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Effects of Aerobic Exercise on Patients with Mental Illness in a Veterans Inpatient Psychiatric Unit: A Review of the Literature

John Allen McCash[1] & Sam Abraham[2]

[1] Battle Creek Veterans Affairs Medical Center, Battle Creek, Michigan, USA

[2] Bethel College School of Nursing, Mishawaka. Indiana, USA

Correspondence: Sam Abraham, Assistant Professor of Nursing, 1001 Bethel Circle, Bethel College School of Nursing, Mishawaka, Indiana, 46545, USA.

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Abstract

Mental illness continues to be a leading cause of stressor especially for veterans in the United States. These problems are affecting the role functioning and relationships. The purpose of this review was to explore extensive literature on the benefits of aerobic exercise that lead to non-pharmacological interventions to help patients who suffer from mental illness in a veterans hospital inpatient mental health unit. Patients admitted to inpatient mental health units have a diagnosis such as schizophrenia, bipolar disorder, major depression, or schizoaffective disorders. They should also meet the diagnostic criteria of suicidal or homicidal ideation. Sometimes it may be a veteran who is unable to care for self or needs medical supervision. Upon conclusion of the literature review, evidence has shown to provide significant data supporting the benefit of aerobic exercises.

Keywords: aerobic exercises, mental illness, veterans, inpatient mental health unit

1. Introduction

A review of the literature was conducted to investigate the benefits of introducing aerobic exercise to veterans in an inpatient mental health unit and the possibility of reducing symptoms of mental illness. The World Health Organization ([WHO], 2003) reports indicate that mental health is a growing issue worldwide, with more than 450 million people suffering from a mental illness. Schizophrenia and major depressive disorders are in the top 10 mental illness diagnoses (Oertel-Knochel et al., 2014) and is known to effect role functioning and relationships negatively for both the individual, loved ones, and society (Mojtabai, 2011). Exercise may help the veteran reduce symptoms of mental illness (Carter, Callaghan, Khalil, & Morres, 2012).

Aerobic exercise can be used to help reduce psychopathological or abnormal behavioral symptoms while improving cognitive ability in people with mental illness (Oertel-Knochel et al., 2014). Physical exercise has been shown to increase neurogenesis and develop neuroplasticity and therefore increasing cognitive functioning (Oertel-Knochel et al., 2014). Furthermore, aerobic exercise has been shown to increase the prevalence of important growth factors including glucocorticoids, brain-derived neurotrophic factor (BDNF), insulin-like growth factor-1 (IGF-1) and vascular endothelial growth factor ([VEGF], Oertel-Knochel et al., 2014). Growth factors such as VEGF are essential in the growth of new capillaries to increase neuroplasticity that positively affects cognitive ability and mood that will, in turn decrease the symptoms of mental illness. Many people suffer from mental illness and veterans are at high risk for mental illness (Pols & Oak, 2007).

Veterans are prone to mental health issues with exposure to combat, conflict, death, carnage, chronic pain, and separation from loved ones (Vazan, Golub, & Bennett, 2013). Participating in multiple acts that are threatening to one's life can potentially lead to mental health problems such as in the veterans (Pols & Oak, 2007). Aerobic exercise could help veterans better cope with their mental health disorders, be more productive in their lives, their relationships with others, and in the society.

Veterans on an inpatient mental health unit may benefit from regular aerobic exercise as an adjunct intervention to their therapy. On an inpatient unit, most of the veteran's day is filled with therapy, eating, and sleeping leading to a sedentary lifestyle. Physical exercise could be used as an intervention to distract the veteran and teach effective coping strategy for dealing with mental illness. Therefore, the purpose of this literature review was to explore extensive literature on the benefits of aerobic exercise that lead to non-pharmacological interventions, to help veterans who suffer from mental illness in an inpatient mental health setting.

2. Method

The searches involved using the databases of Elsevier Science Direct Freedom Collection, ProQuest Central, Gale Academic OneFile, Cengage Learning, ScienceDirect, and Springer Standard Collection to find the primary peer-reviewed research articles to examine for this review of the literature ([ROL], see Table 1). Keywords used to search the literature included a*erobic exercises; mental illness; veterans; and inpatient mental health unit.* This search resulted in 325 peer-reviewed articles. An analysis was conducted of the titles to consider for abstract review based on the preliminary assessment, and 297 articles were excluded. The abstracts were reviewed for inclusion criteria. Qualifiers included severe mental illnesses. An additional exclusion of 18 articles was executed in an effort to balance the representation of mental illness diagnoses because of an abundance of research in schizophrenia. This left the search results with 10 valid articles for review.

