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Brief Theory-based Intervention to Improve Physical Activity in Men with Psychosis and Obesity: A Feasibility Study

Intervention brève ancrée sur des théories motivationnelles visant à augmenter l'activité physique auprès d'hommes ayant un trouble psychotique et une obésité : une étude de faisabilité

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Article abstract

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Keywords

motivational theory; implementation intention; processes of change; exercise; schizophrenia spectrum

Abstract

Introduction: Physical activity (PA) is recommended to improve physical health in people with psychosis, however, most of them are inactive. **Objectives**: The objectives of the study were to assess the feasibility of a four-week brief theory-based intervention to improve PA in men with psychosis and obesity. **Methods**: A Quasi- experimental pre- post design evaluating the feasibility, the participation, and the intervention drop-out rate was conducted. PA, sedentary time, motivational processes of change, and anthropometric measures were evaluated. **Results**: A total of 38 men with psychotic disorders were approached and 32% participated (n = 12). Among these 12 participants, 75% had schizophrenia, their mean age was 33.2 $\pm$ 10.2, and mean Body Mass Index: 35.8 $\pm$ 7.7 kg/m^2. Besides, all 12 participants (100%) completed the intervention. Participants reported a high satisfaction rate in the intervention. Following the intervention, PA level was increased with a moderate effect size. Similarly, an increase in behavioral processes of change was observed with a moderate effect size. **Discussion and conclusion**: Hence, the brief theory-based intervention was feasible and could probably improve the PA level in men with psychosis and obesity.

Mots-clés

théories motivationnelles; implantation d'intention; processus de changement; activité physique; spectre de la schizophrénie

Résumé

Introduction : L'activité physique (AP) est recommandée pour améliorer la santé physique de personnes ayant un trouble psychotique, toutefois la plupart d'entre elles sont physiquement inactives. **Objectifs** : Les objectifs de l'étude étaient d'évaluer la faisabilité d'une intervention brève ancrée sur des théories motivationnelles. L'intervention, d'une durée de quatre semaines, visait l'augmentation de l'activité physique d'hommes ayant un trouble psychotique et une obésité. **Méthodes** : l'Étude pré-post quasi expérimentale visait à évaluer la faisabilité, la participation et le taux d'abandon. L'AP, la sédentarité, les processus motivationnels de changement et les mesures anthropométriques ont été évalués. **Résultats** : Au total, 38 hommes avec un trouble psychotique ont été approchés et 32% ont accepté de participer (n = 12). Parmi ces 12 participants, 75% avaient une schizophrénie, leur âge moyen était 33,2 ± 10,2 et leur indice de masse corporelle, 35,8 ± 7,7 kg/m^2. Les 12 participants (100%) ont complété l'intervention. Les participants ont rapporté de forts taux de satisfaction envers l'intervention. Suivant l'intervention, une augmentation de l'AP a été observée avec une taille d'effet modérée. De plus, une plus grande utilisation des processus de changement comportementaux a été observée avec une taille d'effet modérée. **Discussion et conclusion** : L'intervention brève ancrée sur des théories motivationnelles semble faisable et pourrait probablement améliorer le niveau d'AP chez les hommes ayant un trouble psychotique et une obésité.

INTRODUCTION

People with psychotic disorders, such as schizophrenia or schizophrenia-spectrum disorders, are more likely to have a poor health compared to the general population (Stubbs, Koyanagi, et al., 2016; Vancampfort, Stubbs, et al., 2015) including increased metabolic syndrome (Correll et al., 2017; Vancampfort, Stubbs, et al.), and obesity being the most prevalent condition (Mitchell et al., 2013). Although these obesity rates could be partly explained by the antipsychotic medication, the unhealthy habits of people with schizophrenia should not be neglected. In fact, in addition to their poor dietary intake (Teasdale et al., 2019), population-based studies showed that people with schizophrenia are more likely to be sedentary (approximately 13 hours per day and defined as time spent in sitting, reclining or lying posture excluded sleeping), but also more inactive (defined as failure to meet physical activity recommendations) (Andersen et al., 2018; Stubbs, Firth, et al., 2016; Stubbs, Williams, et al., 2016).

