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EMPOWERING SUBSTANCE USE DISORDERS TREATMENT THROUGH PHYSICAL EXERCISE. AN OVERVIEW OF STUDIES

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Abstract

Several types of Substance Use Disorders (SUDs) treatment include physical exercise as an add-on recovery. This review summarizes research on sports and physical exercise as an adjunct to SUDs treatment with the misuse of illegal drugs. Twenty peer-reviewed papers that met the inclusion criteria for representing cross-sectional, intervention and, review studies were considered. Descriptives for each category are presented as well as synthesized findings regarding outcomes and preferences of patients with SUDs, regarding physical exercise programs. Further, the studies are discussed in terms of quality, quantity, and positive outcomes of physical activity for patients with SUDs. Finally, information regarding the design of sports and physical exercise programs is critically presented and discussed.

Keywords: physical exercise, SUDs, intervention development.

GLOSSARY

<i>Abbreviation</i>	<i>Description</i>
RTS+	Reintegration Through Sport Plus
SUDs	Substance Use Disorders
PE	Physical Exercise
BCTs	Behaviour Change Techniques

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INTRODUCTION

Drug use is one of the most serious problems in modern-day public health and society as a whole, with a significant proportion of young adults in developed countries, have used an illicit drug at some point in their lives. Drug use affects the brain's "reward circuit," causing euphoria as well as flooding the brain with the chemical messenger "dopamine". Surges of dopamine in the reward circuit cause the reinforcement of pleasurable but unhealthy behaviours leading people to repeat the behaviour again and again. These brain adaptations often lead to the person becoming less and less able to derive pleasure from other things they once enjoyed (NIDA, 2018). Consequently, drug use is bound to impact individuals' health and well-being. The health consequences of drug use may include a range of negative outcomes such as substance use disorders (SUDs), mental health disorders, HIV infection, hepatitis-related liver cancer and cirrhosis, overdose, and premature death (World Drug Report, 2020). Drug use, particularly when it develops into SUDs, can also have an impact on the social development of the users. Besides, long-term use also causes changes in other brain chemical systems and circuits, affecting functions that include learning, judgment, decision-making, memory, and behaviour (NIDA, 2018).

According to the *Diagnostic and Statistical Manual of Mental Disorders (DSM-5)* of the American Psychiatric Association (2018), SUDs are defined as the persistence of drug use (including alcohol) despite substantial harm and adverse consequences. SUDs are characterized by an array of mental/emotional, physical, and behavioural problems such as chronic guilt, an inability to reduce or stop consuming the substance(s) despite repeated attempts; driving while intoxicated, and physiological withdrawal symptoms. One severe substance use disorder is addiction. Addiction is a chronic disease characterized by drug seeking and use that is compulsive, or difficult to control, despite harmful consequences (NIDA, 2018). In recent years, our understanding of addiction and the wider range of SUDs has improved significantly, enabling us to respond effectively. Numerous mechanisms underlying addiction have been discovered, having, in turn, spawned a multitude of models, each of which addresses a part of the problem. A large number of addiction models have been proposed that describe such mechanisms, on which recovery interventions and strategies are based (EMCDDA, 2013). SUDs can be treated effectively in most cases, provided people have access to a wide range of services, based on behavioural and medicinal approaches (NIDA, 2018).

However, it is a generally accepted assumption that SUDs treatment is a process of behavioural change through which persons, suffering from SUDs, are supported in their efforts to regain their physical and psychological health and wellbeing whilst aspiring to the reinstatement of their social functioning (NIDA, 2017). In this frame, the application of psychosocial interventions is used in treatment to address motivational, behavioural, psychological, and other psychosocial factors related to SUDs. These interventions have proved effective in reducing drug use, promoting abstinence, and preventing relapse (WHO & UNODC, 2020). Psychosocial interventions are structured to address SUDs by helping patients to recognize the triggers for substance use and learn alternative strategies to handle those triggers (Jhanjee, 2014; EMCDDA, 2016; Murthy, 2018).

Physical exercise-PE (i.e. exercise and sports) is an example of a health-related behaviour with vital effects on physical and mental health and it is promoted as an effective and cost-

efficient alternative treatment approach (Garrett et al., 2011; Guillon et al., 2018). PE is characterized as a planned, organized, and repeated body movement that aims to promote or maintain physical fitness (Caspersen et al., 1985). Exercise leads to the release of brain chemicals, such as dopamine, and serotonin, which play a key role in regulating mood (Lin & Kuo 2013). Regular exercise also has been shown to offer therapeutic benefits in treating the symptoms of depression, anxiety and stress (Asmundson et al., 2013; Carek et al., 2011; Dina et al., 2011). Furthermore, physical exercise advantageous effects cognition and brain function as well the enhancement of self-esteem and self-confidence (Bowker et al., 2003; Feltz, 2007; Hillman et al., 2008).

Bearing in mind the above effects, interventions based on PE can help SUDs patients, discover and develop strategies, which can support successful recovery and social reintegration (WHO & UNODC, 2020). The contribution of PE and sports seems to be crucial in a wide range of long-term benefits for the mental and physical health of SUDs patients. However, there is no extensive literature on the effects of physical exercise as an effective intervention strategy in the treatment of SUDs connected to the misuse of illegal drugs, with the majority of studies suffering shortcomings and limitations.

Different types of SUDs treatment approaches include physical exercise as an add-on therapy. Studies have reported benefits when individuals in SUDs treatment programs exercise regularly. Positive outcomes reported in studies include:

- Reduced drug intake
- Increased abstinence rate
- Reduced cravings during treatment
- Enhanced healing effects on SUDs
- Higher completion rate of the rehabilitation program,
- Relapse prevention
- Alleviation of a number of the factors that contribute to SUDs development and which act as barriers to healthy recovery (e.g., a lack of social support, poor mental health, high stress, and boredom)
- Achievement of 'holistic' goals within treatment programs (e.g., improving interpersonal relationships, and physical and mental health)
- Repair of the damage caused to the muscles and the cardiovascular system and helping the body to recover from drug use complications faster
- Reduced anxiety depressive symptoms and enhanced mood states
- Improved self-confidence, self-esteem, and body image
- Improved general well-being and quality of life
- Adoption of a healthy lifestyle that is incompatible with substance abuse
- Awareness of one's health condition
- Reported increased personal satisfaction through physical and mental improvement, hence the completion of one's transformation.

Nevertheless, some studies did not detect targeted benefits from exercise programs (e.g., McDaniel, 2016).

AIM OF THE REVIEW

The review was conducted in the framework of the project: “Reintegration Through Sport Plus” funded by the Erasmus+ Sport program. One of the main project aims is the development of exercise training programs to be implemented by professionals of drug treatment organizations. In this context, we consider it’s important to summarize the existing knowledge with a broader focus on the existing literature in terms of outcomes and process on how physical exercise has been applied to SUDs treatment. The purpose of this review is to explore previous research regarding sports and physical exercise for SUDs treatment connected to the misuse of illegal drugs (interventions, cross-sectional studies, and literature reviews).