Table 1. Search strategy and limiters

Database Searched	Date of Search	Search Strategy and Limiters	Number of Articles Found	Estimate of Relevant Articles
Gale Academic OneFile	03/26/2017	Key words: Relationships between physical activity; Severe mental illness; Inpatient; Quality of life Limitations: Last 5 years; English; Peer-reviewed journals	16	2
Springer Standard Collection	02/19/2017	Key words: Severe mental illness; Client and clinician perspectives; Walking group Limitations: Last year; English; articles	28	1
ProQuest Agricultural & Environmental Science Database	03/28/2017	Key words: Effects of aerobic exercise; Mental illness; Intensity exercise; Preferred Limitations: Last 5 year; English; articles; Depression	36	3
Cengage Learning, Inc.	03/28/2017	Key words: Effects of aerobic exercise; Mental illness; Intensity exercise; Preferred Limitations: Last year; English; Articles; Physical activity	40	4
Cumulative Index to Nursing and Allied Health Literature (CINAHL)	01/27/2017	Key words: Exercise and mental health qualitative; Limitations: 2010-2016; Linked full text; Academic journals	20	4
ProQuest Central	03/28/2017	Key words: Mental health or illness; Aerobic exercise; Circuit training; Severe mental illness; Effects of aerobic exercise; Intensity exercise; Preferred Limitations: Last 5 years; English; Schizophrenia; Physical activity	85	6
Elsevier Science Direst Freedom Collection	03/28/2017	Key words: Mental health or illness; Aerobic exercise; Circuit training; Severe mental illness; Effects of aerobic exercise; Intensity exercise; Preferred Limitations: Last 5 years; English; Schizophrenia; Physical activity; depression	85	6
ScienceDirect (Elsevier B.V.)	03/28/2017	Key words; Effects of aerobic exercise; PTSD; Mental health; Promotion Limitations: Last year; English;	15	2

3. Findings

3.1 Methods and Designs of Studies

The findings from the review focused on 10 peer-reviewed articles. Frameworks of the reviewed articles were not specifically listed in the literature. However, the articles were found to be a collection of different methods and designs. Designs ranging from qualitative studies (Firth et al., 2016; McArdle, McGale, & Gaffney, 2012) to quantitative (Bonsaksen & Lerdal, 2012; Oretel-Knochel et al., 2014; Pfaff et al., 2014; Powers et al., 2015; Strassnig et al., 2015; Subramaniapillai et al., 2016; Toups et al., 2017) and a mix-method design (Browne, Mihas, & Penn, 2016). Methods found were exploratory (Bonsaksen & Lerdal, 2012; Browne et al., 2016; Firth et al., 2016), experimental (Oretel-Knochel et al., 2014; Strassnig et al., 2015; Toups et al., 2017), ethnographic (McArdle et al., 2012), prospective (Pfaff et al., 2014), pilot (Powers et al., 2015), and cross-sectional (Bonsaksen & Lerdal, 2012; Subramaniapillai et al., 2016).

3.2 Settings of Studies

The settings took place in multiple countries around the world. Studies were based in Norway (Bonsaksen & Lerdal, 2012), United States (Brown et al., 2015; Powers et al., 2015; Strassnig et al., 2015; Toups et al., 2017), Canada (Subramaniapillai et al., 2016), Australia (Pfaff et al., 2014), Germany (Oretel-Knochel et al., 2014), Ireland (McArdle et al., 2012), and the United Kingdom (Firth et al., 2016). Studies were conducted in different facilities. Some settings were inpatient based on a psychiatric unit (Bonsaksen & Lerdal, 2012; Oretel-Knochel et al., 2014), outpatient (Browne et al., 2016; Firth et al., 2016; Subramaniapillai et al., 2016; Toups et al., 2017), physical training facilities (McArdle et al., 2012; Strassnig et al., 2015), home-based (Pfaff et al., 2014), and other settings otherwise not noted or vague in description (Powers et al., 2015). While the samples were not vague, there were a variety of sample sizes and diagnoses that were included.

3.3 Sample Sizes of Studies

Studies included sample sizes from (N = 9) the smallest sample (Powers et al., 2015) to (N = 200) the largest sample of subjects (Pfaff et al., 2014) giving a mean sample size for the review of 64.2. Some studies had an even representation of male and female subjects while others had skewed numbers of males (McArdle et al., 2012) and females (Powers et al., 2015). Other sample focus was at the client and clinicians (Browne et al., 2016). Mental illness diagnoses were a focus of the sample groups for the reviewed studies, which included depression or major depressive disorder (MDD), anxiety, schizophrenia, bipolar disorder, and posttraumatic stress disorder (PTSD). Six of the articles were related to depression and MDD (Bonsaksen & Lerdal, 2012; Browne et al., 2016; McArdle et al., 2012; Oretel-Knochel et al., 2014; Pfaff et al., 2014; Toups et al., 2017) and one PTSD (Powers et al., 2015). Exercise as an intervention was found to be beneficial in six studies for treating mental illnesses (Firth et al., 2016; McArdle et al., 2012; Oretel-Knochel et al., 2014; Powers et al., 2015; Strassnig et al., 2015; Toups et al., 2017) along with other related subthemes.

