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Title: Self-determination and stage of readiness to change physical activity behaviour in schizophrenia

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Manuscript Region of Origin: BELGIUM

**Abstract:** Purpose: The present study examined whether reasons for physical activity, as formulated by the self-determination theory, differed across the stages identified by the transtheoretical model of behaviour change.

**Methods:** A total of 129 persons with schizophrenia completed the Behavioural Regulation in Exercise Questionnaire-2 and the Patient-centred Assessment and Counselling for Exercise questionnaire.

Multivariate and discriminant analyses were applied to determine whether reasons for physical activity differed between men and women and across the stages of change.

**Results:** Discriminant analyses indicated that persons with schizophrenia at the early stages of change are less autonomous in the regulation of their physical activity behaviour than those at the later stages.

Multivariate analyses showed a difference in amotivation, external regulation, and autonomous regulation, but not introjected regulation across the different stages of change.

**Conclusions:** Our results suggest that autonomous motivation may have an important role to play in the adoption and maintenance of health promoting behaviours in persons with schizophrenia.

Suggested Reviewers: Paul Gorczyński  
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Dear Prof. Dr. Guy Faulkner

Dear Esteemed Reviewers,

Please reconsider our manuscript Ref. No.: MENPA-D-14-00001 *Self-determination and stage of readiness to change physical activity behaviour in schizophrenia* for possible publication in the special issue *Physical Activity and Serious Mental Illness* of Mental Health and Physical Activity.

We would like to thank the editor for giving us the opportunity to rework and resubmit our manuscript. We would also like to express gratitude for the efforts of reviewers in directing the manuscript towards a more acceptable form for publication and hope that the added revisions adequately address the comments of the editor and both reviewers.

We illustrate the requested changes in a numerical way, in order to detail the separate points made by reviewer #1 and #2. We use a red font to illustrate the point made for consideration and then underneath a black font to provide our response.

Yours sincerely,

Davy Vancampfort and co-authors

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Yours sincerely,

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Reviewer #1:

1. The purpose of this cross sectional study was to investigate types of motivation toward physical activity across stages of change for individuals living with schizophrenia. This is an interesting study that provides a theoretical basis toward structuring interventions to increase physical activity in this population. This study provides simple practical clinical solutions to help healthcare professionals try to engage clients with respect to being more active. It also lays out a plan for longitudinal research that can test some of the correlations found through this research. Perhaps the most interesting point provided by this paper is the inverse associations between motivational types and stage of changes. Although this point is interesting, is it unique? Do the findings in this paper differ all that much from Vancampfort et al. 2013b? In the 2013b paper, findings on self-regulation are presented in relation to the IPAQ (inactive, active, and highly active), whereas in this paper they're presented in relation to the PACE (stages of change). The findings appear to be very similar.

We would like to thank reviewer #1 for the constructive and positive feedback on our work. We acknowledge that the difference between the two measures (and consequently, articles) requires further elaboration. We would like to highlight several points that support the need for the current study. First, the PACE captures the intention to undertake moderate intensity physical activity, whereas the IPAQ is used to identify the duration of physical (in)activity. Whilst we acknowledge that the IPAQ captures moderate intensity physical activity, it is important to identify it does not consider the patients' intentions or stages of change. Second, the recall period that assesses physical activity levels is different, notably the IPAQ is a 7-day recall questionnaire and the PACE considers a broader 6-month recall period. Thus, whilst the IPAQ may capture short term physical activity levels, it doesn't identify if this behaviour is likely to continue. We clarified in this reworked version why it is important to consider physical activity over a longer period of time: *“There are however three reasons why research is needed to investigate also intentions and maintained engagement in physical activity behaviour over a longer period of time (6-months). First, in light of the complex and dynamic nature of physical activity behaviour, it seems unfeasible that a 7-day recall of physical activity is able to truly capture a patient's behavioural patterns over a longer term. For example, due to the nature of their illness, patients with schizophrenia often experience lapses in trying to adhere to physical activity programmes (Vancampfort et al., 2012d). Such drop-out from physical activity programmes could be partly attributed to the motivation underlying physical activity behaviour (Sorensen, 2006). Second, the consideration of long-*

*term engagement in physical activity is also interesting from a theoretical perspective. That is, although previous studies have found some forms of controlled (i.e., introjected) regulation to be positively associated with concurrent levels of physical activity (Teixeira et al., 2012), these associations have been found to wane when the assessment period is extended, presumably because the pressured regulation is more readily undermining energy required for sustained engagement (Pelletier et al., 2001; Teixeira et al., 2012; Vansteenkiste, et al., 2004). Although a longitudinal design would be ideal to answer this question, the maintained engagement in physical activity can be indirectly captured through the assessment of the stages of change. Third, apart from studying individuals' initiation and maintenance of physical activity behaviour, it is also interesting to find out whether some patients start to formulate intentions to engage in physical activity or do not consider doing so at all. The initial stages of change (pre-contemplation and contemplation) of the TTM precisely captures such emerging readiness to change in the future. For these reasons, it is useful to examine how SDT-based reasons for physical activity relate to stages of change in TTM, an issue that a few previous studies in the general population (Mullan & Markland, 1997; Rose et al., 2005) and among specific populations including African American women (Landry et al., 2004), and college students (Farmanbar et al., 2009) have shed preliminary light on."*

Finally, also in the discussion we focused more on the fact that in using the TTM we were able to investigate *regular* physical activity participation rather than the *actual* level of physical activity. For example, we mention now that: *"The observation that amotivation contributed negatively to the between-groups variability suggests that feelings of discouragement do not characterize the motivational profiles of frequently active participants who have maintained their behaviour for at least 6 months."*

**2. Additionally, the practical solutions that stem from the 2013b paper also appear to be very similar to the ones proposed in this paper. What does the current paper offer that hasn't already been published, aside from the findings relating to the PACE?**

Thank you for making us aware of the similarities and enabling us to further advance our practical solutions. We have reworked the practical solutions: *"One of the greatest challenges facing researchers and clinicians is how to motivate patients with schizophrenia to adopt and maintain an active lifestyle over the long term. According to the stages of change framework, the promotion of optimal motivation and change is best achieved by applying the therapeutic principles and strategies that match with the patients' particular stage (Prochaska & Di*

