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## The importance of self-determined motivation towards physical activity in patients with schizophrenia

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### ABSTRACT

There is a need for theoretically-based research on the motivational processes linked to the commencement and continuation of physical activity in patients with schizophrenia. Within the Self-Determination Theory (SDT) framework, we investigated the SDT tenets in these patients by examining the factor structure of the Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2) and by investigating associations between motivation and PA. The secondary aim was to study differences in motivation according to gender, educational level, treatment setting and disease stage. A total of 129 patients (44♀) with schizophrenia agreed to participate. Exploratory factor analysis showed sufficient convergence with the original factor for amotivation, external and introjected regulation, while identified and intrinsic regulations loaded on a single factor which we labeled "autonomous regulation". Significant positive correlations were found between the total physical activity score and the subscales amotivation ( $r = -0.44$ ,  $P < 0.001$ ), external regulation ( $r = -0.27$ ,  $P < 0.001$ ), and autonomous regulation ( $r = 0.57$ ,  $P < 0.001$ ). Outpatients reported more external ( $P < 0.05$ ) and introjected ( $P < 0.05$ ) regulations than inpatients. Our results suggest that patients' level of self-determination may play an important role in the adoption and maintenance of health promoting behaviors in patients with schizophrenia.

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### 1. Introduction

Physical activity (PA) and exercise, when undertaken regularly, are beneficial for the health as well as psychological quality of life of patients with schizophrenia (Gorczyński and Faulkner, 2010; Scheewe et al., 2013; Vancampfort et al., 2009, 2012a, 2012b). Yet, only a minority of patients with schizophrenia actually engage in PA and exercise at a level compatible with proposed health recommendations (Sharpe et al., 2006; Vancampfort et al., 2012c). For instance, the average total energy expenditure of  $2511 \pm 606$  kcal per day of patients who are prescribed clozapine for at least 6 months (Sharpe et al., 2006) is more than 20% lower than the minimum recommendations of the World Health Organization (2000).

One reason for this minimal engagement in PA is that many patients with schizophrenia lack sufficient motivation (Vancampfort

et al., 2012c). In schizophrenia, lack of motivation can broadly be explained by two factors. First, due to the presence of negative and depressive symptoms, patients with schizophrenia can be disinterested in PA and exercise, or may not value the beneficial outcomes associated with PA enough to make it a priority within their lifestyle (Green et al., 2012; Vancampfort et al., 2013). Second, some patients with schizophrenia may not feel sufficiently competent to initiate PA, feeling either not physically fit or skilled enough to undertake PA (Vancampfort et al., 2011a), or suffering from somatic co-morbidities that present a real or perceived barrier to exercise (Vancampfort et al., 2011b). Whether due to a reduced interest or a low perceived level of competence, previous research (Gorczyński and Faulkner, 2010) indicates that many patients with schizophrenia are either insufficiently motivated, having no intention at all to be more physically active, or are poorly motivated, being primarily driven by external push factors (e.g., rewards, sanctions, and expectations). To address these motivational deficits, several authors (Medalia and Brekke, 2010; Beebe et al., 2012; Green et al., 2012) recently highlighted the need for theoretically based research on the motivational processes linked to the commencement and continuation of healthy behaviors in patients with schizophrenia.

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In the present contribution, we wanted to meet this call by relying on Self-Determination Theory (SDT) (Deci and Ryan, 1985, 2000), a broad-band motivational theory that has been under development for more than four decades (Vansteenkiste et al., 2010). SDT is uniquely placed among theories of human motivation to examine the differential effects of qualitatively different types of motivation that can underlie behavior (Deci and Ryan, 1985, 2000). Originating from a humanistic perspective, hence fundamentally centered on the fulfillment of needs, self-actualization, and the realization of human potential, SDT is a comprehensive and evolving macro-theory of human personality and motivated behavior (Deci and Ryan, 1985, 2000). SDT may provide insight into reasons why patients with schizophrenia adopt and maintain certain health behaviors. Specifically, SDT proposes motivation to be multidimensional and residing along a continuum of increasing self-determination. The regulation towards PA can be amotivated, extrinsically motivated or intrinsically motivated.

