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

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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 neuropsychiatric 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 neuropsychiatric 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 aerobic 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

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

<table>
<thead>
<tr>
<th>Citation</th>
<th>Conceptual Framework</th>
<th>Design/Method</th>
<th>Sample/ Setting</th>
<th>Major Variables Studied and Definitions</th>
<th>Measurement of Major Variables</th>
<th>Data Analysis</th>
<th>Study Findings</th>
<th>Study strengths and weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonsaksen &amp; Lerdal, (2012)</td>
<td>Self-reporting physical activity, depression, anxiety, and quality of life</td>
<td>Quantitative Cross-sectional, correlational study</td>
<td>Sample N = 18</td>
<td>Exercise, Anxiety/Depression, Quality of Life, Functioning</td>
<td>GAF</td>
<td>Bivariate relationship; Pearson’s r</td>
<td>Linear regression analysis for self-reports</td>
<td>Strengths: Used multiple validated tools for data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Exploratory</td>
<td>Inpatient clients with severe mental illness</td>
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<td></td>
<td></td>
<td>Weakness: Quality of evidence is questionable</td>
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<td></td>
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<td></td>
<td>Male (n = 12)</td>
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<td></td>
<td>Small sample</td>
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<td>Female (n = 6)</td>
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<td>One setting</td>
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<td>Mean age 43.7; SD = 13.3</td>
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<td>No follow up</td>
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<td>Norway</td>
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<td>Browne et al. (2016)</td>
<td>An exploration of client and clinician perspectives on exercise and possible barriers with focus on walking groups</td>
<td>Mixed-method Design</td>
<td>Sample N = 26</td>
<td>Exercise, Barriers, Walking group, Incentives to exercise</td>
<td>GAF</td>
<td>Symptoms: M = 33.9</td>
<td>Functioning M = 34.6</td>
<td>(n=4; 22%) Strenuous activity, (n=9; 50%) moderate activity, (n=15; 93.3%) walking</td>
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<tr>
<td></td>
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<td>Focus groups of clients and clinicians</td>
<td>Clients (n=12)</td>
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<td>Diagnosed with schizophrenia, bipolar, or major depression</td>
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</table>

**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

**Weaknesses:**
- Quality of evidence is questionable
- Small sample
- One setting
- No follow up
- 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

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

Semi-structured interviews
- Individuals in early stages of psychosis
- Which exercise was of benefit or hindered psychosis
- Exercise

Thematic analysis to derive themes
- Applied the five stages of qualitative analysis (FSQA)
- Re-read
genrated codes and indexed
- Determine prevalent themes
- Internal homogeneity and external heterogeneity, similar themes determine links
- Themes analyzed for sub-themes

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
- Men not seeking help from formal health care for psychological distress
- Feeling of enjoyment
- Mastery
- Positive affect
- Teamwork
- Problem solving
- Sample: N=15
  - (n=9) focus group
  - (n=6) individual phone interview
  - Men ages 18-40
  - Setting: Ireland
- 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 competitiveness, longer sessions (>55 min), 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
To understand the effects of exercise across disease groups, understand disease specific versus general or overlapping effects of physical training.

Oertel-Knochel et al. (2014)

Sample N=51
- 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 group (control group) (n = 18)

### Independent
- Aerobic activity
- Cognitive training
- Relaxation
- Cognitive performance
- IP
- Waiting group (control group)

### Dependent
- 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

### 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 medication skew findings
- Use of PANSS (clinician use) and BDI II (subjective info) then comparing the two different diseases with different scales

### Quantitative method
- Experimental design
- 4 weeks
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-metro politan 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 • Cross-tabulation • Intention-to-treat analysis • ANOVA • Pearson product-moment correlations • 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 correlate 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 • 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

verbal learning ($d = 0.18-0.24$) for waiting group

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range 0-51; higher score = more severe PTSD

- Exercise +:
  - Pretest M = 42.00 and Posttest M = 5.20
- Small sample
- Only 12 sessions
- Low generalizability

Strassnig et al. (2015) study to focus on changes in ADL abilities. Self-care deficit nursing theory (Orem, 2001)

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

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

- Quantitative, Quasi-Experimental Research
- 8-week study of patients with schizophrenia and bipolar to study acceptance and feasibility of high velocity circuit training

- Study to focus on changes in ADL abilities
- Self-care deficit nursing theory (Orem, 2001)

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: d
  - BACS: 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)

BAC T scores
- Composite: Pretest: 32.3 to Posttest: 35.4; (t = -3.3; df = 11; p = 0.008)
- Effect size: d = 0.48

Evidence was valid but no control group, small sample size, and lack of intention to treat analysis.

Score on PNSS and depression or CG may be biases

Need for scale that is appropriate for younger age group for

No dietary monitoring or interventions

Need for longer training period

More days/wk
Subramanipillai et al. (2016)

- Assessed if schizophrenia client physical activity preference differs from the bipolar disorder client
- Summarized the physical activity design preferences

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: percentage
- 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

Strength:
- Gaining client perspective
- Approved by research and ethics board at the University of Toronto,
- Specific questions to add quantitatively
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

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
- 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/Mood: All mean = 81.5 (96.8)
- MEI total score: All mean = 34.7 (14.4)
- SHAPS total score: All mean = 31.3 (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
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 (Oretel-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 (Oertel-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; Oertel-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; Oertel-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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