*Clemente, 1983; Prochaska & Marcus, 1994). The proposed strategies and techniques in each phase are however not rooted in one single theoretical framework or approach but instead represent a broad collection of diverse techniques taken from various approaches. Whereas the cognitive processes would be used by preference in the earlier, more motivation-oriented stages of change, the behavioural processes would be applied by preference in the last, more action-oriented stages of change (Prochaska & Di Clemente, 1983; Prochaska & Marcus, 1994). Considering the current findings, two issues need to be highlighted here. First, the facilitation of autonomous physical activity motivation seems not be limited to a single stage, but instead seems vitally important across the different stages. Indeed, it has been argued that the enhancement of autonomy represents a non-specific therapeutic factor, which is critical across clinical schools and clinical populations (Ryan et al., 2011). To facilitate autonomous motivation exercisers' psychological needs for autonomy (i.e., experiencing a sense of psychological freedom when engaging in physical activity), competence (i.e., feeling effective to attain desired outcomes) and relatedness (i.e., being socially connected) need to be nurtured across these stages, as these needs represent the nutrients of enduring engagement and growth. The way health care professionals, caregivers or others attend to these needs might depend on the patients' stage of change, with some need-supportive components (e.g., acknowledging resistance, offering choice, providing a rationale) being more critical in some stages than in others. Yet, if patients perceive their psychological needs to be met, they would be more likely to develop and maintain autonomous motivation, leading them to progress across the cycle of change. Second, the critical role of more autonomous forms of motivation may especially manifest with respect to the later stages of change. That is, both autonomously and controlled motivated exercisers may weigh up the pros and cons of change in the earlier stages, yet, autonomous forms of motivation are especially required when translating action into maintenance. Consistent with the idea that autonomous motivation may moderate the transition between the later stages of change, Thøgersen-Ntoumani and Ntoumanis (2006) found external regulation to predict greater relapse in exercising.*

The authors hope that these revisions adequately address the comments of reviewer #1 and the editor.

Reviewer #2:

This is an understudied topic, so it is good to see more research addressing physical activity for individuals with severe mental illness with the aim of better understanding how this particularly vulnerable population can be stimulated to live more physically active lives.

1. The study is in general reasonably well written, but with a somewhat "minimalistic style". There are other studies examining motivational issues for populations with serious mental health illness that may have been natural to mention in the introduction. All in all it seems to be a little premature for publication in its present form.

Thank you for your suggestion. We added the following key paper in the introduction:

- Sorensen, M. (2006). Motivation for physical activity of psychiatric patients when physical activity was offered as part of treatment. *Scandinavian Journal of Medicine and Science in Sports*, 16(6), 391-398.

Also the following papers, although not directly focused on persons with severe mental illnesses were added to strengthen the evidence:

- Teixeira, P.J., Carraça, E.V., Markland, D., Silva, M.N., & Ryan, R.M. (2012). Exercise, physical activity, and self-determination theory: a systematic review. *International Journal of Behavioral Nutrition Physical Activity*, 9, 78.
- Thøgersen-Ntoumani, C., & Ntoumanis, N. (2006). The role of self-determined motivation in the understanding of exercise-related behaviours, cognitions and physical self-evaluations, *Journal of Sports Sciences*, 24(4),393-404.

2. On the positive side, the methodology is sound, and the authors have used measurement instruments already tested out on this particular population.

Thank you for your positive feedback on our methodology used.

3. The theoretical rationale for the comparison of TTM and SDT should in my mind be explained more thoroughly, because it is not obvious, and it could be argued that some of the constructs such as a-motivation and precontemplation are quite similar (no physical activity and no intention/wish to be physical active). The part of the TTM that describes the different processes of change is not described. Including that might help to better understand the usefulness of linking SDT and TTM.

Related to the rationale for the comparison of TTM and SDT we added the following in the introduction: "In distinguishing SDT from TTM, the latter assumes, at least implicitly, a more quantitative perspective on motivation. That is, it can be derived from the TTM-framework

*that individuals who are at higher stages of change are more strongly motivated than those at lower stages of change. In contrast, SDT also highlights the importance of exercisers' type or quality of motivation, as it is maintained that engagement in physical activity can be regulated by autonomous or volitional, relative to more controlled or pressured reasons. The assumption is that when autonomous exercise regulations are supported, not only the initiation but also the regular (i.e. frequent) participation in physical activity will be better secured. That is, as far as the reasons for exercising get fully integrated within individuals' personal values and interests and, hence, become part of their living style, individuals are more likely to willingly exercise over longer periods of time."*

We also added the following regarding the processes of change in TTM: *"TTM also comprises a secondary dimension, the processes of change, which are perceived as techniques and strategies differentially employed by patients across the stages of change. Ten processes of change have received the most empirical support, separated into five cognitive processes of change (e.g., consciousness raising) and five behavioural processes (e.g., stimulus control) (Prochaska et al., 1992). Cognitive processes have been found to peak in the contemplation stage and behavioural processes have been shown to steadily increase from pre-contemplation to action, at which point they level off (Marcus & Simkin, 1994)."*

4. In order to help the general reader to understand better, I would also have liked to see the reasons why " Understanding physical activity behaviour and motives in in people with schizophrenia is arguably more complex than in general populations" (Quote , top , page 6). This may be self-evident for the author (s), but not for all readers of this journal.

Considering the changes made in the introduction and the length of our manuscript we deleted this sentence.

5. The study is more or less a replica of the study of Mullan & Markland from 1997 on a sample of adults from the general population, which in itself is ok. This is another population, and there is at least a reference to that study. However, what intrigues me is that Mullan&Markland found relatively clear gender differences in their study, whereas gender is not even mentioned in this study.From the way the results are generalised to "persons with schizophrenia", I assume that there were both males and females in this study. I would suggest to include information about this, and at least to explore if the gender differences also are replicated in this population.

