of self-monitoring tools. As in the general population (Fitzpatrick et al., 2014), active engagement, including attending and receiving support at group intervention sessions, and keeping weekly monitoring records facilitated healthy changes. Similar to previous studies (Kruger et al., 2006), we found that keeping self-monitoring records was correlated with greater weight loss success (Green et al., 2015). Though self-monitoring tools were not universally popular, many participants endorsed their utility and linked them directly to their ability to monitor calories and lose weight.

8. Bolstering natural supports. Participants who reported that their family members were "on board" noted a significant improvement in dietary and exercise habits, demonstrating, as with other populations, that making lifestyle changes with close family involvement is helpful (Wing & Jeffery, 1999). Future research should explore the best methods for involving supportive family and peers in lifestyle change efforts.

9. Continuing personal contact to sustain accountability for weight maintenance. For many, the accountability and support provided by the group made up for a lack of or inconsistent family or peer support, and helped overcome problems with motivation. We found a strong preference for two proven weight-maintenance components: continued personal contact to remain accountable to eating and exercise changes (Coughlin et al., 2013) and extending structured support during the weight-maintenance phase (Middleton, Patidar, & Perri, 2012). These preferences are also supported by the newly released Guidelines for the Management of Overweight and Obesity in Adults (Jensen et al., 2014).

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Exploring variability and perceptions of lifestyle physical activity among individuals with severe and enduring mental health problems: A qualitative study

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Abstract

Background: While individuals with severe and enduring mental illness (SEMI) may be more sedentary than the general population little is known about what influences physical activity broadly (not just structured programmes) and how best to develop effective community-based interventions.
Aims: The purpose of this qualitative study was to examine the idiographic determinants of community-based lifestyle physical activity to inform the design of interventions among people with SEMI.
Methods: Sixteen individuals with SEMI, attending a community support centre, participated in semi-structured interviews focusing on past and present behavioural assessment, knowledge and attitudes, and sources of support to be physically active.
Results: Among the more active individuals, walking was part of a regular routine, involving considerable distances. Overall, most were ambivalent about becoming more active, receiving little or no support to do more. A complex variety of environmental, personal and psycho-social factors interacted to influence behaviour.
Discussion: Individuals with SEMI are receptive toward receiving more support to be physically active and in increasing their levels of physical activity. Physical activity interventions that address ambivalence, alleviate concerns regarding social evaluation, and target increases in walking need development and evaluation.
Declaration of interest: None.

Keywords: *Physical activity, mental health, exercise*

Background

Individuals with schizophrenia die younger from a largely environmental aetiology (Brown et al., 1999; Harris & Barraclough, 1998). Much of this excess mortality is due to natural causes (Phelan et al., 2001) and mainly attributed to obesity-related diseases (Aquila, 2002). Obesity presents a major risk for developing cardiovascular disease, stroke, some forms of cancer and evidently accountable for the emergence of type 2 diabetes. While it is difficult to identify the relative contributions of disease-specific factors such as genetics, the side-effects of medications, or lifestyle factors such as diet, to the prevalence of obesity and increased

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mortality, it is clear that helping individuals with serious mental illness become more physically active can decrease their health risks (Faulkner, 2005). Specifically, physical inactivity is an important independent risk factor for premature morbidity and mortality.

However, often little is done to intervene and improve the health risk profiles of individuals with chronic psychiatric illness (Osborn, 2001). Previous qualitative research (Dean et al., 2001; Friedli & Dardis, 2002) has identified a neglect of individual's physical health needs in community and inpatient settings while users have demonstrated concerns towards the side effects of medication and a lack of interest and expertise from health care professionals. Despite this, users appear interested and receptive to health promotion information (Desai et al., 2002) and good physical health is a realistic goal (Osborn, 2001). Research has been requested to identify the most effective strategies for health promotion in this population (Phelan et al., 2001).

Research (e.g., Brown et al., 1999; Daumit et al., 2005; Davidson et al., 2001; McCreadie, 2003) has identified a lower level of self-reported physical activity in comparison to the general population, but physical activity is often considered under the broader issue of physical health needs, leaving scope for more detailed consideration of physical activity. Previous qualitative research (Dean et al., 2001; Desai et al., 2002; Friedli & Dardis, 2002) provides a brief description of health practices, but falls short of identifying the role of physical activity within the lifestyle of individuals with Severe and Enduring Mental Illness (SEMI). Further exploration is required regarding the description of individuals' lifestyles that have emerged along side the deinstitutionalized phase of the health care service. Additionally, little research has considered the factors that facilitate or hinder engagement in physical activity. Raine et al. (2002) provide an innovative example of a successful exercise service, which provided therapeutic support during an interim stage of recovery for individuals with SEMI. The scheme benefited from several qualities; the conceptual distance from mainstream services, the participatory approach, the importance of social relationships, and encouragement from staff and other users. While this scheme is an example of successful practice in facilitating access to structured exercise we know less about habitual, lifestyle physical activity in this population.

The aims of the study were to provide a more detailed description of the lifestyle physical activity habits of individuals with SEMI in an outpatient setting. This will contribute to current knowledge by illustrating participants' experience of physical activity, the perceived importance of this behaviour, and how such behaviour is supported or discouraged within the context of outpatient care received by many individuals living in the community with mental health problems. In turn, these findings may highlight opportunities for future interventions to increase physical activity in this population.

Methods

Participants were recruited from a community outpatient centre for mental health, located in a city in the west of England. Following ethical approval from the Local Research Ethics Committee, 16 individuals (49.4 ± 9.5 years) with SEMI took part in one semi structured interview. The individuals represented a maximum variation sample (Miles & Huberman, 1994) purposefully selected to provide a range of community dwelling outpatients who varied by weight, gender, perceived physical activity (e.g., physical capability, current use of facilities provided by Mind or other facilities, lifestyle routine), and mental health (e.g., diagnosis of mental disorder, perceived level of anxiety and depression, need for support). Exclusion criteria consisted of: (i) individuals with co-existing alcohol or drug abuse disorder, (ii) those who could not give informed consent, and (iii) individuals identified by

staff working in the centre who were considered not suitable or to whom the task would provide an unacceptable burden at the time of the interviews. Participants were not recruited into the study unless they understood the nature and duration of the interviews and could provide written consent. One participant was married; all other participants lived on their own. Participants were provided with council accommodation, such as a separated flat or lived in sheltered accommodation with other individuals in similar economic situations. Ten participants were diagnosed with schizophrenia, two with bipolar affective disorder, four with manic depression, and one with social anxiety. One individual with schizophrenia was also diagnosed with learning difficulties.

Data collection

Participants were asked to complete a single questionnaire regarding physical activity, followed by a semi-structured interview. The physical activity questionnaire required participants to identify their perceived level of physical activity. Physical activity was documented by asking participants how many times they had performed moderate and vigorous physical activity during the past week. Moderate physical activity was defined by activities that resulted in an individual breathing a bit harder or feeling warm and was documented if it lasted for 30 minutes or more each day. Vigorous physical activity was defined by activities that resulted in breathing harder or sweating and lasted for 20 minutes or more each a day. Current recommendations of physical activity advocate at least 5 days of moderate physical activity for 30 minutes each day (Department of Health [DoH], 2004).

The semi-structured interviews took place between December 2003 and February 2004 and focused on self-reported levels of physical activity, recall of physical activity support from health professionals, perceived physical health, knowledge of physical activity and barriers to change. Sampling was completed at a final sample size of 16 as that was where a "saturation point" was met in the analysis in terms of the generation of new themes (see Guest, Bunce & Johnson, 2006).

Data analysis

The interviews were transcribed and the data examined in a form of thematic analysis which is a process of induction that involves the identification, coding and organization of themes arising from the raw interview data with extracts serving as units of analysis (Ritchie & Lewis, 2003). Authors GF and AT took the position as "critical friends" and were used to develop and critique the emerging themes. Discussion of these themes forms the basis of the outcomes section in terms of details of physical activity level, physical activity support, interest in physical activity, factors influencing lifestyle, and motives and barriers regarding physical activity.

