

Science of Nursing and Health Practices Science infirmière et pratiques en santé



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

Ahmed Jérôme Romain, Réginald Cadet and Aurélie Baillot

Volume 3, Number 2, 2020

URI: <https://id.erudit.org/iderudit/1076481ar>
DOI: <https://doi.org/10.31770/2561-7516.1084>

[See table of contents](#)

Publisher(s)

Réseau de recherche en interventions en sciences infirmières du Québec (RRISQ)

ISSN

2561-7516 (digital)

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Cite this article

Romain, A., Cadet, R. & Baillot, A. (2020). Brief Theory-based Intervention to Improve Physical Activity in Men with Psychosis and Obesity: A Feasibility Study. *Science of Nursing and Health Practices / Science infirmière et pratiques en santé*, 3(2), 1–16. <https://doi.org/10.31770/2561-7516.1084>

Article abstract

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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

Ahmed Jérôme Romain, Ph. D., École de kinésiologie et des sciences de l'activité physique, Faculté de Médecine, Université de Montréal, Centre de recherche de l'Institut universitaire en santé mentale de Montréal

Réginald Cadet, M. Sc., RN, Département des sciences infirmières, Université du Québec en Outaouais

Aurélié Baillot, Ph. D., Département des sciences infirmières, Université du Québec en Outaouais

Correspondance | Correspondence:

Ahmed Jérôme Romain, Ph. D.

École de kinésiologie et des sciences de l'activité physique

Faculté de Médecine

Université de Montréal

Centre de recherche de l'Institut universitaire en santé mentale de Montréal

aj.romain@umontreal.ca



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 ± 10.2 , and mean Body Mass Index: 35.8 ± 7.7 kg/m². 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.

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 $33,2 \pm 10,2$ et leur indice de masse corporelle, $35,8 \pm 7,7$ kg/m². 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.

Mots-clés

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

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/m²), 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 developed 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 follows: 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 was 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).

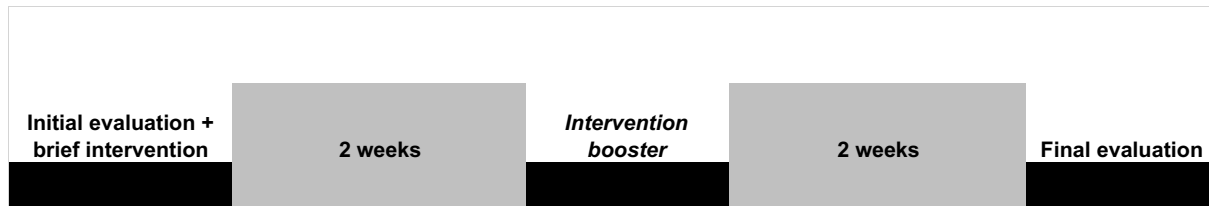


Figure 1. *Schematic representation of the study protocol*

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 (Gorczyński 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 JAMOV 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 ± 10.2 , and mean BMI $35.8 \pm 7.7 \text{ kg/m}^2$. 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.