The guiding research questions are as follows:

- What research is currently available regarding sports, physical activity, or physical exercise programs related to people who are under SUDs treatment?
- What are the preferences and/or attitudes of those with SUDs regarding sports, physical activity, or exercise?
- What are the outcomes of sport and physical exercise interventions on individuals under SUDs treatment?
- Which behaviour change-inducing and motivational techniques were employed in respective studies that showed positive outcomes

METHOD

Inclusion and Exclusion Criteria

Studies were included if they met the following criteria: *a.* The participants should be aged between 15 and 60 years and in illicit drug addiction therapy, *b.* any type of physical activity, exercise, or sport, *c.* language should be English. *d.* Prevention programs employing sport or exercise were excluded.

Information sources

The database search was performed in two main databases: EBSCO and SCOPUS. The databases were searched until May 2020. Included were only published studies from peer-reviewed journals. Journals from various disciplines were considered. Publications in the English language were considered for the review. Relevant references were also searched for possible handpicked suitable studies.

Overall, the authors of 8 articles were contacted to receive various clarifications or to provide us with the full papers, required for the review. Five authors replied to the initial request. The rest of the authors did not reply to emails and reminders.

Search Strategy

The database search was performed using selected keywords. Four groups of keywords were used, incorporating such categories as “illicit drug”, “physical activity (exercise, sports)”, “intervention”, “review” and “addiction therapy”.

Study selection

The studies were selected based on the above-mentioned exclusion criteria. The search results were reviewed by two independent reviewers. Both reviewers were trained well acquainted with the criteria. In case of disagreement, a third reviewer was consulted until an agreement was reached. During the first stage, studies were excluded based on title and abstract whereas the rest of the studies were reviewed in full text.

Data extraction process

After piloting a data extraction sheet (with 3 random studies) and refining it, the most important qualitative and quantitative data from the studies were extracted. Descriptions of the interventions were coded according to behaviour change techniques (BCT) taxonomy as developed by Michie et al., (2013).

In order to be able to retrieve all the necessary information about the intervention contents or any other information, we had to consult articles related to the chosen studies, such as, for example, protocols or qualitative analyses. Five additional articles were consulted for this purpose ^[Dolezal, 2013; Nygard, 2018; Zhu, 2018; Zhu, 2016; Wang, 2017].

Data items

Information was extracted from each study depending on the type of study. From cross-sectional studies we extracted the following information:

- a. Aim
- b. No of participants
- c. Type of Illicit drug
- d. Type of Exercise/Sport/Physical Activity
- e. Relevant Measures/assessments
- f. Results/Outcomes

Appendix 1 presents all data extracted for cross-sectional studies.

From intervention studies we extracted the following information:

- a. Aim
- b. No of participants per group
- c. Type of Illicit drug
- d. Exercise (type/intensity/duration)
- e. Measures/assessments (relevant variables that have been assessed)
- f. BCT coding based on intervention description
- g. Results / Outcomes

- h. Type of delivery of exercise/sport/physical activity
- i. Who delivered the exercise
- j. Individual or Group exercise sessions
- k. Setting

Descriptions of the interventions were coded according to the Behaviour Change Techniques taxonomy (Michie et al., 2013). BCT is a “*systematic procedure included as an active component of an intervention designed to change behaviour*”. These techniques, being an active component in behaviour change interventions, have distinct characteristics such as being observable, replicable, and irreducible. Michie and colleagues (2013) developed a BCT taxonomy that allows identifying and coding various BCTs according to strict categories in different interventions.

Appendix 2 includes all data extracted for intervention studies.

From review studies we extracted the following information:

- a. Type of review
- b. Aim
- c. Number of included studies
- d. Geographic areas
- e. Inclusion criteria
- f. Type of Illicit drug
- g. Types of exercise/sport/physical activity
- h. Results/Outcomes

Appendix 3 includes all data extracted for review studies.

RESULTS

The title and abstract of 393 papers (187/EBSCO and 206 Scopus) were initially reviewed after removing duplicates. After reviewing the title and the abstracts, 320 papers were excluded (reasons: acute exercise only effects, animal studies, prevention studies, etc). Finally, after reviewing 73 full papers, 20 papers fulfilled the inclusion criteria and data extraction started. These represented cross-sectional, intervention, and review papers.

DESCRIPTIVES OF CROSS-SECTIONAL STUDIES

The cross-sectional studies gathered information from 959 participants in total. As of all studies, data were collected from participants using mixed substances (illicit drugs, nicotine, and alcohol) whereas an investigation was carried out with respect to regular physical exercise involvement of any type and intensity, checking whether such practices were in ac-

cordance with the official guidelines. Four of the studies (Caviness, 2013; Linke, 2015; Nani, 2017; Wang, 2019) assessed physical exercise behaviour among other measures whilst one assessed only their motives to participate in exercise (Abrantes, 2011).

DESCRIPTIVES OF INTERVENTION STUDIES

Two intervention studies ^(Brown, 2010; Muller, 2015) had a pre-post design whereas the rest ^(Cutter, 2014; Dolezal, 2013; Gimnez, 2015; McDaniel, 2016; Rawson, 2015; Wang, 2017; Zhu, 2016, 2018) featured a control or comparator group, with six ^(Cutter, 2014; Dolezal, 2013; Rawson, 2015; Wang, 2017; Zhu, 2016, 2018) of them being of a randomized control concept and two a non-randomized one. The number of participants per study varied between 16 and 200 participants with half of the studies ^(Brown, 2010; Cutter, 2014; Dolezal, 2013; Gimnez, 2015; Muller, 2015; Rawson, 2015; Wang, 2017) having less than 50 participants. Four ^(Brown, 2010; Gimnez, 2015; McDaniel, 2016; Muller, 2015) had a sample of mixed dependence (illicit drugs, alcohol, nicotine) participants and six ^(Cutter, 2014; Dolezal, 2013; Rawson, 2015; Wang, 2017; Zhu, 2016, 2018) featured participants with only illicit drug dependence (amphetamines, methamphetamine, methadone).

Exercise intensity varied between light to vigorous, with the majority of the studies using moderate-intensity exercises. All exercise interventions were supervised, mostly by an exercise professional and all were delivered in groups, except two ^(Cutter, 2014; Dolezal, 2013) which delivered individually and one ^(Muller, 2015) mixed. All exercise training sessions were delivered face to face, except one ^(Cutter, 2014) who used a computer game platform.

Eight studies ^(Brown, 2010; Cutter, 2014; Dolezal, 2013; Gimnez, 2015; Muller, 2015; Rawson, 2015; Zhu, 2016, 2018) used measurements for physical exercise (e.g., fitness tests, attendance), whereas one assessed exercise self-efficacy ^(McDaniel, 2016), and one craving measures, and Electroencephalographic (EEG) activity ^(Wang, 2017).