Physical activity is recommended as an important strategy to manage obesity but also improve overall health in people with psychosis (Vancampfort et al., 2019). Indeed, several studies showed its beneficial effects on several outcomes including weight management, cardiovascular health, functioning, or psychotic symptoms (Dauwan et al., 2016; Firth et al., 2017; Ohi et al., 2018; Romain et al., 2019; Rosenbaum et al., 2015). However, despite the positive effects of physical activity, people with psychosis may experience many barriers to its practice (Bernard et al., 2013; Firth et al., 2016) and research consistently showed that lack of motivation is the most prominent along with poor social support from health professionals (Romain et al., 2020; Ussher et al., 2007). Nevertheless, even though motivation has been consistently showed as a barrier to physical activity in people with psychosis, previous studies also highlighted that they are ready to be more active (Subramaniapillai et al., 2016; Ussher et al.). Therefore, it is possible that people with psychosis have difficulties to overcome their intention — behaviour gap regarding physical activity practice (Gollwitzer & Sheeran, 2006; Sailer et al., 2015). One possibility to address this issue is the use of brief interventions. Brief interventions are opportunistic short-duration interventions (1 to 20 minutes) (Lamming et al., 2017) which offers the possibility to be used in clinical routine by health professionals (Lawlor & Hanratty, 2001) and are used in different health contexts (e.g., nutrition, alcohol reduction, obesity) (Armitage, Rowe, et al., 2014; Aveyard et al., 2016; Whatnall et al., 2018). In a physical activity context, brief intervention can be defined as any "intervention involving verbal advice, encouragement, negotiation or discussion with the overall aim of increasing physical activity delivered in a primary care setting by a health or exercise professional, with or without written support or follow-up" (National Institute for Health and Care Excellence, 2013, p. 7). These interventions are particularly relevant given that lack of time is a barrier to physical activity promotion in health professionals (Happell et al., 2012). Furthermore, these type of opportunistic interventions are also particularly suited for people who are less likely to use health services such as men (Affleck et al., 2018). Finally, brief interventions can be based on theoretical models of motivation to better tailor their contents (Armitage & Arden, 2010). This last aspect is particularly important as previous reviews showed that motivational theory-based interventions improve physical activity in the general population (Gourlan et al., 2016) but also in people with psychosis (Ashdown-Franks et al., 2018; Farholm & Sørensen, 2016; Romain et al., 2020). The rationale to focus on motivational theory-based interventions is that they could be more replicable given that they provide mechanisms or psychological processes explaining why interventions are successful (Bernard et al., 2018; Glanz & Bishop, 2010; Knittle et al., 2018). In brief intervention, two theories are widely used: the implementation intentions (Armitage, 2008; Gollwitzer & Sheeran, 2006) with the if-then plans and the transtheoretical model (Prochaska & DiClemente, 1982). The transtheoretical model is a composite model of behaviour change with three core components being decisional balance (perceived advantages/disadvantages related to the decision to change behaviour), self-efficacy (individuals' judgment of their abilities to organize

and execute courses of action required to attain designated types of performance) and the ten processes of change (five experiential and five behavioural strategies used by individuals to modify their behaviour) (Prochaska et al., 2008). Several studies showed this model to improve physical activity in different populations (Gourlan et al.; Romain et al., 2018).

In terms of effects on physical activity, brief interventions have been found to improve physical activity in different populations (e.g., type 2 diabetes, inactive adults, obesity) (Aveyard et al., 2016; Lamming et al., 2017) and to be cost-effective (Gc et al., 2016). In people with schizophrenia, to the best of our knowledge, only one study investigated brief interventions (Sailer et al., 2015) and found increased attendance to jogging sessions. However, this previous study was not specifically conducted among people with psychosis and overweight/obesity although antipsychotic-induced weight gain is a barrier to physical activity (Bernard et al., 2013). Moreover, the Sailer et al. study did not have written material while this strategy could facilitate interventions among people with potential cognitive deficits, or difficulties in functioning such as men with psychosis (Ochoa et al., 2012). In addition, men with psychosis are more likely to die of cardiovascular diseases (Sommer et al., 2020) while having a lower use of health services compared with women (Affleck et al., 2018; Matheson et al., 2014). Therefore, it was necessary to examine whether a brief motivational theory-based intervention could be feasible and effective in men with psychosis and obesity.

OBJECTIVES

The main objective of the present study was to investigate the feasibility of a brief motivational theory-based intervention to promote physical activity in men with obesity and psychosis. The secondary objective was to analyze the limited efficacy testing (whether a "new idea, program, process, or measure show promise of being successful with the intended population") (Bowen et al., 2009) of the intervention on physical activity, motivation to physical activity, anthropometric measures, and participants' subjective effects. It was hypothesized that the study would be feasible in terms of participation rate, and that it would result in an improvement in total physical activity and a reduction in sedentary time. Also, it was expected that the motivational processes of change (notably in the behavioral processes of change) would be improved and that participants would report the study to have beneficial effects on their health. Finally, given the study duration, no changes were expected in anthropometric measurement.