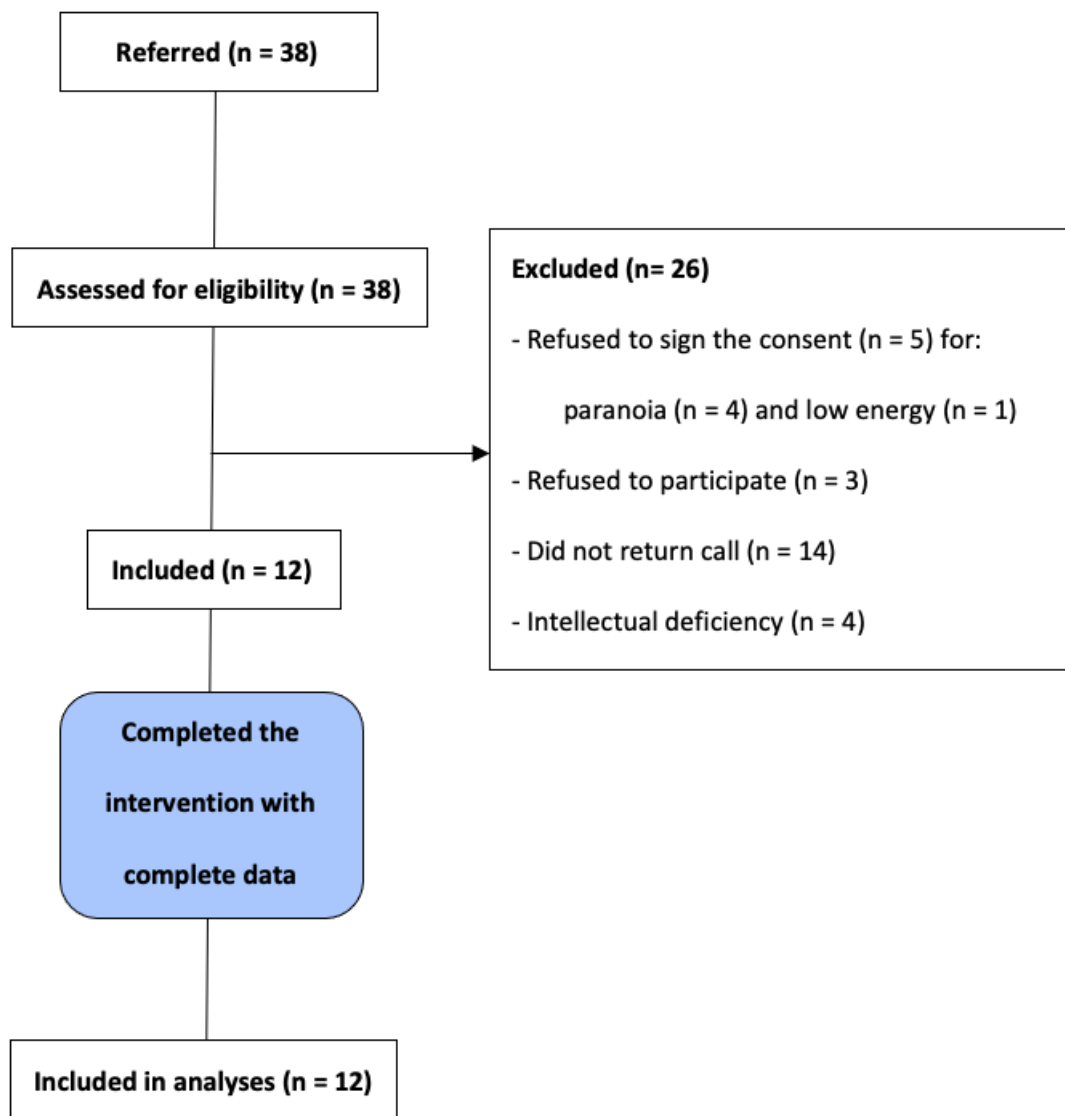


Figure 2. Flow-chart of included participants

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)	<i>p</i> value	Cohen's <i>d</i> , [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.

Authors' contribution: AJR, RC, AB. Intervention implementation, data collection: ReC. Statistical analyses: RC, AJR. Writing the first version of the manuscript: AJR, RC. Article revision: AJR, RC, AB. All authors read, revised and approved the final version.

Acknowledgments: The authors would like to thank Raynald Caron, RN, for the assistance in participants'

recruitment and the Quebec Network on Nursing Intervention Research for funding.

Funding: This study was funded by the Quebec Network on Nursing Intervention Research (#001608).

Conflicts of interest: The authors declare no conflict of interest.

Ethical considerations: The study received ethics approval from the integrated health and social services centre of Gatineau (#2016-179_82) in February 2017.

