

Evaluation of a High Intensity Interval Training (HIIT) Program for Military Personnel Receiving Inpatient Treatment for a Substance Use Disorder

Mikayla Soli
Rhonda Nelson

Abstract

This study aimed to evaluate a high intensity interval training (HIIT) program delivered in an inpatient treatment setting serving military personnel. This recreational therapy (RT) program assessed the impact of a single session (60-minute) HIIT program on participant affect and state-anxiety. Using a single-group pretest-posttest design, 58 data sets were collected from participants ($N = 20$). Results indicated an increase in positive affect ($z = -6.52, p < .001$), a decrease in negative affect ($z = -2.64, p < .01$), and a significant reduction in anxiety, $t(57) = 1.99, p = .05$ following the intervention. The program also resulted in a significant elevation in heart rate, $t(57) = -25.89, p < .001$ with most participants reaching moderate to high intensity physical activity levels. On a scale of 1–10, participants rated their likelihood of participating in HIIT post-discharge at 6.28 ($SD = 2.43$). Additional qualitative data provides valuable insight on the perceived benefits to participants and offers suggestions for future program development and research in this area.

Keywords

Exercise, high intensity interval training, mental health, military personnel, recreational therapy, substance use

Mikayla Soli is an advisor for the Edson College of Nursing and Health Innovation at Arizona State University.

Rhonda Nelson is an assistant professor in the Department of Occupational and Recreational Therapies at the University of Utah.

Please send correspondence to Mikayla Soli, mpardinas4@gmail.com



The American Therapeutic Recreation Association is pleased to offer readers of the *Therapeutic Recreation Journal*, opportunities to earn CEUs through the journal. By reading the articles and successfully completing a post-test (70% or higher), readers have the opportunity to earn .1 CEU/article.

Quizzes can be accessed through the following link: <https://www.pathlms.com/atra/courses/34150>.

Any questions regarding the quizzes and CEUs should be directed to info@atra-online.com.

Introduction

Substance use disorders (SUDs) are a chronic health condition and represent a significant public health issue. Recent data reveals approximately 20.3 million people in the United States aged 12 or older experienced a substance use disorder (SUD) related to their use of alcohol or illicit drugs during the course of a single year (Substance Abuse and Mental Health Services Administration, 2019). While genetics, environment, culture, and trauma are all risk factors, individuals with certain jobs (e.g., healthcare, military service, and law enforcement) may be particularly susceptible (Afuseh et al., 2020). Additionally, adults with mental health (MH) conditions such as anxiety, depression, or posttraumatic stress disorder (PTSD) may use drugs and alcohol as a form of self-medication, thereby increasing their risk for developing a SUD (National Institute of Mental Health, 2021). Resultantly, co-occurring MH conditions and SUD are common in military personnel (Pettinati et al., 2013).

Fortunately, treatments for SUD exist. This includes a variety of non-pharmacological interventions including recreational therapy (RT; Kunstler, 2020). The strengths-based approach that is prominent in RT (Anderson & Heyne, 2016; Heyne & Anderson, 2012; Mikal-Flynn et al., 2018) is recommended because of its emphasis on maximizing an individual's resources and competencies in the recovery process. The RT profession recognizes a number of theories of well-being in advocating for strengths-based interventions, including the Broaden and Build Theory of Positive Emotions (Heyne & Anderson, 2012). Such theories can aid in the design of a variety of RT interventions and programs.

Strengths-based RT programs have been effective in treating the MH and psychological well-being of military personnel (Blumhorst et al., 2020; Craig et al., 2020). However, such programs have typically been offered in the community rather than during inpatient treatment where environmental and safety restrictions can limit options. Since physical activity modalities play an important role in RT practice (Mobily, 2009), are highly used (Hawkins et al., 2020), and recreational therapists indicate a high level of knowledge and skill in delivering such interventions (Hawkins et al., 2020) they may be particularly well suited for military personnel receiving inpatient treatment for SUD. Literature reporting that physical activity can be particularly beneficial in RT focused mental health treatment (Nagata et al., 2020) adds additional support to the rationale for exploring specific physical activity programs appropriate for implementation by RT professionals during inpatient treatment of military personnel with a SUD.

Literature Review

Substance Use Disorders in Military Personnel

Within the military, environment and trauma can both serve as precipitating factors for individuals to engage in heavy drinking or illicit drug use. Resultantly, the prevalence of SUDs among military personnel is high (Teeters et al., 2017). The stressors of deployments, combat, potential death of peers or self, leadership conflicts, and/or post-deployment reintegration all hold the potential to trigger someone to adopt unhealthy behaviors if they lack healthy outlets to manage their stress (Teeters et al., 2017). Military personnel diagnosed with a SUD also frequently present with co-occurring MH issues such as depression, anxiety, and mood disorders, and those who

are veterans commonly meet the criteria for PTSD and adjustment disorder (Pettinati et al., 2013). Therefore, treatment for a SUD often includes interventions that address MH outcomes related to mood and affect. Anxiety, in particular, is often a focus of treatment. Historically, SUD treatments have focused on alleviating negative mood states, negative affect, and anxiety. However, with an increasing emphasis on positive psychology approaches, interventions that promote or increase positive mood or affect are also beginning to garner attention (Lianov et al., 2020).

Positive Affect, Negative Affect, and Anxiety

Positive affect refers to subjective pleasure or engagement while negative affect is indicative of subjective distress (Decker et al., 2018). Both of these frequently affect individuals with SUDs. High levels of negative affect and low levels of positive affect are both thought to increase chances of relapse (Cheetham et al., 2010) in individuals with a SUD. Conversely, high levels of positive affect are associated with lower stimulant use and correlated with lower levels of return to use among individuals receiving in-patient treatment for SUD (Hall et al., 1981). A large body of research affirms that negative affect is associated with desire to use substances (Schlauch et al., 2013).

Research also shows there is a high comorbidity of anxiety disorders and SUDs for adults (Martins & Gorelick, 2011). When looking specifically at active-duty military, researchers found that 33.10% of active-duty participants reported feeling high levels of stress while performing military duties. Of these same participants, 13.10% reported meeting generalized anxiety disorder criteria after their deployment (Lane et al., 2012). Given the high rates of co-occurring MH issues and SUD, efficacious treatments are greatly needed.