METHODS

ETHICAL CONSIDERATIONS

The present protocol was approved by the ethics committee of *Centre intégré de santé et des services sociaux de l'Outaouais* (#2016-179_82) in February 2017. Free informed written consent was obtained by the research nurse for all participants included in the study.

SETTING

Participants were recruited over a 2-month period between March and May 2017 in a setting part of the integrated health and social services centre of Gatineau (QC, Canada) and were referred by the case manager, who was not involved in the intervention. None of the investigators were involved in the treatment of the participants nor worked in the mental health services department of the study setting at the time of study.

EXCLUSION AND INCLUSION CRITERIA

To be included, participants had to meet the following criteria: a) being a man, b) being 18 years old or older, c) having a diagnosis of psychotic disorders (e.g., schizophrenia, schizophrenia-spectrum disorder) according to the DSM-V criteria, d) with overweight/obesity (body mass index, BMI > 25 kg/m^2), e) being able to answer the questionnaires.

The exclusion criteria were as follow: a) medical contra-indication to physical activity, b) being unable to complete the questionnaire, c) being active (defined as meeting physical activity recommendations – 150 minutes of moderate-to-

vigorous physical activity per week). Criteria were checked by a nurse not involved in the intervention and double-checked by one of the investigators (ReC).

DESIGN

The present study was a feasibility open trial with a quasi- experimental pre- post design and had a four-week duration per participant to be completed. The trial was composed of three steps (baseline evaluation/intervention, a booster session, final evaluation) (Figure 1). At baseline, demographic information, physical activity, sedentary time, processes of change, and anthropometric measures were collected, then the intervention was realized. Two weeks following this first step, a booster session was realized, and no evaluation was done. At the final evaluation, i.e., two weeks following the booster session, the same measures, except demographics, were collected. In addition, the feasibility and the subjective evaluation of the intervention were assessed only at this step.

INTERVENTION

The volitional help sheet component. The motivational brief intervention was based on a volitional help sheet develop by Armitage (2008) including the if-then plans. The volitional help sheet was used because participants did not have to generate their own critical situations and strategies as they are provided in the sheet (Armitage, Norman, et al., 2014). Hence, the volitional help sheet was a strategy to address the possible cognitive impairment of our population. Regarding the transtheoretical model, previous studies showed that interventions specifically based on this model should integrate all its components (Gorczynski et al., 2010) with a specific focus on the processes of change as they were found to drive physical activity changes (Nigg et al., 2019). Consequently, to integrate all theoretical components (decisional balance, self-efficacy, processes of change) and create the if-then plans using the volitional help sheet (Armitage & Arden, 2010), the intervention was delivered as follow: firstly, participants were asked about a physical activity they would like to initiate. If they could not provide one, walking was suggested given previous research consistently underlined this activity as preferred among people with psychosis (Subramaniapillai et al., 2016), included among individuals with obesity (Romain et al., 2020). Then, on a specific sheet, participants were presented different situations that are known to be physical activity barriers (decisional balance) in people with psychosis (Firth et al., 2016). After this step, participants were invited to select, among the 10 proposed strategies (five experiential and five behavioral as in the transtheoretical model) (Lipschitz et al., 2015), the most appropriate for them to overcome this barrier (processes of change). Once the if-then plan was formed, participants were orally asked about their confidence (from 0 to 100%) to realize this plan (self-efficacy). If participants provided an answer below 60%, they were invited to re-create a new if-then plan that could improve their confidence. This way to use the if-then plan was based on several articles showing that:

a) motivational theory-based interventions improve physical activity (Gourlan et al., 2016),
b) there is no evidence of superiority among existing motivational theoretical models in terms of efficacy regarding physical activity improvement (Gourlan et al., 2016),
c) to be considered as theory-based and not theory inspired, interventions need to integrate all theoretical components of the transtheoretical model (Ntoumanis et al., 2018),
d) interventions using the transtheoretical model are effective only if all the theoretical components are integrated (Romain et al., 2018),
e) interventions using the transtheoretical model improved physical activity when there were a specific focus on self-efficacy and processes of change but not stages of change (Nigg et al., 2019; Romain et al., 2018),
f) interventions using the transtheoretical model among people with psychosis were found to modify the theoretical components of the model, as expected (Gorczynski et al., 2010, 2014).