Six studies ^(Brown, 2010; Cutter, 2014; Gimnez, 2015; Rawson, 2015; Zhu, 2016, 2018) reported a decrease in substance use (or relapses or cravings) and simultaneously an increase in exercise-related variables (fitness or attendance). One study ^(Dolezal, 2013) reported an improvement in fitness measures only, one study ^(Wang, 2017) reported a decrease in substance use only whereas one study ^(McDaniel, 2016) reported no differences at all between the 2 groups (exercisers vs. non-exercisers). Finally, one study ^(Muller, 2015) reported improvements in physical and psychological health.

BEHAVIOUR CHANGE TECHNIQUES

All but one ^(McDaniel, 2016) study, described how the intervention content was delivered by the exercise specialists. We coded the interventions' contents description based on the Behaviour Change Techniques taxonomy (Michie et al., 2013) and the Self-determination motivational behaviour change techniques (Teixeira et al., 2020); the results (list of techniques and frequency of appearance) are set forth on Table 1. The detailed BCTs per study are displayed in Table 1.

TABLE 1. LIST OF BCTS AND MOTIVATIONAL BCTS - FREQUENCY OF APPEARANCE.

<i>BCTs</i>	<i>Definitions</i>	<i>Frequency</i>
1. Graded tasks	Set easy-to-perform tasks, making them increasingly difficult, but achievable, until behavior is performed	7
2. Self- monitoring of outcome(s) of behavior	Establish a method for the person to monitor and record the outcome(s) of their behavior as part of a behavior change strategy	7
3. Credible source	Present verbal or visual communication from a credible source in favor of or against the behavior	3
4. Instruction on how to perform the behavior	Advise or agree on how to perform the behavior (includes 'Skills training')	3
5. Biofeedback	Provide feedback about the body (e.g. physiological or biochemical state) using an external monitoring device as part of a behavior change strategy	3
6. Provide choice	Provide opportunities to make choices from a collaboratively-devised menu of behavioral options and autonomous goals. It includes the decision not to change, delay change, select focus/intensity of change, personally endorsed intrinsic goals and standards for success, including the timing or pace for certain outcomes.	2
7. Social support (unspecified)	Advise on, arrange or provide social support (e.g. from friends, relatives, colleagues, ' buddies' or staff) or noncontingent praise Or reward for the performance of the behavior. It includes encouragement and counseling, but only when it is directed at the behavior	2
8. Material incentive (behavior)	Inform that money, vouchers or other valued objects will be delivered if and only if there has been an effort and/or progress in performing the behavior (includes 'Positive reinforcement')	2
9. Material reward (behavior)	Arrange for the delivery of money, vouchers or other valued objects if and only if there has been an effort and/or progress in performing the behavior (includes 'Positive reinforcement')	2
10. Behavioral practice/ rehearsal	Prompt practice or rehearsal of the performance of the behavior one or more times in a context or at a time when the performance may not be necessary, in order to increase habit and skill	2
11. Goal setting (outcome)	Set or agree on a goal defined in terms of a positive outcome of wanted behavior	1
12. Reward (outcome)	Arrange for the delivery of a reward if and only if there has been an effort and/or progress in achieving the behavioral outcome (includes 'Positive reinforcement')	1
13. Feedback on behavior	Monitor and provide informative or evaluative feedback on the performance of the behavior (e.g. form, frequency, duration, intensity)	1
14. Prompts/cues	Introduce or define environmental or social stimulus to prompt or cue the behavior. The prompt or cue would normally occur at the time or place of performance	1
15. Information about health consequences	Provide information (e.g. written, verbal, visual) about the health consequences of performing the behavior	1

DESCRIPTIVES OF LITERATURE REVIEWS

There were carried out three systematic reviews^(College, 2018; Simonton, 2018; Wang, 2014), one with a meta-analysis^(Wang, 2014), and two^(More, 2017; Zschucke, 2012) literature reviews the selection criteria.

Through all reviews, 85 studies have been summarized, all of them targeting illicit drugs either integrally or in combination with other substances. The three systematic reviews summarized the existing literature regarding the impact of anaerobic exercise^(College, 2018), the effects of long-term physical exercise^(Wang, 2014) on SUDs therapy, and exercise preferences and attitudes of people with SUDs in therapy programs^(Simonton, 2018). All types of physical exercise and intensity levels were used in the reviewed interventions.

SYNTHESIZED OUTCOME FINDINGS

Preferences and attitudes towards the physical exercise of people with SUDs

Overall, the results of the reviewed cross-sectional studies indicate that, in a variety of SUDs instances, individuals are not as physically active as the typical population; still, they express an interest in physical exercise and sport involvement especially if programs are tailored to their needs.

Identifying barriers and facilitators is also a topic of interest in the reviewed studies. Addicts face issues of poor physical condition; they might be inexperienced in sports and exercise and often feel intimidated in physical exercise environments. An additional finding is that there are significant differences in their preferences due to individual factors (e.g., gender or stage of therapy) regarding exercise-related characteristics, like type, frequency, and intensity.

Finally, one review^(Simonton, 2018) summarized the preferences and attitudes of SUDs people under therapy in five respective studies. They reported the most frequently preferred types of exercise to be walking, strength training, and cycling, activities in which they would like to engage either alone or with small groups, and would prefer their exercise options to be available on the premises of their treatment clinics.

OUTCOMES OF PHYSICAL EXERCISE INTERVENTIONS AND REVIEWS

Overall, according to the reviewed studies, people with illicit SUDs under therapy who managed to increase exercise-related variables (fitness or attendance) reported that exercise contributed to a reduced desire to use substances, a reduction in cravings, and increased abstinence. Physical exercise interventions also had positive psychological outcomes for participants. The reduction of stress, tension, anxiety, and depression symptoms^(Gimnez, 2015; Zhu, 2018), for example, is a common outcome for all exercisers. Individuals in therapy for illicit drug addiction face intense and prolonged stress, in comparison with other addictions. Therefore, they experience more positive effects than people with addictions to nicotine or alcohol^(Wang, 2014). Additional positive psychological outcomes reported were optimism in life, life satisfaction,^(Cutter, 2014) quality of life, such as physical function, mental health, vitality, social function, and general health perception^(Gimnez, 2015), forgetting about everyday problems and improved mood as well as improved self-concept and locus of control^(Zschucke, 2012).

Physical exercise and/or sport involvement had also positive outcomes on employment, and dwelling ^(Gimnez, 2015), as well as physical benefits, like decreased injuries and muscle pain, decreased weight, and increased vitality with improvement in activities of daily living and sleep quality ^(Zhu, 2018).