Substance Use Disorder Treatment

Interventions effective for the treatment of SUD include psychotherapy, pharmacotherapy, and a variety of non-pharmacological approaches. Unfortunately, while the evidence of successful non-pharmacological approaches for treating SUDs is growing, patients are often not aware of them, or do not receive them as part of their treatment (Woorley, 2020). It has been argued that in quality, comprehensive treatment, patients with SUDs should be offered and receive evidence-based care that includes non-pharmacological therapy approaches (Woorley, 2020). It is also important to assist military personnel with finding healthy alternatives to substances and alcohol (Teeters et al., 2017). One possible solution is RT interventions (Kunstler, 2020) that offer strengths-based approaches rooted in positive psychology (Heyne & Anderson, 2012) and theories such as the Broaden and Build Theory of Positive Emotions.

Theoretical Framework

The Broaden and Build Theory of Positive Emotions (BBT) suggests that experiences generating positive emotions broaden an individual's momentary thought-action repertoires while also building the individual's physical, intellectual, social, and psychological resources (Fredrickson, 2004). The primary premise of BBT is that as an individual broadens their repertoire of positive experiences, they will also broaden their positive reactions to various situations. While negative emotions narrow an individual's thought-action reserves, positive emotions broaden these repertoires (Fredrickson, 2004). Since positive emotions serve as the springboard or catalyst for an upward spiral of emotions and experiences that ultimately lead to enhanced health and well-being (Fredrickson, 2004), identifying activities that generate positive emotions is

essential. The versatility of BBT allows it to apply to diverse populations and situations, including SUD treatment and RT (Akhtar & Boinwell, 2010; Heyne & Anderson, 2012; Krentzman, 2013). As RT professionals work to design non-pharmacological interventions, the literature suggests exercise may hold promise for this population (Mobily, 2009; Nagata et al., 2020).

Exercise

Exercise is an intentional form of physical activity (Caspersen et al., 1985) that can improve and maintain not only physical health, but also mental health, overall well-being, and quality of life (World Health Organization [WHO], 2020). Individuals who participate in exercise frequently experience increased positive emotions and decreased anxiety (Zhao & Wang, 2020). Given this, exercise may be particularly well suited as a non-pharmacological intervention that addresses mood and affect in SUD treatment.

Unfortunately, despite continuous advocacy and encouragement for physical activity, many individuals remain sedentary due to personal preference or barriers. Commonly stated barriers for not engaging in exercise, especially for individuals with mental illnesses, include poor quality of health, lack of access to equipment, and lack of motivation (Firth et al., 2016). Thus, it may be beneficial for individuals to receive resources for exercise programs that require little to no facilities or equipment that can be adapted for different baseline abilities. One style of exercise that meets these criteria is aerobic exercise.

Aerobic activity is a style of moderate to high intensity exercise that can provide the physical and mental satisfaction of a quality workout with minimal equipment required. Examples of aerobic exercises can include running, walking, swimming, or high intensity interval training (HIIT). In order to achieve best health results, current recommendations state that adults should engage in 150-300 minutes of moderate physical activity per week, or 75-150 minutes of high intensity aerobic activity each week (WHO, 2020).

High Intensity Interval Training (HIIT)

High intensity interval training (HIIT) is a style of exercise that involves alternating short bursts of high intensity movements with short recovery periods (Nicolò & Girardi, 2016). Research indicates that HIIT allows for improvements in mental and physical health, as well as the ability to overcome some common barriers for more traditional styles of exercise. Due to the focus on brief, high intensity exercises, standard HIIT programs hold the potential to be up to three times shorter than traditional low to moderate intensity training (Nicolò & Girardi, 2016). Shorter sessions address a frequently identified barrier of finding time for exercise. Typical HIIT programs also allow for the flexibility to be implemented either at home with no equipment, or at the gym with exercise equipment. Popular exercise equipment that can be utilized are treadmills, stationary bikes, rowing machines, and elliptical machines. Popular exercises that require no equipment and are often incorporated into HIIT programs are jumping jacks, jumping squats, running in place or high knees, mountain climbers, push-ups, wall sit, and lunges (Klika & Jordan, 2013). This flexibility allows for individuals to overcome the barriers of equipment and facilities.

A variety of physical and psychological benefits have been linked to participation in HIIT programs. The U.S. Health and Human Services (HHS) identify several

immediate and long-term benefits for individuals that engage in higher intensity physical activity. The HHS reports that acute physical activity can reduce current levels of anxiety (state anxiety) immediately after moderate to high levels of exercise. Additionally, habitual physical activity leads to a reduction in feelings of anxiety, decreases depression, increases quality and depth of sleep, and increases cognitive levels in adults (U.S. Health and Human Services [HHS] 2018).

In addition to promoting mental well-being, high intensity exercise has been linked to the prevention of some mental illnesses, including but not limited to diagnoses such as depression, anxiety, substance use disorders, PTSD and schizophrenia (Teychenne et al., 2020). Korman and colleagues (2020) conducted research on the effects of exercise and found that six of seven trials yielded a significant reduction in depression scores following HIIT interventions. It has also been reported that short bouts of physical activity can reduce stress, depressive symptoms and improve self-esteem in adults (Barr-Anderson et al., 2011).

In order to determine if the intensity of an exercise program is “high intensity” for specific individuals, heart rate is frequently monitored with a goal of determining the percentage of maximum heart rate achieved during the exercise experience. For heart rate to be properly measured, the individual can calculate their maximum heart rate (HR) by using the equation $211 - (0.64 \times \text{age})$ (Taylor et al., 2019). After maximum HR is calculated, the next step is to calculate the target range. According to the Centers for Disease Control and Prevention (CDC), individuals reaching 77%–93% of their maximum HR have reached high or vigorous intensity physical activity. Individuals documenting levels between 64%–76% have reached moderate intensity physical activity (CDC, n.d.). Heart rate can be found using carotid artery palpation and easily monitored by individuals participating in exercise programs.

HIIT Exercise Programs and Substance Use Disorder Treatment

Since studies have shown that exercise can regulate emotions and reduce depressive symptoms for substance users (Brown et al., 2010) and yield positive effects in individuals with mental health diagnoses (Firth et al., 2016), therapeutic programs that use exercise to address SUD and MH outcomes are needed. These may be particularly beneficial for military personnel receiving inpatient treatment. Programs that incorporate a positive psychology approach and assist patients in broadening and building their personal resources for enhanced coping would add to the existing literature. Furthermore, programs such as HIIT training that eliminate barriers such as time and equipment would not only be appropriate for inpatient clinical settings, but also hold greater likelihood for client use post-discharge. In particular, such programs may be well suited for military personnel receiving inpatient treatment for a SUD.