3.4 Other Themes of Studies

Other major themes found in the reviews were preference such as exercise choice, exercise structure, and exercise length (Browne et al., 2016; McArdle et al., 2012; Subramaniapillai et al., 2016), which helped improve compliance in one study (McArdle et al., 2012). Another theme found is symptom severity (Bonsaksen & Lerdal, 2012; Firth et al., 2016; McArdle et al., 2012; Pfaff et al., 2014; Powers et al., 2015) and exercise was effective in reducing mental illness symptom severity in three studies (Firth et al., 2016; McArdle., 2012; Powers et al., 2015). Cognitive ability was a predominant sub-theme that was found as well and effectively treated with exercise (Oretel-Knochel et al., 2014; Strassnig et al., 2015).

3.5 Measurement Tools Used in Studies

Measurements of major variables were completed with some strategies that included multiple measurement tools. The Diagnostic and Statistical Manual is a tool that was used to measure the severity of depression (Pfaff et al., 2014). Other measurements of anxiety and depression were measured with the hospital anxiety and depression scale ([HADS], Bonsaksen & Lerdal, 2012). Depression measurements were conducted with the motivation energy inventory ([MEI], Bonsaksen & Lerdal, 2012) and Center for Epidemiologic Studies depression scale ([CES-D], Smith-Marek et al., 2017). Trauma was measured with the life event checklist for DSM-5 (LEC-5). Measures of cognitive training and performance were captured by using the brief assessment of cognition in schizophrenia (BACS), which would also be used to help measure items such as symbol coding (Oertel-Knochel et al., 2014). There were many other forms of measure and measurement tools found in the ROL that are listed in Table 2.

Table 2. Primary research for aerobic exercise and the effects on mental illness

Citation	Conceptual Framework	Design/Method	Sample/ Setting	Major Variables Studied and Definitions	Measurement of Major Variables	Data Analysis	Study Findings	Study strengths and weaknesses
Bonsaksen & Lerdal, (2012)	Self-reporting physical activity, depression, anxiety, and quality of life	• Quantitative Cross-sectional, correlational study • Exploratory	Sample N = 18 • Inpatient clients with severe mental illness • Male (n = 12) • Female (n = 6) • Mean age 43.7; SD = 13.3 Setting • DP OUH • Norway	• Exercise • Anxiety/Depression • Quality of Life • Functioning	GAF • Scale 0-100; 21-30 = severe problems • Measures Functioning • Divided into 2 sub-scales; symptoms and functional ability IPAQ • Measures the number of days where performance of strenuous, moderate, or walking activity and how long each day HADS • 14-item questionnaire measuring anxiety and depression • Likert scale; (0) = occasionally to (3) very often • Score range 0-21; > 11 = depression or anxiety; > 19 = mixed anxiety/depression BREF • 26-item quality of life questionnaire • Four domains: physical, psychological, social relations, and environment • 0-100 scale	• Bivariate relationship; Pearson's r • Linear regression analysis for self-reports	GAF • Symptoms: M = 33.9 • Functioning M = 34.6 IPAQ • (n=4; 22%) Strenuous activity, (n=9; 50%) moderate activity, (n=15; 93.3%) walking HADS • Anxiety M = 10.5; SD = 4.9 • Depression M = 10.3; SD = 4.6 BREF • Total M = 50.2; SD = 18.5	Strengths: • Used multiple validated tools for data • 18-month study • Risk was low Weakness: • Quality of evidence is questionable • Small sample • One setting No follow up
Browne et al. (2016)	An exploration of client and clinician perspectives on exercise and possible barriers with focus on walking groups	• Mixed-method Design • Focus groups of clients and clinicians	Sample N = 26 • Clients (n=12) • Diagnosed with schizophrenia, bipolar, or major depression	• Exercise • Barriers • Walking group • Incentives to exercise	Client questionnaire • Rate their activity, comfort with pedometer, and walking group Clinician questionnaire	Questionnaire • Two raters to read transcript, code data, decipher any substantive differences • Multiple	Exercise • both identified similar reasons to exercise • differing views of the client's	Strength: • Perspective of both clinician and client • Use of feedback to solidify interest in