Reçu/Received: 3 Sept 2020 **Publié/Published:** 8 Dec 2020

REFERENCES

- Affleck, W., Carmichael, V., & Whitley, R. (2018). Men's Mental Health: Social Determinants and Implications for Services. *Canadian Journal of Psychiatry. Revue Canadienne De Psychiatrie*, 63(9), 581-589. <https://doi.org/10.1177/0706743718762388>
- Andersen, E., Holmen, T. L., Egeland, J., Martinsen, E. W., Bigseth, T. T., Bang-Kittelsen, G., Anderssen, S. A., Hansen, B. H., & Engh, J. A. (2018). Physical activity pattern and cardiorespiratory fitness in individuals with schizophrenia compared with a population-based sample. *Schizophrenia Research*, 201, 98-104. <https://doi.org/10.1016/j.schres.2018.05.038>
- Archie, S. M., Goldberg, J. O., Akhtar-Danesh, N., Landeen, J., McColl, L., & McNiven, J. (2007). Psychotic disorders, eating habits, and physical activity: Who is ready for lifestyle changes? *Psychiatric Services (Washington, D.C.)*, 58(2), 233-239. <https://doi.org/10.1176/ps.2007.58.2.233>
- Armitage, C. J. (2008). A volitional help sheet to encourage smoking cessation: A randomized exploratory trial. *Health Psychology: Official Journal of the Division of Health Psychology, American Psychological Association*, 27(5), 557-566. <https://doi.org/10.1037/0278-6133.27.5.557>
- Armitage, C. J., & Arden, M. A. (2010). A volitional help sheet to increase physical activity in people with low socioeconomic status: A randomised exploratory trial. *Psychology & Health*, 25(10), 1129-1145. <https://doi.org/10.1080/08870440903121638>
- Armitage, C. J., Norman, P., Noor, M., Alganem, S., & Arden, M. A. (2014). Evidence That a Very Brief Psychological Intervention Boosts Weight Loss in a Weight Loss Program. *Behavior Therapy*, 45(5), 700-707. <https://doi.org/10.1016/j.beth.2014.04.001>
- Armitage, C. J., Rowe, R., Arden, M. A., & Harris, P. R. (2014). A brief psychological intervention that reduces adolescent alcohol consumption. *Journal of Consulting and Clinical Psychology*, 82(3), 546-550. <https://doi.org/10.1037/a0035802>
- Ashdown-Franks, G., Williams, J., Vancampfort, D., Firth, J., Schuch, F., Hubbard, K., Craig, T., Gaughran, F., & Stubbs, B. (2018). Is it possible for people with severe mental illness to sit less and move more? A systematic review of interventions to increase physical activity or reduce sedentary behaviour. *Schizophrenia Research*, 202, 3-16. <https://doi.org/10.1016/j.schres.2018.06.058>
- Aveyard, P., Lewis, A., Tearne, S., Hood, K., Christian-Brown, A., Adab, P., Begh, R., Jolly, K., Daley, A., Farley, A., Lycett, D., Nickless, A., Yu, L.-M., Retat, L., Webber, L., Pimpin, L., & Jebb, S. A. (2016). Screening and brief intervention for obesity in primary care: A parallel, two-arm, randomised trial. *Lancet (London, England)*, 388(10059), 2492-2500. [https://doi.org/10.1016/S0140-6736\(16\)31893-1](https://doi.org/10.1016/S0140-6736(16)31893-1)
- Barnes, M., Wiles, N., Morrison, J., Kessler, D., Williams, C., Kuyken, W., Lewis, G., & Turner, K. (2012). Exploring patients' reasons for declining contact in a cognitive behavioural therapy randomised controlled trial in primary care. *The British Journal of General Practice: The Journal of the Royal College of General Practitioners*, 62(598), e371-377. <https://doi.org/10.3399/bjgp12X641492>
- Bernard, P., Romain, A. J., Esseul, E., Artigues, M., Poy, Y., Baghdadli, A., & Ninot, G. (2013). Barrières et motivation à l'activité physique chez l'adulte atteint de schizophrénie : Revue de littérature systématique. *Science & Sports*, 28(5), 247-252. <https://doi.org/10.1016/j.scispo.2013.02.005>
- Bernard, P., St Amour, S., Kingsbury, C., & Romain, A. J. (2018). We need reproducible health behaviour change interventions to help adults with severe mental illness. *Schizophrenia Research*, 202, 404-405. <https://doi.org/10.1016/j.schres.2018.06.046>
- Bernard, P., Romain, A.-J., Trouillet, R., Gernigon, C., Nigg, C., & Ninot, G. (2014). Validation of the TTM processes of change measure for physical activity in an adult French sample. *International Journal of Behavioral Medicine*, 21(2), 402-410. <https://doi.org/10.1007/s12529-013-9292-3>
- Bowen, D. J., Kreuter, M., Spring, B., Cofta-Woerpel, L., Linnan, L., Weiner, D., Bakken, S., Kaplan, C. P., Squiers, L., Fabrizio, C., & Fernandez, M. (2009). How we design feasibility studies. *American Journal of Preventive Medicine*, 36(5), 452-457. <https://doi.org/10.1016/j.amepre.2009.02.002>
- Bull, F. C., Maslin, T. S., & Armstrong, T. (2009). Global physical activity questionnaire (GPAQ): Nine country reliability and validity study. *Journal of Physical Activity & Health*, 6(6), 790-804.
- Chu, A. H. Y., Ng, S. H. X., Koh, D., & Müller-Riemenschneider, F. (2015). Reliability and Validity of the Self- and Interviewer-Administered Versions of the Global Physical Activity Questionnaire (GPAQ). *PloS One*, 10(9), e0136944. <https://doi.org/10.1371/journal.pone.0136944>
- Correll, C. U., Solmi, M., Veronese, N., Bortolato, B., Rosson, S., Santonastaso, P., Thapa-Chhetri, N., Fornaro, M., Gallicchio, D., Collantoni, E., Pigato, G., Favaro, A., Monaco, F., Kohler, C., Vancampfort, D., Ward, P. B., Gaughran, F., Carvalho, A. F., & Stubbs, B. (2017). Prevalence, incidence and mortality from cardiovascular disease in patients with pooled and specific severe mental illness: A large-scale meta-analysis of 3,211,768 patients and 113,383,368 controls. *World*

