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Physical activity during a treatment for substance use disorder: A qualitative study

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ABSTRACT

Background: Individuals with substance use disorder face a higher mortality rate, attributed in part to the presence of chronic physical conditions. Physical activity emerges as a promising solution, as it could impact on physical conditions as well as on the symptoms of substance use disorder itself. Although there is promising evidence, studies are still needed to fully understand the mechanisms, as well as their acceptability in real life. In order to address these issues, we need to include the perceptions of people who participate in these programs to determine the clinical importance and feasibility of physical activity.
Objective: To understand the physical activity perception of people undergoing treatment for substance use disorder.
Methods: Thirteen people (69% men; 33.4 ± 8.3 years old) were interviewed after experiencing a physical activity intervention during their treatment.
Results: Following the content analysis, three predominant themes emerged: physical activity was (1) a way to take care of themselves, through the perceived improvement of health; (2) used as a protective mechanism against relapse, through the occupation time, behavior replacement and the creation of a healthy network; (3) served as a facilitator of treatment retention because participant developed social support.
Conclusion: Physical activity during treatment could improve the therapeutic process for people with substance use disorders, as well as helping to develop healthy lifestyle habits and reinforce confidence in coping with future relapses.

1. Introduction

Substance use disorder (SUD) impacts about 2% of the Canadian population (Institute for Health Metrics and Evaluation, 2022) and is defined as a pathological behavior pattern related to 11 psychoactive substances (i.e., alcohol, cannabis, hallucinogens, inhalants, opioids, sedatives, hypnotics, anxiolytics, stimulants, tobacco, and other substances; American Psychiatric Association, 2013). SUD reduces life expectancy by up to 20 years compared with the general population (Hayes et al., 2011; Nordentoft et al., 2013). The leading cause of excess mortality (73%) is primarily related to physical health conditions such as cardiovascular disease, cancer, chronic respiratory disease, diabetes and all of their consequences (Heiberg et al., 2018; Iturralde et al., 2021). One promising avenue to manage physical health problems, and symptoms like craving, social impairment or withdrawal is physical activity (PA).

Among people with SUD, PA been found to improve abstinence rates (Wang et al., 2014), reduce depressive and anxiety symptoms (Dowla et al., 2022; Giménez-Meseguer, Tortosa-Martínez, & Remedios Fernández-Valenciano, 2015; Wang et al., 2014), and improve quality of life (Dowla et al., 2022; Roessler, 2010), and mood (Dowla et al., 2022; Giménez-Meseguer, Tortosa-Martínez, & Remedios Fernández-Valenciano, 2015). In addition, PA has been found to reduce self-reported withdrawal (Horrell et al., 2020; Wang et al., 2014), and reduce craving during treatment (Piché et al., 2023). Furthermore, when PA is compared with motivational treatments, a comparable reduction in

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consumption is observed in people with alcohol use disorders (Gunillasdotter, Andréasson, Jirwe, et al., 2022). Although the benefits of PA have been described, the underlying mechanisms are still poorly understood. Furthermore, these effects were observed in well-controlled settings. To bridge the gap between evidence and implementation, it is essential to consider the patient's daily context and personal experience when determining the effectiveness of PA, rather than only its efficacy.

Still, two studies specified how participants perceived PA during a treatment for SUD. The study by Dai et al. (2020) showed participants' perceptions regarding the effects of a walking/running program aiming to prepare them for a race event. According to participants (80% with opioid use disorder), the PA intervention reduced symptoms of craving, improved personal health, and provided a sense of accomplishment and belonging (Dai et al., 2020). A study by Fagan et al. (2021) investigated PA offered on a voluntary basis (walking/running groups, aerobics classes, outdoor activities, and free gym time). According to participants (73% using multiple substances such as alcohol, opioids, and cocaine), PA was perceived as a method to replace the 'high' of drug use, and to regulate their emotions (Fagan et al., 2021).

Although these two studies provided important information about how the patient perceived PA into a real clinical context, some limitations in terms of intervention, methods, and design have been identified. Firstly, in terms of intervention, participants reported a lack of diversity in the PA sessions (Dai et al., 2020), and a lack of supervision by an exercise professional (Fagan et al., 2021). Secondly, the fact that PA was not an integral part of treatment could have an impact on outcomes. Indeed, the study by Fagan et al. (2021) offered the PA intervention has an option in a community center located at a 15-min walk of the treatment center. In the study by Dai et al. (2020), participants reported perceiving PA more as a competition to prepare for, rather than a lifestyle habit to maintain in their daily lives. These limitations prevent us from painting an overall picture of SUD patients' perceptions of PA. Also, the adoption of new approaches or treatments, especially in mental healthcare, is a complex endeavor. PA is not different as it requires benefits but also an evaluation of the applicability of these findings in real-world healthcare settings (Czosnek et al., 2021; Machaczek et al., 2022). Therefore, gaining a deeper understanding of the context is crucial, with a particular emphasis on ensuring the inclusion of user perspectives, a practice that is often overlooked in the mental health context (Ashdown-Franks et al., 2022; Vancampfort et al., 2022). To overcome these limitations and contribute to the existing body of knowledge, this study aims to explore individuals' perceptions of PA intervention as part of SUD treatment in a residential center. This research aims to complement and expand upon previous qualitative studies on PA, offering valuable insights for future clinical recommendations.