DISCUSSION

To overview the available literature regarding sports and physical exercise in relation to illicit drug addiction treatment, we summarized results of interventions, cross-sectional, and literature review studies to inform the aim of the *Reintegration Through Sport Plus (RTS+)* project (www.rtsport.eu).

AVAILABLE RESEARCH REGARDING PHYSICAL EXERCISE FOR INDIVIDUALS UNDER SUDS TREATMENT

Overall, the published research in the area of physical exercise for people under treatment for SUDs with the misuse of illegal drugs is small in quantity and low to moderate in quality. Nevertheless, in the latest years, there is a trend showing interest in this area of research, and some studies in the last decade comply with higher standards in research design and methodology. This is also reflected in the number of recently published reviews, which summarize the growing number of research publications. Nevertheless, because of the still small number of existing studies and with the heterogeneity thereof, reviews may not feed in meta-analyses. Finally, very few intervention studies used criteria for a BCT, some were of a quasi-experimental design, whereas other studies suffered several methodological limitations.

There are reasonable justifications to explain such a lack of research in this area. There are several difficulties: for example, in any longitudinal study design, like behavioural interventions, having recruiting volunteers to participate is a challenge, since most illicit drug users may just as well not cross paths with the healthcare system for their addiction. Therefore, recruitment for trials is done via advertisements placed at treatment centres where patients of illicit drugs receive therapy. Another issue amongst people with illicit substance use disorders is that they are stigmatized, and consequently afraid of further social or legal consequences of their addiction, which discourages potential volunteers from signing up to participate in research. Moreover, people with addiction often do not wish to engage in treatment or believe they need no treatment at all. Finally, as many people with addictions are unemployed, poor, or homeless (possibly because of their addiction), they may lack the resources needed for attending exercise programs. As a result, the attrition rate (discontinuation of participation) in studies is more than 50%, which ultimately undermines the representability of the results.

OUTCOMES OF PHYSICAL EXERCISE

Physical exercise in combination with other types of therapy may effectively attenuate withdrawal and abstinence symptoms for illicit drug addictions. Further, the multitude of benefits of exercise on individuals under SUDs treatment helps them stay motivated towards recovery. As the changes in their body and psychosocial condition set in, progress

helps them to form a new healthier identity whilst the increased confidence may transfer to their effort to stay off their addiction (Cutter 2014).

Most of the studies that identified psychological positive benefits reported positive changes in mood regulation (stress, depression) and aspects relevant to the quality of life. One of the mechanisms likely to underlay the stress-relieving effects of exercise could be the stimulation, through exercise, of the production of the brain's feel-good neurotransmitters, called endorphins (Goldfarb, 1997).

A number of quality-of-life relevant aspects have also been identified in the reviewed studies to have been positively affected as a result of engaging in physical exercise (e.g., increased vitality and function). Similar effects on life quality have been found with respect to Yoga programs for women undergoing detoxification for heroin dependence (Zhuang, 2013). The latest review from Giménez-Meseguer (2020) also postulates that physical exercise - both body-mind and physical fitness programs - can be effective in improving the quality of life in SUDs patients.

DESIGNING PHYSICAL EXERCISE INTERVENTIONS FOR SUDS TREATMENT CONNECTED TO THE MISUSE OF ILLEGAL DRUGS

According to cross-sectional studies' results, tailoring physical exercise interventions to the unique needs and preferences of the SUDs people under treatment is a crucial element (Abrantes, 2011; Linke, 2015). Tailoring interventions to the needs of the target group is a key strategy for a successful exercise intervention (Michie et al., 2014). Exploration of the SUDs population's preferences and attitudes regarding exercise may lead to more efficacious exercise interventions with improved adherence and attrition rates and therefore lead to improved recovery outcomes. Moreover, identification of barriers and facilitators of the specific group helps exercise program designers to better tailor physical exercise programs and enhance motivation and adherence. The provision of PE opportunities needs to be flexible and regular enough to allow the continued engagement of participants (Horrell et al., 2020). There is also some evidence that the person-centred approach might be effective, because of participants' varying fitness levels and underlying medical conditions (Horrell et al., 2020). Finally, the type of drug, as well as the type of therapy (e.g., with or without replacement) may play a significant role in the physical exercise program design.

BEHAVIOUR CHANGE AND MOTIVATIONAL TECHNIQUES USED AT THE INTERVENTION GROUPS OF EFFECTIVE STUDIES

The most frequent behavior change techniques used in the reviewed intervention studies were the "graded tasks" and "self-monitoring" by the participants, of their physical exercise behaviour. This indicates that for drug addicts to progress slowly with exercise duration and intensity is a very important technique. In so doing, they are bound to build their confidence up step-by-step, especially if they are inexperienced and express concerns regarding their ability to exercise. Similarly, by "self-monitoring their physical exercise behaviour", they may actually become conscious of their progress, which in turn boosts their self-esteem towards continuing the effort. The BCT's of "credible source"

and “instruction on how to perform the exercise behaviour” heralds the need to have as an instructor a specialist who is not only knowledgeable of the specific physical exercise or sport but also a person they value and trust. Finally, “providing choices” and “social support” to participants implies that they need to feel autonomous and supported by their group members while participating in physical activities (Horrell et al., 2020). Access to physical exercise programs and affordability may also play an important role in SUDs patients in therapy, especially when they face stigma or poverty. For that reason, using techniques as “material rewards” and “incentives” may also help them to be able to attend physical exercise programs.

PHYSICAL EXERCISE CHARACTERISTICS

Most of the reviewed studies provided information regarding the type, intensity, frequency, duration, structure, and delivery modes. Regarding the type of exercise, studies delved into a wide array thereof, ranging from aerobic exercise to body and mind types of exercise, with various outcomes. Preferences of participants play a significant role in deciding what types of physical exercise we should include in programs for drug-addicts. Therefore, an assessment of needs with respect to preferences, as well as to barriers and facilitators is a *sine-qua-non* process for physical exercise program designers. Moreover, an exercise program should be preceded by a medical check due to the varying health conditions of participants.

Physical exercise intensity varied along a continuum from light to moderate to vigorous. According to some researchers, vigorous exercise is not recommended for substance use populations, therefore, moderate-intensity exercise is preferred for reasons such as the risk of injury or other adverse effects (Simonton, 2018). Moreover, moderate-intensity exercise has greater adherence rates in comparison to vigorous-intensity exercise (Heinrich et al., 2014). According to (Nani et al., 2017) exercise intensity did not predict happiness with life for attendants of rehabilitation centres in Greece, but frequency did. However, intensity should also be matched to participants’ perceptions of what is achievable.

The majority of the studies considered used group-based delivery of exercise sessions. It seems that addicts under therapy prefer to engage in physical activities in small groups or a “buddy” system suggesting that they need social interaction and support when they exercise. Nevertheless, individual preferences should be taken into account, because exercising alone might also be a preference or a necessity for some.