Results

Recall of moderate and vigorous physical activity

Over the previous week, ten participants reported accumulating at least 30 minutes of moderate physical activity each day and four participants reported achieving two bouts of vigorous physical activity for 20 minutes or more, but, three participants reported no activity. The accumulation of moderate physical activity reflected the role of walking for those individuals who were physically able. Walking was mainly for transportation and a

significant amount of time was devoted to walking from home to the centre, and around the city environment.

George, Mark, Paul, Ben and Sarah reported low amounts of physical activity. Physically, the only participants who found walking difficult were Nick and George. Nick would walk from the centre into the city on most days of the week, but George had no significant form of physical activity outside the centre. Janet and Ben both reported fluctuations in their daily physical activity although even when their mental health was poor both would still walk on some days of the week. Paul, Nick and George used the hospital transport and did not walk to the centre. Mark used taxis for transportation as his paranoia affected him being outside with people. Sarah reported one day of moderate exercise and would sometimes walk to the river nearby. Only, Ben, Lucy, Phil and Virginia took part in planned/structured exercise (exercise at a set time, in a group) provided by the centre. David and Ben attended the community-based activities and Virginia had attended a local GP referral scheme (DoH, 2001).

Recall of physical activity support

Participants were asked several questions regarding whether a health care provider had undertaken an assessment, offered advice or given assistance with their physical activity in the previous year. Participants were also asked if they had been advised to lose weight and if so, had they been told how to lose weight. Only Virginia, Lucy and Sarah had spoken to a health care professional about physical activity. Lucy had been advised on the advantages of physical activity and how to become more active. Virginia had received advice on how to lose weight, but Sarah had been told that whilst on her medication, losing weight would be impossible. No other participant could recall being given any counselling. A low level of support was a consistent and compelling theme throughout the interviews.

The importance of a healthy lifestyle and change

All individuals had an awareness of the role of physical activity in healthy behaviours, but, the level of interest they had varied. George and Paul were the least interested. Virginia was the only one who was actively planning to find out more about physical activity. David, Ben, Janet and Lucy were interested and demonstrated a good knowledge of the benefits of physical activity, but, like the majority, their psychological, social and environmental situation left them with worries that were perceived as more significant to changing behaviours as Lucy states:

> I think at the moment I can see the importance of doing more, but it's everything else, it just staying alive basically.... Cause the trouble is if you try and do too much, it becomes so overwhelming you end up doing nothing.

For most, coping with the day was a task in itself and the importance of physical activity was viewed as a more trivial issue. When asked if they had observed any recommendations or promotional material, all individuals, apart from Andy, recognized that guidelines existed, but were unable to cite anything specific. Paul and George were least interested and would suggest that they were aware of the information, but, that such an issue was of little importance to them.

Some individuals were ambivalent about changing (Jeff, William, Paul, Mark and George), but they were still receptive in interviews to the suggestion of receiving information

and talking about it. Nevertheless it appeared unlikely that any of them (apart from Virginia) would actively seek further information about physical activity. Mark had the biggest barrier due to mental health and paranoia, but still stated:

> It is possible that at some stage in the future I could be getting into running or walking or anything really, I haven't closed the book on the idea. It's just, at the moment it's not appealing.

Factors influencing lifestyle

The most prominent influence on physical activity appeared to be associated with the social and environmental context in which individuals lived. Janet had various events that played on her mind such as family problems and not wanting to see certain people: These events stopped her going out so much. Virginia believed at times even certain staff members in the centre did not like her. It is possible that ruminating about the negative appraisals by others may in turn lead to isolation and physical inactivity in the safety of one's home. It became clear that participant's routines and lifestyle could change frequently and unpredictably due partly to their illness. The manifestation of the mental health problems appeared to represent deterioration in the individual's lifestyle, and for those who were previously active there certainly was an impact on their ability to participate and enjoy activity. This change in lifestyle then impacted on their fitness level and possibly influenced weight gain to some degree as Ben explained. Ben recalled how before the relapse of his illness he used to swim for fitness and appreciated the benefits of a swim as his mood was enhanced following his exercise:

> When my problem manifested itself, it affected my swimming, the number of times I went and it took the pleasure away from it as well... that lead to me not walking out so much so there was a general deterioration... I think my self esteem has gone downhill, my confidence has gone downhill and you sort of take on a sheltered existence, to protect yourself.

At its worst, Ben's paranoia meant that when going out he felt that he was "watched" and eventually he came to think even the sport centre staff were involved (these were people he knew well). He had stopped going out all together before finding stability from a new course of anti-psychotic medication. As a result his perceived fitness level had decreased and another obstacle had been added to his physical activity behaviour. Ben's reasons for going had changed too. The swim was a more social event and this meant he wanted to swim less (approximately half his previous distance) to have more time with his close friends enjoying a coffee afterwards. Similarly, David, Janet, Virginia, Sarah and Lucy found social interaction difficult and this may have influenced their behaviour in two ways; first it enforced the need they had for using the centre as a safe location, and second, it highlights a reliance on close trusted friends, family or health care workers (who were often at the centre).

Motives, barriers and physical activity

Most participants used walking for many purposes, but the most frequent was to get to the centre. Walking was used to get outside and provided a coping strategy when they were feeling worse. David suffered from bipolar disorder and experienced paranoid delusions.

Whether he was high or low he felt the need to get out of the house and become physically active:

> I have a list at home about what to do, when I am pretty high and when I am getting pretty low. Then there are some things that are pretty good, I mean exercise is one, but the difference is when I am getting high, is not to over do it, because its like caffeine . . . to have a bit of exercise but not get carried away . . . then with depression . . . you got to step up and out a bit and push yourself a bit more.

If he felt high he would need to avoid people and select a quiet place to go, and if he was low he could appreciate the benefit of friends' support. Lucy and William enjoyed walks near to the river to relax; again this was a solitary activity. While Ben and Janet would sometimes use walking to meet people and for fitness, they would also have times when they would avoid people to reduce stress. Jeff always seemed highly anxious and used smoking, art activities and walking as a process for distracting and relaxing himself:

> I would just come down here [outpatient centre] go to city centre, most days I would just come here really, they know me here now, all these people know me in here now . . . I don't want to stress things up, I just want to relax now.

The precise intensity and distance walked was not determined in the interviews, but it was a part of daily living and would contribute to health benefits and psychological well-being. Lucy also suffered from chronic fatigue syndrome although walking still had a significant influence in her lifestyle:

> Most places that I go I walk, within walking distance I walk, even when I intend not to, occasionally I tend to get a taxi back home if I am really tired. Because sometimes I just think I don't know how I am going to get home, I always try to, I just say put one foot in front of the other and you will get there.

James, Michelle, Sarah, Virginia and Lucy were dieting with the intention of controlling their weight and were also conscious of their size. Mike, William, Ben and James were also aware of their size, although less concerned about dieting. Women in the current study appeared more sensitive and concerned towards weight gain. Janet had a very low self-esteem, she was sensitive about her body image and she didn't want other people to judge her by appearance:

> I want them to look at me as if I am a metal object or something, a picture or something, a mantel you know that has got nothing to look at . . . I don't want them to have any sort of thing like oh she looks alright or whatever.

Although some males would suggest contentment with their size, others did highlight it as a problem. James wanted to get back into shape before going back to the swimming pool and also to be fitter for the next time he saw his family. George and Nick were not concerned despite being overweight to the point where movement was difficult, although Nick could still walk into town. William, Phil, and Mark were more accepting of their size and felt no need to lose weight.

Sarah reported a low level of walking; she was keen to lose weight, although she would not elaborate on this in the interview. She did mention how she was ashamed of her weight.