Purpose of the Study

The purpose of this study was to evaluate a HIIT program designed for use as part of recreational therapy (RT) service delivery for military personnel receiving inpatient treatment for a SUD. Specifically, the research aimed to (a) evaluate the impact of the HIIT program on state anxiety, positive affect, and negative affect; (b) record heart rate levels during the program and determine if target heart rates were achieved; (c) document possible changes in primary emotion following the HIIT intervention; and (d) determine the likelihood of participants using HIIT post discharge.

Methods

Design and Setting

A single group, pretest-posttest, mixed-methods design was used to evaluate the impact of this program. Study procedures occurred at a private, freestanding, 116-bed psychiatric hospital that specializes in MH and SUD treatment. The intervention was offered as standard recreational therapy (RT) programming on one of the facility's units. Thus, the program was deemed exempt from Institutional Review Board (IRB) oversight.

All study procedures occurred on a 20-bed unit offering a 28-day specialized treatment program for active-duty service members and veterans. Using a multi-faceted approach to treatment, including RT, the program aims to help individuals stabilize from addiction and learn strategies for recovery while connecting to a recovery community.

Participants

Adults receiving inpatient treatment services on the designated unit were included. Policy for this inpatient program specifies that patients are expected to attend all scheduled therapeutic programs. Resultantly, all patients were automatically referred to the HIIT program and then evaluated based on the specified program inclusion/exclusion criteria to ensure participant health and safety.

Inclusion criteria were: (a) military personnel (either active duty or veterans), (b) diagnosis of a SUD, and (c) clearance by a physician for physical activity. Exclusion criteria were: (a) acute illness or injury that restricts physical activity, (b) age-related functional limitations that restrict physical activity, (c) chronic conditions that restrict physical activity, and (d) cognitive impairment at a level that restricts the ability to complete written assessments.

The following demographic data were collected on all participants: (a) age, (b) sex, (c) race/ethnicity, (d) military status (active duty or veteran), (e) primary diagnosis, and (f) secondary diagnoses.

Intervention

The HIIT program was designed and implemented by a Certified Therapeutic Recreation Specialist (CTRS®) employed full-time at the agency. The same facilitator implemented all of the scheduled HIIT sessions. Per hospital policy, a psychiatric technician was assigned for the duration of the group to provide support in monitoring participants.

The program was offered twice weekly over the course of four consecutive weeks as part of regularly scheduled RT service delivery. This resulted in data collected from a total of eight sessions. The program was implemented in an indoor exercise room/gym available for therapeutic programming that could accommodate all patients from the unit and provided adequate space to complete the exercises associated with the HIIT program. A circuit of seven separate exercises shown to have efficacy in research studies was used. The exercises were: (a) jumping jacks, (b) plank, (c) wall sit, (d) push-ups (regular or modified), (e) high knees/run in place, (f) abdominal crunches, and (g) lunges (Andreassen et al., 2019; Atakan et al., 2021; Klicka & Jordan, 2013). Separate spaces in the room were allocated for each exercise and were noted with picture cue cards posted to the wall to prompt participants on the exercise. As recommended in

the literature (Klicka & Jordan, 2013), stations were ordered so that different muscle groups were used at neighboring stations.

Participants were divided among the stations as their starting point. While this arrangement had participants completing the exercises in a different order, they all rotated through each station twice. One minute was provided at each station with participants instructed to engage at maximum effort. A one-minute break was provided between stations to allow for recovery and preparation for the next exercise. A two-minute break was provided between the first and second rotations. This format was selected since past clinical observations had indicated some individuals were less self-conscious of their performance/abilities if they were doing different exercises/activities than their peers. The research team also viewed this arrangement as being more in line with a personal fitness format instead of something modeling a military training structure.

Table 1 shows the breakdown of the overall program including a welcome/program overview, educational elements, and post-program discussion. The welcome included general guidelines for group behavior and safety. The educational elements emphasized HIIT benefits and carotid artery palpation procedures. The post-program discussion allowed participants to process their experience.

Table 1
Program Elements and Time/Duration for Each

Program Element	Time/Duration
Welcome, Program Overview	5 minutes
Educational Elements	5 minutes
Pre-Intervention Assessments	5 minutes
HIIT Rotation #1 (7 exercise stations @ 1 minute each with 6 breaks between stations @ 1 minute each)	13 minutes
Break Between HIIT Rotation 1 & 2	2 minutes
HIIT Rotation #2 (7 exercise stations @ 1 minute each with 6 breaks between stations @ 1 minute each)	13 minutes
Post-Intervention Assessments	7 minutes
Post-Program Discussion/Processing	10 minutes
Total Program	60 minutes

A unique element of this program is that it requires no equipment. This is ideal for inpatient treatment settings where lack of exercise equipment and/or budgetary constraints can create barriers to the provision of exercise interventions. In an inpatient MH facility, this type of programming also limits infection control issues, and minimizes risk management concerns that are often introduced with traditional

exercise equipment. For the targeted population, a “no equipment” exercise program also reduces barriers to continued participation post-discharge. Military personnel frequently travel extensively and may be in locations where they do not have access to gyms or fitness equipment. Cost barriers are also eliminated as individuals could complete this HIIT program in a variety of locations at no cost.

In addition to minimizing risk through the “no equipment” format of the HIIT program, the CTRS® checked with the treatment team prior to every group to receive current status reports on all participants. Of particular interest were concerns such as newly reported symptoms, changes in medication, signs of aggression/agitation, cardiovascular or respiratory complaints, and any other issues considered possible contraindications for participation. During the group, the CTRS® monitored physical engagement and encouraged patients that were experiencing symptoms such as fatigue, dizziness, nausea, light-headedness, joint pain, or muscle aches to reduce their intensity and/or halt participation.

Assessment Tools

Positive and Negative Affect were assessed using the Positive and Negative Affect Schedule (PANAS). State Anxiety was evaluated using the Visual Analog Scale for Anxiety (VAS-A). A program-specific assessment was used to identify the primary mood of participants. Heart rate was assessed using participant palpated carotid artery pulse. Additional program feedback was gathered from a participant survey designed for this program. Specific items on this questionnaire assessed participant understanding of the benefits of HIIT, their likelihood of participating in HIIT post-discharge, and provided an opportunity for individuals to offer additional feedback on the program.