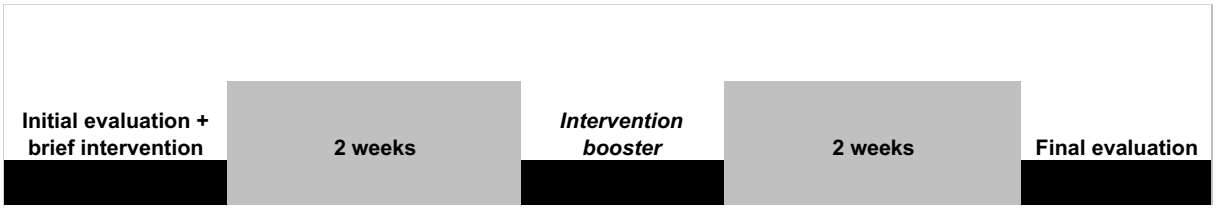

Figure 1. *Schematic representation of the study protocol*

Intervention setting. The intervention itself consisted of two meetings. During the first meeting, after the evaluations were completed, the brief intervention (5 to 10 minutes maximum) using the volitional help sheet (including the if-then) was realized with the participant. Two weeks later, during the second meeting, a booster session was conducted. During this session, the physical activity if-then plan was revised and adjusted if necessary. At this step, there were two possibilities. If participants failed to achieve what they planned, a new if-then plan was created as previously described. Otherwise, if participants were successful, they were reinforced in their plan and were asked to continue. Nevertheless, they had the possibility to re-create an if-then plan if wanted. Finally, two weeks following this second step, the final evaluation was performed.

Health professional. The present intervention was conducted by a registered nurse (RC) who had five years of experience in care in people with mental disorders. This nurse received three training sessions (one hour per session) by one of the investigators (AJR) before the beginning of the study. During these sessions, the nurse was trained to use the volitional help sheet.

MEASURES

Demographics. Participants were asked about their age, tobacco status, education level, socio-professional status, diagnosis of psychotic disorders and medication. The health professionals who referred the participants also provided the diagnosis to confirm it.

Feasibility. The feasibility of the intervention was assessed with different methods. At the end of the intervention, using a 3-item questionnaire (Theriault, 2014), participants were asked the following open-ended questions: 1) Would you recommend this intervention to friends or family members? 2) If you had the possibility to continue the project, would you do it? 3) Did the project meet your expectations?

Feasibility was also evaluated using the participation rate to engage in the project and the drop-out rate once engaged in the intervention. The participation rate was defined as the number of participants meeting the inclusion criteria who accepted to participate in the study, and the drop-out rate as the number of participants who started the project but further decided to withdraw from it.

Subjective evaluation of the intervention effects. To evaluate whether participants felt improvements following the intervention, a questionnaire dedicated to the present project was created. This questionnaire had 9 items and was completed with the nurse. In addition, participants were offered to write their responses if wanted, to provide more details. These open-ended questions were: 1) Did you observe any improvement in your physical health? 2) Did you observe any improvement in your psychological health? 3) Did you feel any improvement in your self-esteem? 4) Does this project enabled you to make changes in other behaviors? 5) Did you notice any change in your psychiatric symptoms? 6) Has this research project encouraged you to do more physical activity? 7) Do you feel your energy level has improved? 8) Do you think you are more motivated to walk on longer distances? 9) Do you believe you are in a better physical condition compared with the last year?

Physical activity level. Physical activity and time spent in sedentary activities were evaluated using the Global Physical Activity Questionnaire (Bull et al., 2009). Including 16 items, the questionnaire assessed different amounts of physical activity (total, vigorous and moderate) in different contexts (working, transportation, and

leisure time). In the present study, only total physical activity (minutes/week) and sedentary time (in hours/week) were selected. The questionnaire was completed using an interview-administered method by the nurse to minimize the physical activity over-reporting bias (Chu et al., 2015) notably among those with reading issues.

Motivational processes of change. Processes of change (a definition of the processes of change has been provided in Romain et al., 2018) were evaluated using the F-processes of change questionnaire (Bernard et al., 2014). This questionnaire assessed the five experiential (consciousness-raising, dramatic relief, self-reevaluation, environmental reevaluation and social liberation) and the five behavioral processes of change (self-liberation, helping relationships, counter-conditioning, reinforcement management and stimulus control) on a 5-point Likert scale with anchors going from 1 (never) to 5 (repeatedly). This questionnaire has been found to be invariant according to sex, socio-professional status and obesity (Bernard et al.; Romain et al., 2016), and associated with physical activity in people with psychosis (Gorczynski et al., 2010; Romain & Abdel-Baki, 2017).