At the lowest end of the continuum is amotivation, in which case patients lack the motivation to act, either because they do not feel they achieve recommended targets or do not see the value of being active. Extrinsic motivation implies that a patient engages in the behavior to achieve outcomes that are separable from the behavior itself. Within extrinsic motivation there is a continuum of behavioral regulations, reflecting the degree of autonomy or self-integration. External regulation refers to exercising to avoid punishment and other-disappointment or to obtain promised rewards or other-appreciation. While external regulation is associated with external pressures to engage in PA, 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. Both external and introjected regulations represent controlled types of motivation as individuals will likely feel pressured to perform the behavior. For identified regulation on the contrary, the behavior is performed more willingly even though the activity is not enjoyable. A person will participate in PA, because the behavioral outcomes are personally important, for example to improve mental health or physical fitness. The most self-determined form of the extrinsic motivation continuum is integrated regulation, in which case the PA level is consistent with other prevailing values and has become prioritized within one's lifestyle. Although these types of extrinsic motivation attain a separable outcome than the activity itself, identified and integrated regulation involve personal endorsement of the reason to engage in the activity and, as a result, are more likely to be accompanied with feelings of choice and psychological freedom. Finally, intrinsic motivation represents the most self-determined type of motivation and involves engaging in PA for its own sake, that is, because patients find them challenging or enjoyable.

Extensive research in the general population has shown that there is good evidence for the SDT in understanding PA and exercise behavior, highlighting the importance of more self-determined forms of regulation in fostering PA and exercise (Teixeira et al., 2012). More recently, studies have begun to focus on the relevance of motivation for PA in clinical populations. For instance, in a group of obese children, Verloigne et al. (2011) reported that increasing levels of self-determination related to more PA. Considering the consistently lower levels of PA in individuals with schizophrenia, it is important to investigate whether in this population more self-determined types of motivation are positively associated with participation in healthy behaviors (i.e., an active lifestyle). Although previous studies demonstrated that psychiatric patients do not differ from the normal population in relation to motivational mechanisms (Sørensen, 2006; Roman et al., 2012), the predictive validity of SDT has to the best of our knowledge not been investigated in this

population. This is a critical issue, though, if future research aims to test interventions informed by the principles of SDT to encourage patients with schizophrenia to adopt a more active lifestyle.

Knowledge on demographic correlates of physical activity motives which will help to identify high-risk patients in need for special care. Lower educated patients might be considered as a vulnerable subgroup since the prevalence of overweight is higher in low educational level groups and since they are an at risk population for lower PA levels (Vancampfort et al., 2012d). The lower PA levels of low educated patients might be partly explained by lower degree of autonomous motivation. However, no studies have ever compared the degree of different types of motivation for PA in low versus high educated patients. Additionally, it might be interesting to investigate whether age and gender have a different effect on different types of motivation for PA.

The current study has three major aims. The first aim involved examining the applicability of the questionnaire commonly used to measure the different motivational subtypes for exercising (i.e., Behavioral Regulation in Exercise Questionnaire-2, BREQ-2) (Markland and Tobin, 2004) in patients with schizophrenia by investigating its factor structure.

Secondly, we will investigate if PA levels of patients with schizophrenia are related to the different motivation types. Based on SDT, we hypothesized that the association between different forms of motivation outlined in SDT and PA becomes decreasingly negative and increasingly positive as one moves along the self-determination continuum.

A tertiary aim is to examine differences in types of motivation across distinct groups: male versus female patients, low versus high educated patients, in inpatients versus outpatients and in first-episode versus multi-episode patients.

## 2. Method

### 2.1. Participants and procedure

A cross-sectional multi-center design was used. Thirteen of 15 invited centers agreed to participate. One center did not treat patients with schizophrenia while another refused to participate due to practical reasons. The 13 participating centers (see acknowledgments) were located across the five Dutch-speaking provinces of Belgium.