Positive and Negative Affect Schedule (PANAS)

The PANAS is a 20-item self-report scale where participants assess the current intensity of a variety of feelings using a five-point Likert scale (Watson et al., 1988). It has been deemed a valid and reliable measure of state levels of affect in substance users (Serafini et al., 2016). Cronbach's α indicates excellent internal consistency for both positive and negative affect (.90 and .91, respectively). Test-retest reliability is also strong (Positive affect = .80, Negative affect = .76) (Serafini et al., 2016).

Visual Analog Scale for Anxiety (VAS-A)

The VAS-A is a visual scale consisting of a 100 mm horizontal line with end points labeled “no anxiety” at 0 mm and “intense anxiety” at 100 mm (Ghita et al., 2021). The participant marks a vertical line intersecting with the horizontal scale to indicate their level of state anxiety. The clinician/researcher then calculates a score by measuring from the left side of the scale in millimeters (Williams et al., 2010). Validity and reliability of the VAS-A for measuring state anxiety levels is documented in the literature including test-retest reliability ($r = .44, p < .001$) and convergent validity with the State-Trait Anxiety Inventory's state subscale ($r = .60, p < .001$) (Abend et al., 2014).

Assessment of Primary Emotion/Mood

Using a fill-in-the-blank single item survey, participants answered the following question. “What one word best describes your current emotion or mood? The purpose

of this assessment was two-fold. First, if participants self-reported similar scores on all PANAS items, this would more clearly delineate their primary emotional/mood state. Secondly, if the HIIT program elicited change in primary emotion/mood from beginning to end of the program, this assessment could assist participants in recognizing that participation in HIIT changed or altered their emotion or mood state.

Heart Rate via Carotid Artery Pulse

The simplest and most original way to measure heart rate (HR) is to palpate the arteries including the carotid artery in the neck. Time of palpation can vary from 6 to 60 seconds with the result multiplied by a factor to obtain the number of heartbeats in one minute (Almeida et al., 2019). For this program, participants collected their own HR via self-palpation of the carotid artery for 30 seconds and the CTRS® multiplied participant collected HR x 2 to establish heartbeats per minute.

While some inconsistencies in self-palpated HR are to be expected, Sedlock et al. (1983) concluded that individuals can accurately and safely determine their post-exercise heart rate by carotid artery palpation. Similarly, Garner and Wagner (2013) found post-exercise HR collected by exercisers through artery palpation did not differ significantly from HR palpated by certified fitness trainers or collected via HR monitors. Additionally, test-retest reliability indices for subject palpated HR have been recorded to exceed .70 (Da Silva, 2012).

Participant Survey (End of Program Questionnaire)

After completing the program, participants answered four questions that aimed to document additional outcomes. Individuals were asked to indicate on a scale of 1–10 how likely they were to engage in HIIT after discharge. Corresponding follow-up questions asked how/why they would use HIIT post-discharge or why they would not engage in HIIT post-discharge. To assess learning from the session's educational content, participants were asked to identify one benefit of HIIT. Finally, the questionnaire provided an opportunity for participants to share any additional comments regarding the HIIT program they completed.

Assessment Schedule

At the start of the HIIT session, participants completed the PANAS, VAS-A, Assessment of Primary Emotion/Mood, and recorded their Heart Rate. Following completion of the HIIT session, participants again completed the PANAS, VAS-A, Assessment of Primary Emotion/Mood, and recorded their Heart Rate. Heart rate was assessed immediately after completing the final exercise. Participants also completed the brief Participant Survey at the conclusion of the session.

Data Analysis

Demographic data were gathered from the electronic medical record of participants and analyzed using descriptive statistics. Following each session, a pre- and post-session score was calculated for both positive and negative affect using PANAS data. A paired samples *t*-test was used to determine any significant changes in positive and negative affect ($p < .05$). Pre- and post-session VAS-A scores were also compared using paired sample *t*-tests. Maximum heart rate for each participant was calculated using the equation $211 - (0.64 \times \text{age})$ (Taylor et al., 2019), and Excel calculation features were used to determine percentage of maximum HR achieved following the HIIT program.

Since CDC target heart rate guidelines (CDC, n.d.) state individuals reaching 77.00%–93.00% of their maximum HR have reached high intensity physical activity levels, frequency counts were used to determine how many participants successfully reached that level. The number of individuals reaching moderate intensity physical activity levels (64.00%–76.00% of maximum heart rate) was also recorded.

Two lists of primary emotion/mood were generated (pre-intervention and post-intervention) with specific emotions/moods summarized with frequency counts. Lists were condensed by having two evaluators agree on related themes among the responses. Likelihood to engage in HIIT post discharge was evaluated using measures of central tendency to summarize participant scores collectively. Reasons/ways for engaging or for not engaging in HIIT post-discharge as well as any additional comments were transferred to separate lists and summarized using frequency counts following grouping in themes by two reviewers.

Results

Participants

A total of 20 participants were involved in the program. This included 19 males and one female. They ranged in age from 23–45 years ($M = 32.45$, $SD = 7.47$). The majority were Caucasian ($n = 14$), with the remaining participants identifying as African American ($n = 3$), Asian ($n = 2$), and Hispanic ($n = 1$). Sixteen were classified as active-duty military, and the remainder were veterans ($n = 4$). All ($N = 20$) had a primary diagnosis of SUD. Almost half ($n = 9$) also had secondary mental health diagnoses including post-traumatic stress disorder (PTSD) ($n = 4$), major depressive disorder (MDD) ($n = 3$), or generalized anxiety disorder (GAD) ($n = 2$). Participants were involved in the HIIT program anywhere from one ($n = 2$) to five ($n = 3$) times during their admission, which generated a total of 59 individual data sets. Most participants engaged in the program for two ($n = 7$), three ($n = 4$) or four ($n = 4$) sessions. One participant refused to complete assessments during his final session, so that data set was removed leaving 58 data sets for review. During implementation of the eight sessions, group size ranged from 5 to 10 participants ($M = 7.67$, $SD = 1.58$).

Positive and Negative Affect

Data analysis revealed participants had significantly higher positive affect scores following HIIT participation ($M = 27.00$, $SD = 3.72$) than at the start of the group ($M = 20.52$, $SD = 5.53$), $t(57) = -13.46$, $p < .001$ (Table 2). Negative affect scores averaged 14.34 pre-intervention ($SD = 4.21$) and 13.55 post-intervention ($SD = 3.06$), indicating negative affect was significantly lower following participation in the HIIT program, $t(57) = 2.91$, $p = .003$.