Thank you for this valuable suggestion. We included a multivariate analysis of variance (MANOVA) now to test for significant differences in BREQ-2 subscale scores across the TTM stages of change and between men and women. Where significant main effects were demonstrated, we followed up with comparisons of differences across groups using one-way analyses of variance (ANOVA) with post hoc tests (Scheffe) (stages of change) or T-tests (gender). Significance level was set at  $p < 0.05$ . No gender effects were found (Wilks' Lambda = 0.98,  $F(4,118)=0.70$ ,  $p=0.59$ ). Also no interaction effects for gender by stage of change were found (Wilks' Lambda = 0.91,  $F(12,350)=0.95$ ,  $p=0.50$ ). Based on the multivariate analyses, the current discriminant analysis was not conducted for men and women separately. We indicated in the discussion that future research is needed to explore why these findings differ with the findings from Mullan and Markland.

6. Further, I would suggest more consistency in, and sometimes more precise, use of terms and descriptions. It is confusing for readers that the types of motivation regulation as described by SDT are sometimes referred to as "reasons for engaging in physical activity", and other times called "types of motivation/motivation types". On the previous page the TTM (Trans Theoretical Model) is presented. It is not precise to describe TTM as "a theory utilised to explain a range of health behaviours ". TTM is a descriptive model that categorise individuals related to one particular behavior (quite correctly stated further down on the same page!), but it does not explain the behavior, as is also pointed out. That is why it is not a theory, it is a useful categorical model.

We agree with reviewer #2 that it is better to state that TTM is a descriptive model that categorises individuals related to one particular behaviour. We changed the sentence to: "*The model has been successfully utilised to describe the different phases that individuals with schizophrenia pass through in the acquisition and maintenance of health behaviours (Archie et al., 2007; Gorczynski et al., 2010).*" Related to the confusion regarding the words "reasons for engaging in physical activity, and "types of motivation/motivation types", we tried to clarify that different motivation types are distinguished depending on people's reasons for exercising. See also our responses to your comment 3. Therefore, we still report that the self-determination theory (SDT) is a motivational theory that provides insight into the reasons why persons adopt and maintain certain health behaviours.

7. There is no mentioning of ethical issues and considerations. Has the study been examined and approved by any ethical committee? I think that should be a natural part of any research report, and in particular when studying vulnerable populations.

We believe this was overlooked by reviewer #2 since we reported on the ethical issues in the methods sections (§1 participants and procedure). We indicated over there that the study procedure was approved by the 13 ethical committees based at each centre. All participants gave their written informed consent.

8. The discussion ( 3.1.) is very short and limited. It sums up the results, but is no real discussion of a lot of interesting issues that ought to be discussed. The last paragraph of this part is hard to understand: How can less a-motivation and more autonomous motivation be quantity of motivation, and more autonomous motivation and less controlled regulation be quality of motivation?

- See also our responses to the comments of reviewer #1 here. We reworked the practical implications sections.
- We also added the following: *“The observation that amotivation contributed negatively to the between-groups variability suggests that feelings of discouragement do not characterize the motivational profiles of frequently active participants who have maintained their behaviour for at least 6 months.”*
- We clarified that with a higher quantity we mean higher levels of either autonomous or controlled motivation, while with a better quality we mean a shift from controlled to autonomous regulations.

9. Small detail: Page numbers are missing, and that makes it more problematic to identify where in the manuscript I am dealing with.

We included page numbers now.

All in all, I hope the comments may help improving the manuscript, it is dealing with an important issue.

The authors wish to express their gratitude for the valuable comments of reviewer #2. This way we were able to direct the manuscript towards a more acceptable form for publication. The authors hope that the added revisions adequately address the comments of reviewer #2.

**Self-determination and stage of readiness to change physical activity behaviour in  
schizophrenia**

Davy Vancampfort<sup>1,2,\*</sup>, Maarten Vansteenkiste<sup>3</sup>, Marc De Hert<sup>1</sup>, Amber De Herdt<sup>2</sup>, Andrew  
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## **Disclosures related to the present work**

Davy Vancampfort is funded by the Research Foundation – Flanders (FWO – Vlaanderen).

## Abstract

1  
2 *Purpose:* The present study examined whether reasons for physical activity, as formulated by  
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4 the self-determination theory, differed across the stages identified by the transtheoretical  
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6 model of behaviour change.  
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9 *Methods:* A total of 129 persons with schizophrenia completed the Behavioural Regulation in  
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11 Exercise Questionnaire-2 and the Patient-centred Assessment and Counselling for Exercise  
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13 questionnaire. Multivariate and discriminant analyses were applied to determine whether  
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21 *Results:* Discriminant analyses indicated that persons with schizophrenia at the early stages of  
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25 the later stages. Multivariate analyses showed a difference in amotivation, external regulation,  
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27 and autonomous regulation, but not introjected regulation across the different stages of  
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29 change.  
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33 *Conclusions:* Our results suggest that autonomous motivation may have an important role to  
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35 play in the adoption and maintenance of health promoting behaviours in persons with  
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37 schizophrenia.  
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Research is needed to develop our understanding of physical activity behaviours in persons with schizophrenia (Beebe et al., 2012; Vancampfort et al., 2012a) since it has been found to yield a plethora of benefits (Gorczyński & Faulkner, 2010; Scheewe et al., 2013; Vancampfort et al., 2009, 2012b). Despite this, there is a relatively high prevalence of physical inactivity (Faulkner et al., 2006; Lindamer, 2008; Vancampfort et al., 2013a). As a result, clinicians face the challenge of promoting physical activity behaviours in this population group.

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One of the most commonly adopted models of behaviour change is the transtheoretical model (TTM) (Prochaska & Di Clemente, 1983; Prochaska & Marcus, 1994). The model has been successfully utilised to describe the different phases that individuals with schizophrenia pass through in the acquisition and maintenance of health behaviours (Archie et al., 2007; Gorczyński et al., 2010). The TTM provides a framework for categorising a person's readiness to change their behaviour and includes five stages. In the first stage, the pre-contemplation phase, individuals are physically inactive and are not thinking about becoming more active within the next six months. During the next stage, the contemplation stage, individuals think about becoming more active within the next six months. In the third stage, the preparation stage, individuals are engaging in some physical activity, while in the penultimate action stage individuals have been regularly active for less than six months. Lastly, the maintenance stage is characterised by an individual having sustained regular physical activity for more than six months. TTM also comprises a secondary dimension, the processes of change, which are perceived as techniques and strategies differentially employed by patients across the stages of change. Ten processes of change have received the most empirical support, separated into five cognitive processes of change (e.g., consciousness raising) and five behavioural processes (e.g., stimulus control) (Prochaska et al., 1992).