Regarding the type of delivery, the majority of studies were based on delivery through the physical presence of an exercise trainer or counsellor, except for one study based on virtual delivery. The importance and need for the presence of a trained physical exercise instructor have been discussed earlier. In addition to the previously mentioned reasons, a trained exercise specialist is in a position to make decisions regarding how much supervision the participants need, and based on that to provide feedback and encouragement in order to support retention and adherence to physical exercise programs. The support, encouragement, and guidance provided by staff are generally highly valued across a number of study findings (e.g., Linke et al., 2019). Finally, technology-supported exercise needs further intervention studies to give evidence about the adequacy of this population.

LIMITATIONS

Studies currently reviewed in the field of SUDs treatment with the misuse of illegal drugs provide some useful initial information allowing us to develop physical exercise training programs that can be used by professionals of drug treatment organizations and sports organizations. Moreover, they provide some evidence as to positive treatment effects likely to be achieved using PE interventions as an add-in, under SUDs treatment schemes. Regarding the identified most effective behavior change techniques, results should be treated with caution, as in several cases the description of the intervention has not been sufficiently detailed. Therefore, there is a possibility that exercise programs used more techniques than they described. This is a common problem when intervention studies do not use the BCT taxonomy to report their intervention contents. Moreover, as a result of the application of our inclusion criteria, certain studies may have been left out that could have provided us with additional information. Systematic reviews and meta-analyses have already started to become available in the literature, although featuring questions of a more limited scope than the ones we needed and which we ultimately decided to use. Therefore, readers need to further explore literature if they need more specific answers to questions regarding the effects of exercise as an adjunct to therapies for SUDs. Nevertheless, during our study, it became obvious that evidence concerning physical exercise for illicit drug users under therapy is rather scarce.

CONCLUSION

Following a review of the literature regarding sports and physical exercise programs as an adjunct to therapy SUDs treatment, we presented initial useful information about designing physical activity programs for the needs of the Reintegration Through Sport Plus/RTS+ project (www.rtsport.eu). To our mind, physical activity-based interventions that have, to this day, been implemented in SUDs treatment are mostly meant to delve into the aspects of physical effort and the benefits such exercise eventually holds for physical health, rather than actually utilizing the sport environment as a psychological model to enhance motivation and support training as part of behaviour-changing strategies. To sum up, several gaps in our knowledge remain and we need more specific and valid information regarding exercise as an adjunct intervention for SUDs. What is definitely and most specifically required are future studies investigating and testing the potential of mechanisms of interaction between exercise and positive outcomes for SUDs population.

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Appendix 1. Data extracted from cross-sectional studies

#	1st author/year	Aim	N of participants	Type of Drug(s)	Type of Exercise(s)	Relevant Measures/assessments	Results/Outcomes
1	Abrantes/2011	<p>1. To investigate the extent to which substance dependent patients are interested in engaging in an exercise intervention as an adjunct to their substance abuse treatment.</p> <p>2. To examine patients' preferences regarding the type, intensity, and timing of exercise interventions in relation to their ongoing substance abuse treatment.</p> <p>3. To determine if there exist differences in exercise preferences across substance abuse treatment type (i.e., alcohol dependence only or drug dependence with or without alcohol dependence) and by gender.</p>	N = 97	<p>47.4% alcohol dependence only,</p> <p>52.6% primary drug dependence only or with concomitant alcohol problems</p>	<p>Participants were queried on whether they regularly engage in an exercise program of moderate intensity activity for at least 20 uninterrupted minutes.</p>	<p>Motives for Physical Activity Measure, Barriers to physical activity.</p>	<p>The vast majority (95%) expressed an interest in engaging in an exercise program specifically designed for persons in substance use recovery and 89% reported wanting to initiate an exercise program within the first 3 months of sobriety. Specific exercise preferences regarding type of physical activity, exercise intervention components, and perceived benefits and barriers to exercise differed between males and females. These findings suggest low rates of regular exercise, high level of interest in engaging in exercise during early recovery, and point toward the need to tailor interventions to the unique preferences of individuals.</p>
2	Caviness/2013	<p>To provide a comprehensive examination of exercise attitudes and physical activity in a sample of MMT smokers (benefits and barriers to exercise).</p>	N = 305	Methadone-maintained smokers	Physical activity guidelines - Any type	<p>International Physical Activity Questionnaire, Perceived barriers to exercise, Benefits to exercise (Motives for Physical Activity Measure), Body-mass index (BMI).</p>	<p>Nearly 45% endorsed fair or poor physical health. Although participants perceived many benefits of exercise and few barriers, only 38% of participants met weekly recommendations for physical activity, and nearly 25% reported no physical activity. Those who met recommended guidelines were significantly more likely to endorse relapse prevention as a benefit of exercise. Motivating MMT patients to increase physical activity could have important physical, mental health, and drug treatment benefits.</p>

<p>3</p> <p>Linke/2015</p>	<p>Formative research: To evaluate the following information among veterans in treatment for SUDs:</p> <ol style="list-style-type: none"> 1. Interest in an adjunctive exercise program to supplement their current SUD treatment. 2. Exercise program design considerations. 	<p>N = 19</p>	<p>Alcohol (50%), Cocaine (18%).</p>	<p>Physical activity guidelines - Any type</p>	<p>"Health Behavior Survey" (past and current exercise habits and exercise preferences), Small group interviews (exercise preferences of veterans in recovery, with the goal of designing an exercise program that would maximize adherence).</p>	<p>A survey and small group interviews were conducted to obtain both quantitative and qualitative data. Results suggested that veterans with SUDs are interested in exercise, and participants provided perceptible suggestions for modifying an existing evidence-based program. These findings used to design an exercise-based treatment program tailored specifically for veterans with SUDs.</p>
<p>4</p> <p>Nani/2017</p>	<p>To explore the influence of physical activity on the degree of happiness among drug abusers</p>	<p>N = 73</p>	<p>69% opioids, 21% cannabis, 5% cocaine</p>	<p>Any type</p>	<p>Godin Leisure-Time Exercise Questionnaire, Happiness with life (Oxford Happiness Questionnaire)</p>	<p>For the dimension of the happiness with life, the results showed that the respondents were only moderately happy. They also moderately exercise in terms of intensity and frequency. Regression analysis indicated that the exercise intensity did not predict the respondents' happiness with life. On the contrary, frequency of exercise predicted the respondents' happiness. Results suggest that attendants of rehabilitation centers in Greece should be motivated to participate more frequently in exercise and recreation programs to somehow improve their happiness with their life.</p>
<p>5</p> <p>Wang 2019</p>	<p>To determine the critical role of internal inhibition in the path of physical exertion affecting the drug cravings of women drug users</p>	<p>N = 465</p>	<p>Mixed drugs</p>	<p>Any type</p>	<p>Physical Activity Rating Scale (PARS-3), internal Inhibition Scale, Drug Craving Scale.</p>	<p>Women with traditional drug users had the strongest internal inhibition and new drug use disorder had the highest drug craving. The longer the duration of drug abuse, the lower the internal inhibition and the higher the drug craving. Women with moderate-intensity activity had the strongest internal inhibition and the lowest drug craving. The physical activity intensity was negatively correlated with drug craving, positively correlated with intrinsic inhibition, and negatively correlated with drug craving. Internal inhibition played a partial mediating effect between physical activity intensity and drug craving.</p>