Stages of change were evaluated using the French translation (Romain et al., 2012) of the stages algorithm (Nigg et al., 2005). The algorithm had four questions with a dichotomous response choice. According to their responses, participants were classified in one of the five stages. In the present study, participants were classified in pre-action stages (precontemplation, contemplation, preparation) or post-action stages (action, maintenance). This measure was used only for descriptive purposes.

Anthropometric measures. One investigator (ReC) measured weight, height and waist circumference and body mass index (BMI) was calculated. Height and weight were measured wearing light clothing and no shoes. The waist circumference was evaluated with participants standing in an upright position with their arms across their chest and was measured twice using a tape measure at the iliac crests at the end of a normal expiration as recommended (Poirier & Després, 2003). The measure was recorded at 0.1 cm precision using a non-stretch tape.

Statistical Analyses. To describe the satisfaction, and the feasibility, frequency statistics (and percentage) were performed. To select the appropriate test, data were checked for normality with the Shapiro-Wilk test. If normal, to analyze the intervention's effect on physical activity and the other parameters (sedentary time, experiential and behavioral processes of change, BMI, waist circumference), paired sample t-test were used. If data were not normal, the Wilcoxon rank test was used. To evaluate the intervention's effects, and given that the present study was not powered to detect effects of the intervention, Cohen's *d* for paired sample was used as a measure of effect size and by definition 0.2, 0.5 and 0.8 represent small, moderate and large effect size. Statistical analyses were performed with JAMOVI v.1.2 (The jamovi project, 2020). Effect size and its 95% confidence intervals were run using R studio (R studio Team, 2020) and the 'effect size' package.

RESULTS

PARTICIPANTS' ENROLMENT

Over the 38 participants approached, 12 were recruited (reasons for non-inclusion are in Figure 2). Regarding the 12 participants' characteristics (Table 1), the main diagnosis was schizophrenia (75%; n = 9), mean age was 33.2 $\pm$ 10.2, and mean BMI 35.8 $\pm$ 7.7 kg/m^2. Also, 75% (n = 9) were smokers, and 83% were unemployed (n = 10). At baseline, 92% of participants were in pre-action stages (contemplation = 4; 33% and preparation = 7; 58%).

FEASIBILITY

In terms of feasibility, the 12 included participants (indicating a participation rate of 32%) were recruited in eight weeks. All participants (100%) completed the intervention. Based on their answers to the feasibility questionnaire, 92% (n = 11) of participants reported they would refer a friend or a relative to the project, 92% (n = 11) said they would want to continue the project and 83% (n = 10) reported that the project met their expectations.