- Psychiatry: Official Journal of the World Psychiatric Association (WPA)*, 16(2), 163-180. <https://doi.org/10.1002/wps.20420>
- Dauwan, M., Begemann, M. J. H., Heringa, S. M., & Sommer, I. E. (2016). Exercise Improves Clinical Symptoms, Quality of Life, Global Functioning, and Depression in Schizophrenia: A Systematic Review and Meta-analysis. *Schizophrenia Bulletin*, 42(3), 588-599. <https://doi.org/10.1093/schbul/sbv164>
- Dixon, L. B., Holoshitz, Y., & Nossel, I. (2016). Treatment engagement of individuals experiencing mental illness: Review and update. *World Psychiatry: Official Journal of the World Psychiatric Association (WPA)*, 15(1), 13-20. <https://doi.org/10.1002/wps.20306>
- Farholm, A., & Sørensen, M. (2016). Motivation for physical activity and exercise in severe mental illness: A systematic review of intervention studies: Motivation, Exercise, and Mental Illness. *International Journal of Mental Health Nursing*, 25(3), 194-205. <https://doi.org/10.1111/inm.12214>
- Firth, J., Cotter, J., Elliott, R., French, P., & Yung, A. R. (2015). A systematic review and meta-analysis of exercise interventions in schizophrenia patients. *Psychological Medicine*, 45(6), 1343-1361. <https://doi.org/10.1017/S0033291714003110>
- Firth, J., Rosenbaum, S., Stubbs, B., Gorczynski, P., Yung, A. R., & Vancampfort, D. (2016). Motivating factors and barriers towards exercise in severe mental illness: A systematic review and meta-analysis. *Psychological Medicine*, 46(14), 2869-2881. <https://doi.org/10.1017/S0033291716001732>
- Firth, J., Stubbs, B., Rosenbaum, S., Vancampfort, D., Malchow, B., Schuch, F., Elliott, R., Nuechterlein, K. H., & Yung, A. R. (2017). Aerobic Exercise Improves Cognitive Functioning in People With Schizophrenia: A Systematic Review and Meta-Analysis. *Schizophrenia Bulletin*, 43(3), 546-556. <https://doi.org/10.1093/schbul/sbw115>
- Gc, V., Wilson, E. C., Suhrcke, M., Hardeman, W., & Sutton, S. (2016). Are brief interventions to increase physical activity cost-effective? A systematic review. *British Journal of Sports Medicine*, 50(7), 408-417. <https://doi.org/10.1136/bjsports-2015-094655>
- Glanz, K., & Bishop, D. B. (2010). The role of behavioral science theory in development and implementation of public health interventions. *Annual Review of Public Health*, 31, 399-418. <https://doi.org/10.1146/annurev.publhealth.012809.103604>
- Gollwitzer, P. M., & Sheeran, P. (2006). Implementation Intentions and Goal Achievement: A Meta-analysis of Effects and Processes. *Advances in Experimental Social Psychology*, 38, 69-119. [https://doi.org/10.1016/S0065-2601\(06\)38002-1](https://doi.org/10.1016/S0065-2601(06)38002-1)
- Gorczynski, P., Faulkner, G., Cohn, T., & Remington, G. (2014). Examining the efficacy and feasibility of exercise counseling in individuals with schizophrenia: A single-case experimental study. *Mental Health and Physical Activity*, 7(3), 191-197. <https://doi.org/10.1016/j.mhpa.2014.04.002>
- Gorczynski, P., Faulkner, G., Greening, S., & Cohn, T. (2010). Exploring the construct validity of the transtheoretical model to structure physical activity interventions for individuals with serious mental illness. *Psychiatric Rehabilitation Journal*, 34(1), 61-64. <https://doi.org/10.2975/34.1.2010.61.64>
- Gourlan, M., Bernard, P., Bortholon, C., Romain, A., Lareyre, O., Carayol, M., Ninot, G., & Boiché, J. (2016). Efficacy of theory-based interventions to promote physical activity. A meta-analysis of randomised controlled trials. *Health Psychology Review*, 10(1), 50-66. <https://doi.org/10.1080/17437199.2014.981777>
- Happell, B., Scott, D., Platania-Phung, C., & Nankivell, J. (2012). Should we or shouldn't we? Mental health nurses' views on physical health care of mental health consumers. *International Journal of Mental Health Nursing*, 21(3), 202-210. <https://doi.org/10.1111/j.1447-0349.2011.00799.x>
- Hughes-Morley, A., Young, B., Waheed, W., Small, N., & Bower, P. (2015). Factors affecting recruitment into depression trials: Systematic review, meta-synthesis and conceptual framework. *Journal of Affective Disorders*, 172, 274-290. <https://doi.org/10.1016/j.jad.2014.10.005>
- Jørgensen, R., Munk-Jørgensen, P., Lysaker, P. H., Buck, K. D., Hansson, L., & Zoffmann, V. (2014). Overcoming recruitment barriers revealed high readiness to participate and low dropout rate among people with schizophrenia in a randomized controlled trial testing the effect of a Guided Self-Determination intervention. *BMC Psychiatry*, 14, 28. <https://doi.org/10.1186/1471-244X-14-28>
- Keyworth, C., Epton, T., Goldthorpe, J., Calam, R., & Armitage, C. J. (2019). « It's difficult, I think it's complicated': Health care professionals » barriers and enablers to providing opportunistic behaviour change interventions during routine medical consultations. *British Journal of Health Psychology*, 24(3), 571-592. <https://doi.org/10.1111/bjhp.12368>
- Knittle, K., Nurmi, J., Crutzen, R., Hankonen, N., Beattie, M., & Dombrowski, S. U. (2018). How can interventions increase motivation for physical activity? A systematic review and meta-analysis. *Health Psychology Review*, 12(3), 211-230. <https://doi.org/10.1080/17437199.2018.1435299>
- Lamming, L., Pears, S., Mason, D., Morton, K., Bijker, M., Sutton, S., & Hardeman, W. (2017). What do we know about brief interventions for physical activity that could be delivered in primary care consultations? A systematic review of reviews. *Preventive Medicine*, 99, 152-163. <https://doi.org/10.1016/j.ypmed.2017.02.017>
- Lawlor, D. A., & Hanratty, B. (2001). The effect of physical activity advice given in routine primary care consultations: A systematic review. *Journal of Public Health Medicine*, 23(3), 219-226.