Anxiety

As shown in Table 2, prior to the intervention, participants presented with VAS-A scores averaging 46.40 ($SD = 17.93$). Following participation in the HIIT session, their anxiety scores were significantly reduced ($M = 43.21$, $SD = 16.57$), $t(57) = 1.99$, $p = .05$.

Heart Rate

Participants documented both their pre-intervention heart rates ($M = 84.59$, $SD = 11.63$) and post-intervention heart rates ($M = 127.55$, $SD = 9.47$) during each session. The evaluation of percentage of maximum heart rate reached immediately

after completing the final exercise revealed participants achieved 57.16%–77.67% of their maximum heart rate with an average of 67.30% ($SD = 5.36$) at the end of the HIIT session. Using CDC interpretation guidelines (CDC, n.d.), two recordings met the threshold of 77.00% of maximum heart rate to be considered high intensity exercise. Moderate intensity physical activity levels (64.00%–76.00% of maximum heart rate) were reached in 38 participant recordings.

Table 2

Results of t-test for Changes in Positive Affect, Negative Affect, and State Anxiety

Measure	N	Pre-Intervention		Post-Intervention		t (57)	p
		M	SD	M	SD		
Positive Affect (PANAS)	58	20.52	3.72	27.00	5.53	-13.46	<.001
Negative Affect (PANAS)	58	14.34	4.21	13.55	3.06	2.91	.003
State Anxiety (VAS-A)	58	46.40	17.93	43.21	16.57	1.99	.05

Primary Emotion or Mood

As outlined in Table 3, at pre-intervention data collection, participants identified their primary emotion or mood as good/fine ($n = 16$), annoyed/upset ($n = 10$), tired ($n = 8$), calm/relaxed ($n = 7$), anxious ($n = 5$), happy ($n = 4$), interested/curious ($n = 3$), bored ($n = 1$), ignored ($n = 1$), sad ($n = 1$), sore ($n = 1$), and “here” ($n = 1$). Following participation in the HIIT program, the participants specified that their primary emotion or mood was best described as, good/great ($n = 22$), energized/awake ($n = 9$), calm/relaxed ($n = 6$), improved/better ($n = 4$), tired ($n = 4$), annoyed ($n = 3$), proud ($n = 2$), strong ($n = 1$), sore ($n = 1$), fat ($n = 1$), and bored ($n = 1$). The remaining individuals ($n = 4$) did not provide a response.

Table 3

Primary Emotions Identified by Participants Pre-Intervention and Post-Intervention

Primary Emotion	Pre-Intervention		Post-Intervention	
	Primary Emotion	N	Primary Emotion	N
Good/Fine	Good/Great	16	Good/Great	22
Annoyed/Upset	Energized/Awake	10	Energized/Awake	9
Tired	Calm/Relaxed	8	Calm/Relaxed	6
Calm/Relaxed	Improved/Better	7	Improved/Better	4
Anxious	Tired	5	Tired	4
Happy	Annoyed	4	Annoyed	3
Interested/Curious	Proud	3	Proud	2
Bored	Strong	1	Strong	1
Ignored	Sore	1	Sore	1
Sad	Fat	1	Fat	1
Here	Bored	1	Bored	1

While primary emotions at the program's onset were fairly evenly split between emotions that reflected positive affect ($n = 30$) and negative affect ($n = 28$), more participants identified post-session primary emotions that were positive ($n = 44$) as opposed to negative ($n = 10$).

Likelihood to Engage in HIIT Post Discharge

When asked to rate their likelihood of engaging in HIIT post discharge on a scale of 1–10 with higher scores indicating greater likelihood, participant ratings trended positively and fell slightly above the midpoint ($M = 6.28$, $SD = 2.43$). Explanations for why they would or would not engage in HIIT in the future (post-discharge) follow and are summarized in Table 4.

Table 4

Reasons Given for Engaging or Not Engaging in HIIT in the Future (Post-Discharge)

Reasons For Engaging in HIIT		Reasons For Not Engaging in HIIT	
<i>Reason Given</i>	<i>N</i>	<i>Reason Given</i>	<i>N</i>
Improved Mood/Self-Esteem	12	Dislike Exercise	8
Ease of Access/Location	9	Physical/Psychological Reasons	5
Enjoyed Activity	5	Prefer Other Exercise	5
Use as Healthy Coping	4	May Not Remember Routine	1
Not Time Consuming	4		
Add to Another Workout	3		
Not as Hard on Body	1		

Explaining why they might engage in HIIT post-discharge, participants reported it improved their mood and self-esteem ($n = 12$), they found it convenient to do in many locations and acknowledged this type of exercise can be done just about anywhere ($n = 9$), and they enjoyed the activity/exercises ($n = 5$). Additionally, the HIIT program was perceived to be a quick workout that removed time constraints and barriers ($n = 4$), it was recognized as a positive coping skill ($n = 4$), and participants reported it could be easily added to other exercise and workout programs they currently use ($n = 3$).

When providing reasons for not engaging in HIIT post-discharge, the most common response was a general dislike for exercise ($n = 8$). Other responses for not engaging in HIIT in the future included physical or psychological reasons such as injuries or mental health concerns ($n = 5$), and preferences for other styles of exercise that are not considered HIIT ($n = 5$).

Identified Benefits of HIIT and Other Comments

The majority of participants demonstrated learning from the instructional content provided during the session by listing benefits of HIIT presented by the facilitator at the start of the session. Specifically, participants noted that exercise can: (a) release dopamine, serotonin, and endorphins ($n = 17$); (b) improve self-esteem or confidence ($n = 13$); (c) serve as a healthy coping strategy ($n = 11$); and (d) be beneficial for overall health ($n = 2$). Only a few participants were unable to identify any benefits of HIIT ($n = 5$).

Some of the participants provided additional feedback when asked for other comments. Several simply reiterated that they liked/enjoyed the group ($n = 10$). While the program was designed to be feasible with no equipment, several individuals ($n = 8$) suggested adding equipment (e.g., weights, exercise bands). Other program suggestions were to provide different exercises and routines ($n = 6$), add music ($n = 2$), and offer handouts that documented the exercises ($n = 2$). The remaining comments indicated that some participants would prefer if participation in the HIIT group was optional ($n = 4$), and that some viewed the assessments as burdensome ($n = 4$).