2. Materials and methods

The present study followed the Consolidated Criteria for Reporting Qualitative Research (COREQ) guidelines (Booth et al., 2014; Tong et al., 2007). The project was accepted by the ethics committee of the Université du Québec à Trois-Rivières (CER-20-268-07.10) and the team of the residential center for SUD. This study was not preregistered.

2.1. Context

2.1.1. Design

The present study used a qualitative approach with a case study design to investigate people's perceptions regarding a five-week group PA intervention during treatment for SUD. The principle of case study has been defined by many authors. In our case, we used Simon's (2009) definition: the case study acts as an approach that allows for in-depth research using multiple perspectives of a single, specific case in a real-world context, and one of its purposes is to inform. In line with this definition, the present case study approach will not be used with the goal of generalization, but rather as a means of understanding the particularity of a case (Stake, 2005). The case study principle was chosen because of the complexity of the phenomenon, as the case (PA intervention) is intrinsically related to the context (SUD treatment). In our context, the case refers to the uniqueness of the PA intervention in the SUD treatment center, rather than to an individual. Besides, the case study approach was selected because it allows taking the context into account (Moore et al., 2012; Yin, 2014).

2.1.2. Participants and setting

The SUD residential center chosen was a live-in treatment facility in a medium-sized city (137,188 inhabitants) located in Quebec, Canada. The residential center is for adults and can accommodate up to 98 residents with substance use issues. The residential center receives the vast majority (77%) of its clientele as part of a judicial measure (Maison Carignan, 2022). Upon admission, over 85% of the resident rated 'high' in the addiction severity index following their assessment (Maison Carignan, 2022; McLellan et al., 1992). Participants are in the residential center 24/7, without access to a cellphone, the internet, and with only one TV for all residents in the center. All residents have group therapy from 9 a.m. to 5 p.m. Monday to Thursday, and the remaining time is considered non-therapeutic and can include housework, social activities, or lectures, which takes place in the evenings and at weekends.

To explain the project and release consent forms, an information session was held at the residential center. Residents were left with one week to agree with the project and to sign the consent form. To be included residents had to meet the following inclusion criteria: a) more than two months remaining in SUD treatment, b) not being pregnant, and c) no contraindications to PA participation.

2.1.3. Physical activity intervention

The PA intervention included supervised in-person group sessions (3 times a week, 60-min duration) for 5 weeks for a total of 13 sessions, two sessions were missed because of COVID-19. During sessions, different types of exercises were offered, such as yoga, cardiovascular, and muscular circuits. Each week, one session focused more on balance, flexibility, and relaxation, while the other two focused on cardiovascular and resistance training. According to the type of exercises of each session, different PA intensity levels (i.e., low, moderate, high) were suggested by the exercise professional and would vary between sessions, but participants were encouraged to maintain a pace they felt comfortable with, allowing them to enjoy the sessions (Oliveira et al., 2015). All sessions were supervised by an accredited kinesiologist with 2 years of experience, who is also the first author of the study, which is frequent in case studies (Stake, 2005). During the intervention, when a participant missed a session, a follow-up sheet was used to collect the reasons for his/her absence. In what follows, when we refer to the PA program practiced by the participants, we will use the term PA intervention.

2.1.4. Procedure and evaluation

The study took place from September 2020 (information session) to November 2020 (end of the interview; Fig. 1). After the first session of PA intervention, a sociodemographic questionnaire was completed. Also, a follow-up sheet at the end of each session was completed by participants to assess their perception of the intensity of the session, using the Borg scale on a scale from 0 to 10 (0 = not at all; 10 = very strong; Borg, 1982), and their level of satisfaction with the PA session on a scale from 0 to 10 (0 = not satisfied at all; 10 = extremely satisfied).

As we wanted to understand each participant's perceptions regarding the PA intervention, we used individual interviews. A semi-structured guide was created and included 15 predefined questions and is available in Appendix A. The questions were open-ended and developed using the qualitative model of evaluation of the Donabedian model (Donabedian, 1988). To make the participant feel comfortable, the interview guide began with introductory questions. Subsequently,