			• Ages 25-50; M = 39.7; SD = 7.7 • Clinicians (n=14) • Master's level social workers • Ages 24-55; M = 37.3; SD = 10.1 Setting • Outpatient clinic in two cities South Eastern state	• How active clients are, is there a need for feasible exercise, would refer to walking group Focus groups examining • exercise, barriers, incentives, and attitudes about walking groups • All ratings used a Likert scale for feedback; (1) not at all to (5) very	choice questions	activity level • Differing view on the reason to exercise (client=better mood, clinician=transportation) Barriers • Client same as to public motivation • Clinician believes symptom related Walking group • Highly interested (Both) Incentives to exercise Social interaction, tangible motivation (pedometer),	walking program • Low risk • Feasible to use in practice Weakness: • Low sample N • Only one facility • 4-month duration = limited time
Firth et al. (2016)	Qualitative method to discuss incentives, barriers, and opinions to exercise and optimal interventions	• Exploratory-descriptive of the iBeep feasibility trial • 10-week intervention • Achieve ≥ 90 min of moderate-to-vigorous activity each week • Follow up interviews	Sample: N=19 interviewees • (n=9) interviews immediately post program • (n=10) interviews at 6-month follow up • (n=6) subgroup follow up of both immediate and 6-month • Recruited from EIP services in Greater Manchester, UK Setting: • Community leisure schemes' • Commonplace throughout the UK	• Individuals in early stages of psychosis • Which exercise was of benefit or hindered psychosis • Exercise	Semi-structured interviews • Discuss incentives and barriers to exercise • Short and long term effect • Opinions on optimal interventions • Topic guides • Interviews conducted by different RA than participated in exercise	• Thematic analysis to derive themes • Applied the five stages of qualitative analysis (FSQA) • Re-read • Generated codes and indexed • Determine prevalent themes • Internal homogeneity and external heterogeneity, similar themes determine links • Themes analyzed for sub-themes	• Length of time of exercise: M = 119 min. of moderate to vigorous exercise Three overarching themes • Exercise alleviating psychiatric symptoms • Improved self-perception • Factors determining exercise participation	Strengths: • Longitudinal study with interviews right after intervention and 6 months later • Use of different RA's to do interviews than did exercise • FSQA • Subject perspective of quantitative research Weakness: • Study from one area limiting culture • 92% male

McArdle et al. (2012)	Qualitative methods to document the experiences of participants of the BTN portion of the pilot study	• Ethnographic research/ Interviewing participants post BTN intervention	Sample: N=15 • (n=9) focus group • (n=6) individual phone interview • Men ages 18-40 Setting: • Ireland	• Men not seeking help from formal health care for psychological distress • Feeling of enjoyment • Mastery • Positive affect • Teamwork • Problem solving	Researcher developed topic guide • Group discussion • Asked number of questions, open-ended Further development of questions • Individual phone interview • More topics that researchers felt warranted from groups Overall topic guide • Covered 5 topics related to BTN	• Investigator triangulation to reduce bias • Interpretive thematic analytic approach • Member checking post data collection for clarification with subject • Audio recording of group discussions and individual interviews • First and second author independently analyzed data	Core structural features: • Cooperative ethos; Participants felt comfortable in the environment. Less competitive than anticipated. • Woven modalities; The health promotion of CBT was integrated into the sport of football, less perceived stigma Impact of a combined exercise/CBT program on participants' experiences: • Therapeutic experience; Having the "craic" or good enjoyment with the lads • Anticipation to going to event was good • Increased self-care, better time management, increase in pleasant • A feeling of respite from daily life • Able to use group as a means to talk Extended impact • Disappointment that program ended at 10 weeks • Participants	Strength • Central ideas of importance: Emphasizing cooperation, cooperation instead of competition, longer sessions (>55min), different times for group talk Weaknesses • Small sample with only completers of the BTN program • Possible positive bias • Weakness/ Strength: • Coach was a key aspect to the program success

Oertel-Knochel et al. (2014)	• To understand the effects of exercise across disease groups, understand disease specific versus general or overlapping effects of physical training	• Quantitative method • Experimental design • 4 weeks	Sample N=51 • inpatients • MDD (n = 22); male (n = 11); female (n =11) • Schizophrenia (n = 29); male (n = 12); female (n = 17) • Cognitive and physical exercise (n = 16) • Cognitive and relaxation (n = 17) • Waiting control group (n = 18) Setting • Frankfurt, Germany • DP GUF	Independent • Aerobic activity • Cognitive training • Relaxation Dependent • Cognitive performance • IP • Waiting group (control group)	Cognitive performance TMT A • Psychomotor speed BACS SC • Assessment of cognition r/t symbol coding WMS-III SS • Working memory and spatial span • LNS HVLT-R • Fluency: animal naming and verbal learning BVMT-R • Visual learning STAI • Measuring state anxiety • 20 item test • Subjects instructed to rate anxiety • to rate anxiety with scores ranging from 20-80; higher score = higher anxiety SF-12: PSK • Mental health subscale • Score; 0 = low subjective health, 100 = high subjective health PANSS • Semi structured interview • Measurement of psychosis symptoms	Anxiety • 4-point Likert scale LNS; WMS-III SS; TMT A; BACS SC; HVLT-R; BVMT-R; STAI • ANCOVAs SF-12: PSK • Nonparametric Wilcoxon test	Speed of Processing • Increased in all groups (Time: F (46) =37.55; p < 0.001) Working Memory • Decrease in MDD but increase in all other groups (Intervention group: F (46) = 10.32; p = 0.02) Verbal Learning • Increased in all groups (p > 0.05) Visual Learning • (F (46) = 9.53; p = 0.004) STAI • Time (F (46) = 6.06; p = 0.02) • SF-12 • (Time: F (46) = 18.62, p < 0.001) • BDI II • Depressive symptoms (F (19) = 24.10; p < 0.001) • PANSS Negative (F (26) = 8.34; p = 0.02) • PANSS Positive no change (p > 0.05) • Power analysis: high effect for visual learning (d = 0.91) for exercise; low effect for joined other sports to keep activity and socialization	Strengths • Multiple Valid assessment tools • Control group • Multiple groups comparing different approaches for Tx • Low risk of harm • Feasible in practice Limitations • Short intervention period • Use/Changes of medications skew findings • Use of PANSS (clinician use) and BDI II (subjective info) then comparing the two different diseases with different scales