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Although the TTM has been recognised as an important model for behaviour change in individuals with schizophrenia (Esterberg & Compton, 2005; Archie et al., 2007; Gorczynski et al., 2010), the model has limitations. For instance, it fails to explain why individuals engage in physical activity or remain inactive, nor does it identify the mechanisms that underlie physical activity adoption and/or maintenance. However, it is essential to gain insight in the reasons why some people are physically active while others in the same environment are not. Thus, it is important that research examines individuals' reasons for being physically active.

The self-determination theory (SDT) (Deci & Ryan, 1985, 2000; Vansteenkiste, et al., 2010) is a motivational theory that provides an insight into reasons why persons adopt and maintain certain health behaviours. The theory proposes motivation is multidimensional and resides along a continuum of increasing self-determination. The lowest end of the continuum is identified as amotivation which represents a general lack of motivation to change behaviour due to discouragement. Following along the continuum, external regulation refers to exercising to avoid punishment or criticism or to obtain promised rewards or external appreciation. Introjected regulation refers to the imposition of pressures onto one's own functioning, for instance, by buttressing one's activity engagement with feelings of guilt, self-criticism, or contingent self-worth. More volitional or autonomous forms of functioning include identified regulation, which involves foreseeing the personal importance of the activity, and integrated regulation, which implies that physical activity is brought in harmony with other prevailing life values, such that being active becomes prioritised within one's lifestyle. Finally, intrinsic motivation involves engaging in physical activity for its own sake, that is, because one finds being active stimulating or enjoyable by itself.

In distinguishing SDT from TTM, the latter assumes, at least implicitly, a more quantitative perspective on motivation. That is, it can be derived from the TTM-framework

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There are however three reasons why research is needed to investigate also intentions and maintained engagement in physical activity behaviour over a longer period of time (6-months). First, in light of the complex and dynamic nature of physical activity behaviour, it seems unfeasible that a 7-day recall of physical activity is able to truly capture a patient's behavioural patterns over a longer term. For example, due to the nature of their illness, patients with schizophrenia often experience lapses in trying to adhere to physical activity programmes (Vancampfort et al., 2012d). Such drop-out from physical activity programmes could be partly attributed to the motivation underlying physical activity behaviour (Sorensen, 2006). Second, the consideration of long-term engagement in physical activity is also interesting from a theoretical perspective. That is, although previous studies have found some forms of controlled (i.e., introjected) regulation to be positively associated with concurrent levels of physical activity (Teixeira et al., 2012), these associations have been found to wane

1 when the assessment period is extended, presumably because the pressured regulation is more  
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7 find out whether some patients start to formulate intentions to engage in physical activity or  
8 do not consider doing so at all. The initial stages of change (pre-contemplation and  
9 contemplation) of the TTM precisely captures such emerging readiness to change in the  
10 future. For these reasons, it is useful to examine how SDT-based reasons for physical activity  
11 relate to stages of change in TTM, an issue that a few previous studies in the general  
12 population (Mullan & Markland, 1997; Rose et al., 2005) and among specific populations  
13 including African American women (Landry et al., 2004), and college students (Farmanbar et  
14 al., 2009) have shed preliminary light on.

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34 The aim of this study was to evaluate in persons with schizophrenia the associations  
35 between the TTM stages of change and the reasons for being physically active as discerned  
36 within SDT. It was hypothesised that more autonomous forms of motivation (i.e. identified  
37 and intrinsic regulations) would be prevalent in more advanced stages of change (i.e.  
38 preparation, action and maintenance). In contrast, more controlling forms of motivation (i.e.  
39 external and introjected regulations) and in particular amotivation would be enhanced in the  
40 least advanced stages of change (i.e. pre-contemplation and contemplation).  
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## 1. Methods

### 1.1. Participants and procedure

A cross-sectional multi-centre design was used incorporating 13 centres that treat persons with schizophrenia (see acknowledgements). The centres were located across the five Dutch-speaking provinces of Belgium. All patients who had a DSM-IV diagnosis of schizophrenia (American Psychiatric Association, 2000) were invited to participate. The diagnosis was established by experienced psychiatrists responsible for the treatment. Individuals were included if they were: (1) inpatients or outpatients with schizophrenia, (2) had a full or partial remittance in symptoms, and (3) were able to concentrate for 20 to 25 minutes. Individuals were excluded if they were located within an intensive supervision unit. Also persons who experienced acute paranoid delusions were excluded. No incentive was provided for participation. The study procedure was approved by the 13 ethical committees based at each centre. All participants gave their written informed consent. More detailed information regarding to the demographical data of the included participants is presented elsewhere (Vancampfort et al., 2013b).

### 1.2. Behavioural Regulation in Exercise Questionnaire

The Behavioural Regulation in Exercise Questionnaire-2 (BREQ-2) (Markland & Tobin, 2004) is used as an interviewer-administered questionnaire. The questionnaire comprises of 19 items relating to reasons to be physically active derived from the self-determination theory. Each item is measured on a five-point Likert-scale, from 0 ('Not true for me') to 4 ('Very true for me'). In accordance with previous research (Vancampfort et al., 2013b) "identified regulation" and "intrinsic regulation" were combined to a single factor labelled "autonomous regulation".