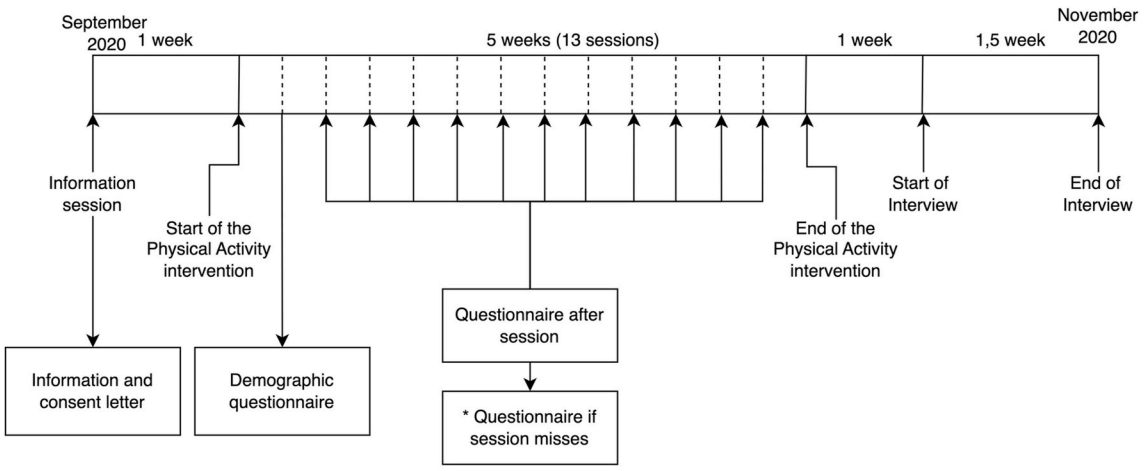

Fig. 1. Procedure.

based on the Donabedian model, we questioned three key concepts through various questions: 1) structure (the professional delivering the intervention), 2) process (how the intervention unfolded, what could have been done better), and 3) outcomes (the perceived effects). Lastly, we concluded with an open question, inviting participants to share anything we might not have covered during the interview to ensure comprehensive coverage of the topic. Interviews were scheduled after regular therapy hours and took place in a room set aside for this purpose at the residential center. The interviews were conducted by the first author to ensure a good relationship between the interviewer and the participants, as well as an open attitude and an immediately safe environment. Although we know that this option will potentially lead to a social desirability bias towards the interviewer, we believe that having a good confidence link was more important for the relevance of the results. The interviews had an average duration of 41.3 min (SD = 6.2).

2.1.5. Data analysis

Given the limited available literature on the perception of PA in the context of SUD treatment and our intention to bring no restrictions on the theme, we employed an inductive approach following the steps outlined by Thomas (2016) for our content analysis. This analytical approach includes four steps: 1) data cleaning, 2) familiarization, 3) coding, and 4) revision and refinement. For step 1, data cleaning involved standardizing each interview format. The interviews were primarily audio-recorded, and for the purpose of the study, the contents were transcribed and de-identified (using pseudonymization for anonymity) into verbatim by two members of the research team (FP and CC) using NVivo software, version 12 (QSR International). The verbatim were originally in French, and for transparency, we decided to make those selected in the article available as they were originally transcribed (see Appendix A). For step 2, to facilitate data familiarization, FP and CC read the verbatim several times to become familiar with the content. For step 3, coding consisted of creating categories that summarized the meaning of the verbatim based on what the participants expressed in the interviews. The categories were created directly from the data, meaning they were a word or part of a sentence in the verbatim to help retain meaning. The first author conducted the analysis, coded all verbatim and produced a list of categories with definitions. During the creation of the categories, we aimed to reach saturation, which occurs when no further categories emerge despite having new interviews (Saunders et al., 2018). For step 4, FP and CC read each verbatim in the same category to ensure there were no subtopics into the same category and to explore the possibility of combining several categories into a bigger one (themes). All categories were then discussed by the entire team (all authors) during a series of meetings and were subsequently transformed into themes if needed. We reached saturation point after analyzing 13 verbatim, which gave us three predominant themes with six categories. We also used quantitative data (e.g., sociodemographic characteristics) to describe the sample as these may nuance the responses given in the interviews (Savoie-Zajc, 2018).

3. Results

3.1. Characteristics of participants

Fifteen residents were respecting the inclusion criteria and at the end of the PA intervention, and because of the drop-out from the SUD treatment center, 13 adults including four women and nine men participated in the interview (Fig. 2). Over the sessions, the participation rate was 77%, and the principal reasons for non-participation were related to their treatment (e.g., mandatory therapy meeting).

The average age for women was 26.8 years old (*SD* = 2.5) and 36.3 years old (*SD* = 8.3) for men. The majority of the group (92%) had reached at least secondary school level (n = 12) and were already practicing PA before starting the intervention. Over 77% (n = 10) of the group were in court-ordered therapy, and 62% (n = 8) had already undergone substance use therapy. The problematic substances were mainly alcohol (n = 12, 92%) and stimulants (n = 10, 77%) and the average duration of problematic substance was 13.3 years for alcohol (*SD* = 5.4) and 13.6 years (*SD* = 10.02) for drugs. The detailed characteristics of the participants are shown in Table 1.

3.2. Perception of participants

Participants perceived PA intervention as (1) a way of taking care of themselves, (2) a protective factor against relapse, and (3) a facilitator for treatment retention (see Table 2 for the number of participants mentioning each theme). According to these results, PA is perceived to be beneficial by people undergoing treatment for SUD.