Just to go for a walk had no meaning for Sarah: She wanted it to serve a purpose and within the interview she showed great interest towards the availability of exercise referral schemes (DoH, 2001) and shortly afterwards began using a local scheme.

Going into a situation where people were present could be a very draining task. David, Ben, and Virginia were the only individuals that currently participated in community-based physical activity. David would go to the gym, if he felt up to it, but would mix it with going out walking or cycling if he couldn't face people:

> Sometimes I feel that I have to make myself get to the gym, invariably I feel better when I get there . . . if I am hyper and I am getting irritable or angry then its probably better I am cycling outside really and trying to do really more outdoor things.

Those attending community activities would often rely on perception and inferences from others in that environment to make judgements. Examining expressions, glances, gestures, conversations, may all influence decision-making within the exercise environment. Currently facing people was a challenge for Ben, but he still managed one swim a week, although as he said "the enjoyment was taken from it". He would just about manage to go swimming, but preferred a good trusted friend to go with him for support and to counter his paranoid thoughts. Interestingly Janet disliked stationary equipment within the gym because she thought people would look at her, Janet explains the problem for her:

> Going to an ordinary gym, I would find it difficult and uncomfortable especially if I didn't know the people there. Because obviously they have different people, they obviously have their regulars, but then they are going to have new people joining which I would find quite intimidating.

Jeff and Lucy were conscious and very sensitive of how they were seen when performing sport and physical activity. The swimming pool was an example of an extreme display of the body (especially on entering poolside) that caused feelings of insecurity and judgment. James recalled times where children had called him names, referring to his physique and this was very apparent in his mind. Virginia would easily be put off by her perception of what other people might be thinking or saying about her. Virginia had fewer problems when she was swimming than to when she was just entering the pool or was stationary in the water. Concerns were normally with other swimmers, or sometimes staff members if they were chatting on poolside. Physical activity periodically, and at times when a new activity is being attempted, may create worries, stress and anxiety that creates another potential hurdle to overcome.

Physical activity summary

A descriptive summary of participant's physical activity involvement along with key motives and barriers to physical activity is presented in Table I. Physical activity is considered as: volitional behaviour, mainly walking, and structured exercise, including physical activity organized as a group or sport.

Discussion

In general, walking appeared fundamental to each user's lifestyle and contributed to a higher prevalence of self-reported physical activity. There appeared to be little physical activity

Table I. A summary of physical activity involvement, motives and barriers.

	Lifestyle physical activity	Structured exercise
Examples	Physical activity (walking most frequently) to: • See friends • Do shopping • Relax • Get out of the house • Voluntary work	Physical activity located at a set place and time: • Community exercise group, e.g., GP referral scheme • Badminton organized by the centre • Football organized by the centre • Walking group • Other activities found in a community sports centre
Interaction	Most often solitary behaviour in order to undertake movement for transport	Activity with others in the group Performed to meet people
Frequency, volume & intensity	Self reported as a high volume (daily) at low intensity	Weekly event Self reported moderate to high intensity
Motives	As part of the lifestyle routine To centre for social support and food Personal needs like shopping	Weight loss Social support Fitness
Barriers	During ill health an individual may find more security in their home	Less security in a new environment Self-presentation concerns Negative verbal or non-verbal interaction

support for individuals, but individuals appeared receptive to physical activity promotion, although ambivalent about enacting behaviour change. Social support was important within an exercise environment, but individuals' social skills made interaction difficult. Initiating or adhering to physical activity was a potentially stressful event and individuals used self-presentation strategies to cope when interacting in a demanding environment or with unfamiliar people.

In the present study 11 out of the 16 participants reported physical activity levels that met current recommendations for healthy adults (DoH, 2004). Walking appeared to act as a bridge for enabling inclusion to the outpatient day centre, where support and resources for users were in abundance. In contrast to our findings, previous surveys of physical activity identify a high level of sedentary behaviour (e.g., Brown et al., 1999). Given our small sample and that individuals with an interest in physical activity may have been more motivated to participate, we can only tentatively suggest that perhaps individuals with SEMI are more physically active than typically thought. The present study relied on a self-report measure of physical activity, clearly a more objective measure is needed to determine just how active individuals with SEMI are, particularly when considering low-moderate intensity exercise that may be harder to recall (Tudor-Locke & Myers, 2001).

While caution is required when interpreting the level of physical activity in individuals with SEMI, the health benefits of walking should be noted, for example three short bouts of brisk walking include the ability to reduce risk factors for cardiovascular disease and provide reduction in anxiety and tension, particularly in subjects with a higher baseline score (Murphy et al., 2002). The current results provide a clear rationale for future interventions to focus on increasing walking behaviour, as encouraging an existing physical activity may be a simpler task than trying to initiate new one. The flexibility, lower cost, and easy integration into daily schedules of walking might be particularly appealing to individuals with SEMI.

By engaging individuals with serious mental health problems in discussions about physical activity and their health needs we have identified a number of issues that may be of relevance

to the development of initiatives to promote physical activity to similar individuals. First, previous research suggests a lack of health promotion within primary and secondary health care (Friedli & Dardis, 2002) and accordingly we found that only three participants could recall receiving advice about physical activity. Furthermore, at least one individual (Sarah) had received inaccurate advice that weight loss was impossible while on antipsychotic medication. A systematic review of interventions to reduce antipsychotic-induced weight gain concluded that weight loss is indeed possible (Faulkner et al., 2003). As our participants described, there are mental health specific barriers to physical activity that can be more appropriately addressed by individuals trained to be sensitive and supportive around these issues. Changing health behaviors can be difficult and frequent reinforcement by mental health professionals attuned to the needs of individuals with SEMI will play a critical role in successful long-term adoption of regular physical activity (Richardson et al., 2005). Given growing acceptance of the high prevalence of obesity and the metabolic syndrome in this population, greater attention now needs to be given to highlighting this important promotional role to mental health professionals and equipping them with the knowledge, skills and resources to support their clients in being more physically active. Many of our participants valued physical activity as a beneficial coping strategy for their mental health problems and this strategy should be disseminated more convincingly.

Second, it is important to highlight the receptiveness of our participants toward receiving more support to be physically active and in increasing their levels of physical activity. Such a finding illustrates grounds for optimism rather than a nihilistic scepticism in the feasibility of helping individuals with SEMI change their health behaviours (Le Fevre, 2001). At the same time, such receptiveness was often marked by ambivalence to change. In promoting health behaviour change to this population this ambivalence becomes the central issue and demands an approach such as motivational interviewing for eliciting behaviour change through helping clients to explore and resolve ambivalence (Rollnick & Miller, 1995). Motivational interviewing has been shown to outperform traditional advice giving in the treatment of a broad range of behavioural problems and diseases (Rubak et al., 2005) but to date no intervention study has been conducted to develop a model of motivational interviewing for use in serious mental illness in relation to physical activity. Such an approach deserves urgent attention while addressing the key barriers reported by our participants.

For example, self-presentation concerns were the most significant barrier reported by our participants. Self-presentation (an attempt to control and monitor impressions others form of oneself) concerns may influence a vast number of behaviours within the exercise setting, for example the activity and context chosen, the motivation for exercise and the affective response to exercise (Leary, 1992). Individuals often used activities to acquire social benefits but sensitivity to body image and concerns that one's body may be negatively evaluated, difficulties in social communication and a lack of self-confidence contributed to a tendency to avoid physical activity participation with others. Often previous negative experiences would also contribute to avoidance behaviour in community settings. These findings clearly distinguish problems encouraged by uncertainty and vulnerability within a social environment, influencing such factors may encourage self-confidence, social integration and behaviour change. Promotional efforts clearly need to alleviate these concerns and provide a very gradual approach to increasing physical activity. A successful exercise environment needs to be supportive to the individual and sensitive to self-presentation concerns.