							verbal learning (d = 0.18-0.24) for waiting group	
Pfaff et al. (2014)	• Focus on decreasing depressive symptoms of older adults	• Randomized controlled trial • Prospective, two group parallel • 12-week home-based program to meet guidelines for people 65 and older • Monitored for 52 weeks	Sample: • N=200 adults ≥ 50 years of age suffering from a clinically depressive illness • Usual care (n=92) • Exercise program (n=108) Setting: • Community-based • Perth-metropolitan region of Western Australia	• IV=Usual medical care plus physical activity • DV1=Severity of depression • DV2=Change in physical activity • Control=usual care	Telephone assessment • Interview subjects throughout the 52 week program DSM-I Axis I diagnoses • MADRS/SIGMA • Measure severity of depression • Sensitive to change with antidepressant treatment • 10 item CHAMPS questionnaire • Measure physical activity in older adults Timed chair • Simple measurement of lower limb function	SCID-I • Used to make all major DSM-IV Axis I diagnoses • Cross-tabulation • Intention-to-treat analysis • ANOVA • Pearson product-moment correlations • Paired sample t test	SIGMA: • F(2,196) = 1.394, p = 0.280; (r • R = -0.115, n=78, p = 0.318 Paired t test: • Timed chair stand; Baseline: 13.51(2.45); week 12: 11.89(2.07); p Value: <0.001 • History of depression: P value: 0.862 • SCID-I: P value: 0.679	Strengths: • Exploration of convenient home-based program • Showed that the program did not work • Guidelines for future studies and what not to do Weaknesses: • Unsupervised intervention • Focused on one age group (≥ 50 years old) • Lack of ongoing motivation for the subjects • Failure to collect objective data from the control group
Powers et al. (2015)	• Theory that BDNF levels corollate with maintenance of PTSD symptoms	• Pilot quantitative intervention study • 12 weekly sessions	Sample: N = 9 • Male (n=1) • Female (n=8) • Ages 18-65 M age = 34 • Diagnosed with PTSD Setting: • Dallas area	• Exercise group (control) • Exercise + acute bout of exercise prior to exercise (Intervention) • BDNF • Symptom severity	Blood draw • Determine plasma BDNF levels • Measured prior to first session and immediately after last session PSSI • PTSD symptom scale • Clinician rated • Assessed at baseline, prior to each session, and at posttreatment • 17 item interview, scale of 0-3, score	ELISA kit • Analyzed plasma BDNF • Likert scale	BDNF: • Exercise group: Pretest M = 1.77 and Posttest M = 1.75 • Exercise +: Pretest M = 1.38 and Posttest M = 3.73 PSSI: • Exercise group: Pretest M = 37.00 and Posttest M = 8.25	Strengths: • Tracking of plasma BDNF levels • No report of dropouts • Using a physiological biomarker for identification of PTSD symptom control Weaknesses: • Pilot study

					range 0-51; higher score = more severe PTSD		• Exercise +: Pretest M = 42.00 and Posttest M = 5.20	• Small sample • Only 12 sessions • Low generalization
Strassnig et al. (2015)	• Study to focus on changes in ADL abilities • Self-care deficit nursing theory (Orem, 2001)	• Quantitative, Quasi-Experimental Research • 8-week study of patients with schizophrenia and bipolar to study acceptance and feasibility of high velocity circuit training	Sample: N=12 • Male (n = 9) • Female (n = 3) • Overweight/ Obese • Bipolar (n=3) • Schizophrenia (n=9) • Ages 18-75 Setting: • State of the art training facility at UMMSM • Community dwelling	• PNSS/Bipolar Strength • 1RM Power • Rated by the highest value of repetitions and loading conditions Anthropometric measures • Measurements of the body composition Physical function and ADL assessments • Ability to complete ADL tasks and have physical ability of gait, balance, and lower extremity function	PNSS • Positive, negative, and general schizophrenic symptoms • Used to gather baseline of positive and negative schizophrenic symptoms BACS • assessment of cognition • Verbal memory, digit sequencing, verbal fluency, symbol coding, composite scores • Used shortened version to reduce time CDS • Measurement of depression SPPB • Function and performance of ADL assessment • Examine lower extremity performance, e.g., rise from chair performance PFP-10 • Measurement of upper extremity strength and flexibility, lower extremity strength, balance, coordination Strength • 1RM • Power tested at 30% to 90% of 1RM load, • Perform as quickly as possible	Paired t-test • NSC • CDS • BACS • CGI ANOVA • Neuromuscular • BC • DFV Significance • P value set at 0.05 • Effect size n2 computed for all variables	Strength • 1RM, Chest press: (p = 0.008; F = 10.481; n2 = 0.488) Power • Leg extension: (p = 0.003; F = 14.50; n2 = 0.569) BAC T scores • Composite: Pretest: 32.3 to Posttest: 35.4; (t = -3.3; df = 11; p = 0.008) • Effect size: d = 0.48 PNSS T scores • Total: Pretest: 58.6 to Posttest: 54.3; (t = 2.5; df = 11; p = 0.03) CDS T scores • Pretest: 4.8 to Posttest: 3.2; (t = 2.6; df = 11; p = 0.025)	• Evidence was valid but no control group, small sample size, and lack of intention to treat analysis. • scores on PNSS and depression or CG may be biases • Need for scale that is appropriate for a younger age group for • No dietary monitoring or interventions • Need for longer training period • More days/wk