3.2.1. Theme 1: taking care of themselves

One of the main themes was that PA intervention was a way of taking care of themselves. Two categories emerged from this theme: 1) Perception of PA to improve health in general; 2) association of PA with the development of a recovery identity.

Perception of Physical Activity to Improve Health in General. One of the recurring and extensively discussed topics among participants was the perception of PA to improve health. The PA intervention was perceived as a time when all participants felt that they were taking care of themselves. In fact, during and following the PA intervention, participants experienced various positive effects on physical and psychological health. For example, following the PA intervention,

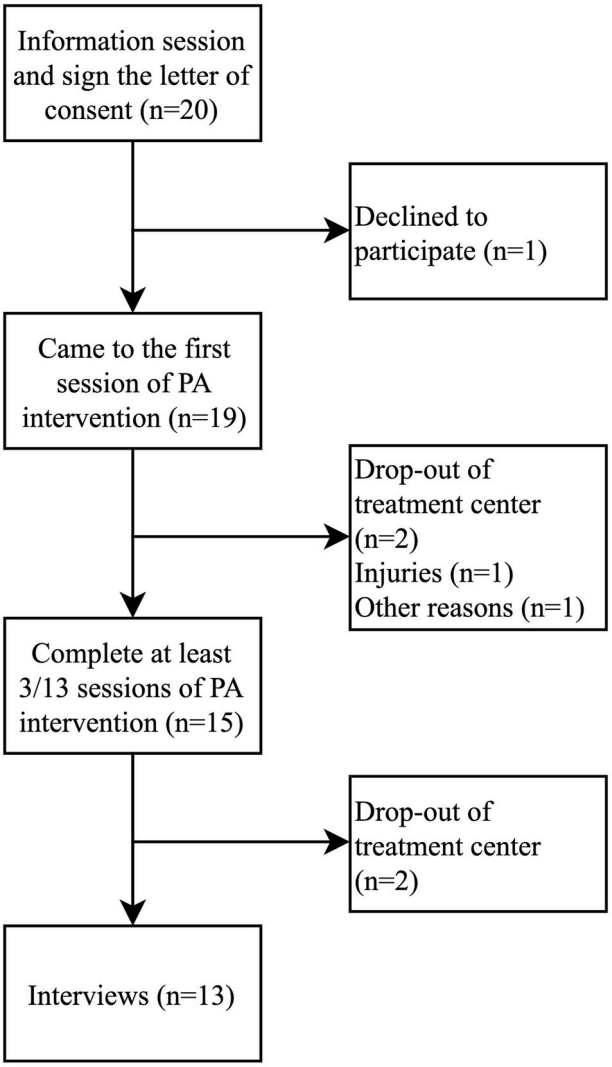

Fig. 2. Participant flowchart.

participants were feeling that they had better control of their emotions:

> I'm an anxious and hyperactive person and when I do sport and expend energy, I'm able to control my emotions and my impulsiveness. I'm able to take a step back and maybe make better decisions. Especially when I do cardio, I realize that after [that], then I'm calmer. (Anthony, V1, all the names have been changed and the number corresponds to the French version in Appendix A).

The PA intervention represented an opportunity to reinvest some of the competencies that participants had learned in therapy, which made them proud of themselves and reinforced their self-esteem:

I didn't have a strong self-esteem, so by doing that [PA intervention], it increased my self-esteem. Because basically, I gave myself challenges, I gave myself objectives, and when I achieved them, I went to look for my pride by myself and not by others. I'm an emotional addict, because I often tend to look for my pride in the eyes of men, but this [PA intervention] gave me a way to look for my own pride because once I'd done it, I was proud of myself, I went to bed and I slept even better, so no, it gave me a pride there. (Charlotte, V2).

Experiencing these benefits during their voluntary participation in the PA intervention made them feel like they were taking better care of themselves, instead of just doing therapy without concern for their physical health:

> The whole therapy is about taking care of myself so I'm proud to take care of myself and my body. I've been doing everything wrong with my life for a long time now and I'm on the verge of losing everything, let's say I've lost half of it. Because I don't take my responsibilities in hand and I take everything too lightly, so just taking care of myself concretely with my body makes me proud. (Jeanne, V3)

Most participants also felt that they were more likely to adopt new healthy behaviors in accordance with their PA participation. For example, they mentioned that they were having more consideration for their diet following the PA intervention:

> Since you [the kinesiologist] started coming, I've started to pay more attention to what I eat too. Before I used to have dessert all the time, now I don't have dessert […] I just take glasses of water, no more juice. And yeah, I'm careful about what I eat, I don't take soup either, it's often cream, I don't take it. Yeah, I try to be as careful as possible. (Normand, V6)

Another example of healthy behavior was the inclination to cease tobacco, which was the case for four participants (Jean, Adam, Gabriel, and Anthony). They were all in the process of tobacco cessation and noticed that PA intervention was congruent with their process. Indeed, the fact that they were seeing progress due to PA intervention was a source of motivation for them (e.g., the breath becoming 'longer' as opposed to 'short' at the beginning when they were smoking).