### 1.3. Stage of readiness to change

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2 Stages of change were assessed using a modified version of the stage of change  
3 questionnaire from the Patient-centered Assessment and Counseling for Exercise (PACE)  
4 questionnaire (Long et al., 1996). For this study, physical activity was defined as moderate  
5 intensity activity for 30 minutes on most days of the week (e.g., activities that take moderate  
6 physical effort and make you breathe somewhat harder than normal). Participants chose one  
7 of five options: “I’m not physically active and I don’t intend to start” (pre-contemplation);  
8 “I’m not physically active but I’m thinking about starting” (contemplation); “I’m active  
9 occasionally” (preparation); “I’m active regularly and started in the last 6 months” (action);  
10 and “I’m active regularly and have been for longer than 6 months” (maintenance). The PACE  
11 has been successfully used in individuals with schizophrenia (Archie et al., 2007; Gorczynski  
12 et al., 2010). For the purposes of this research the questionnaire was interviewer administered.  
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### 1.4. Statistical analyses

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32 A multivariate analysis of variance (MANOVA) was used to test for significant  
33 differences in BREQ-2 subscale scores across the TTM stages of change and between men  
34 and women. Where significant main effects were demonstrated, we followed up with  
35 comparisons of differences across groups using one-way analyses of variance (ANOVA) with  
36 post hoc tests (Scheffe) (stages of change) or T-tests (gender). Significance level was set at  
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48 Next to this, a discriminant function analysis was used to determine whether the stages of  
49 change could be discriminated on the basis of BREQ-2 subscale scores. In the discriminant  
50 analysis, Box’s M was significant [Box’s M = 115.1, approximate  $F(30; 33483) = 3.6$ ,  
51  $p < 0.001$ ]. This indicates the null hypothesis of equality of covariance matrices across groups  
52 has to be rejected. However, Box’s M is a conservative test. Discriminant analysis procedures  
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1 are fairly robust against departures from the assumptions of multivariate normality within  
2 groups and equality of covariance matrices across groups (Duarte Silva &Stam, 1995).  
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4 Variables with structure coefficients greater than 0.30 were used to define the meaning of the  
5 functions (Pedhazur, 1982). Stage of change group differences were evaluated by examining  
6  
7 the values of the discriminant functions at the group centroids. Positive values indicate that a  
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9 group scores high on a function while negative values indicate that a group has a low score on  
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11 that function. Lastly, classification functions for each stage of change group were then  
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13 generated from the discriminant functions. The classification functions permit the input of an  
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15 individual's raw score for each of the BREQ-2 variables to estimate the probability of the  
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17 membership in each of the stage of change groups. The individual was predicted to belong to  
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19 the group for which the highest probability estimate was obtained.  
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26 SPSS 20.0 was used for data analysis (SPSS Inc, Chicago, IL).  
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## 2. Results

### 2.1. Participants

A total of 168 Belgian individuals (all Caucasian) with a DSM-IV diagnosis of schizophrenia (American Psychiatric Association, 2000) were initially recruited. Thirty-two persons declined participation and missing data was identified in seven cases. A total of 129 persons (44♀) with schizophrenia with a mean ( $\pm$ SD) age of  $40.6\pm 12.7$  years and a mean ( $\pm$ SD) body mass index (BMI) of  $27.4\pm 4.7$  were included in the final analysis. Sixty-eight persons (55.7%) were outpatients, 16 were in their first-episode (13.1%).

### 2.2. Stages of change

Eleven (8.5%) persons with schizophrenia reported being in pre-contemplation, 17 (13.2%) in contemplation, 25 (19.4%) in preparation, 37 (28.7%) in action, and 39 (30.2%) in maintenance. Due to the relatively small numbers in the first two stages, we followed Mullan and Markland (1997) who combined the two stages of change to form a single stage that was labelled “pre-preparation” ( $n=28$ ; 21.7%). Means and standard deviations at each stage of change for each BREQ-2 subscale are presented in Table 1.

[Add Table 1 about here]

### 2.3. Analyses of variance

MANOVA was performed with the BREQ-2 scores as dependent variables and gender and stage of change as independent variables. Overall, the analysis demonstrated only main effects for stages of change (Wilks' Lambda = 0.44,  $F(12,312)=9.6$ ,  $p<0.001$ ), and not for gender (Wilks' Lambda = 0.98,  $F(4,118)=0.70$ ,  $p=0.59$ ). Also no interaction effects for gender by stage of change were found (Wilks' Lambda = 0.91,  $F(12,350)=0.95$ ,  $p=0.50$ ). Follow-up ANOVA with post hoc Sheffe demonstrated that amotivation, external regulation and

1 identified and intrinsic regulations, but not introjected regulation differed across the different  
2 stages of change. All (sub-) analyses investigating differences in motivation regulations  
3 across stages of change are presented in Table 1. Based on the multivariate analyses, the  
4 current discriminant analysis was not conducted for men and women separately.  
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#### 10 11 12 2.4. Discriminant analysis

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14 Table 2 summarises the findings of the discriminant analysis for the entire group. One  
15 function (canonical  $r=0.76$ ; Wilks'  $\lambda=0.38$ ,  $df =12$ ,  $p<0.001$ ) explained 91% of the  
16 between-groups variability. As judged by the correlations between the discriminating  
17 variables and the discriminant function, the function was dominated by autonomous  
18 regulation ( $r=0.76$ ) and by amotivation ( $r=-0.74$ ). The values of the discriminant functions at  
19 the group centroids were examined. The structure coefficients of this function identified that  
20 amotivation made a significant negative contribution to the discriminant function, while  
21 autonomous regulation made a significant positive contribution. The centroid values indicate  
22 that the pre-preparation group can be located at the positive end of the continuum and the  
23 maintenance group at the negative end. Overall, 74 (57.4%) of the participants were  
24 accurately classified, which is an improvement over the base rate (chance) prediction of 29%  
25 (i.e., the sample size [ $n = 38$ ] of the largest group divided by the total sample [ $N = 129$ ] and  
26 multiplied by 100).  
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### 3. Discussion

#### 3.1. Main findings

Promoting physical activity is an increasing health priority in psychiatric rehabilitation programmes (Richardson et al., 2005) and investigating the motivational correlates of physical activity in those with schizophrenia is important in order to understand the mechanisms that facilitate behaviour change **in the long term**. The present study is the first among persons with schizophrenia to demonstrate that more autonomous forms of motivation are observed in more advanced TTM stages of physical activity participation. Individuals with schizophrenia in the preparation, action, and maintenance stages were less amotivated and more autonomously motivated toward physical activity than those in the pre-preparation stages. Individuals with schizophrenia who are either beginning or continuing to engage in regular physical activity are more autonomously motivated than those who are not. In the same way those with schizophrenia who are beginning or continuing to engage in regular physical activity report less controlled forms of motivation and, in particular, less external pressures. **The observation that amotivation contributed negatively to the between-groups variability suggests that feelings of discouragement do not characterize the motivational profiles of frequently active participants who have maintained their behaviour for at least 6 months.** Our results therefore suggest that the maintenance of frequent participation in physical activity **over a longer period** in this particular population is reflective of both the quantity **(i.e., lower levels of amotivation)** and quality **(i.e. a shift from controlled to autonomous regulations)** of motivation.