Subramaniapillai et al. (2016)	• Assess if schizophrenic client physical activity preference differ from the bipolar disorder client • Summarize the physical activity design preferences	• Quantitative cross-sectional	Sample: N=173 • Schizophrenia (n=113) • Bipolar disorder (n=60) Setting: • Centre for Addiction and Mental Health in Toronto, Canada	• Major diagnoses of schizophrenia and bipolar Two-part questionnaire • Personal preferences • Preferred program structure	Stages of change algorithm • Self-characterization of physical activity MINI • Confirmed diagnoses • Descriptive statistics: percentages Physical activity questionnaire short form • Two part: Preferences; Preferred structure of exercise • How much moderate to vigorous intensity completed in the last week	• Chi square analysis • Median split	Diagnoses: • 66.4% schizophrenia; 30.7% schizoaffective; 2.1% psychosis NOS; Bipolar: 36.7% bipolar I; 60.0% bipolar II; 3.3% bipolar NOS Chi square: • No significant differences Stages of changes: • Schizophrenia: 48.7% preparation stage • Bipolar: 33.3% preparation stage	Strength: • Gaining client perspective • Approved by research and ethics board at the University of Toronto, • Specific questions to add quantitative data Weaknesses: • Questions were narrowed with no room for elaboration of preferences • Need for more research to strengthen findings • Only two mental illnesses screened
Toups et al. (2017)	• Evaluated the effect of exercise on positive valence symptoms of MDD as part of the TREAD program for clients taking a stable dose of SSRI	• Experimental • 12-week • Exercise program	Sample: N=119 • High dose (n=119); female (84.5%) • Low dose (n=61); female (78,7%) Setting: • Cooper Institute in Dallas, TX for initial two weeks • Remaining program at home	• Valence symptoms • MDD severity • Baseline level of fitness • Inventory of depression symptomatology	SHAPS • Measuring positive valence symptoms • Used to evaluate the effect of exercise on MDD • Score > 2 = clinically abnormal MEI • Measuring positive valence • Used to evaluate effect of exercise on MDD • Measure: physical energy, mental energy, social motivation • 27 item, scored 0-6, range 0-162 and higher score = higher energy and motivation QIDS	• ROC analysis • Likert Scale • SAS PROC MIXED • Spearman's correlation • Path analysis • Cross-lagged panel model using MPLUS Version 7.3 • Significance 0.05	Baseline level of fitness: • Episode/Month: All mean = 81.5(96.8) • MEI total score: All mean = 34.7(14.4) • SHAPS total score: All mean = 3.1(3.0) Post intervention: • SHAPS at 6 weeks: All mean total = -0.81 = 2.29 total • MEI at 6 weeks: All mean total = 9.96 = 44.66 total • SHAPS at 12 weeks: All	Strengths: • 12-week study • Showing significant improvement in depression • Supports the use of TREAD Weaknesses: • Exclusion of many clients that suffer from MDD • Already stable on SSRI • No power analysis • Low generalization

		• Measurement of overall MDD severity	mean total = -1.19 = 1.91total • MEI at 12 weeks: All mean total = 16.08 = 50.78 total P-value for All at week 12 = 0.054