> I've been thinking about quitting smoking for a long time, but I didn't know how, but doing this activity [PA intervention] helped me a lot to take care of myself and my body and my health and it helped me to quit smoking. (Jean, V7)

Physical activity in the development of a recovery identity. The SUD treatment provides individuals with the opportunity for a fresh start and the asset to help change their future. The participant tied the PA practice to this new perceptive of life, PA was seen as a needed lifestyle change to be successful in their therapy.

> […] you know I come here to educate myself, to help me, to change my life, to stop consuming, but I want to include that [PA] too. Yeah, for me it's like, you know, it's a healthy lifestyle, because if I'm going to stop consuming, well, it's simple, I'm going to do PA as well. (Rosalie, V8)

> Basically, you come in here to rebuild, to reconstruct, it's a complete social reintegration, so I think, it [PA] goes with it because it fits into, outside, the routine will have to integrate that too. For me, some have a passion for arts or music, for me, it's sports. So, I just want to say, for me, it's a perfect mix. (Jeanne, V9)

The PA intervention help to bring back positive memories of healthier day for participants that they identified as 'good days' which gave them hope and they were able to project themselves after the therapy through their past practice of PA.

> Interviewer: In the future, what role do you want to give to PA, say, in the short, medium, and long term?

> Arnaud: Well, it [PA intervention] allows me to regain the desire to get back into sports, to do my old activities, what I used to do before, when I was younger. It makes me want to sign up for hockey, join a soccer league, more like a senior, you know? (Arnaud, V10)

PA was also associated with a better life and the achievement of becoming a 'better person', which helps into the PA integration into the recovery of participants. PA was often associated with positive moments in the participants past lives and this increased the motivation that the participants would be able to relive moments like these again.

> I'm sorry, but I would say that when I had that [PA] in my life, when I was training, generally, my life was great! (Anthony, V10)

Table 1
Participants characteristic.

Name	Age	Sex	BMI	Level of education	Substance	Duration of problematic consummation		Number of therapy		Imposed by the judicial system	Presence of symptoms	Medication taken	Physical activity (min/ weeks)
						Alcohol (years)	Drug (years)	Start	Finish				
Jean	43	M	22,4	Primary school	Tobacco, alcohol			3	1	Yes	None	Corticosteroids	90
Augustin	43	M	24,4	University Diploma	Tobacco, alcohol, stimulants		33	2	1	Yes	None	Amitriptyline	180
Arnaud	40	M	23,7	Secondary school	Tobacco, alcohol, stimulant	27	4	2	1	Yes	None	Methylphenidate, Pregabalin	No answer
Clara	30	F	23,4	Secondary school	Tobacco, alcohol, opioid, stimulant	10	3	1	0	Yes	Delirium, toxic psychosis, trembling	Zopiclone	90
Adam	41	M	24,2	University diploma	Stimulant	12	13	8	7	Yes	Anxiety, sleep disturbance	Mirtazapine	180
Gabriel	43	M	24	College diploma	Alcohol	17	31	1	0	Yes	None	Quetiapine	30
Charlotte	24	F	24	Secondary school	Tobacco, alcohol, hallucinogen, opioid, sedative, stimulant	0	8	2	1	Yes	None	None	120
Anthony	26	M	27,5	College diploma	Alcohol, stimulant	8	10	7	7	Yes	Irritability, craving, depression, mood swings, aggressiveness, insomnia, anxiety	Lisdexamfetamine	300
Jeanne	27	F	22,8	Secondary school	Alcohol, sedative, stimulant	13	13	3	0	No	Extreme fatigue	None	30
Rosalie	26	F	27,3	Secondary school	Alcohol	10	2	1	0	Yes	None	None	90
Loic	41	M	30	Secondary school	Tobacco, alcohol, hallucinogen, opioid, sedative, stimulant	13	20	1	0	Yes	None	None	150
Normand	25	M	27,3	Secondary school	Alcohol, stimulant	13	13	1	0	No	None	None	300
Keven	25	M	29,4	Secondary school	Tobacco, alcohol, stimulant	10	13	2	0	No	Depression, mood swings	None	130

Table 2
Main themes and categories with prevalence.

Main themes	Categories	n, %
Taking Care of Themselves	Perception of PA to improve health in general	13, 100%
	PA in the development of a recovery identity	4, 31%
Protective Factor Against Relapse	Avoiding Boredom	9, 69%
	Creation of a Healthy Social Network	5, 38%
	Maintaining a Healthy Weight	5, 38%
Facilitator of Treatment Retention	Social Support via the Group	11, 85%

PA: Physical activity.