Discussion

Findings from this program evaluation are encouraging and provide support for both the feasibility and efficacy of delivering HIIT as part of RT treatment in an inpatient MH facility and specifically to military personnel being treated for a SUD. Findings add to the RT body of literature surrounding interventions that enhance the well-being of military personnel (Blumhorst et al., 2020; Craig et al., 2020) and document the efficacy of physical activity as a RT intervention (Mobily, 2009; Nagata et al., 2020). Participants in this program recorded significant improvements in positive and negative affect as well as state-anxiety following the one-hour HIIT session. Thus, the specific protocol used in this study will assist RT professionals in providing evidence-based practice. Since recreational therapists indicate a high level of knowledge and skill in delivering such interventions (Hawkins et al., 2020), widespread adoption should be feasible.

The specific exercise sequence used for this HIIT program also resulted in an elevation of heart rate for participants. While only two individuals reached levels considered “high intensity,” the majority of data sets ($n = 40$, 68.97%) met CDC thresholds for either moderate intensity or high intensity activity. The research team noted that since HR was gathered via carotid artery pulse immediately after the last exercise, participants were not actively exercising at the time they recorded their HR. Many HIIT programs use heart rate monitors to record highest levels of HR achieved during active exercise. It is possible that more participants reached “high intensity” levels while actively engaging in the exercises, but HR was reduced by the time they were recording their pulse post-exercise. The facilitator also noted that some exercises were more aerobically focused than others (e.g., jumping jacks vs. plank). Since participants did not complete the exercises in the same order, individuals finishing with more aerobic or cardio focused exercises likely had higher final heart rates than those completing less cardio-intensive exercises at their final station.

Since an aim of the program was to introduce participants to a recreational activity they could use for improved coping both in and out of treatment, it is encouraging that many participants indicated they were likely to engage in HIIT post-discharge. This is important since it is acknowledged many individuals struggle to maintain behaviors learned in SUD treatment post-discharge (Manuel et al., 2017). While participants readily acknowledged the convenience of an exercise program that could be done in a variety of settings and did not require any equipment, it was interesting that several participants indicated they would have liked the option to add equipment (e.g., weights, exercise bands), and suggested other elements that could be added in the future (e.g., music, different exercises, handouts). Some of the participants who requested these additional items shared that they would have access to this equipment post-discharge as well. This is noteworthy since eliminating barriers is an important

step in maximizing participation in physical activity in military personnel (Walker et al., 2021).

Limitations and Research Implications

In reviewing all evaluation findings, the following limitations are noted. While data collection yielded 58 data sets for analysis, these were generated from 20 individuals. Although individual participants generated different data each session, some similarities are to be expected. The participants were also predominately male, Caucasian, and active-duty military, which does limit generalizability of findings to more diverse groups of military personnel.

This program also relied heavily on self-report assessments. The potential for self-report bias, particularly in this type of setting where participants are aware of the goals of their treatment, is acknowledged. Future studies should incorporate additional measures (e.g., staff observational data and/or heart rate monitors) to verify and support self-report data. The use of heart rate monitors would also better capture the intensity of exercise participants reach while actively engaged in specific exercises. Since some individuals attended the program multiple times during their treatment, these participants often commented that they found the assessments repetitious and burdensome. This potentially yielded some responses that were impacted by feelings of participant frustration.

The timing of this group in regard to other treatment sessions was not considered in this evaluation. However, some participants shared with the facilitator that they were coming to the HIIT program immediately after a trauma focused therapy session where negative emotions were discussed and processed. Future studies could explore the impact of offering HIIT at different times of day to determine when it is most beneficial to patients and to determine if other therapeutic programming affects patient participation and outcomes in HIIT.

This study also lacked a comparison or control group. Future studies should examine the impact of this HIIT program on positive affect, negative affect, and anxiety compared not only to other physical activities but also to other non-pharmacological RT interventions. This would aid therapists in selecting the most efficacious treatments for this population. Data from a control group that does not receive RT services could also lend support to the value of RT in SUD treatment for military personnel.

Conclusion

Substance use disorder (SUD) is a significant health issue affecting the lives of many military personnel (Teeters et al., 2017). Co-occurring mental health conditions including negative affect and heightened anxiety are also prevalent (Pettinati et al., 2013). As clinicians aim to find efficacious treatments that can be used both in inpatient treatment and post-discharge for improved coping, HIIT appears to be a viable treatment option. Recreational therapists have the knowledge and skills to introduce patients to HIIT programming (Hawkins et al., 2020) and this program evaluation adds to the existing literature by documenting a specific program that is appropriate for use by RT professionals in an inpatient mental health facility. Findings from this study also suggest this programming can lead to clinical outcomes of increased heart rate to levels that meet the CDC guidelines for moderate to high intensity exercise, improved

positive affect, reduced negative affect, and reduced anxiety. Furthermore, findings indicate military personnel view HIIT positively and many see it as a resource and activity they may continue to use post-discharge. This research supports the practice of HIIT programming as a non-pharmacological evidence-based RT intervention.