#### 3.2. Practical considerations

**One of the greatest challenges facing researchers and clinicians is how to motivate patients with schizophrenia to adopt and maintain an active lifestyle over the long term.**

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According to the stages of change framework, the promotion of optimal motivation and change is best achieved by applying the therapeutic principles and strategies that match with the patients' particular stage (Prochaska & Di Clemente, 1983; Prochaska & Marcus, 1994). The proposed strategies and techniques in each phase are however not rooted in one single theoretical framework or approach but instead represent a broad collection of diverse techniques taken from various approaches. Whereas the cognitive processes would be used by preference in the earlier, more motivation-oriented stages of change, the behavioural processes would be applied by preference in the last, more action-oriented stages of change (Prochaska & Di Clemente, 1983; Prochaska & Marcus, 1994).

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Considering the current findings, two issues need to be highlighted here. First, the facilitation of autonomous physical activity motivation seems not be limited to a single stage, but instead seems vitally important across the different stages. Indeed, it has been argued that the enhancement of autonomy represents a non-specific therapeutic factor, which is critical across clinical schools and clinical populations (Ryan et al., 2011). To facilitate autonomous motivation exercisers' psychological needs for autonomy (i.e., experiencing a sense of psychological freedom when engaging in physical activity), competence (i.e., feeling effective to attain desired outcomes) and relatedness (i.e., being socially connected) need to be nurtured across these stages, as these needs represent the nutrients of enduring engagement and growth. The way health care professionals, caregivers or others attend to these needs might depend on the patients' stage of change, with some need-supportive components (e.g., acknowledging resistance, offering choice, providing a rationale) being more critical in some stages than in others. Yet, if patients perceive their psychological needs to be met, they would be more likely to develop and maintain autonomous motivation, leading them to progress across the cycle of change. Second, the critical role of more autonomous forms of motivation may especially manifest with respect to the later stages of change. That is, both autonomously and

1 controlled motivated exercisers may weigh up the pros and cons of change in the earlier  
2 stages, yet, autonomous forms of motivation are especially required when translating action  
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4 into maintenance. Consistent with the idea that autonomous motivation may moderate the  
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6 transition between the later stages of change, Thøgersen-Ntoumani and Ntoumanis (2006)  
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8 found external regulation to predict greater relapse in exercising.  
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### 11 12 13 14 3.3. *Limitations and future research*

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16 Caution should be exercised in generalising from the present findings given the cross-  
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18 sectional nature of this research. Therefore it is not possible to ascertain whether those in the  
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20 later stages of change became more autonomous in the regulation of their physical activity  
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22 behaviour over time as they increased their stage of change, or whether they reached the later  
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24 stages of change because they were more autonomous from the start. Longitudinal and  
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26 intervention studies should therefore be designed to identify the causal pathways between the  
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28 different constructs. Grounded in SDT, such intervention studies should strive to foster  
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30 perceptions of choice, competence, and enjoyment for physical activity, particularly for  
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32 individuals who are not active on a regular basis (those in the pre-preparation and preparation  
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34 stages of change). In contrast with previous research in the general population (Mullan &  
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36 Markland, 1997) the current results identified no gender differences in reasons for being  
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38 physically active across the stages of change in patients with schizophrenia. Future research  
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40 including larger sample sizes should explore this difference with general population data more  
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42 in detail. Lastly, one should be aware that the majority of the included participants were  
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44 hospitalised at the time of the study. Previous research (Vancampfort et al., 2013c)  
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46 demonstrated that environmental variables are significantly associated with multiple types of  
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48 physical activity participation in persons with schizophrenia.  
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#### 4. Conclusion

Our data demonstrates that in persons with schizophrenia a higher autonomous motivation appears to be a prerequisite for participation in regular physical activity. We encourage longitudinal research that is able to consider the underlying motivational processes involved in physical activity behaviour change in persons with schizophrenia.

#### References

- American Psychiatric Association. (2000). *Diagnostic and Statistical Manual of Mental Disorders*. 4<sup>th</sup> edition. Washington DC: American Psychiatric Association.
- 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*, 58(2), 233-239.
- Beebe, LH, Smith K, Burk R, McIntyre, K., Dessieux, O., Tavakoli, A., et al. (2012). Motivational intervention increases exercise in schizophrenia and co-occurring substance use disorders. *Schizophrenia Research*, 135(1-3), 204-205.
- Deci, E.L., Ryan, R.M. (1985). *Intrinsic motivation and self-determination in human behaviour*. New York: Plenum Press.
- Deci, E.L., & Ryan, R.M. (1991). A motivational approach to self: Integration in personality. In *Nebraska Symposium on Motivation, vol. 38: Perspectives on Motivation* (edited by R. Deinstbier), pp. 237-288. Lincoln, NE: University of Nebraska Press.
- Deci, E.L., Ryan, R.M. (2000). The “what” and “why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11, 227-268.
- Duarte Silva, A. P., & Stam, A. (1995). Discriminant analysis. In: L.G. Grimm and P.R. Yarnold (Eds.), *Reading and understanding multivariate statistics* (pp. 277-318). Washington, DC: American Psychological Association.