- Lipschitz, J. M., Yusuf, M., Paiva, A., Redding, C. A., Rossi, J. S., Johnson, S., Blissmer, B., Gokbayrak, N. S., Velicer, W. F., & Prochaska, J. O. (2015). Transtheoretical Principles and Processes for Adopting Physical Activity: A Longitudinal 24-Month Comparison of Maintainers, Relapsers, and Nonchangers. *Journal of Sport and Exercise Psychology*, 37(6), 592-606. <https://doi.org/10.1123/jsep.2014-0329>
- Matheson, F. I., Smith, K. L. W., Fazli, G. S., Moineddin, R., Dunn, J. R., & Glazier, R. H. (2014). Physical health and gender as risk factors for usage of services for mental illness. *Journal of Epidemiology and Community Health*, 68(10), 971-978. <https://doi.org/10.1136/jech-2014-203844>
- Mitchell, A. J., Vancampfort, D., Sweers, K., van Winkel, R., Yu, W., & De Hert, M. (2013). Prevalence of metabolic syndrome and metabolic abnormalities in schizophrenia and related disorders—A systematic review and meta-analysis. *Schizophrenia Bulletin*, 39(2), 306-318. <https://doi.org/10.1093/schbul/sbr148>
- National Institute for Health and Care Excellence. (2013). Physical activity: Brief advice for adults in primary care (NICE guideline) nice. org.uk/guidance/ph44; p. 1-60). <https://www.nice.org.uk/guidance/ph44/resources/physical-activity-brief-advice-for-adults-in-primary-care-pdf-1996357939909>
- Nigg, C., Hellsten, L., Norman, G., Braun, L., Breger, R., Burbank, P., Coday, M., Elliot, D., Garber, C., Greaney, M., Keteyian, S., Lees, F., Matthews, C., Moe, E., Resnick, B., Riebe, D., Rossi, J., Toobert, D., Wang, T., ... Williams, G. (2005). Physical activity staging distribution: Establishing a heuristic using multiple studies. *Annals of behavioral medicine: a publication of the Society of Behavioral Medicine*, 29 Suppl(2), 35-45. https://doi.org/10.1207/s15324796abm2902s_7
- Nigg, C. R., Harmon, B., Jiang, Y., Martin-Ginis, K. A., Motl, R. W., & Dishman, R. K. (2019). Temporal sequencing of physical activity change constructs within the transtheoretical model. *Psychology of Sport and Exercise*, 45, 101557. <https://doi.org/10.1016/j.psychsport.2019.101557>
- Ntoumanis, N., Thøgersen-Ntoumani, C., Quested, E., & Chatzisarantis, N. (2018). Theoretical approaches to physical activity promotion. In Oxford Research Encyclopaedia of Psychology (p. 1-47). Oxford University Press.
- Ochoa, S., Usall, J., Cobo, J., Labad, X., & Kulkarni, J. (2012). Gender differences in schizophrenia and first-episode psychosis: A comprehensive literature review. *Schizophrenia Research and Treatment*, 2012, 916198. <https://doi.org/10.1155/2012/916198>
- Ohi, K., Kataoka, Y., Shimada, T., Kuwata, A., Okubo, H., Kimura, K., Yasuyama, T., Uehara, T., & Kawasaki, Y. (2018). Meta-analysis of physical activity and effects of social function and quality of life on the physical activity in patients with schizophrenia. *European Archives of Psychiatry and Clinical Neuroscience*. <https://doi.org/10.1007/s00406-018-0903-5>
- Poirier, P., & Després, J.-P. (2003). Waist circumference, visceral obesity, and cardiovascular risk. *Journal of Cardiopulmonary Rehabilitation*, 23(3), 161-169.
- Prochaska, J. O., & DiClemente, C. C. (1982). Transtheoretical therapy: Toward a more integrative model of change. *Psychotherapy: Theory, Research & Practice*, 19(3), 276-288. <https://doi.org/10.1037/h0088437>
- Prochaska, J. O., Redding, C. A., & Evers, K. E. (2008). The transtheoretical model and stages of change. In K. Glanz, B. K. Rimer, & K. Viswanath (Eds.), *Health behavior and health education: Theory, research and practice* (4th ed., pp. 97-121). Jossey-Bass.
- Rhodes, R. E., & Pfaeffli, L. A. (2010). Mediators of physical activity behaviour change among adult non-clinical populations: A review update. *The International Journal of Behavioral Nutrition and Physical Activity*, 7, 37. <https://doi.org/10.1186/1479-5868-7-37>
- Romain, A. J., Bernard, P., Attalin, V., Gernigon, C., Ninot, G., & Avignon, A. (2012). Health-related quality of life and stages of behavioural change for exercise in overweight/obese individuals. *Diabetes & Metabolism*, 38(4), 352-358. <https://doi.org/10.1016/j.diabet.2012.03.003>
- Romain, A. J., Longpré-Poirier, C., Tannous, M., Abdel-Baki, A. (2020). Physical activity for patients with severe mental illness: Preferences, barriers and perceptions of counselling. *Science & Sports*, 35(5), 289-299. <https://doi.org/10.1016/j.scispo.2020.03.005>
- Romain, A. J., & Abdel-Baki, A. (2017). Using the transtheoretical model to predict physical activity level of overweight adults with serious mental illness. *Psychiatry Research*, 258, 476-480. <https://doi.org/10.1016/j.psychres.2017.08.093>
- Romain, A. J., Bernard, P., Akrass, Z., St-Amour, S., Lachance, J.-P., Hains-Monfette, G., Atoui, S., Kingsbury, C., Dubois, E., Karelis, A. D., & Abdel-Baki, A. (2020). Motivational theory-based interventions on health of people with severe mental illness: A systematic review and meta-analysis. *Schizophrenia Research*, 222 (2020), 31-41. <https://doi.org/10.1016/j.schres.2020.05.049>
- Romain, A. J., Bortolon, C., Gouylan, M., Carayol, M., Decker, E., Lareyre, O., Ninot, G., Boiché, J., & Bernard, P. (2018). Matched or nonmatched interventions based on the transtheoretical model to promote physical activity. A meta-analysis of randomized controlled trials. *Journal of Sport and Health Science*, 7(1), 50-57. <https://doi.org/10.1016/j.jshs.2016.10.007>