Another noteworthy aspect is that participants viewed PA as incompatible with excessive consumption, further motivating them to incorporate it into their treatment and sustain it after therapy. It is essential to acknowledge that this perspective was not universally shared among participants. For some, it was associated with the period during which they were able to avoid use of substance, while for others, PA did not interfere:

> Sport also helped me a lot because when I wasn't doing it, I was consuming. (Jean, V11)

> In the evening, I drank like two big cans of beer, but I was still going to train the next day, but I didn't really think it had any impact, except that I was more tired for sure. (Rosalie, V12)

3.2.2. *Theme 2: protective factor against relapse*

PA was considered as a strategy to avoid thinking about consumption during treatment, but also as a way to prevent relapse once at home after the end of treatment. In this sense, three categories emerged: 1) avoiding boredom, 2) creating a healthy social network, and 3) maintaining a healthy weight.

Avoiding Boredom. Participants mentioned that, during treatment, they had a lot of free time during which they did not know what to do. Therefore, PA was seen as a way to occupy oneself outside of therapy hours.

> 'Well, sometimes the week is long here, but I found that having this extra stuff [PA intervention] filled up my weeks more.' (Charlotte, V13)

Even though there were other activities offered at the residential center to occupy participants (e.g., listening to TV, reading, meditation), PA intervention was an activity that participants found meaningful.

> 'Well, because it's fun and you don't see the time passing and it feels good. You feel like you're doing something with your own skin.' (Jeanne, V14)

Participants felt that PA could be used in the future to prevent their consumption. Indeed, by keeping them occupied with a healthy behavior, it decreased the risk to consume.

> For me, boredom is a relapse process, because I know that outside of here, of course, there's Covid, but I can go running outside, I can train by myself, and it's something that I'm going to have to continue outside, because I have to stay in the action so that I don't fall into boredom so that I don't relapse. (Charlotte, V16)

Creation of a Healthy Social Network. Participants felt that they developed positive relationships during the PA intervention, which encouraged them to be more active after the therapy and to consider PA as a promising strategy to develop future healthy relationships.

> I realized when I was doing it that it was a lot of fun, […] everyone is respectful, and it encourages me to make a new circle of friends outside, like doing yoga in a fitness center, […] because those who are there are not so much down to go and get high afterwards, they are not drug addicts, theoretically no, maybe they are regular users, but not drug addicts, it gives a new circle of friends. (Loic, V17)

In addition, some participants were planning to have a new start after the treatment, starting 'a new life', in another city, where everything is new, and PA was going to be a new and easy way of making a group of friends with a lower possibility of meeting problematic consumers.

Maintaining a Healthy Weight. 'Lose weight' and becoming 'in shape' were sources of motivation to start the PA intervention for some participants. Women participants explained that, depending on the type of substance they consumed (or stopped consuming), it could have a different impact on their weight (gain or loss):

> 'Speeds to death, really a lot of speed, enough to not sleep, not eat, and to be in shape, well to look in shape.' (Jeanne, V18)

Participants also mentioned that PA was a new strategy to help them become 'in shape' without substance consumption and to prevent weight gain during therapy, which was associated with a relapse process for some participants.

> I had already done another therapy before, and when I came out of the other therapy, I had gained a lot of weight, and it was a relapse process for me because I wanted to lose weight quickly, that's why I want to continue [PA] outside. (Charlotte, V19)

3.2.3. Theme 3: facilitator of treatment retention

Social Support via the Group. Doing PA intervention in group sessions was perceived as a facilitator for treatment retention because of many factors including the overall good participation, the supportive environment created by the kinesiologist, the mutual support among participants, and the enjoyment experienced during PA intervention.

In fact, not only participants considered the group as a crucial support during SUD treatment, but they also recognized that the PA intervention facilitated the creation of trusting relationships between them. The fact that participants felt that everyone attending the exercise sessions really wanted to be there really enhanced their positive experience as a group.

> Everyone was open, everyone was motivated, in fact, there was no one who just wanted to save time. (Keven, V20)

During PA intervention, participants were helping and comforting each other, and this resulted in the creation of trusting relationships between them.

> […] it [PA intervention] also allowed me to have trust in the others and to become aware that they are there to help me and that I could also ask them what movements [to do] because sometimes I didn't see you, so I asked them. (Jean, V22)

The feeling of enjoyment was also considered by participants as a retention factor.

> Well, I thought it was funny, I mean it was good, you could see that everyone was smiling, and it brought joy to the house, in the morning we said ah it's evening training with Florence! Really, everyone was happy, it gave joy in the house, there are not really activities, the activities are more on the weekend here, and that put something more in the week, it seems like it passed more quickly, it gave something more to the therapy. (Charlotte, V23)

The fact that PA intervention was seen as uniquely different from therapy (e.g., lighter, voluntary) really enabled participants to stay motivated and engage themselves into treatment, as well as into PA intervention.

> Because at some point you disconnect, especially given you're in therapy all the time, it becomes heavy, it's all very well to be sad all the time and to share, but this [PA intervention] frees you up, you don't need to think about anything, you come here and it frees up your mind, you don't think about anything else, and it's more on the physical side, you don't think about your problems, you just disconnect a bit, it allowed me to do that during the activities. (Arnaud, V24)

During the PA intervention, competition between participants was experienced differently: some were perceiving it as encouraging, and others as discouraging. Competition has sometimes been associated with mutual encouragement and seeing others do better have helped some participants to excel.