Appendix 2. Data extracted from intervention studies													
#	1st author/year	Design	Aim	No of participants	Type of Drug(s)	Type of Exercise(s)	Measures/Assessments	BCT coding	Results/Outcomes	Type of delivery exercise	Who delivered the Exercise	Individual or Group sessions	Setting
1	Brown/2010	Pre-post	To examine the feasibility of aerobic exercise as an adjunct to substance abuse treatment among drug dependent patients.	N=16	(81.3%) Alcohol (31.3%) cocaine (31.3%) marijuana (12.5%) opiates (6.3%) reported sedative use	12-week, moderate-intensity aerobic exercise intervention	1. Physical activity screen. 2. Structured clinical interview for DSM-IV (SCID-P; First, Spitzer, Gibbon, & Williams, 1995). 3. The TLFB interview (Sobell et al., 1980) was utilized to assess alcohol and drug use at baseline and during the follow-up intervals. 4. Cardiorespiratory fitness was assessed using a submaximal graded exercise protocol on a motorized treadmill at baseline and follow-up evaluations. 5. ACSM's Guidelines for Exercise Testing. 6. 20-item Intervention feedback questionnaire.	8.1. Behavioral practice/rehearsal, 8.7 Graded tasks, 2.6 Bio-feedback, 2.4 Self-monitoring of outcome(s) of behavior, 9.1 Credible source, 10.1. Material incentive (behavior), 10.2. Material Reward (behavior).	Participants demonstrated a significant increase in percent days abstinent for both alcohol and drugs at the end of treatment, and those who attended at least 75% of the exercise sessions had significantly better substance use outcomes than those who did not. In addition, participants showed a significant increase in their cardiorespiratory fitness by the end of treatment.	Face to face	Exercise specialist	Group	Rehabilitation

2	Cutter/2014	Randomized control trial	<p>To investigate the feasibility and acceptability of an exercise intervention comprising the Wii Fit Plus™ and of a time-and-attention sedentary control comprising Wii™ videogames. We also explored their impact on physical activity levels, substance use, and psychological wellness.</p>	<p>N=29: Active Game play (N=15) or Sedentary Game Play (N=14)</p>	<p>Methodone-maintained patients</p>	<p>Active Game Play (Wii Fit Plus™ involving physical exertion) or Sedentary Game Play (Wii™ videogames played while sitting)</p>	<p>1. Acceptability: Satisfaction with the intervention, perceptions of enjoyment, usefulness, accomplishment, and motivation to continue. 2. Physical Activity Ir-session activity: Kilocalories (kcal), standardized units of energy expenditure. Exercise intensity was expressed as %METs, kcal for intermittent time spent standing between exercises in Active Game Play as well as for sitting and gaming in Sedentary Game Play sessions, Height and Weight. Extra-session activity: Levels of overall moderate-to-vigorous physical activity (MVPA) outside of the Wii sessions were measured weekly with the International Physical Activity Questionnaire-Long Version (IPAQ-L) in five domains: work, transportation, house work, recreation, and time spent sitting. 3. Substance Use: The Weekly Substance Use Inventory, Time Line Follow Back, detailed day-by-day self-report of drug use. 4. Psychological Wellness Outcomes: Perceived Stress Scale Perceived Stress Scale (PSS), Optimism - Life</p>	<p>MBCT 6. Provide choice.</p>	<p>Participants had high satisfaction and study completion rates. Active Game Play participants reported greater physical activity outside the intervention than Sedentary Game Play participants despite no such differences at baseline. Substance use decreased and stress and optimism improved in both conditions.</p>	Mediated	Exercise specialist	Individual	Rehabilitation
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3	Dolezal 2013	Randomized control trial	To assess the feasibility and efficacy of an 8-week endurance and resistance training program on fitness measures in individuals undergoing residential treatment for methamphetamine (MA) dependence.	N=29, Exercise training (ET, N=15) or Health Education without training (EA, N=14)	Methamphetamine-Dependence	Endurance and resistance exercise routines	VO2max, LP strength, and CP strength, body weight, body fat, fat weight, Physical activity 7-day recall	Orientation Test-Revised (LOT-R), Psychiatric Symptomology Brief Symptom Inventory-18 (BSI-18), Life satisfaction, Brief Life Satisfaction Scale (BLSS).	10.10 Reward (outcome), 2.3. Self-monitoring of behaviour, 8.7. Graded tasks, 4.1. Instruction on how to perform the behavior, 2.2. Feedback on behaviour,	Individuals recovering from methamphetamine dependence showed substantial improvements in aerobic exercise performance, muscle strength and endurance, and body composition with exercise training. The ET group significantly improved VO2max, LP strength, and CP strength and showed significant reductions in body weight, % body fat and fat weight. All changes were significant ($P < 0.001$) for ET, and no changes were seen for the EA group. These findings demonstrate the feasibility of an exercise training intervention in these participants and also show excellent responsiveness to the exercise stimulus resulting in physiological changes that might enhance recovery from drug dependency.	Face to face	Exercise specialist	Individual	Rehabilitation
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4	Gimnez/ 2015	Non-Randomized control trial	To evaluate quality-of-life changes in drug-dependent patients after participation in a group-based exercise program.	N=37: Group exercise program (n = 18) - Routine care (n = 19)	DSM-IV criteria for drug dependence	3 days/week for 60-90 minutes per session/ over 12 weeks/ aerobic capacity and muscular endurance/ moderate to vigorous intensity	The Six-Minute Walk Test (6MWT) - submaximal test measuring aerobic fitness. TGUG - agility and dynamic balance, Chair Stand Test (CST) - lower limb strength, Short Form Health Survey (SF-36) - quality-of-life. Qualitative Assessment: Interviews took place in the rehabilitation center, lasted up to 45 minutes, and were conducted by the same researcher of the exercise program.	9.1 Credible source, 3.1 Social support (unspecified), 8.7 Graded tasks, 2.4 Self-monitoring of outcome(s) of behavior	Quantitative results showed improvements in fitness and different aspects of quality of life, such as physical function, mental health, vitality, social function, and general health perception. Qualitative results showed specific physical benefits (decreased injuries and muscle pain, decreased weight, and increased vitality with activities of daily living), psychological benefits (forgetting about everyday problems, improved mood, decreased stress and anxiety), social benefits, and a reduction in craving. The results of this study provide insight into the importance of exercise for the quality of life and recovery process of drug-dependent patients.	Face to face	Exercise specialist	Group	Rehabilitation
5	McDaniel/ 2016	Non-Randomized control trial	To assess yoga as a moderator of substance abuse treatment effectiveness, as indicated	N=200: Yoga group (N=100) or Non Yoga group (N=100).	SUD disorder	Yoga / moderate intensity	Exercise Self-Efficacy (ESE) survey, Treatment Effectiveness Assessment, and adjunct yoga exercise were both an independent and moderating variable.	No description	The results demonstrated no significant difference with respect to treatment effectiveness for either the yoga or non yoga treatment groups. This study	Face to face	Exercise specialist	Group	Rehabilitation