Creating a successful exercise environment may be encouraged by group physical activity, which enhances social support and develops social skills (Saxena et al., 2005). Raine et al. (2002) highlights the benefit of a supported environment and social network between users

and staff in reducing psychological risk to attendance, the development of trust was seen as a major difference between their service and a typical mainstream gym facility. The promotion of physical activity may benefit from considering social support as a provision to exercise initiation and adherence in a community setting. This may aid long-term rehabilitation and provide a safeguard against social withdrawal, especially since close relationships are particularly important at times of greatest vulnerability (Green et al., 2002). The current results suggest both the quality and stability of social relationships could impact on physical activity levels; good social support may promote good health behaviours.

Overall, this study extends our understanding of the meaning of physical activity and the scope for its promotion in a community care setting among individuals with SEMI. This study has been able to support and further existing literature in several ways: The low rates of physical activity support currently received by mental health users supports existing qualitative reports and identifies the need for more reinforcement from mental health professionals. The attention towards all forms of physical activity allowed an understanding of the positive and negative influences on participation and while individuals were receptive to the idea of becoming more physically active, they were also ambivalent about change. The possibility that broader environment factors may encourage changes in physical activity in individuals with SEMI provides a distinct requirement for future research. The high volume of walking reported by some has not been previously reported in the literature and illustrates that while promoting physical activity may be difficult it is not impossible.

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ORIGINAL ARTICLE

Exercise can seriously improve your mental health: Fact or fiction?

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Abstract
The World Health Organization predicts that depression will create the second greatest burden of disease by 2020, requiring cost-effective prevention and intervention strategies. The evidence to support the benefits of exercise in offering protection from depression and as an intervention in the treatment of mental illness is growing. The literature is reviewed with 11 prospective longitudinal studies that include measures of physical activity and depression at two or more time points showing a protective effect from physical activity. Fifteen randomized controlled trials (RCTs) and three meta-analyses provide evidence that exercise can reduce depression and that it can be as effective as cognitive therapy. Four RCTs report exercise as an intervention in alcohol addiction and two RCTs in the use of illicit drugs. While many of the studies reviewed have methodological weaknesses, including lack of concealment in randomization, limited use of intention to treat and blinding, the benefits of exercise far outweigh the risks. Neurobiological and psychological explanations as to why exercise should work are discussed. There is evidence that exercise protects against depression and is an effective intervention and adjunctive intervention for the treatment of mild to moderate depression. Exercise provides some health and psychological benefits as an adjunct to treatment in complex mental health problems such as alcohol and drug rehabilitation.

Key words: *Alcohol abuse, cognitive–behavioural techniques, depression, drug abuse, physical activity*

Introduction

Depression affects 121 million people worldwide; however, under-reporting is common and only 25% receive treatment (1,2). Lack of access to treatment, particularly in developing countries, is linked to the increased risk of suicide, which claims 850 million lives every year and is one of the three highest causes of death in young adults aged 15–35 years (3). Depression is more common in women and more prevalent in developing countries (4). The World Health Organization highlights mental illness as a public health issue, predicting that depression will create the second highest burden of disease by 2020 (1). Exercise is a low-cost intervention, which has the potential, if effective, to play a significant role in both developed and developing countries in the prevention and treatment of depression.

The rise in mental illness is also associated with the global increase in the abuse of alcohol and illegal drugs (5). It is estimated that 76.3 million people are addicted to alcohol causing 60 types of disease and 195,000 deaths per year in Europe. The impact of alcohol abuse on disability is high accounting for 4.5 million disability-adjusted life-years (6). Global mortality figures for injecting drug users are estimated to be 13 million; however, mortality figures for drug misuse are difficult to assess with many deaths recorded as suicide, accidents or HIV related (7). This paper will not attempt to cover all areas of mental health in which exercise can play a role but will focus on the globally important areas of depression and addiction.

What is causing this global pandemic of mental health problems? There are many indicators that have been associated with the rise in mental health problems. Mental health is associated with the economy of the country, employment levels and quality of housing. War, political conflict and natural disasters have specific effects on the mental health of societies. At a family and community level, mental health is associated with social support, and

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an environment with manageable levels of stress. At an individual level, mental health is linked to individual coping strategies, lifestyle and life satisfaction.

Definitions

Defining mental health is complex the terminology is viewed negatively in the context of mental illness and positively in the context of mental well-being. Mental health is defined by WHO as a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully and is able to make a contribution to his or her community (8). Clinical depression is diagnosed by a cluster of symptoms that persist for more than 2 weeks. Symptoms include feelings of unbearable sadness and loss of pleasure in association with four or more of the following: sleep disturbance, lack of energy, inability to concentrate, feelings of worthlessness and thoughts of suicide (9). Addiction to alcohol or illicit substances can be described as an individual who experiences multiple serious life problems as a result of prolonged and heavy drinking or illicit drug use (7). Physical activity is any movement of the body that results in energy expenditure rising above resting level and includes activities of daily living, domestic chores, gardening and walking (10). Exercise is a subset of PA and is undertaken to improve health or for leisure-time activities including activities such as swimming, jogging, brisk walking, going to the gym and sports such as tennis and football.

Is exercise important for mental well-being?

There are three critical reasons why exercise is important for mental well-being. The literature reviewed by a panel of experts to produce the UK National Consensus Statements (11) provides support for; exercise and decreased depression, the stress reduction effects of exercise, the association of exercise and positive mood, improvement in cognitive function in fit older adults, and positive effects of exercise on physical self-perceptions and body image. Research has also found that people who experience mental health benefits from exercise are more motivated to continue exercising (12). In addition, exercise and regular physical activity is known to offer protection in the prevention of obesity, cardiovascular disease, hypertension and diabetes. The promotion of exercise thus benefits both physical and mental health and can be seen as a "win–win" situation (13).

Is there sufficient evidence to support the premise that exercise can seriously improve your mental health?

In order to address this question, the literature on depression was reviewed and is discussed alongside commentary from a published review by the author on the use of exercise in drug and alcohol rehabilitation (14).

All studies from 1970 onwards were located by standard search methods Firstsearch, MEDLINE, PsychInfo Embase, SPORTDiscuss, Cinahl, Bandolier, Cochrane Database of Systematic Reviews (CDSR) and the Social Citation Index. The search words "depression", "dysthymia", "depressive disorder", "mild depression", "moderate depression" and "severe depression" were combined with "exercise", "physical activity" and "running". To be included in the review, a study had to be published between 1970 and 2006. The studies had to be longitudinal studies with measures at two or more time points, a randomized controlled exercise intervention for a clinically defined population of people with depression, or a meta-analysis of exercise and depression. Studies that looked only at the effect of exercise on anxiety or neurotic disorders were excluded.

There are numerous quasi-experimental exercise intervention studies and the numbers of those have grown exponentially over the last decade; however, these have not been included in this review. In total, 12 prospective longitudinal studies were included, 11 with positive outcomes supporting the links between regular physical activity, exercise and reduced risk of mental health problems. Fifteen RCTs provide evidence of exercise in the treatment of depression alongside three meta-analyses. In addition, key policy documents in the UK and NICE guidelines relating to exercise and mental health published between 2000 and 2006 were reviewed in order to consider the impact of the evidence on policy and practice in the UK.

Evidence for prevention

Eleven prospective longitudinal studies that include measures of exercise and depression at two or more time points have demonstrated a positive association between physical activity and the reduced risk of depression (Table I). This research has been carried out by research teams in the USA, Netherlands and Finland using different populations of community dwellers, workers, adults, adolescents and older people. The findings show that people who are physically active and exercise regularly are less likely to be diagnosed with depression in the period

Table I. Prospective longitudinal studies that include measures of physical activity and depression at two or more time points demonstrating a protective effect.