> When you see people pushing further, it pushes you to go a little bit further, like me, sometimes I've stopped, and I see the people going on, and go ahead, it helps you go a little bit more, sure it's fun, it takes a group to do it, I think that it motivates you a little more. (Gabriel, V25)

For other participants, they saw people better than them as a threat and were 'afraid of looking ridiculous.' The competition was a lot based on the comparison between people in the group.

4. Discussion

The objective of our study was to explore individuals' perceptions regarding a five-week supervised group PA intervention during SUD treatment in a residential center. Results indicated that PA was perceived as a way of taking care of themselves because of its positive effects. PA was also perceived as a way to improve participants' health in general, to help develop a recovery identity with new lifestyle habits like eating better and help to diminish smoking. PA was a protective factor against relapse because it helps to avoid boredom, it facilitates the creation of a healthy social network and make it easier for the maintenance of a healthy weight. Lastly, PA was found to be a facilitator of treatment retention through the social support created in the group PA intervention.

One of the recurring and extensively elaborated themes among participants was the enhancement of global health. This finding is in line with previous research findings (Ashdown-Franks et al., 2020; Dai et al.,

2020; Fagan et al., 2021; Giménez-Meseguer, Tortosa-Martínez, & Remedios Fernández-Valenciano, 2015; Gunillasdotter, Andréasson, Hallgren, & Jirwe, 2022; Stoutenberg et al., 2015). Participants mentioned lifestyle benefits, including smoking cessation. This is a relatively common goal in the treatment of SUD, and many patients strive to stop using all psychoactive substances (tobacco and other) at the same time (Joseph et al., 2004). Therefore, it is not surprising that four participants decided to stop smoking during the PA intervention period. These four participants reported that PA was part of their smoking cessation process because it helped them to take care of themselves. Although the effects of PA on smoking cessation in terms of reduced craving and consumption are uncertain (Haasova et al., 2013, 2016; Taylor et al., 2023), a qualitative study by Glowacki et al. (2019) did also highlight that PA was seen by participants as congruent with a smoking cessation process. In the present study, the benefits were related to the fact that PA intervention was really considered as an important part of the therapy because it was voluntary (participants were free to come or not) compared with the therapy, which was mandatory. Participants felt more responsible for all the benefits they gained during the PA intervention compared to other studies (Dai et al., 2020; Fagan et al., 2021) where this was not mentioned.

Relapse is a major concern in treatment, as it is one of the most important challenges and it is very prevalent (40–60%) in SUD patients (McLellan et al., 2000). Using PA to prevent relapse was seen as a viable and low-risk option, and some mechanisms have been proposed in the literature (Zschucke et al., 2012). Our results indicate that PA could reduce boredom and improve occupation time, which is consistent with previous studies on adults undergoing residential treatment for SUD, including those with multiple substance use (Giménez-Meseguer, Tortosa-Martínez, & Remedios Fernández-Valenciano, 2015) or heroin use disorders primarily (Neale et al., 2012). Previous studies highlighted that a key factor in the maintenance of PA is being occupied with a meaningful alternative during therapy (Neale et al., 2012). Our result aligns with previous studies and showed that a critical part of the intervention was the fact that PA was found to be fun and enjoyable (Furzer et al., 2020; Neale et al., 2012). Also, PA represents a good counterconditioning option by substituting substance use cues and replace them with healthier behaviors (Substance Abuse and Mental Health Services Administration, 2019). Boredom was seen as a high-risk situation for relapse by the participants and PA as a coping response which, if done, will increase self-efficacy into the ability to cope with relapse and decrease the likelihood of relapse (Dai et al., 2020; Larimer et al., 1999).

Secondly, using PA to maintain a healthy weight is well studied and interventions are heterogeneous in people with mental illness (Vancampfort et al., 2019) despite being an important motivator to initiate PA in people with SUD (Dai et al., 2020; Giménez-Meseguer, Tortosa--Martínez, & Remedios Fernández-Valenciano, 2015; Neale et al., 2012). One specificity from our study is the association between weight fluctuation and the prevention of relapse. The prevention of relapses linked to weight fluctuations has been proposed in the literature and one of the hypotheses is the fact that certain drugs (e.g., amphetamine) are known to decrease weight (Cowan & Devine, 2008; Mahboub et al., 2020) and that cessation of these drugs could lead to weight gain, due to the normalization of metabolism or increased food intake (Jeynes & Gibson, 2017). Our results show that people following PA during their treatment perceived PA as being able to help them regulate their weight. The 'maintaining a healthy weight' category was seen to be linked to the risk of relapse as observed in the previous qualitative study by Warren et al. (2013) including women undergoing treatment for SUD. Warren et al. (2013) observed that weight gain during treatment was associated with the risk of relapse after treatment. Interestingly, the 'maintaining a healthy weight' category was also more prevalent among women in our study, which is consistent with the limited literature on this topic. Further research is needed to better understand the mechanisms and the involvement of PA in this relationship (Giménez-Meseguer, Tortosa-Martínez, & Remedios Fernández-Valenciano, 2015; Neale et al., 2012; Warren et al., 2013).