7	Rawson/2015	Randomized control trial	The primary aim of this study was to characterize the effects of an 8-week exercise intervention on	Methamphetamine use outcomes at 1-, 3-, and 6-months post-discharge from residential treatment, compared to a health education control group.	N=135: Exercise Group (N=69) or Health education control (N=66)	Methamphetamine dependence per DSM-IV	Aerobic/moderate/3 times a week for 8 weeks. Exercise sessions consisted of a 5-min warmup, 30 min of aerobic activity on a treadmill, followed by 15 min of weight training and a 5-min cool-down/stretching period.	Primary outcome measures included MA use as measured by both urine drug screens (UDS) and self-report using the Substance Use Inventory and maximal exercise performance test	8.1 Behavioral practice/rehearsal, 8.7 Graded tasks, 2.6 Bio-feedback, 2.4 Self-monitoring of outcome(s) of behavior, 9.1 Credible source, 1.3 Goal setting (outcome)	While fewer exercise participants returned to methamphetamine (MA) use compared to education participants at 1-, 3- and 6-months post-discharge, differences were not statistically significant. A significant interaction for self-reported MA use and MA urine drug test results by condition and MA severity was found: lower severity users in the exercise group reported using MA significantly fewer days at the three post-discharge timepoints than lower severity users in the education group. Lower severity group also had a lower percentage of positive urine results at the three timepoints than lower severity users in the education group. These relationships were not present in the comparison of the higher severity conditions. Participants who were MA abstinent at the 1-month post-discharge follow-up reported significantly more minutes of exercise (i.e., 118.97 minutes per week) via	Face to face	Exercise specialist	Group	Post-residential treatment care
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8	Wang 2017	Randomized control trial	To determine the effects of aerobic exercise training on craving and inhibition control among people with MA dependencies.	N=50: Aerobic group (N=25) or Attention Control group (N=25)	Methamphetamine dependence	Three 30-min sessions per week of moderate intensity aerobic exercise (i.e., cycling, jogging, or jump rope) for 12 weeks.	Craving measures, Inhibitory control measures, neutral and MA-related inhibitory control, elicited neuroelectric activation (Electroencephalographic (EEG) activity).	8.7 Graded tasks, 2.6 Bio-feedback, 2.4 Self-monitoring of outcome(s) of behavior.	The current study provides the 1st evidence that aerobic exercise training may be efficacious for MA-associated cravings and inhibitory control from behavioral and neuroelectric perspectives among MA-dependent individuals.	Face to face	Exercise specialist	Group	Drug Rehabilitation Bureau	the IPAQ than those who were not MA abstinent (i.e., 90.8 minutes per week) using UDS results ($p = .03$; response rate for the 1-month interview was $N = 102$ (exercise $n = 54$ and health education $n = 48$)). Results support the value of exercise as a treatment component for individuals using MA 18 or fewer days/month.
9	Zhu 2018	Randomized control trial	To investigate if Tai-Chi practice can improve sleep quality and mood of females who are dependent on	N=80: Tai Chi group (N=42) or Standard Care (N=38).	Amphetamine-type stimulant (ATS)	Tai Chi (medium intensity, five times a week during the first 3 months and three times a week during the second 3 months).	Self-rated Pittsburg Sleep Quality Index (PSQI), Self-Rating Depression Scale (SDS), fitness after 3 and 6 months.	8.7 Graded tasks, 4.1. Instruction on how to perform the behavior.	Result suggested that TaiChi (TC) had positive effects on sleep quality, depression and fitness. Long-term study demonstrated that TC may be a cheap and potential supplementary treatment for ATS.	Face to face	Exercise specialist	Group	Rehabilitation center	

10	Zhu 2016	Randomized control trial	To assess the quality of life and physical effects of a Tai Chi intervention on individuals with amphetamine-e-type stimulant dependence.	N=59: Tai Chi group (N=30) or Standard Care (N=29).	Amphetamine-type stimulant (ATS)	Tai Chi (medium intensity, five times a week for 12 weeks).	Quality of life scale for drug addiction (QOL-DAv2.0), Fitness test	8,7 Graded tasks, 4.1. Instruction on how to perform the behavior.	dependent individuals. TC may also be considered as an alternative exercise to escalate abstinence for ATS-dependent females. Test scores of the QOL-DA in the Tai Chi group significantly increased after 12 weeks in the following areas: physiology, symptoms, society, and QoL total score. A post hoc test further revealed that quality of life improved in the Tai Chi group but not in the standard care group. Physical results showed a significant interaction with balance and participants in the Tai Chi group improved by 10 s while there was no change in the standard care group. Although there were no significant interactions in the fitness outcomes (i.e., hand-grip and sit-and-reach tests), the within-group factor displayed significant changes in body fat ($F(1,56) = 27.79, p < 0.001$) in both groups.	Face to face	Exercise specialist	Group	Rehabilitation center
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Appendix 3. Data extracted from review studies									
#	1st Author/Year	Review type	Aim	No of included studies	Geographic areas	Inclusion criteria	Type of Drug(s)	Type of Exercise(s)	Results/Outcomes
1	Colledge/2018	Systematic Review	To document the implementation of anaerobic exercise in the treatment of SUDs.	26	University of Connecticut Health Center, Farmington, CT	Included in the review are all studies which, as a form of treatment for SUDs, involved acute or chronic exercise of the following type: (1) reported by authors as being at or above the specifically determined IAT; (2) at or above a heart rate which corresponds to 75% of maximum; (3) at or above 70% of heart rate reserve; (4) at a score of 14 or above on the Borg scale; (5) described by the authors as vigorous, intense, or anaerobic; or (6) involving activities which may incorporate bouts above the IAT, where the authors do not explicitly state that this was not the case, by reporting physiological data (for example, heart rate below 75% of maximum). These activities are defined as any type of sport, exercise or structured physical activity excluding yoga, Pilates, stretching, walking, medical rehabilitation, Qi Gong, or Tai Chi.	Cigarettes (12 studies), alcohol (1 study), and all illicit and prescription drugs (13 studies)	Anaerobic exercise training	The findings of this review suggest that anaerobic or vigorous exercise may have a positive effect on a number of outcomes in populations with a SUD. The most positive effects being found for abstinence in nicotine dependence. The effects of anaerobic exercise cannot be determined, and therefore not evaluated or compared with other forms of exercise. "Further studies are required to establish the optimum intensity of exercise intervention required."