Note: Activities of Daily Living (ADL); Back of the Net (BTN); Body Composition (BC); Brief Assessment of Cognition in Schizophrenia (BACS); Brief Assessment of Cognition in Schizophrenia: Symbol Coding (BACS SC); Center for Epidemiologic Studies Depression Scale (CES-D); Community Healthy Activities Model Program for Seniors (CHAMPS); Clinical Global (CG); Cognitive Behavior Techniques (CBT); Calgary Depression Scale (CDS); Daily Function Variables (DFV); Department of Psychiatry (DP); Five Stages of Qualitative Analysis (FSQA); Germany (GER); Global Assessment of Functioning Scale (GAF); Goethe-University, Frankfurt (GUF); High Velocity Circuit Resistance Training (HVCR); Hospital Anxiety and Depression Scale (HADS); Inventory of Depression Symptomatology-Clinician Rated (IDS-C); Inventory of Depression Symptomatology-Self-Rated (IDS-SR); Investigating the Benefits of Exercise in Early Psychosis (iBeep); Individual Psychopathology (IP); International Physical Activity Questionnaire (IPAQ); Life Event Checklist for DSM-5 (LEC-5); Letter Number Span (LNS); Montgomery-Asberg Depression Rating Scale (MARDS); Medical Research Council (MRC); Mechanical Power (MP); Major Depressive Disorder (MDD); Mini International Neuropsychiatric Interview (MINI); Motivation and Energy Inventory (MEI); Non-completers (NC); Oslo University Hospital (OUH); One-repetition maximum (1RM); Patient Health Questionnaire (PHQ-9); Positive and Negative Symptom Score (PNSS); Posttraumatic Stress Disorder (PTSD); PTSD Symptom Scale-Interview (PSSI); Post Traumatic Stress Disorder Checklist (PCL-5); Power/1RM exercise include: Leg extension, chest press, overhead press, calf raise, lat pulldown, leg curl; Physical Functional Peromance-10 (PFP-10); Quality of Marriage Index (QMI); Quick Inventory of Depression Symptomatology (QIDS) Quick Inventory of Depression Symptomatology-Clinician (QIDS-C); Quick Inventory of Depression Symptomatology-Self-Rated (QIDS-SR); Receiver Operating Characteristic (ROC); Research Assistant (RA); Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I); Short Physical Performance Battery (SPPB); Snaith Hamilton Pleasure Scale (SHAPS); Symptoms and Cognition (SC); Total (T); Treatment with Exercise Augmentation for Depression (TREAD); Trial Making Test (TMT); Treatment (Tx); United Kingdom (UK); University of Miami Miller School of Medicine (UMMSM); World Health Organization Quality of Life (BREF)

3.6 Diagnosis Specific Information

Mental illness is a debilitating diagnosis that effects much more than the person's psyche but also the person's social abilities, loss of autonomy, and job-related problems (Oretel-Knochel et al., 2014). Exercise was found to be a very effective activity that positively influenced participants' mental health among those with the diagnoses of depression (Bonsaksen & Lerdal, 2012; Browne et al., 2016; McArdle et al., 2012; Oretel-Knochel., 2014; Toups et al., 2017), anxiety (Bonsaksen & Lerdal, 2012; Oretel-Knochel., 2014), schizophrenia disorders (Browne et al., 2016; Firth et al., 2016; Oretel-Knochel., 2014; Strassnig et al., 2015; Subramaniapillai et al., 2016), Bipolar (Browne et al., 2015; Strassnig et al., 2015; Subramaniapillai et al., 2016), and PTSD (Powers et al., 2015). There were significant improvements in subjects who suffer from schizophrenia disorders (Firth et al., 2016; Oretel-Knochel., 2014; Strassnig et al., 2015; Subramaniapillai et al., 2016). Positive (hallucinations and paranoia) and negative symptoms (amotivation and anhedonia) in schizophrenic subjects were shown to have symptom relief related to the intervention of exercise (Firth et al., 2016). Improvements in speed processing, working memory, verbal learning were found as a result of physical exercise and or relaxation therapy (Oertel-Knochel et al., 2014). High-velocity circuit resistance training (HVCR) can be beneficial for those who suffer from schizophrenia as well. HVCR improved the neuromuscular performance of subjects in an eight-week program. This program also had positive outcomes in cognitive scores including verbal memory, symbol coding, and verbal fluency addressed by the brief assessment of cognition (Strassnig et al., 2015). Depression was found to be relieved by the introduction of exercise as an intervention (Browne et al., 2016; Oretel-Knochel., 2014;

Toups et al., 2017) and as an opportunity for socialization (McArdle et al., 2012).

Two studies dedicated to depression found opposite results with the intervention of exercise. Both studies were not located in an inpatient unit. One study was focused on an age group that was 50 years of age and greater and solely based at the subject's home (Pfaff et al., 2014). While the other study that had more positive results were using an age group ranging from 18-70 years of age, was well supervised in a training facility for the initial two weeks, and then continued the intervention at home (Toups et al., 2017). Subjects did poorer with the intervention solely in their home and supervision from a booster telephone call. The lack of observation perhaps led to the lack of intensity of the exercise interventions, which may have had an impact on the results. However, exercise was shown to have improvements in motivation as well as depressive severity that led to better social motivation for subjects (Toups et al., 2017). The exercise was also found to be beneficial in the enhancement of functioning and cognitive abilities (Oertel-Knochel et al., 2014; Strassnig et al., 2015).

The highest results of cognitive improvements and positive mood alterations were found in studies that had the usage of a facility with a directed program (Oertel-Knochel et al., 2014; Strassnig et al., 2015). This would include the use of on staff researchers, coaches, and physiologists to help encourage subjects to exert proper energy and complete the entire workout for the day (Oertel-Knochel et al., 2014; Strassnig et al., 2015). Programs were organized at clean state-of-the-art athletic facilities, which the subjects stated helped them continue the program (McArdle et al., 2012; Strassnig et al., 2015). The structured physical activities at a training facility (McArdle et al., 2012; Strassnig et al., 2015; Toups et al., 2017) and in an inpatient setting (Oretel-Knochel et al., 2014) were found to be more effective than the unobserved home-based programs (Pfaff et al., 2014).