Lastly, two categories (physical activity in the development of a recovery identity and, social support via the group) could be explained by the identity theory (Burke & Stets, 2009; Stryker & Burke, 2000). This psychological theory is very frequent in SUD treatment (consumer identity vs. recovery identity) and contains three components: personal identity (the way a person can define himself as a unique individual independent of others), role identity (expectation and related to social position), and social identity (related to the group). Our results can be interpreted considering the personal and social components. Change in identity is often made during a critical period such as the treatment of SUD. The present study observed a desire for participants to return to a past identity who was active, which is in line with the study by Neale et al. (2012) where we see that heroin users associate their PA practice with the fact that they had positive memories of it when they were younger. Among people with no SUD, past behavior has been found to be a predictor of future change in identity (Rhodes et al., 2016; Stryker & Burke, 2000). The existence of an identity conflict between being an exerciser and substance use simultaneously could prevent future relapse, according to the theory, because the PA identity would act as a protector against substance use, as demonstrated in the case of tobacco users (Priebe et al., 2020). Nevertheless, the conflict between new identities needs to be interpreted with caution, as for some participants, this conflict was not existing and therefore could not be considered a protective factor against relapse. Regarding social identity, which is based on and associated with the social group, it is probable that a social identity was formed during the PA intervention, as is often observed in PA groups (Stevens et al., 2017). Living through a new shared experience led to the development of social connections distinct from those related to therapy, these connections were transferrable into therapy as people continued to remain together after the PA intervention. Relationships of trust are formed in situations of vulnerability such as new experiences and experiencing them in a group can strengthen group cohesion. Group cohesion has been observed in other studies of PA in people with SUD, the study by Giménez-Meseguer, Tortosa-Martínez and Remedios Fernández-Valenciano (2015) which was also three times a week during treatment for people with SUD, showed that relationships between participants improved as the intervention progressed. Also, the life-course theory study by Landale and Roderick (2014), which followed two patients with SUD in a program that offered PA over 12 months, highlighted the importance of the group in motivating people to stay in the program, and also that it prepared them for social reintegration.

Our study has several strengths that should be mentioned such as the use of the COREQ criteria grid (Booth et al., 2014) to report all necessary elements (see Appendix B). Second, the fact that the first author was familiar with the environment (equipment, practitioner, residential center) and therefore a greater familiarity with the PA intervention. Lastly, the use of the case study method allowed us to go in-depth into the topic and to really consider the environment (treatment residence). The present study also has limitations such as a potential social desirability bias as the kinesiologist was the interviewer and this situation could have had repercussions on the interview, and the results. Nevertheless, this situation was counterbalanced by a better alliance between participants and the interviewer, which in turn provided us with richer content. Another point would be in conducting a peer-review process of the qualitative content. While our team extensively discussed the emerging themes, we acknowledge that the involvement of a sole reviewer in both the interviews and subsequent discussions might introduce bias. A peer-review process during the content analysis would have provided an additional layer of objectivity, ensuring that the themes were identified independently of the primary reviewer. Another limitation is the fact that the intervention was given during COVID-19, which may have prevented some people from participating, as some were uncomfortable or afraid of being contaminated. It is also important

to consider that participants were in treatment during their intervention, so it is difficult to distinguish the effects of the therapeutic program from the PA intervention. Finally, given participants were volunteers to participate, it should be considered that they were probably more likely to engage in PA and motivated to do so.

5. Conclusion

The present study showed that PA could be useful during SUD treatment, in view of the many perceived benefits. We found that participant perceived PA to be a tool into taking care of themselves, help in the prevention to relapse and be a facilitator or treatment retention. Treatments for SUD could benefit from incorporating a PA component to treatment, ultimately promoting recovery optimal during and after treatment, but further research is needed to better understand the role of PA initiation in personal and social identity formation during SUD treatment. Also, future studies may look at the effects of PA on weight fluctuations during treatment, which seemed to be a very important aspect both in terms of motivation to do PA and prevention of relapse.

CRediT authorship contribution statement

Florence Piché: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Software, Validation, Writing – original draft. **Stéphanie Girard:** Conceptualization, Formal analysis, Investigation, Methodology, Resources, Supervision, Writing – review & editing. **Chantal Plourde:** Conceptualization, Formal analysis, Funding acquisition, Methodology, Resources, Supervision, Writing – review & editing. **Ahmed Jérôme Romain:** Formal analysis, Investigation, Methodology, Supervision, Writing – review & editing.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Florence Piché reports financial support was provided by Quebec Health Research Fund (317231). Florence Piché reports financial support was provided by University Institute for Addictions.

Data availability

The data that has been used is confidential.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.mhpa.2024.100590.

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