References

- Abend, R., Dan, O., Moaz, K., Raz, S., & Bar-Haim, Y. (2014). Reliability, validity and sensitivity of a computerized visual analog scale measuring state anxiety. *Journal of Behavioral Therapy and Experimental Psychology*, *45*(2014), 447–453. <https://doi.org/10.1016/j.jbtep.2014.06.0040005-7916>
- Afuseh, E., Pike, C. A., & Oruche, U. M. (2020). Individualized approach to primary prevention of substance use disorder: Age-related risks. *Substance Abuse Treatment Prevention Policy* *15*, 58. <https://doi.org/10.1186/s13011-020-00300-7>
- Akhtar, M., & Boinwell, I. (2010). Applying positive psychology to alcohol misusing adolescent: A group intervention. *Groupwork*, *20*(20), 6–316.
- Almeida, M., Bottino, A., Ramos, P., & Araujo, C. (2019). Measuring heart rate during exercise: From artery palpation to monitors and apps. *International Journal of Cardiovascular Science*, *32*(4), 396–407. <https://doi.org/10.5935/2359-4802.20190061>
- Anderson, L., & Heyne, L. (2016). Flourishing through leisure and the upward spiral theory of lifestyle change. *Therapeutic Recreation Journal*, *50*(2), 118–137. <http://dx.doi.org/10.18666/TRJ-2016-V50-12-7333><http://dx.doi.org/10.18666/TRJ-2016-V50-12-7333>
- Andreassen, Ø., Brønnick, K., Njå, A. L., Furulund, E., & Nesvåg, S. (2019). The effect of high-intensity interval/circuit training on cognitive functioning and quality of life during recovery from substance abuse disorder. A study protocol. *Frontiers in Psychology*, *10*, 2564. <https://doi.org/10.3389/fpsyg.2019.02564>
- Atakan, M., Li, Y., Kosar, S., Turnagol, H., & Yan, X. (2021). Evidence-based effects of high-intensity interval training on exercise capacity and health: A review with historical perspective. *International Journal of Environmental Research and Public Health*, *18*(7201), 1–27. <https://dx.doi.org/10.3390%2Fijerph18137201>
- Barr-Anderson, D. J., AuYoung, M., Whitt-Glover, M., Glenn, B., & Yancey, A. (2011). Integration of short bouts of physical activity into organizational routine a systematic review of the literature. *American Journal of Preventative Medicine*, *40*(1), 76–93. <https://doi.org/10.1016/j.amepre.2010.09.033>
- Blumhorst, E., Kono, S., & Cave, J. (2020). An exploratory study of adaptive scuba diving's effect on psychological well-being among military veterans. *Therapeutic Recreation Journal*, *54*(2), 173–188. <https://doi.org/10.18666/TRJ-2020-V54-12-9954>
- Brown, R. A., Abrantes, A. M., Read, J., Marcus, B., Jakicic, J., Strong, D., Oakley, J., Ramsey, S., Kahler, C., Stuart, G., Dubreuil, M. E., & Gordon, A. A. (2010). A pilot study of aerobic exercise as an adjunctive treatment for drug dependence. *Mental Health and Physical Activity*, *3*(1), 27–34. <https://doi.org/10.1016/j.mhpa.2010.03.001>
- Caspersen, C., Powell, K., & Christenson, G. (1985). Physical activity, exercise, and physical fitness: Definitions and distinctions for health-related research. *Public Health Reports* *100*(2), 126–131.

- Centers for Disease Control and Prevention. (n.d.). *Target heart rate and estimated maximum heart rate*. <https://www.cdc.gov/physicalactivity/basics/measuring/heartrate.htm>
- Cheetham, A., Allen, N., Yucel, M., & Lubman, D. (2010). The role of affective dysregulation in drug addiction. *Clinical Psychology Review, 30*(6), 621–634. <https://doi.org/10.1016/j.cpr.2010.04.005>
- Craig, P., Alger, D., Bennett, J., & Martin, T. (2020). The transformative nature of fly-fishing for veterans and military personnel with posttraumatic stress disorder. *Therapeutic Recreation Journal, 54*(2), 150–172. <https://doi.org/10.18666/TRJ-2020-V54-12-9965>
- Da Silva, S. (2012). Validity and reliability of a classroom heart-rate collection procedure, with application for assessing arousal related to test anticipation. *Psychology Learning and Teaching, 11*(2). <https://doi.org/10.2304/plat.2012.11.2.186>
- Decker, S., Morie, K., Malin-Mayo, B., Nich, C., & Carroll, K. (2018). Positive and negative affect in cocaine use disorder treatment: Change across time and relevance to treatment outcome. *The American Journal on Addictions, 27*, 375–382. <https://doi.org/10.1111/ajad.12716>
- Firth, J., Rosenbaum, S., Stubbs, B., Gorczynski, P., Yung, A. R., & Vancampfort, D. (2016). Motivating factors and barriers towards exercise in severe mental illness: A systematic review and meta-analysis. *Psychological Medicine, 46*(14), 2869–2881. <https://doi.org/10.1017/s0033291716001732>
- Fredrickson, B. L. (2004). The broaden-and-build theory of positive emotions. *Philosophical transactions of the Royal Society of London. Series B, Biological Sciences, 359*(1449), 1367–1378. <https://doi.org/10.1098/rstb.2004.1512>
- Garner, R., & Wagner, D. (2013). Validity of certified trainer-palpated and exercise-palpated post-exercise heart rate. *Journal of Exercise Physiology Online, 16*(6), 31–38. https://www.asep.org/asep/asep/JEPonlineDECEMBER2013_Garner_Wagner.pdf
- Ghita, A., Hernandez-Serrano, O., Fernandez-Ruiz, J., Moreno, M., Monras, M., Ortega, L., Mondon, S., Teixidor, L., Gual, A., Gacto-Sanchez, M., Porrás-García, B., Ferrer García, M., & Gutierrez-Maldonado, J. (2021). Attentional bias, alcohol craving, and anxiety implications of the virtual reality cue-exposure therapy in severe alcohol use disorder: A case report. *Frontiers in Psychology, 12*, 543586. <https://doi.org/10.3389/fpsyg.2021.543586>
- Hall, J., Roter, D., & Rand, C. (1981). Communication of affect between patient and physician. *Journal of Health and Social Behavior, 22*(1), 18–30.
- Hawkins, B., Kemeny, B., & Porter, H. (2020). Recreational therapy competencies, part 2: Findings from the ATRA competencies study [Special issue ATRA Annual]. *Therapeutic Recreation Journal, 54*(4), 402–435. <https://doi.org/10.18666/TRJ-2020-V54-14-10238>
- Heyne, L., & Anderson, L. (2012). Theories that support strengths-based practice in therapeutic recreation. *Therapeutic Recreation Journal, 46*(2), 106–128.
- Klicka, B., & Jordan, S. (2013). High-Intensity circuit training using body weight: Maximum results with minimal investment. *American Colleges of Sports Medicine, 17*(3), 8–13. <https://doi.org/10.1249/FIT.0b013e31828cb1e8>