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- Epstein, L.H. (1998). Integrating theoretical approaches to promote physical activity. *American Journal of Preventive Medicine, 15*(4), 257-265.
- Esterberg, M.L., & Compton, M.T. (2005). Smoking behavior in persons with a schizophrenia-spectrum disorder: a qualitative investigation of the transtheoretical model. *Social Science & Medicine, 61*(2), 293-303.
- Farmanbar, R., Niknami, S., Heydarnia, A., Hajizadeh, E., & Lubans, D.R. (2009). Predicting Exercise behavior among Iranian college students using the transtheoretical model and structural equation modeling. *European Journal of Scientific Research, 31*(3), 355-365.
- Faulkner, G., Cohn, T., & Remington, G. (2006). Validation of a physical activity assessment tool for individuals with schizophrenia. *Schizophrenia Research, 82*, 225-231.
- Gorczyński, P., & Faulkner, G. (2010). Exercise therapy for schizophrenia. *Schizophrenia Bulletin, 36*(4), 665-666.
- Gorczyński, 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.
- Landry, J.B., & Solomon, M.A. (2004). African American women's self-determination across the stage of change for exercise. *Journal of Sport & Exercise Psychology, 26*(3), 457-469.
- Lindamer, L.A., McKibbin, C., Norman, G.J., Jordan, L., Harrison, K., Abeyesinhe, S., et al. (2008). Assessment of physical activity in middle-aged and older adults with schizophrenia. *Schizophrenia Research, 104*, 294-301.
- Long, B.J., Calfas, K.J., Wooten, W., Sallis, J.F., Patrick, K., Goldstein, M., et al. (1996). A multisite field test of the acceptability of physical activity counseling in primary care: Project PACE. *American Journal of Preventive Medicine, 12*(2), 73-81.

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- Markland, D. (1999). Self-determination moderates the effects of perceived competence on intrinsic motivation in an exercise setting. *Journal of Sport and Exercise Psychology*, 21, 351-361.
- Markland, D., & Tobin, V. (2004). A modification to the behavioural regulation in exercise questionnaire to include an assessment of amotivation. *Journal of Sport and Exercise Psychology*, 26, 191-196.
- Mullan, E., & Markland, D., (1997). Variations in self-determination across the stages of change for exercise in adults. *Motivation & Emotion*, 21, 349-362.
- Pedhazur, E.J. (1982). *Multiple regression in behavioral research: Explanation and prediction*. New York: Holt, Rinehart & Winston.
- Pelletier, L., Fortier, M., Vallerand, R., Brière, N. (2001). Associations among perceived autonomy support, forms of self-regulation, and persistence: A prospective study. *Motivation and Emotion*, 25, 279-306.
- Prochaska, J.O., DiClemente, C.C. (1983). Stages and processes of self-change of smoking: towards an integrative model of change. *Journal of Consulting and Clinical Psychology*, 51, 390-395.
- Prochaska, J.O., Norcross, J.C., Fowler, J., Follick, M., & Abrams, D.B. (1992). Attendance and outcomes in a work-site weight control program: Processes and stages of change as process and predictor variables. *Addictive Behaviors*, 17, 35-45.
- Prochaska, J.O., Marcus, B.H. (1994). *The transtheoretical model: Applications to exercise*. In: R.K. Dishman (Ed.), *Advances in exercise adherence* (pp. 161-180). Champaign, IL: Human Kinetics.
- Richardson, C.R., Faulkner, G., McDevitt, J., Skrinar, G., Hutchinson, D., & Piette, J. Integrating physical activity into mental health services for persons with serious mental illness. *Psychiatric Services*, 56, 324-331.

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- Rose, E.A., Parfitt, G., & Williams, S. (2005). Exercise causality orientations, behavioral regulations for exercise and stage of change for exercise: Exploring their relationships. *Psychology of Sport & Exercise*, 6, 399-414.
- Ryan, R.M., & Deci, E.L. (2003). *On assimilating identities to the self: A self-determination theory perspective on internalization and integrity within cultures*. In M.R. Leary, & J.P. Tangney (Eds.), *Handbook on self & identity* (pp. 253-274). New York: Guilford Press.
- Ryan, R.M., Lynch, M.F., Vansteenkiste, M., & Deci, E.L. (2011). Motivation and autonomy incounseling, psychotherapy, and behavior change: A look at theory and practice. *Counseling Psychologist*, 1, 1-68.
- Scheewe, T.W., Backx, F.J., Takken, T., Jörg, F., van Strater, A.C., Kroes, A.G., et al. (2013). Exercise therapy improves mental and physical health in schizophrenia: a randomised controlled trial. *Acta Psychiatrica Scandinavica*, 127(6), 464-473.
- Sorensen, M. (2006). Motivation for physical activity of psychiatric patients when physical activity was offered as part of treatment. *Scandinavian Journal of Medicine and Science in Sports*, 16(6), 391-398.
- Teixeira, P.J., Carraça, E.V., Markland, D., Silva, M.N., & Ryan, R.M. (2012). Exercise, physical activity, and self-determination theory: a systematic review. *International Journal of Behavioral Nutrition Physical Activity*, 9, 78.
- Thøgersen-Ntoumani, C., & Ntoumanis, N. (2006). The role of self-determined motivation in the understanding of exercise-related behaviours, cognitions and physical self-evaluations. *Journal of Sports Sciences*, 24(4),393-404.
- Vancampfort, D., Knapen, J., De Hert, M., van Winkel, R., Deckx, S., Maurissen, K., et al. (2009). Cardiometabolic effects of physical activity interventions for people with schizophrenia. *Physical Therapy Reviews*, 14, 388-398.

1 Vancampfort, D., Knapen, J., Probst, M., Scheewe, T., Remans, S., & De Hert, M. (2012a). A  
2 systematic review of correlates of physical activity in patients with schizophrenia.  
3  
4 *Acta Psychiatrica Scandinavica*, 125(5), 352-362.  
5  
6

7 Vancampfort, D., Probst, M., Skjaerven, L.H., Catalán-Matamoros, D., Lundvik-Gyllensten,  
8  
9 A., Gómez-Conesa, A., et al. (2012b). A systematic review of the benefits of physical  
10 therapy within a multidisciplinary care approach of patients with schizophrenia.  
11  
12 *Physical Therapy*, 92(1), 11-23.  
13  
14  
15

16 Vancampfort, D., De Hert, M., Skjaerven, L.H., Gyllensten, A.L., Parker, A., Mulders, N., et  
17  
18 al. (2012d). International Organization of Physical Therapy in Mental Health  
19 consensus on physical activity within multidisciplinary rehabilitation programmes for  
20  
21 minimising cardio-metabolic risk in patients with schizophrenia. *Disability and*  
22  
23 *Rehabilitation*, 34(1), 1-12.  
24  
25  
26  
27

28 Vancampfort, D., Probst, M., Scheewe, T., De Herdt, A., Sweers, K., Knapen, J., et al.  
29  
30 (2013a). Relationships between physical fitness, physical activity, smoking and  
31  
32 metabolic and mental health parameters in people with schizophrenia. *Psychiatry*  
33  
34 *Research*, 207(1-2), 25-32.  
35  
36  
37