Authors (ref.)	Participants	Physical activity	Follow-up	Results
Farmer et al., 1988, USA (15)	1497	Recreational activity	8 years	Women not engaged in regular activity twice as likely to develop depression (95% CI 1.1–3.2)
Camacho et al., 1991, USA (16)	8023	Low active and high active	9 and 18 years	At 9 years, increased risk of depression for men and women who are low active (RR 1.8 men, 1.7 women) compared with high active. At 18 years, ↓activity increases risk of depression (OR = 2.02)
Paffenbarger et al., 1994, USA (17)	10,201 men only	Self-report of physical activity exercise and sport	23–27 years	Men taking 3 h of sport a week at baseline had 27% ↓ risk of depression compared with men who played less than 1 h a week. Evidence of dose–response
Mobily et al., 1996, USA (18)	2084 older adults	Self-reported walking	3 years	Those that walked daily and reported more depression at baseline were a third less likely to report depression at follow-up (OR = 0.38)
Strawbridge et al., 2002, USA (19)	1947 (age 50–94)	Physical activity, 8-point scale	5 years	Increased levels of physical activity provided protection from depression at 5-year follow-up (OR = 0.83)
Van Gool et al., 2003, Netherlands (20)	1280 older adults	Change from active to sedentary lifestyle	6 years	From baseline to follow-up, 155 people reported depression associated with decreased amount of minutes in physical activity and changing from an active to a sedentary lifestyle (RR = 1.62)
Motl et al., 2004, USA (24)	4594 adolescents	Self-reported physical activity- after school	3 time points over 2 years	Decrease (1 SD) in physical activity inversely related to increase in depression (0.25 SD)
Motl et al., 2005, USA (22)	174 sedentary older adults	Walking or low-intensity resistance/flexibility training	1 year and 5 years	Depressive symptoms scores decreased after the 6-month intervention, followed by a sustained reduction for 12 and 60 months. Findings similar for both types of physical activity
Bernaards et al., 2006, Netherlands (23)	1747 workers	Strenuous physical activity 1–2 times a week	3 years	Strenuous leisure-time activity 1–2 times a week reduced risk of depression and emotional exhaustion. Activity at greater frequencies did not show this relationship
Lampinen et al., 2006, Finland (21)	1124 older adults	Leisure-time physical activity	8 years	Mental well-being in later life is associated with activity, better health and mobility
Harris et al., 2006, Netherlands (25)	424 depressed adults	Walking and leisure-time physical activity	1, 4, 10 years	More physical activity was associated with less concurrent depression with physical activity countering the effects of negative life events on depression

between baseline and follow-up. The findings of the first prospective study (15) suggest that women who had engaged in little or no recreational activity were twice as likely to develop depression when compared with women who had engaged in moderate or high levels of activity. The same protective effect for men was not evident. However, for men who were depressed at baseline, inactivity was a predictor of depression at follow-up. The protective factor of physical activity for both men and women was demonstrated in a study reported 3 years later (16). The Harvard Alumini (17), one of the largest longitudinal studies of its kind, confirms the protective effects of physical activity and the risk reduction of developing depression for men.

The evidence for prevention has also been demonstrated in studies of older people. Adults over the age of 65 were followed up for 3 years providing evidence that daily walking reduced risk of depression (18). A further study in the USA with middle-aged and older adults found similar protective factors (19). This is further supported by the work of researchers in the Netherlands (20), who found that study participants who became depressed from baseline to follow-up had changed from an active to a sedentary lifestyle, and research undertaken in Finland (21) with evidence that mental well-being in later life is associated with activity, better health and mobility.

A study to determine if changing to a more active lifestyle would impact on vulnerability to depression was undertaken with formerly sedentary, older adults. Study participants were randomly assigned into 6-month conditions of either walking or low-intensity resistance/flexibility training. Depressive symptoms scores decreased after the 6-month intervention, followed by a sustained reduction for 12 and 60 months. The effect was similar for both types of physical activity (22). A study in the Netherlands looking at how much exercise was needed to offer protection found that those with sedentary jobs only needed to engage in strenuous physical activity once

or twice a week to reduce the risk of depression and emotional exhaustion (23). Interestingly, higher levels of activity three or more times a week did not offer this protection.

Protective factors of physical activity have also been found in adolescents (24). The findings indicate that a decrease in the frequency of leisure-time activity was inversely related to an increase in depressive symptoms. All of these studies have been undertaken in communities and the workplace. In a recent study, the relationship between physical activity and depression was investigated in a clinical sample of 424 initially depressed patients with a 1-, 4- and 10-year follow-up (25). More physical activity was associated with less concurrent depression, with physical activity countering the effects of negative life events on depression. One further longitudinal study following up 973 medical school students from 1978 until 1993 did not find a link between levels of physical activity and associated risk of depression (26).

Evidence for intervention

Sixteen randomized clinical trials (Table II), and three meta-analyses demonstrate the effectiveness of exercise as a treatment or as an adjunct to treatment for people with mild to moderate depression. The most recent of these meta-regression analyses (27) included a systematic review of 14 RCTs; the findings are similar to previous meta-analyses (28,29). The results demonstrate that exercise reduces symptoms of depression, standardized mean difference in effect size of −1.1 (95% confidence interval, CI −1.5 to −0.6) when compared with a no treatment group. This is a large effect size (30). The effect size was found to be significantly greater for studies with a shorter follow-up period and for studies only reported in scientific conferences. Exercise was also found to be as effective as cognitive–behavioural therapy in reducing depression, standardized mean difference in effect −0.3 (95% CI −0.7 to 0.1). While these are convincing findings of the efficacy of exercise, the authors concluded that the effectiveness of exercise in reducing symptoms of depression could not be determined because of the lack of good-quality research. The methodological weaknesses in the studies include lack of information regarding treatment allocation, only three studies appeared to have appropriate concealment, and intention-to-treat analysis was only undertaken in two studies. In 12 of the studies, the main outcome was measured by self-assessment using a questionnaire. Nine of the studies included non-clinical populations with most participants being recruited through the media and assessed by a cut-off point on the Beck Depression Inventory (31); only four of these studies used additional clinical interview to confirm the presence of depression. Generalizing these studies, which include non-clinical participants, to populations with a clinical diagnosis of depression may be difficult. The most robust indicator of the clinical effectiveness of exercise is whether at follow-up the participants are still depressed. The lack of follow-up data a year post-intervention is missing in these studies. Undoubtedly there are weaknesses in the methodology to date. While this challenges the evidence, the effect size is large and consistent across the studies, and this should not be ignored. In considering whether exercise can be an effective intervention for depression, the potential benefits are far greater than the potential risks. In addition to the likelihood of the mental health benefits, considering intervention alongside the evidence for prevention the additional physical benefits to health are an added value from this approach.

The RCTs reviewed to inform this paper are outlined in Table II (32–48); this includes studies published after the most recent meta-regression analysis (27), including two studies with older adults (46,47) and a further study reporting dose–response (48). This area of investigation is still relatively new with the earliest of these studies undertaken in 1979 in the USA (32). The findings indicate that running three times a week for 30–45 min over 10 weeks was as effective as time-limited or non-time-limited psychotherapy. Researchers in Norway were the first to demonstrate the effectiveness of a 9-week programme of aerobic exercise to reduce the symptoms of depression in people hospitalized with depression (36). All of the studies demonstrated a positive effect, whether looking at the effectiveness of exercise versus standard treatment or where compared with psychotherapy or medication. Exercise appears to be effective whether it is undertaken with adults or older adults. The mode of exercise does not seem to be important with studies including weight training, aerobic exercise, mixed games and exercise. The length of treatment has varied with periods of 8–12 weeks being most prominent.

Recent work from researchers in the USA informs us that exercise has to be equivalent to the public health dose to be effective in reducing depression but that frequency does not matter (48). This study compared frequency of exercise [3 or 5 days per week] and total energy expenditure per week [7 kcal/kg/week "low dose" versus 17.5 kcal/kg/week "public health dose"] in a 12-week protocol. Four aerobic exercise conditions allowed these comparisons; two groups exercised on 3 days a week – one expended 7 kcal/kg/week and the other 17 kcal/kg/week; two

other groups exercised on 5 days a week but expended the same totals of either 7 or 17.5 kcal/kg/week. Participants were randomly assigned to one of these four groups or to a placebo exercise condition, which involved stretching exercises on 3 days of the week.