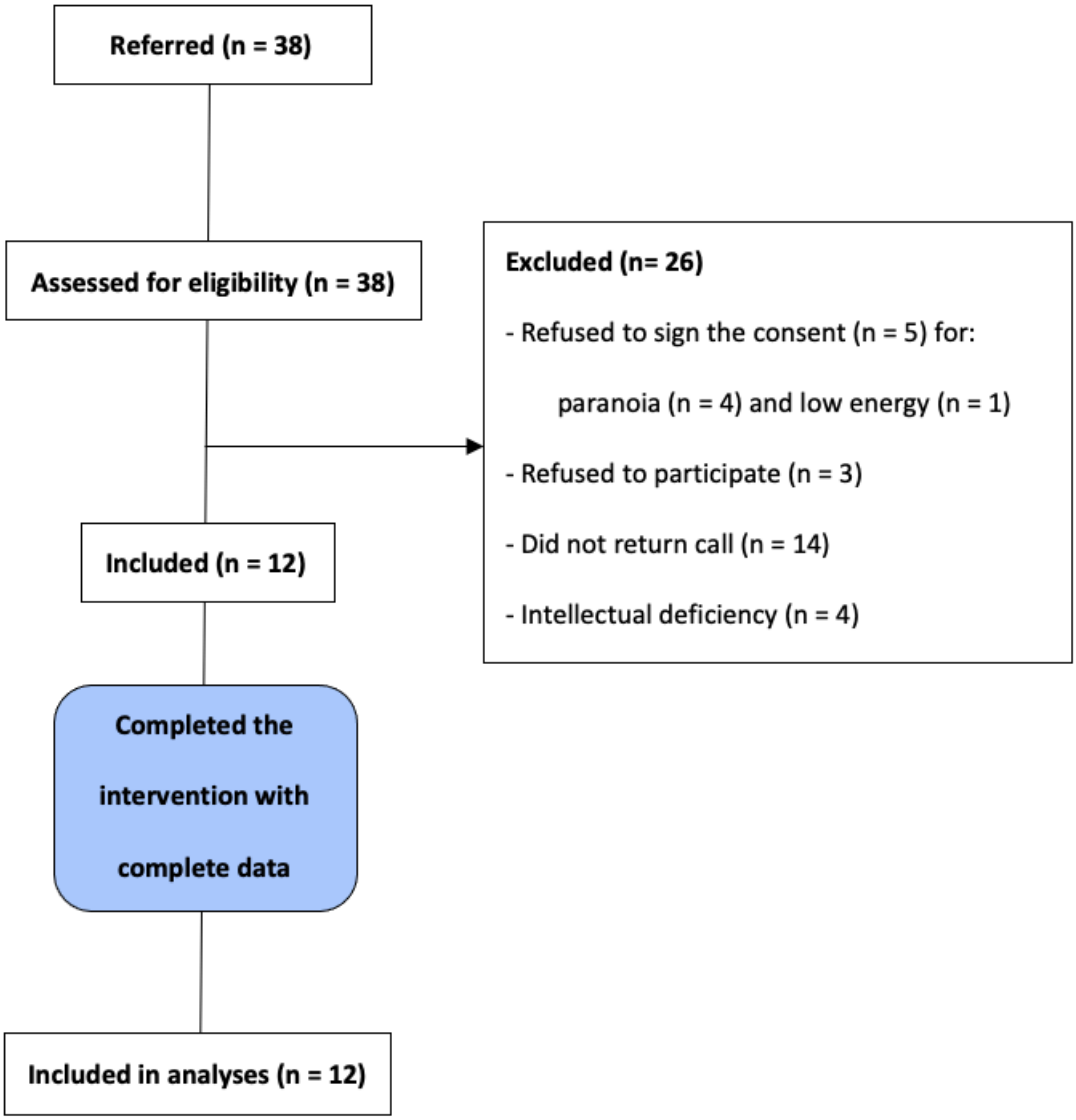

Figure 2. *Flow-chart of included participants*

VOLITIONAL HELP SHEET RESULTS

To create their if-then plans, the most selected physical activities were walking (59%; n = 7), indoor training (25%; n = 3), cycling (8%; n = 1) and soccer (8%; n = 1). At baseline, main reported physical activity barriers were weather (33%; n = 4), anxiety (25%; n = 3), and depressed mood (17%; n = 2). To overcome these barriers, the most selected processes of change selected by the participants were helping relationships (17%; n = 2), dramatic relief (17%; n = 2), reinforcement management (17%; n = 2) and counter-conditioning (17%; n = 2). Regarding the if-then plans, 75% (n = 9) of participants met their physical activity goals.

During the booster intervention, the main barriers were the weather (33%; n = 4), and depressed mood (17%; n = 2). The two most selected processes of change were self-liberation (25%; n = 3), and dramatic relief (25%; n = 3).

Table 1

Descriptive Characteristics of the Included Population

Descriptive characteristics	Population (*N* = 12)	
	N (%)	(Mean±SD)
Sex (Men)	12 (100)	
Age		33.2 ± 10.1
BMI (Kg/m²)		35.8 ± 7.7
Tobacco smoking	9 (75)	
Employment status		
Unemployed	10 (83.3)	
Diagnostic		
Schizophrenia	9 (75)	
MDD + psychotic features	3 (25)	
Stages of change		
Contemplation	4 (33)	
Preparation	7 (58)	
Action	1 (9)	

BMI = body mass index

MDD = major depressive disorder

INTERVENTION EFFECTS

Subjective evaluation. When participants were asked for their subjective evaluation of the intervention's effects, almost all (92%, n = 11) reported an improvement in their energy level, 83% (n = 10) felt more motivation to walk on longer distance, and 75% (n = 9) reported to exercise more following the beginning of the intervention. Also, 75% (n = 9) reported a better self-esteem and 67% (n = 8) mentioned an improvement in their physical and psychological health. Moreover, 60% (n = 7) reported the intervention helped them to change another health behavior (e.g., sleeping, tobacco cessation or eating). Finally, 58% (n = 6) reported an improvement on their psychiatric symptoms.

Physical activity and sedentary time. Regarding total physical activity, the Shapiro-Wilk test of normality indicates a violation of this assumption and the Q-Q plot indicates the presence of one outlier. Using the Wilcoxon rank test, an increase of +142.0 minutes (standard error = 114; p = 0.004) was observed after the intervention with a moderate effect size (*d* = 0.56, 95%CI[-0.07, 1.21]) (Table 2). Given the potential impact of extreme values with such a small sample size, the analysis was re-run without the outlier. Following this step, the pre-post intervention mean difference in total physical activity indicated a difference of +110.0 minutes (standard error = 37.6; p = 0.01) along with a large effect size (*d* = 0.89, 95%CI[0.21, 1.61]) (data not shown).