- Romain, A J, Caudroit, J., Hokayem, M., & Bernard, P. (2018). Is there something beyond stages of change in the transtheoretical model? The state of art for physical activity. *Canadian Journal of Behavioural Science / Revue Canadienne Des Sciences Du Comportement*, 50(1), 42-53. <https://doi.org/10.1037/cbs0000093>
- Romain, A J, Fankam, C., Karelis, A. D., Letendre, E., Mikolajczak, G., Stip, E., & Abdel-Baki, A. (2019). Effects of high intensity interval training among overweight individuals with psychotic disorders: A randomized controlled trial. *Schizophrenia Research*, 210, 278-286. <https://doi.org/10.1016/j.schres.2018.12.021>
- Romain, A J, Trottier, A., Karelis, A. D., & Abdel-Baki, A. (2020). Do Mental Health Professionals Promote a Healthy Lifestyle among Individuals Experiencing Serious Mental Illness? *Issues in Mental Health Nursing*, 41(6), 531-539. <https://doi.org/10.1080/01612840.2019.1688436>
- Romain, A.J., Bernard, P., Hokayem, M., Gernigon, C., & Avignon, A. (2016). Measuring the Processes of Change From the Transtheoretical Model for Physical Activity and Exercise in Overweight and Obese Adults. *American Journal of Health Promotion*, 30(4), 272-278. <https://doi.org/10.1177/0890117116633829>
- Rosenbaum, S., Tiedemann, A., Ward, P. B., Curtis, J., & Sherrington, C. (2015). Physical activity interventions: An essential component in recovery from mental illness. *British Journal of Sports Medicine*, 49(24), 1544-1545. <https://doi.org/10.1136/bjsports-2014-094314>
- RStudio Team. (2015). *RStudio: Integrated Development Environment for R*. Boston, MA. <http://www.rstudio.com/>
- Sailer, P., Wieber, F., Pröpster, K., Stoewer, S., Nischk, D., Volk, F., & Odenwald, M. (2015). A brief intervention to improve exercising in patients with schizophrenia: A controlled pilot study with mental contrasting and implementation intentions (MCII). *BMC Psychiatry*, 15, 211. <https://doi.org/10.1186/s12888-015-0513-y>
- Sommer, I. E., Tiihonen, J., van Mourik, A., Tanskanen, A., & Taipale, H. (2020). The clinical course of schizophrenia in women and men-a nation-wide cohort study. *NPJ Schizophrenia*, 6(1), 12. <https://doi.org/10.1038/s41537-020-0102-z>
- St-Amour, S., Romain, A. J., Karelis, A. D., & Abdel-Baki, A. (2019). Factors associated to self-reported walking and sedentary behaviours in a study sample of individuals with severe mental illness. *German Journal of Exercise and Sport Research*, 49(4), 395-401. <https://doi.org/10.1007/s12662-019-00599-w>
- Stubbs, B., Firth, J., Berry, A., Schuch, F. B., Rosenbaum, S., Gaughran, F., Veronesse, N., Williams, J., Craig, T., Yung, A. R., & Vancampfort, D. (2016). How much physical activity do people with schizophrenia engage in? A systematic review, comparative meta-analysis and meta-regression. *Schizophrenia Research*, 176(2-3), 431-440. <https://doi.org/10.1016/j.schres.2016.05.017>