Exercise has been shown to be as effective as antidepressants or exercise plus anti-depressants in reducing depression with the benefits sustained at 6 months (44). In this study, participants ($n = 156$; 113 women, mean age 57 years) who were assessed as clinically depressed according to DSM-IV criteria or HDRS >7 were randomized into one of three groups. The 16-week exercise intervention comprised of three 45-min aerobic sessions a week. All three groups reduced depression scores at 16 weeks and maintained the reduction at 6 months; at 10 months depression rates were lower for the exercise group. The participants self-selected to join the study and motivation may have been a factor influencing these findings.

RCTs undertaken with home-dwelling older people who were not self-selecting also show a reduction in depression from exercise. A 10-week exercise programme was found to be as effective as an adjunct to antidepressant therapy in reducing depressive symptoms in older people (46). Patients (aged 53–78 years) were randomized to attend either exercise classes or health education talks for 10 weeks. Results showed that at 10 weeks, a significantly higher proportion of the exercise group (55% compared with 33%) experienced a greater than 30% decline in depression. Two studies looked at unsupervised exercise as a long-term treatment for clinical depression in elderly people (42,43). The authors studied 32 older adults (aged 60–84 years) in a 20-week, randomized, controlled trial, with follow-up at 26 months. Exercisers engaged in 10 weeks of supervised weight-lifting exercise followed by 10 weeks of unsupervised exercise. Depression was significantly reduced at both 20 weeks and 26 months of follow-up in exercisers compared with controls. In a further study of 60 older adults, high-intensity progressive resistance training (80%) was found to be more effective than low-intensity progressive resistance training or general practitioner (GP) care (47). These studies provide some clinical evidence for group exercise lowering depression in home-dwelling older people. Like the studies in adults, the mode of exercise appears to be flexible with both weight training and aerobic exercise providing sustainable benefits; these studies vary in frequency.

Undoubtedly further research, which highlights longer periods of follow-up, is required before we can confirm the causal link between exercise and depression. A well-funded investigation into the effectiveness and cost-effectiveness of exercise on prescription for people with depression is currently being undertaken at the University of Bristol (49) and the team will report their findings in 2011.

However, the benefits of exercise are not limited to the treatment of depression

A systematic review undertaken by the author highlights the emerging evidence of the impact of exercise in the treatment of people with mental health problems such as alcohol and drug addictions (14). Four RCTs (50–53) provide some evidence for the use of exercise as an adjunct in the rehabilitation of problem drinkers and two RCTs (57,58) provide evidence for exercise as an adjunct to the rehabilitation from substance misuse (Table III). Of the four RCTs relating to problem drinkers, only two (52,53) had a sufficient sample size to provide conclusive findings. Both of these studies had a high dropout rate and only one (53) used intention-to-treat analysis. Both of these studies followed the American College Sports Medicine guidelines (ACSM) (54) on the frequency, duration and intensity of exercise required in order to develop and maintain aerobic and strength fitness. Estimated oxygen uptake was the most commonly used measure of fitness. Various measures were used for psychological outcome, depression, perceived body image and self-esteem. One study found benefits that included improvements in fitness and strength, physical activity levels, physical self-perceptions and self-worth (53). The perceptions of the study participants in regard to how their physical fitness and strength had changed were in line with actual changes. These physical changes and mental awareness of these changes impact on physical self-worth with a significant improvement noted at 1 month and 2 months in this study. Physical self-worth has a direct influence on self-esteem. Enhancing self-esteem is critical when people are attempting to change behaviour. For some, the exercise programme enabled them to change their lifestyle and get back to doing activities they used to enjoy, e.g. cycling, hill walking, and for one teenager boxing. An interesting outcome was that the study participants did not link the benefits from exercise to their addiction problem. There were many quotes similar to this one "Feeling fitter is great I feel less like drinking but that doesn't mean I go to the gym instead of drinking, they are very different things" (53).

In the treatment of substance misuse, two studies using an RCT design have been published (Table III). One of these studies (55) had an insufficient sample size ($n = 15$ in each group) to have a realistic

Table II. Characteristics of randomized controlled studies of exercise for clinically defined depression.

Authors and country of study (ref.)	Study participants	Criteria for depression	Length of training	Comparison groups	Outcome measures	Results
Greist et al., 1979, USA (32)	$n=28$, M, F, outpatient clinic	RDC criteria for depression	10 weeks, 1- and 3-month follow-up	(i) Time-limited psychotherapy; (ii) Time-unlimited psychotherapy; (iii) Running 3 × 30–45 min/week	SCL	Running as effective as the two psychotherapy treatments
Reuter et al. 1982, USA (33)	$n=18$, M, F	BDI criteria for depression	10 weeks	(i) Running 3 × 30–45min/week and counselling; (ii) Counselling alone	BDI	The running and counselling group was more effective
McCann and Holmes, 1984, USA (34)	$n=43$, F	BDI criteria for depression	10 weeks	(i) Aerobic exercise 2 × 60 min/week; (ii) Relaxation training; (iii) Waiting list control	BDI	Depression scores lowered in all groups
Klein et al., 1985, USA (35)	$n=74$, mean age 30, M, F, outpatient psychiatric clinic	RDC criteria for depression	12 weeks, 1-, 3- and 9-month follow-up	(i) Running with a leader, 2 × 45 min/week; (ii) Group meditation 2 h/week; (iii) Group therapy 2 h/week	SCL and psychiatric interview	Running as effective as the other two treatments
Martinsen et al. 1985, Norway (36)	$n=43$, mean age 40 years, M, F, psychiatric inpatients	Clinical assessment by DSM-III	9 weeks of treatment	(i) Aerobic training 50–70% max. VO_2 1 h, 3 × week; (ii) Control group occupational therapy 1 h, 3 × week	BDI; predicted max. VO_2	Depression scores lowered and increased fitness in exercise group
Doyne et al., 1987, USA (37)	$n=40$, mean age 29 years, F, recruited via media	Clinical assessment by RDC	8 weeks, 1-, 7- and 12-month follow-up	(i) Running 4 × week; (ii) Weight-lifting 4 × week; (iii) Waiting list control group	BDI; HRSD; predicted max. VO_2	Running and weight training reduced depression more than control. Remained lower at 1 year
Fremont & Craighead, 1987, USA (38)	$n=49$, M, F, recruited via media	BDI criteria for depression	10 weeks and 2-month follow-up	(i) Cognitive therapy 1 h/week; (ii) Running with a leader, 3 × 20 min/week; (iii) Both cognitive therapy and running	BDI	All three groups lowered depression Improvements maintained at 2-month follow-up
Martinsen et al., 1989, Norway (39)	$n=99$, mean age 41 years, M, F, inpatients with depression	Clinical assessment by RDC	8 weeks	(i) Aerobic training, 3 × 1 h/week; (ii) Strength and flexibility training, 3 × 1 h/week	Montgomery-Asberg predicted VO_2 max.	Both groups decreased depression scores. The aerobic group made gains on max. VO_2