38 Vancampfort, D., De Hert, M., Vansteenkiste, M., De Herdt, A., Scheewe, T.W., Soundy, A.,  
39  
40 et al. (2013b). Self-determined motivation towards physical activity in schizophrenia:  
41  
42 a multicentre study. *Psychiatry Research*, 210(3), 812-818.  
43  
44  
45

46 Vancampfort, D., De Hert, M., De Herdt, A., Vanden Bosch, K., Soundy, A., Bernard, P., et  
47  
48 al. (2013c). Associations between physical activity and the built environment in  
49  
50 patients with schizophrenia: a pilot study. *General Hospital Psychiatry*, 35(6), 653-  
51  
52 658.  
53  
54

55 Vansteenkiste, M., Simons, J., Lens, W., & Soenens, B. (2004). De kwaliteit van motivatie  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65

telt: Over het promoten van intrinsieke doelen op een autonomieondersteunende wijze.

*Nederlands Tijdschrift voor de Psychologie*, 59, 119-131.

Vansteenkiste, M., Niemiec, C., & Soenens, B. (2010). The development of the five mini-theories of self-determination theory: An historical overview, emerging trends, and future directions. In T. Urdan & S. Karabenick (Eds.). *Advances in Motivation and Achievement*, vol. 16: *The decade ahead* (pp. 105-166). UK: Emerald Publishing.

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**Table 1**

Means and standard deviations and differences in the BREQ-2 subscales by stage of change

Motivational type	Pre-preparation		Preparation		Action		Maintenance		F-value	p-value
	M	SD	M	SD	M	SD	M	SD		
Amotivation	1.5 <sup>a,b,c</sup>	1.0	0.4 <sup>a</sup>	0.5	0.3 <sup>b</sup>	0.5	0.1 <sup>c</sup>	0.2	34.7	<0.001*
<b>Men</b>	<b>1.5<sup>a,b,c</sup></b>	<b>1.0</b>	<b>0.3<sup>a</sup></b>	<b>0.5</b>	<b>0.3<sup>b</sup></b>	<b>0.5</b>	<b>0.09<sup>c</sup></b>	<b>0.2</b>	<b>25.3</b>	<b>&lt;0.001*</b>
<b>Women</b>	<b>1.6<sup>a,b,c</sup></b>	<b>1.2</b>	<b>0.5<sup>a</sup></b>	<b>0.5</b>	<b>0.3<sup>b</sup></b>	<b>0.5</b>	<b>0.1<sup>c</sup></b>	<b>0.2</b>	<b>8.7</b>	<b>&lt;0.001*</b>
External regulation	1.3 <sup>c</sup>	1.2	1.0	1.0	0.8	0.8	0.5 <sup>c</sup>	1.0	3.7	0.013*
<b>Men</b>	<b>1.3<sup>c</sup></b>	<b>1.2</b>	<b>0.6</b>	<b>0.6</b>	<b>0.8</b>	<b>0.8</b>	<b>0.5<sup>c</sup></b>	<b>0.9</b>	<b>3.6</b>	<b>0.017*</b>
<b>Women</b>	<b>1.2</b>	<b>1.1</b>	<b>1.5</b>	<b>1.1</b>	<b>0.8</b>	<b>0.9</b>	<b>0.7</b>	<b>1.3</b>	<b>1.4</b>	<b>0.26</b>
Introjected regulation	1.0	0.8	1.1	1.0	1.0	0.9	1.0	0.9	0.05	0.98
<b>Men</b>	<b>0.9</b>	<b>0.8</b>	<b>1.0</b>	<b>0.9</b>	<b>1.2</b>	<b>0.8</b>	<b>0.9</b>	<b>0.9</b>	<b>0.68</b>	<b>0.58</b>
<b>Women</b>	<b>1.5</b>	<b>0.5</b>	<b>1.2</b>	<b>1.2</b>	<b>0.8</b>	<b>0.9</b>	<b>1.2</b>	<b>1.0</b>	<b>0.99</b>	<b>0.41</b>
Autonomous regulation	1.7 <sup>b,c</sup>	0.9	2.2 <sup>d,e</sup>	0.6	2.8 <sup>b,d,f</sup>	0.8	3.3 <sup>c,e,f</sup>	0.5	33.3	<0.001*
<b>Men</b>	<b>1.7<sup>b,c</sup></b>	<b>0.8</b>	<b>2.1<sup>d,e</sup></b>	<b>0.6</b>	<b>3.0<sup>b,d,f</sup></b>	<b>0.8</b>	<b>3.3<sup>c,e,f</sup></b>	<b>0.5</b>	<b>26.3</b>	<b>&lt;0.001*</b>
<b>Women</b>	<b>1.7<sup>b,c</sup></b>	<b>1.0</b>	<b>2.4<sup>d,e</sup></b>	<b>0.6</b>	<b>3.3<sup>b,d,f</sup></b>	<b>0.6</b>	<b>3.3<sup>c,e,f</sup></b>	<b>0.6</b>	<b>6.6</b>	<b>&lt;0.001*</b>

MANOVA (\*model significant at p<0.05) with post hoc Scheffe when indicated (significance set here at p<0.05),Df=degrees of freedom (between groups; within groups), M=mean, SD=standard deviation,a=pre-preparation versus preparation, b=pre-preparation versus action, c=pre-preparation versus maintenance, d=preparation versus action, e=preparation versus maintenance, f=action versus maintenance,.

**Table 2**

Discriminant function analysis using the BREQ-2 motivational types to differentiate stages of change

<b>Discriminating variable</b>	<b>Function</b>
<i>Motivational regulations</i>	
Amotivation	0.58
External motivation	0.24
Introjected regulation	-0.007
Autonomous regulation	-0.68
<i>Stages of change</i>	
Pre-preparation	1.96
Preparation	0.31
Action	-0.44
Maintenance	-1.17

## **Highlights**

- Frequently physically active persons with schizophrenia are more autonomously motivated.
- Professionals should empower patients to generate their own reasons for being active.
- Physical activity interventions should foster perceptions of choice, competence and enjoyment.