Regarding physical activity from transportation (e.g, walking), an increase of 45.6 minutes (standard error = 22.9; p = 0.01) after the intervention along with a large effect size (*d* = 0.82, 95%CI[0.15, 1.53]) was observed.

Regarding sedentary time, after the intervention, a decrease of 1.67 hours/day (standard error = 0.89; p = 0.08) was observed with a moderate effect size (*d* = - 0.54, 95%CI[-1.19, 0.08]) (Table 2).

Motivational processes of change. Regarding the use of processes of change, the pre-post intervention mean difference showed no change in the use of experiential processes of change (-0.012, standard error = 0.18; p = 0.47) and the effect size was small (*d* = 0.14, 95%CI[-0.45, 0.74]). However, after the intervention, a pre-post intervention mean difference in the use of behavioral processes of change was observed (+0.30, standard error = 0.18, p = 0.06) along with a moderate effect size (*d* = 0.38, 95%CI[-0.23, 1.00]) (Table 2).

Anthropometric measures. No results following the intervention were noted and effect size were small either for the weight (p = 0.76), BMI (p = 0.88), or the waist circumference (p = 0.24) (Table 2).

Table 2

Pre-post effects of the brief intervention in men with psychotic disorder (N=12)

	Pre-intervention (Mean±SD)	Post-intervention end (Mean±SD)	*p* value	Cohen's *d*, [95%CI]
Physical activity – sedentary time				
Total physical activity (min/week)	66.3 ± 44.8	285.0 ± 403.9	0.004	0.56 [-0.07, 1.21]
Transportation physical activity (min/week)	52.5 ± 34.7	117.5 ± 84.0	0.01	0.82 [0.15, 1.53]
Sedentary time (h/day)	10.83 ± 1.89	9.17 ± 2.48	0.06	- 0.54 [-1.19, 0.08]
Motivational processes of change				
Experiential processes of change	2.92 ± 0.44	2.94 ± 0.74	0.47	0.14 [-0.45, 0.74]
Behavioral processes of change	2.86 ± 0.73	3.16 ± 0.73	0.06	0.38 [-0.23, 1.00]
Anthropometrics				
Weight (kg)	110.7 ± 17.52	111.2 ± 19.23	0.76	0.09 [-0.50, 0.68]
BMI (kg/m^2)	35.8 ± 7.71	35.9 ± 7.37	0.88	0.19 [-0.40, 0.79]
Waist circumference (cm)	124.1 ± 13.89	122.7 ± 15.78	0.24	-0.36 [-0.98, 0.24]

DISCUSSION

In the present study, the objective was to assess the feasibility, then the limited-testing efficacy of a motivational theory-based brief intervention using a volitional help sheet to improve physical activity in men with psychotic disorders and obesity. In terms of feasibility, with a participation rate of 32%, our study illustrated the difficulty to engage people with mental disorders in research activities as shown in previous studies (Barnes et al., 2012; Jørgensen et al., 2014). Several factors could explain this participation rate. First, the role of psychiatric symptoms in this participation rate should be considered because several participants refused to take part to the project because of their psychotic symptoms or due to their depressed mood. This result is not surprising as negative symptoms and difficulties in functioning are known to impair physical activity engagement in people with schizophrenia (Ohi et al., 2018; Romain et al., 2019). Another explanation could be the initial level of motivation given that, in our study, most of participants were in the preparation or contemplation stage, which means they had an interest towards physical activity (Archie et al., 2007). So, it is possible that we did not reach participants who had low or no interest in physical activity (i.e., those who are mainly in the precontemplation stage). Nevertheless, it remains possible that other factors not evaluated in the present study (e.g., substance use, lack of peer support) could explain the low participation rate (Dixon et al., 2016). However, given we reached our recruitment target in the planned time (8 weeks), the present participation rate indicates that our strategy to involve health professionals in research purposes, as recommended (Hughes-Morley et al., 2015), was accurate. Regarding the drop-out rate, all participants completed the intervention. This low drop-out rate can be explained on one hand by the short intervention and research protocol duration (four weeks) and on the other hand, by the low number of meetings with the nurse who delivered the study intervention. Similarly, the satisfaction rate with the intervention was excellent with 83%

to 92% of participants reporting the intervention as satisfactory. These results indicate that the intervention was adequately developed for this population as previous research underlined that retention rate in lifestyle intervention remains a challenge in people with severe mental illness (Firth et al., 2015; Ward et al., 2015). Moreover, these findings probably indicate that the intensity of the intervention was adequate for both participants and the nurse This last point is particularly important as health professionals report multiple barriers regarding the provision of opportunistic behaviour change intervention, including the beliefs that these interventions would be poorly received by patients or skepticism about their ability to provide these interventions (Keyworth et al., 2019).