Bosscher, 1993, Netherlands (41)	$n=24$, mean age 34 years, M, F, inpatient hospitalized depressives	RDC classification, SDS >40	8 weeks of treatment	(i) Standard movement therapy of mixed games and exercises, 50 min, 3 × week; (ii) Running 45 min, 3 × week	SDS	Only the running group showed significant decreases in depression. No fitness measures taken
Singh et al., 1997, USA (42); Singh et al., 2001 (43)	$n=32$, mean age 71 years, M, F	Clinical assessment by DSM-IV criteria	10 weeks treatment follow-up at 20 weeks; 26-month follow-up	(i) Progressive resistance training (PRT) 3 × week; (ii) Attention–control group meeting 2 × week	BDI, HRSD, SF-36, strength (1 repetition max.).	At 10 weeks depression, strength pain and social functioning showing improvements in exercisers. Depression lower at 20 weeks and 26 months in exercisers. 33% exercisers still weight lifting at 26 months
Blumenthal et al., 1999 (44) and Babyak et al., 2000, USA (45)	$n=156$, mean age 57 years, M, F, media and local physician recruitment	Clinical assessment by DSM-IV criteria.	16 weeks of treatment, and follow-up 6 months later	(i) Aerobic exercise 3 × week supervised; (ii) Antidepressant medication; (iii) A combination of (i) and (ii)	HRSD, BDI, peak aerobic capacity (Balke protocol)	All groups reduced depression at 16 weeks maintained at 6 months. Exercise groups increased aerobic fitness. At 6 months, fewer in exercise group only had relapsed or used medication.
Mather et al., 2002, UK (46)	Older adults aged over 53 years	Clinical interview with ICD-10 classification	10 weeks of treatment and follow-up at 34 weeks	(i) Exercise classes; (ii) Health education talks	HRSD	A higher proportion of participants in exercise classes experienced greater than 30% decline in HRSD scores at 10 weeks
Singh et al., 2005, USA (47)	$n=60$, M, F, older adults aged over 60 years	Clinical assessment by DSM-IV criteria	8 weeks	(i) High-intensity (80% max) PRT 3 days per week; (ii) Low-intensity (20% max) PRT (iii) 3 days per week; Standard care by GP	HRSD, response rate and various quality of life indices including sleep.	High-intensity PRT was more effective than low-intensity PRT or GP care. A 50% reduction in HRSD score in 61% of the high-intensity, 29% of the low-intensity, and 21% of the GP care group
Dunn et al., 2005, USA (48)	$n=80$, age range 20–45, M, F, recruited in a medical centre	Clinical assessment by DSM-IV criteria	12 weeks of supervised exercise in laboratory. Public health dose defined as 17.5 kcal/kg/week	(i) Placebo exercise control (stretching); (ii) 7 kcal/kg/week achieved in 3 days aerobic exercise; (iii) 7 kcal/kg/week achieved in 5 days aerobic exercise; (iv) 17.5 kcal/kg/week achieved in 3 days aerobic exercise (public health dose); (v) 17.5 kcal/kg/week achieved in 5 days	HRSD, response and remission rates	The public health dose of exercise was more effective in reducing depression scores to a clinically acceptable level than the lower dose or the control condition. Frequency was not important

BDI, Beck Depression Inventory; CES, Center for Epidemiological Studies Depression Scale; CIS, Clinical Interview Schedule; DSM-III or IV, Diagnostic and Statistical Manual of Mental Disorders; HRSD, Hamilton Rating Scale; POMS, Profile of Mood States; RDC, Research Diagnostic Criteria; SCL, Symptom Checklist; SDS, Zung Depression Scale; SF-36, Medical Outcomes Survey Short Form.

Table III. Characteristics of randomized controlled studies on exercise interventions with problem drinkers or other substance abuse.

Authors and country of study	Study participants	Problem drinkers or substance misuse	Length of training	Comparison groups	Outcome measures	Results
Gary & Guthrie 1972, USA (50)	$n=20$, Male only, inpatient alcohol clinic	Problem drinkers	4 weeks	(i) Usual treatment plus running 5 ×week; (ii) Usual treatment	Schneider fitness, Jourard body Cathexis	↑ Fitness and self-esteem in exercise group only
Donaghy et al., 1991, Scotland (5)	$n=37$, Male only, outpatient alcohol clinic	Problem drinkers	8 weeks	(i) Aerobic 3 ×week, 30 min; (ii) Weight training 3 ×week, 30 min; ACSM guidelines followed for both exercise programmes	Est. max. VO_2, BDI Depression Inventory, Leeds Scale, strength and flexibility	↓ Anxiety and depression, and ↑ strength in both exercise groups change in fitness in aerobic group only
Anstiss, 1991, UK (52)	$n=166$, M, F, inpatient alcohol clinic	Problem drinkers	4 weeks	(i) Aerobic high-intensity 5 ×week; (ii) Aerobic low-intensity below training zone, 5 ×week	Unspecified fitness test, BDI Depression Inventory, STAI	↓ Depression in both groups; ↑ fitness in both groups, no between-group difference on VO_2 max, BDI, STAI, relapse rate, drinking behaviour or psychosocial functioning. Increased dropout in high-intensity exercise group
Donaghy M.E 1997, Scotland (53)	$n=117$, M, F, Outpatient and inpatient alcohol clinics Multi-site with four sites across Scotland 2 inpatient and 2 outpatient	Problem drinkers	3 weeks, + 12-week home-based programme	(i) Aerobic and strength exercise; group 3 ×week, 30 min; (ii) Stretching exercise group 3 ×week, 30 min	Est. max. VO_2, strength and flexibility, PSPP, BDI, Zung anxiety, 7-day, recall physical activity, Serum CDT, 1-, 2- and 5-month follow-up	At 1 month, ↑ strength, fitness, body condition, strength and self-worth in exercise group only; ↓ anxiety and depression both groups. At 2 months, ↑ fitness, strength, physical activity levels, body condition and strength in exercise group only ↓ anxiety and depression both groups, no between-group difference in abstinence levels; At 5 months, ↑ fitness maintained
Li et al., 2002, China (56)	$n=86$, Inpatients	Heroin Substance misuse	10 days	(i) Usual treatment; (ii) Qigong group-based, 25–30 min 4–5 times a day	Urine morphine, SESWS, HAS	For Qigong group versus both controls: ↓ withdrawal, anxiety, morphine
Palmer et al., 1995, North America (55)	$n=45$	Range of Substance misuse	4 weeks	(i) Weight strength training 30–40 min, 3 ×week; (ii) Aerobic exercise 30–40 min, 3 ×week; (iii) Circuit training 30–40 min, 3 ×week	Aerobic power, CES-D, skin-folds, resting pulse rate, blood pressure, strength	↓ Depression in strength group only

BP, blood pressure; Est. max. VO_2, estimated maximum oxygen consumption; LOC, locus of control; BDI, Beck Depression Inventory; STAI, Speilberger State and Trait anxiety inventory; CDT, Carbohydrate deficiency transferrin blood analysis; PSPP, Physical self-perception profile; CES-D, Centre of Epidemiological Studies – Depression; SESWS, Standard Evaluation Scale of Withdrawal Symptoms; HAS, Hamilton Anxiety Scale.

chance of showing any significant effects from the exercise, neither were the findings analysed on an intention-to-treat basis, with 35 participants excluded from analysis as they did not complete the programme. The other study used an intensive programme of Qigong over 10 days, although the analysis indicate a reduction in withdrawal and morphine use, the transferability of this type of programme outside of China may be limited (56). While these results are interesting the lack of consistency in the use of outcome measures and the small number of well designed RCTs limit the conclusions. However, we can say that there is unequivocal support that physical exercise regimens have a positive effect on aerobic fitness and strength if used as an adjunct in alcohol rehabilitation. The link between improvements in self-esteem and exercise with alcohol and drug rehabilitation is at this time equivocal. The evidence for exercise improving abstinence levels or controlled drinking levels is equivocal. The fitness benefits may be important for people attempting to change behaviour.

There are no longitudinal studies supporting the use of exercise as prevention in alcohol and drug addiction. Some large cross-sectional studies of adolescents have found a negative association between substance use and physical activity, whereas others have found no relationship, or have shown a negative relationship only in females or only in males. From this evidence, there appears to be a complex relationship between substance abuse and exercise, which is mediated by gender, personality, mode of activity and type of drug used (14).