Outcomes of the research were positive for the promotion of exercise as an intervention for mental illness (Firth et al., 2016; McArdle et al., 2012; Oretel-Knochel et al., 2014; Powers et al., 2015; Strassnig et al., 2015; Toups et al., 2017). The act of physical fitness showed a multi-layered positive effect for people who suffer from mental illness. There was an increased sense of well-being as well as an increased motivation for social interaction and a sense of excitement for the activity and increase in self-perception (Firth et al., 2016; McArdle et al., 2012; Oretel-Knochel et al., 2014; Powers et al., 2015; Strassnig et al., 2015; Toups et al., 2017). Exercise, in particular, aerobic exercise, can influence the BDNF plasma levels in the body and have a profound positive impact on PTSD symptom management (Powers et al., 2015). Other factors that influence a better quality of life were an increase in cognitive skills including working memory, verbal learning, and visual learning in subjects with schizophrenia (Oertel-Knochel et al., 2014). Exercise lowered symptoms of depression and anxiety while increasing daily functioning abilities even in inpatient adults with severe mental illness (Bonsaksen & Lerdal, 2012). Other important outcomes are subject perspectives of the intervention and their perceived barriers to exercise (Browne et al., 2016). Some subjects found that exercise was very useful in relieving them of their daily stressors and looked forward to the activity (McArdle et al., 2012). While others in the early stages of psychosis found exercise therapeutic to their symptoms (Firth et al., 2016).

4. Discussion

Aerobic exercise is a beneficial intervention for people who suffer from mental illness and veterans are prone to mental health disorders with exposure to combat situations and high-stress environments (Pols & Oak, 2007). Aerobic exercise was shown to have improvements in cognition and symptom management. Exercise as an intervention for veterans' post-military with acute mental health symptoms may show decreased severity of symptoms and may also reduce the frequency of acute exacerbations of chronic symptoms.

Exercise improves plasma levels of BDNF that aids in symptom management of PTSD, which is a rising mental health symptom of veterans who are returning from combat areas (Pols & Oak, 2007). Mental health complications and symptoms are better controlled with the introduction of aerobic excise. The increased physical activity helps increase neuroplasticity helping the veteran in an acute mental health setting gain increased physiological pathways for increased neurological growth versus only using medication and therapy. Exercise can be used as a coping skill to help treat mental illness. An additional factor found to help motivate veterans to exercise was whether they were being cared for in an inpatient or outpatient setting.

The most beneficial setting in promoting active engagement in aerobic exercise was inpatient units with coaches. Coaching veterans in the inpatient mental health setting may be effective in increasing participation and gaining their feedback for program improvements. Veterans receiving mental health care may benefit from alternative therapies that help increase their level of healthy activity. Guidance to help combat the tendency for a sedentary lifestyle and antipsychotic medications increases susceptibility for weight gain as they can lead to other physical complications such as cardiovascular disease.

5. Limitations

There were various limiting factors found in the reviewed studies. One of which was small sample sizes with a mean sample size of 63.3. Other limiting factors found were low generalization with interventions taking place at one facility. Some studies were skewed with a dominant presence of one sex in the study. Positive bias was found in a feedback study post intervention with a qualitative study and inclusion of only the completers of the intervention. Other interventions included the non-supervised approach to implementation leading to skewed data and non-compliance.

6. Clinical Implications

Staff can implement exercise as an intervention for patients in an inpatient mental health setting. Appropriate assessments, facility, and clearance from providers will be necessary to ensure safety for staff and patients. Staff can designate aerobic exercise as part of the veteran's treatment plan as they progress through the acute mental illness state to recovery. This would be most effective if led by a program supervisor to facilitate the exercise activities for the inpatients. The benefit for the veteran who participates could be lifelong, as exercise is a relatively inexpensive, learned intervention that they can continue as an outpatient.

7. Recommendations for Further Research

Further research would benefit with the exploration of aerobic activity and its effect on veterans in the inpatient setting through to the outpatient setting. Staff researchers and veterans would benefit from the retrieval of data from veteran patients that are admitted into the inpatient mental health setting and are introduced to aerobic activity as an aspect of their treatment plan. It will be beneficial to follow their progression through to recovery and compare with a control group of usual mental health recovery care. Researchers could continue the study into the outpatient setting and monitor the rates of return to the acute mental health setting between the intervention and control group to identify if the intervention group has an improved level of mental health recovery as compared to usual care.

8. Conclusion

Aerobic exercise is highly recommended for patients in the inpatient setting. This would be an intervention that could aid the veteran in mental health symptom management as well as physical symptoms that may accompany the disorder. Increases in activity would have a positive effect on the veteran's relationships and socialization opportunities. The veteran will be more apt to learn positive coping skills with exercise that is inexpensive and may reduce the chance of using substances to self-medicate (e.g., alcohol) and deter them from treatment.

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