- Korman, N., Armour, M., Chapman, J., Rosenbaum, S., Kisely, S., Suetani, S., Firth, J., & Siskind, D. (2020). High intensity interval training (HIIT) for people with severe mental illness: A systematic review & meta-analysis of intervention studies –considering diverse approaches for mental and physical recovery. *Psychiatry Research*, 284. <https://doi.org/10.1016/j.psychres.2019.112601>
- Krentzman, A., Cranford, J., & Robinson, E. (2013). Multiple dimensions of spirituality in recovery: A lagged mediational analysis of Alcoholics Anonymous' principal theoretical mechanism of behavior change. *Substance Abuse*, 34(1), 20–32. <https://doi.org/10.1080/08897077.2012.691449>
- Kunstler, R. (2020). Substance use disorders. In D. Austin, M. Crawford, B. McCormick, & M. Van Puymbroeck (Eds.), *Recreational therapy: An introduction* (5th ed., pp. 85–122) Sagamore Venture.
- Lane, M., Hourani, L., Bray, R., & Williams, J. (2012). Prevalence of perceived stress and mental health indicators among reserve-component and active-duty military personnel. *American Journal of Public Health*, 102(6), 1213–1220. <https://doi.org/10.2105/AJPH.2011.300280>
- Lianov, L. S., Barron, G. C., Fredrickson, B. L., Hashmi, S., Klemes, A., Krishnaswami, J., Lee, J., Le Pertel, N., Matthews, J., Millstein, R., Phillips, E., Sannidhi, D., Purpur de Vries, P., Wallace, A., & Winter, S. J. (2020). Positive psychology in health care: Defining key stakeholders and their roles. *Translational Behavioral Medicine*, 10(3), 637–647. <https://doi.org/10.1093/tbm/ibz150>
- Manuel, J., Yuan, Y., Herman, D., Svikis, D., Nichols, O., Palmer, E., & Deren, S. (2017). Barriers and facilitators to successful transition from long-term residential substance abuse treatment. *Journal of Substance Abuse Treatment*, 74, 16–22. <https://doi.org/10.1016/j.jsat.2016.12.001>
- Martins, S., & Gorelick, D. (2011). Conditional substance abuse and dependence by diagnosis of mood or anxiety disorder or schizophrenia in the U.S. population. *Drug and Alcohol Dependence*, 119, 28–36.
- Mikal-Flynn, J., Anderson, L., & Hoffman, J. (2018). Posttraumatic growth and metahabilitation in recreational therapy practice. *Therapeutic Recreation Journal*, 52(3), 269–287. <https://doi.org/10.18666/TRJ-2018-V52-13-8675>
- Mobily, K. (2009). Role of exercise and physical activity in therapeutic recreation services. *Therapeutic Recreation Journal*, 43(2), 9–26.
- Nagata, S., McCormick, B., & Austin, D. (2020). Physical activity as treatment for depression in recreation therapy: Transitioning from research to practice. *Therapeutic Recreation Journal*, 54(1), 77–91. <https://doi.org/10.18666/TRJ-2020-V54-I1-9745>
- National Institute of Mental Health. (2021, March). *Substance use and co-occurring mental disorders*. <http://www.nimh.nih.gov/health/topics/substance-use-and-mental-health>
- Nicolò, A., & Girardi, M. (2016). The physiology of interval training: A new target to HIIT. *The Journal of Physiology*, 594, 7169–7170. <https://doi.org/10.1113/JP273466>
- Pettinati, H., O'Brien, C., & Dundon, W. (2013). Current status of co-occurring mood and substance use disorders: A new therapeutic target. *American Journal of Psychiatry*, 170(1), 23–30. <https://doi.org/10.1176/appi.ajp.2012.12010112>
- Schlauch, R., Gwynn-Shapiro, D., Stasiewicz, P., Molnar, D., & Lang, A. (2013). Affect and craving: Positive and negative affect are differentially associated with approach

- and avoidance inclinations. *Addictive Behaviors*, 38(4), 1970–1979. <https://doi.org/10.1016/j.addbeh.2012.12.003>
- Sedlock, D., Knowlton, R., Fitzgerald, P., Tahamont, M., & Schneider, D. (1983). Accuracy of subject-palpated carotid pulse after exercise. *The Physician and Sports Medicine*, 11(4), 106–116. <https://doi.org/10.1080/00913847.1983.11708512>
- Serafini, K., Malin-Mayor, B., Nich, C., Hunkele, K., & Carroll, K. (2016). Psychometric properties of the Positive and Negative Affect Schedule (PANAS) in a heterogeneous sample of substance users. *The American Journal of Drug and Alcohol Abuse*, 42(2), 203–212. <http://dx.doi.org/10.3109/00952990.2015.1133632>
- Substance Abuse and Mental Health Services Administration. (2019). *Key substance use and mental health indicators in the United States: Results from the 2018 national survey on drug use and health*. (HHS Publication No. PEP19-5068, NSDUH Series H-54). Rockville, MD: Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration. <https://www.samhsa.gov/data/>
- Taylor, J., Holland, D., Spathis, J., Beetham, K., Wisloff, U., Keating, S., & Coombes, J. (2019). Guidelines for the delivery and monitoring of high intensity interval training in clinical populations. *Progress in Cardiovascular Diseases*, 62, 140–146. <https://doi.org/10.1016/j.pcad.2019.01.0040033-0620>
- Teeters, J., Lancaster, C., Brown, D., & Back, S. (2017). Substance use disorders in military veterans: Prevalence and treatment challenges. *Substance Abuse Rehabilitation*, 8, 69–77. <http://doi.org/10.2147/SAR.S116720>
- Teychenne, M., White, R., Richards, J., Schuch, F., Rosenbaum, S., & Bennie, J. (2020). Do we need physical activity guidelines for mental health: What does the evidence tell us? *Mental Health and Physical Activity* (18). <https://doi.org/10.1016/j.mhpa.2019.100315>
- U.S. Department of Health and Human Services. (2018). *Physical Activity Guidelines for Americans* (2nd ed.). https://health.gov/sites/default/files/2019-09/Physical_Activity_Guidelines_2nd_edition.pdf#page=31
- Walker, R., Limbert, C., & Smith, P. (2021). Exploring the perceived barriers and benefits of physical activity among wounded, injured, and/or sick military veterans. *Journal of Social, Behavioral, & Health Sciences*, 15. <https://doi.org/10.5590/JSBHS.2021.15.1.11>
- Watson, D., Clark, L. A., & Tellegan, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, 54(6), 1063–1070.
- Williams, V., Marlock, R., & Feltner, D. (2010). Psychometric evaluation of a visual analog scale for the assessment of anxiety. *Health and Quality of Life Outcomes* 8(57). <https://doi.org/10.1186/1477-7525-8-57>
- Woorley, J. (2020). Therapy strategies for substance use disorders. *Journal of Psychosocial Nursing*, 58(3), 14–18.
- World Health Organization. (2020). *Physical activity*. <https://www.who.int/news-room/fact-sheets/detail/physical-activity>
- Zhao, C., & Wang, Z. (2020). Influence of physical exercise on mental health and positive emotions of college students. *Revista Argentina de Clínica Psicológica*, 29(1), 1234. <https://doi.org/10.24205/03276716.2020.177>