Clinical guidelines and policy documents

In addition to the scientific literature key reports, clinical guidelines and policy documents promote the use of exercise for mental health. The United States Department of Health and Human Services and the Department of Health (57–60) highlight the links between exercise and mental health promotion. The National Institute for Clinical Effectiveness (NICE) guidelines for Depression (61,62) highlights exercise as an adjunctive treatment for mild and moderate depression. The recent Scottish Executive policy document Delivering for Mental Health (63) highlights exercise within its self-care management programme.

Do people with mental health problems want to exercise?

A survey by the charity Mind (64) found that 83% of people with mental health problems looked to exercise to lift their mood or to reduce stress with two-thirds indicating that it helped to relieve their depression; however, 58% did not know that some GPs can prescribe exercise. The GP exercise-referral schemes introduced in the late 1990s in the UK allow people with mental health problems to access exercise facilities in their local community. The commissioned report, "Up and Running" Treatment for Mild and Moderate Depression (65), came out strongly in favour of advocating exercise as a first-line treatment for depression and led to the production of posters and leaflets for distribution through GP surgeries. The findings outlined in the report, however, suggest that only 5% of the GPs surveyed consider exercise as one of their three most common treatment responses compared with 92% who would consider using medication.

How does exercise help in preventing and alleviating mental health problems?

The association between exercise and positive mood can be explained by physiological and psychological explanations. The increased blood flow to the brain stimulates the release of naturally occurring mood-enhancing chemicals known as endorphins; these natural opiates are similar to morphine and have been linked to the "runners high". Studies have demonstrated their presence in blood samples of people following exercise (13). This explanation, however, remains speculative, as we don't know if endorphins can cross over the blood–brain barrier. Animal studies have found that chemicals known to be depleted during depression – norepinephrine, dopamine and serotonin – are released during exercise (66). These neurotransmitters have been associated with elevating mood. Antidepressant medication such as Prozac works by boosting these chemicals. This may partially explain why exercise offers protection to depression and is effective as a treatment intervention. Exercise is known to increase levels of brain-derived neurotrophic factor (BDNF); this substance is associated with enhancing mood and helping the brain cells survive longer. This may also be linked to improved cognitive function (66). It has also been suggested that increased levels of phenylethylamine, a known stimulant in the brain occurring during exercise, is linked to the release of dopamine and endorphins, acting as a natural antidepressant. This has been evidenced by a rise in phenylacetic acid found in urine samples following exercise (67).

Explanations from psychology suggest links between exercise and physical self-perceptions such as body image, physical self-worth and self-esteem (12). The findings from the Mind survey support this explanation, with 50% stating that exercise

boosted their self-esteem. Planning and undertaking exercise allows setting and achieving goals, skill development, building self-confidence and it may also provide a mechanism for social support if exercising with others. The anxiety reduction effects of exercise have been linked to improved cardiovascular fitness reducing reactivity to and recovery from psychosocial stressors (11).

It has recently been suggested that exercise can influence brain plasticity and bring about changes by facilitating neurogenerative, neuroadaptive and neuroprotective processes (68). Currently the mechanism for this is not well understood but metabolic and chemical pathways among the brain, spinal cord and muscles offer plausible testable mechanisms. While agreeing with this, the author would argue that we have ignored the importance of emotions and feelings and their role in neuroadaptation. The human genome (the totality of our chromosomes) cannot account for the entire structure of the brain but it helps set the circuits in the older part of the brain (69). This part of the brain, which includes the brain stem, hypothalamus, limbic system and amygdala, is pre-set for survival ensuring we continue breathing, regulating our heartbeat and balancing our metabolism. Although pre-set, these circuits adapt with experience, ensuring that we can adjust to different environments across our lifespan. From early childhood, we learn about social conventions and ethical rules. These layers of new facts and experiences shape our behaviour leading to desirable decision-making strategies, increasing our chances of survival.

Studies have shown that we have reward circuits in the brain linked to the limbic system. Rewarding experiences release dopamine telling the brain "to do it again" (70). Memories associated with rewarding experiences are laid down in the cerebral cortex and are triggered by certain cues, which stimulate the recurrence of the behaviour. Thus the brain adapts over time to new experiences that are repeated. The sub-cortex or evolutionary part of the brain keeps us alive and helps us shape and change our behaviour as and when required (69). The cerebral cortex enables us to reason, make decisions, build and store knowledge. Our emotions and feelings are like a river with information continually flowing to ensure a concerted effort.

Recent research highlights how repeated abuse of illicit drugs or alcohol lays down memories that are difficult to diminish (70). These memories are triggered by cues associated with drug taking or drinking, increasing risk of relapse in addicts. Changing behaviour requires new pleasurable experiences to be repeated over time in order to rewire the circuits. Exercise has the potential to play a key role in this rewiring.

In summing up, exercise increases the blood flow to the brain. It stimulates the circuits in the sub-cortex resulting in increased heart rate, increased levels of cortisol and adrenaline. Regular exercise changes these pre-set circuits modifying the response to stress. This in turn lays down new associations in the cerebral cortex, which influences our thoughts, how we interpret situations, how we interact with our environment and the people within it. Through this mechanism of adaptation, regular exercise has the potential to influence other health behaviours such as alcohol and drug addiction, smoking and diet.

It has been argued that the benefits of exercise and mental health are likely to be best explained by an integrated theory that takes account of the biochemical physiological, psychological explanations (71). In doing so, the importance of the brain circuitry involved in emotions and feelings should not be ignored. The mind–body link is important in all of these explanations.

So are we really taking this evidence on board and what can we do to influence change?

Firstly, GPs need to shift their views about choosing exercise as a treatment option. In the UK, only 5% prescribed exercise as one of their three most common treatments for depression, compared with 92% who would prescribe anti-depressants (64). Why is this? Perhaps the idea that something as complex as the "mind" can be treated by something as simple as "exercise" is difficult for GPs, healthcare professionals and the public to accept. The 17th-century Cartesian view that the mind and body are separate entities may still pervade medicine today (69), resulting in the psychological consequences of disease being disregarded. There is a need to consider how exercise and the associated changes in the body relating to fitness and strength influence our emotions and feelings the somatopsychic response. By considering this response alongside the psychosomatic response, knowledge of how exercise can seriously impact on mental health may become evident.

What we need to do

There is a need to heighten awareness of GPs, physiotherapists, occupational therapists and exercise specialists on the benefits of exercise for people with mental health problems. We need to consider the training needs of those who deliver exercise programmes in the community at outpatients clinics and exercise-referral schemes. At this time, we do not know the optimum strategy to engage people

with depression or addiction problems into exercise. Research from exercise psychology with other populations (12) indicates that incorporating cognitive–behavioural techniques such as motivational interviewing, identification of barriers to exercise, goal setting, self-monitoring, contracting, social support and reinforcement are all likely to be beneficial if included into programmes. This needs to be evaluated with people with mental health problems to see whether it does increase adherence and maintenance to exercise and physical activity. Likewise, we do not know whether involving spouse or family in exercise will increase motivation and participation. The dose–response relationship is still not clearly defined, and while any type of exercise or physical activity undertaken regularly seems to be beneficial, using the public health dose as a guide and following the ACSM recommendations should be encouraged.

Conclusion

There is substantial evidence from longitudinal studies that physical activity and exercise offers protection from depression in adolescents, adults and older adults. This evidence has been gathered from different countries and with different populations. The preventative role in regard to alcohol and drug use appears to be more complex and less well established at this time. There is support for the use of exercise in the treatment of mild to moderate depression. The effect size is large and while this has to be tempered by the limitations of the methodologies one could argue that the findings across the studies are consistent in demonstrating a reduction in depression. In the context of alcohol and drug rehabilitation, exercise has the potential to encourage a healthy lifestyle, which is incompatible with substance misuse. It can provide valuable social support, and can enhance psychological well-being and coping skills. In both the treatment of depression and addiction, the benefits for mental health improvement and general health benefits are far greater than the health risks associated with remaining sedentary.

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