- Stubbs, B., Koyanagi, A., Veronese, N., Vancampfort, D., Solmi, M., Gaughran, F., Carvalho, A. F., Lally, J., Mitchell, A. J., Mugisha, J., & Correll, C. U. (2016). Physical multimorbidity and psychosis: Comprehensive cross sectional analysis including 242,952 people across 48 low- and middle-income countries. *BMC Medicine*, 14(1), 189. <https://doi.org/10.1186/s12916-016-0734-z>
- Stubbs, B., Vancampfort, D., Hallgren, M., Firth, J., Veronese, N., Solmi, M., Brand, S., Cordes, J., Malchow, B., Gerber, M., Schmitt, A., Correll, C. U., De Hert, M., Gaughran, F., Schneider, F., Kinnafick, F., Falkai, P., Möller, H.-J., & Kahl, K. G. (2018). EPA guidance on physical activity as a treatment for severe mental illness: A meta-review of the evidence and Position Statement from the European Psychiatric Association (EPA), supported by the International Organization of Physical Therapists in Mental Health (IOPTMH). *European Psychiatry*, 54, 124-144. <https://doi.org/10.1016/j.eurpsy.2018.07.004>
- Stubbs, B., Williams, J., Gaughran, F., & Craig, T. (2016). How sedentary are people with psychosis? A systematic review and meta-analysis. *Schizophrenia Research*, 171(1-3), 103-109. <https://doi.org/10.1016/j.schres.2016.01.034>
- Subramaniapillai, M., Arbour-Nicitopoulos, K., Duncan, M., McIntyre, R. S., Mansur, R. B., Remington, G., & Faulkner, G. (2016). Physical activity preferences of individuals diagnosed with schizophrenia or bipolar disorder. *BMC Research Notes*, 9(1). <https://doi.org/10.1186/s13104-016-2151-y>
- Teasdale, S. B., Ward, P. B., Samaras, K., Firth, J., Stubbs, B., Tripodi, E., & Burrows, T. L. (2019). Dietary intake of people with severe mental illness: Systematic review and meta-analysis. *The British Journal of Psychiatry: The Journal of Mental Science*, 214(5), 251-259. <https://doi.org/10.1192/bjp.2019.20>
- The jamovi project (2020). jamovi (Version 1.2) [Computer Software]. <https://www.jamovi.org>
- Theriault, L. (2014). *Impact d'un programme d'entraînement périodisé sur la santé physique et psychologique de personnes atteintes de maladies mentales* [Mémoire de maîtrise, Université du Québec à Chicoutimi]. Constellation. https://constellation.uqac.ca/3706/1/ThxE9riault_uqac_0862N_10161.pdf
- Ussher, M., Stanbury, L., Cheeseman, V., & Faulkner, G. (2007). Physical activity preferences and perceived barriers to activity among persons with severe mental illness in the United Kingdom. *Psychiatric Services (Washington, D.C.)*, 58(3), 405-408. <https://doi.org/10.1176/appi.ps.58.3.405>
- Vancampfort, D., Firth, J., Correll, C. U., Solmi, M., Siskind, D., De Hert, M., Carney, R., Koyanagi, A., Carvalho, A. F., Gaughran, F., & Stubbs, B. (2019). The impact of pharmacological and non-pharmacological interventions to improve physical health outcomes in people with schizophrenia: A meta-review of meta-analyses of randomized controlled trials. *World Psychiatry*, 18(1), 53-66. <https://doi.org/10.1002/wps.20614>