2	More/2017	Literature Review	<p>1. To identify factors associated with the development and persistence of substance use disorders among youth.</p> <p>2. To identify current treatment modalities, and present evidence to support the efficacy of incorporating exercise participation during rehabilitation.</p> <p>3. To provide a series of recommendations for future research that explores the feasibility and effectiveness of exercise participation as a complement to substance use disorder treatment among youth.</p>	Unspecified	Young person as 'at risk' within Western societies	Not applicable	SUD disorders according to DSM	Exercise participation in general - Any type	<p>1. 'At-Risk' Populations: Parents and family, School, Peers, Stress, Boredom, Mental health.</p> <p>2. No consistent and universally accepted therapy approach exists, the primary goal of many SUD rehabilitation programs is abstinence, attained through the treatment of the physiological, psychological, and sociological problems presented by the individual. More holistic goals, including harm minimization, facilitating access to education, reducing substance use, improving interpersonal relationships, and improving physical and mental health, may also be targeted.</p> <p>3. Very little research exists in the area of exercise on SUD, and as a result, the feasibility and/or outcomes of exercise participation within youth SUD populations are relatively unknown.</p> <p>RECOMMENDATIONS FOR FUTURE RESEARCH: 1. : Examine Exercise Perceptions and Attitudes among Youth with SUDs; 2. Examine Recovery-Related Outcomes Associated with Exercise Participation; 3. : Identify Community Transition Pathways and Long-Term Outcomes.</p>
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3	Simontoni/2018	Systematic Review	<p>To explore previous research regarding PA/exercise preferences for those with SUDs. Research questions:</p> <ol style="list-style-type: none"> 1. What research is currently available regarding PA/exercise preferences in those with a SUD? 2. What were the designs (location, SUD population, data collection methods, etc.) of these studies? 3. What were the preferences and/or attitudes of those with SUDs regarding PA/exercise? 	5	United States	<ol style="list-style-type: none"> 1. Written in English, 2. peer reviewed, 3. pertaining to a population with a SUD, 4. preferences or attitudes as a primary outcome. 	SUD	Any type	<p>The findings of this review, though limited, nonetheless suggest that people with SUDs are interested in increasing their PA.</p> <p>Facilitators/Benefits: PA would provide a sense of accomplishment and confidence, would improve physical health, and could increase one's confidence to stay sober.</p> <p>Barriers: lack of motivation, financial restrictions, disability or injury and lack of energy. Social environment: Preferred engaging in PA alone or with a small group or a buddy system, indicating that foster support and encouragement for PA should be a part of an intervention.</p> <p>Types of preferred exercise: interested in discussing exercise (women more than men), incorporating strength/resistance training, activity tracks (pedometer), Walking, Gym, bicycling, Sports, Yoga, Recreational activities, Competitive without friction, Exercise counseling during treatment.</p> <p>Structure: Face-to-face from an exercise counselor, Scheduled, Combined supervised / unsupervised or supervised, with a Mentor, Unsupervised, self-paced, or Do it yourself with professional guidance.</p> <p>Intensity: Moderate, Light, Multiple, ranging from easy to difficult. Emphasized it can't be too strenuous or intense</p>
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4	Wang/2014	Systematic Review with Meta-analysis	To examine whether long-term physical exercise could be a potential effective treatment for substance use disorders (SUDs).	22	Raj, Georgia Regents University, United States of America	<p>1. The selected papers were studying physical exercise intervention's effect on drug abuse, excluding preventive studies. 2. All research use RCT. 3. Objects of the study were adults over 18 years old who were assessed as alcohol, nicotine, and illicit drug abusers through the DSM-III(R)/IV.</p>	Alcohol (3 studies), nicotine (11 studies), illicit drug abusers (5 papers), and polydrug abusers of alcohol, nicotine, and illicit drugs (4 studies) / DSM-III(R)/IV	Any type	<p>The results indicated that physical exercise can effectively increase the abstinence rate, ease withdrawal symptoms, and reduce anxiety and depression. The physical exercise can more ease the depression symptoms on alcohol and illicit drug abusers than nicotine abusers, and more improve the abstinence rate on illicit drug abusers than the others. Similar treatment effects were found in three categories: exercise intensity, types of exercise, and follow-up periods. Although physical exercise has been proven effective in facilitating drug abstinence, its effects on alcohol, nicotine and illicit drug abusers are different. From the results of the meta-analysis, the effects of physical exercise on illicit drug abusers are significantly greater compared to others. Given the limitation of materials, these issues require further investigation.</p>
5	Zschucke/2012	Literature Review	This paper aims at summarizing empirical evidence for therapeutic effects of PA and EX in SUD and arriving at conclusions concerning further research and clinical practice.	Alcohol (9 RCTs), nicotine (17 RCTs), and illicit drug (8 studies)	Not specific	<p>For nicotine abuse and dependence, only randomized-controlled trials (RCTs) were included into this paper. Since the literature was very limited concerning RCTs on alcohol abuse/dependence and illicit drug abuse/dependence, studies with inadequate control strategies and small samples were also included into this paper. Studies in English or German published between 1970 and 2011 which had investigated any form of EX as therapeutic intervention strategy. Search terms included "exercise," "physical activity," "substance use disorder," "dependence," "abuse," "illicit drugs," "alcohol," "nicotine," "cannabis," "opiate," "stimulant," and "cocaine," in the respective languages.</p>	Illicit drugs	Any type	<p>Illicit drugs: Positive outcomes for craving, percentage of abstinent subjects, continuous days of abstinence. Secondary psychological and social outcomes like depression, anxiety, tension, self-concept, locus of control, employment, and dwelling were increased at least in one of the exercise conditions. Fitness increased in 3 studies. / Alcohol: Significant improvements on drinking episodes, craving, or days of abstinence as substance-related outcomes. Secondary psychological outcomes like depression, anxiety, stress, self-concept, locus of control, and sleep quality, which increased at least in one of the EX conditions. / Nicotine: Evidence is concerning favorable effects of EX intervention in smoking cessation. Acute effects of exercise are favorable for a number of variables. EX adherence rather than the admission to an EX intervention per se predicted smoking abstinence, suggesting an important role of motivation, individual resources, and self-efficacy. Exercise interventions showed the clearest effects when compared to standard treatment, which becomes more unequivocal, when EX is compared to control groups which offer a similar amount of social support, therapeutic contact, and preoccupation with health-related topics. The majority of studies have shown that EX interventions are as effective as other standard interventions for smoking cessation, such as CBT or NRT/medication.</p>

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