In terms of participants' subjective evaluations about the project, they reported several improvements on their health, notably their physical fitness but also their psychological health. These results are in line with previous findings highlighting the benefits of physical activity (Dauwan et al., 2016; Firth et al., 2015; Vancampfort, Rosenbaum, et al., 2015). Moreover, the results pointed out that some subjective improvements could be seen after 1 month with intervention as short as 2 meetings.

In terms of intervention, we noted an increase in the total physical activity level, and in the walking level among our participants along with moderate to large effect sizes. These results underlined that the motivational theory-based brief intervention using the volitional help sheet is interesting to increase physical activity in men with psychosis and that behavior change is possible in this population (Ashdown-Franks et al., 2018; Farholm & Sørensen, 2016). Moreover, this result corroborates the hypothesis that people with psychosis preferentially choose walking as their main activity (Subramaniapillai et al., 2016). This activity should be privileged when trying to initiate physical activity also because of its association with motivational features (St-Amour et al., 2019).

Interestingly, in terms of motivational strategy, the increase in physical activity was associated with an increase in the use of behavioral, but not experiential, processes of change with a moderate effect size. This finding corroborates results from a previous cross-sectional study in people with psychotic disorders and obesity (Romain & Abdel-Baki, 2017). Indeed, this previous study compared inactive and active people with psychotic disorder and obesity, and underlined that the latter had a higher use of behavioral processes of change (Romain & Abdel-Baki). Furthermore, as in the present study, the previous cross-sectional study did not show any associations between physical activity and experiential processes of change (Romain & Abdel-Baki). In terms of theoretical advancement, this set of results suggests a possible more prominent role of behavioral processes of change, compared with experiential processes of change, in physical activity behavior change (Rhodes & Pfaeffli, 2010). Consequently, future studies should consider this point when developing future physical activity interventions.

However, the increase in physical activity should not hide the absence of results on the time spent in sedentary time, even though this finding should be tempered as a reduction of 1.6 hours per day spent in sedentary time along with a moderate effect size was observed. Thereby, as the present study was a pilot, this result is encouraging for future interventions. Nevertheless, this finding also shed light on the fact that interventions that are being effective on increasing physical activity are probably not the same that are effective on reducing sedentary time. Hence, given sedentary time is a distinct health behavior, new theoretical development or alternative interventions would be needed in the future.

Finally, for the anthropometrics measurement, as expected given the short study duration, no results were found, and the effect sizes were small. This finding is not new as the impacts of physical activity on these markers are inconsistent (Firth et al., 2015; Stubbs et al., 2018). In the present study, it is likely that the physical activity intensity in which participants spontaneously engaged was not enough to observe these specific effects.

LIMITATIONS

Regarding the present study, several limitations should be noted. First, the sample size was small and not powered to detect finding on the

different outcomes, hence our statistical power was impacted. Indeed, it should be noted that the present study main objective was to assess the feasibility of the brief intervention. Also, our sample only included men with psychosis and obesity, hence the population cannot be representative of the population of people with psychotic disorders. Furthermore, the present study should not distract from the fact that women with psychosis are at greater risk of metabolic complications compared with men. To another extent, physical activity was self-reported so we cannot ignore the possibility of an overestimation bias even though the questionnaire was well validated and administered by interview. Finally, the study was underpowered, without a control group, so the results and effect size should be interpreted with caution.

CONCLUSION

In conclusion, and to summarize, the different results showed that a motivational theory-based brief intervention is feasible in terms of recruitment, professional training, participants' evaluations and potentially improve physical activity in man with psychosis and obesity. However, the recruitment strategy should be improved to increase the participation rate as only one-third of patients approached accepted to participate. Consequently, brief intervention using a volitional help sheet could be used to initiate the discussion about physical activity in men with psychotic disorders and obesity. It also underlines that nurses have an important role on physical activity promotion in this population. Future studies should consider realizing a randomized controlled trial including a larger and more diverse population along with a longer follow-up duration.

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