- Vancampfort, D., Rosenbaum, S., Ward, P. B., & Stubbs, B. (2015). Exercise improves cardiorespiratory fitness in people with schizophrenia: A systematic review and meta-analysis. *Schizophrenia Research*, 169(1-3), 453-457. <https://doi.org/10.1016/j.schres.2015.09.029>
- Vancampfort, D., Stubbs, B., Mitchell, A. J., De Hert, M., Wampers, M., Ward, P. B., Rosenbaum, S., & Correll, C. U. (2015). Risk of metabolic syndrome and its components in people with schizophrenia and related psychotic disorders, bipolar disorder and major depressive disorder: A systematic review and meta-analysis. *World Psychiatry: Official Journal of the World Psychiatric Association (WPA)*, 14(3), 339-347. <https://doi.org/10.1002/wps.20252>
- Ward, M. C., White, D. T., & Druss, B. G. (2015). A meta-review of lifestyle interventions for cardiovascular risk factors in the general medical population: Lessons for individuals with serious mental illness. *The Journal of Clinical Psychiatry*, 76(4), e477-486. <https://doi.org/10.4088/JCP.13r08657>
- Whatnall, M. C., Patterson, A. J., Ashton, L. M., & Hutchesson, M. J. (2018). Effectiveness of brief nutrition interventions on dietary behaviours in adults: A systematic review. *Appetite*, 120, 335-347. <https://doi.org/10.1016/j.appet.2017.09.017>