Over a 4-month period (November 2012–February 2013), in- and outpatients with a DSM-IV diagnosis of schizophrenia (American Psychiatric Association, 2000), psychiatrically stable on current psychotropic regimen for at least 4 weeks, were invited to participate. The diagnosis was established by experienced psychiatrists responsible for the patients' treatment. Only patients with a clinical global impression severity scale (Guy, 1976) score of 3 or less assessed by a trained psychiatrist during a semi-structured interview, and who were able to concentrate for 20–25 min were included. No incentive was provided for participation. The study procedure was approved by all the 13 ethical committees. All participants gave their written informed consent.

### 2.2. Behavioral regulation in exercise questionnaire

The Dutch version of the Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2) (Markland and Tobin, 2004) is used as an interviewer-administered questionnaire in order to ensure that patients with any literacy problems were not excluded. The BREQ-2 considers an individual's motivation towards exercise. We adapted the BREQ-2 by replacing the term "exercise" with the term "physical activity". This was undertaken for two reasons, firstly, PA recommendations refer to all physical activities and not to exercise in particular which is only one part of PA (Caspersen et al., 1985). Secondly, a similar change was made and successfully applied in previous research (Verloigne et al., 2011). The questionnaire comprises 19 items relating to five motivation types from the SDT. Each item is measured on a five-point Likert-scale, from 0 ("Not true for me") to 4 ("Very true for me"). The mean of the five subscales is calculated on a five-point scale to form an idea of the extent of each motivation type separately.

### 2.3. Physical activity level

The International Physical Activity Questionnaire (IPAQ)-short version (Craig et al., 2003) was used. The IPAQ considers a 7-day recall period, identifying PA undertaken in the morning, afternoon and evening. For the purposes of this research the questionnaire was interviewer administered. Data from the IPAQ is summarized according to minutes of walking, moderate PA (e.g., activities that make one breathe somewhat harder than normal such as carrying light loads, bicycling at a regular pace, or easy swimming), and vigorous PA (e.g., activities that make you breathe much harder than normal such as heavy lifting, digging, aerobics, or fast bicycling) per week. Previous research (Faulkner et al., 2006) has identified that the IPAQ is a reliable and valid surveillance tool to assess levels of PA in patients with schizophrenia.

### 2.4. Demographic variables

Demographic variables assessed included gender, age, education, disease stage and body mass index (BMI). Dichotomous variables were constructed for education (lower: vocational or technical training; higher: general education or college), treatment setting (in- versus out-patients) and disease stage (first-episode versus multi-episode episode).

### 2.5. Statistical analyses

An exploratory factor analysis of principal components with varimax rotation was executed to investigate the BREQ-2 factor structure (Aim 1). To determine the number of factors to retain, we used the eigenvalue > 1 rule (Kaiser, 1960). An item with a factor loading higher than 0.40 on a factor was considered to load sufficiently high on the relevant factor. Cronbach's  $\alpha$ 's were calculated to determine internal consistency of the items of the retained factors. Subsequently, Pearson's correlations among the retained motivation-types were inspected. Next, as part of Aim 2, the association between motivation and PA was examined through (a) a categorical analysis, which involved dividing participants in three categories (i.e., inactive, active, and highly active patients) (Craig et al., 2003) and (b) a dimensional analyses, which involved inspecting the correlations between motivation and the separate indicators of PA (total minutes of PA, total minutes of walking, total minutes of moderate intensity PA, and total minutes of vigorous intensity PA). To test differences in self-determined motivation between different PA groups a one-way ANOVA was performed. Post hoc contrasts were conducted by the Scheffe

method for complex contrasts. The dimensional analyses yielded the advantage of shedding more light into the exact associations between motivational subtypes and certain types of PA. Finally, unpaired *t*-tests were executed to investigate the differences in motivation towards PA (a) among the high and low educational level groups, (b) among in- versus out-patients, and (c) among first-episode versus multi-episode patients (Aim 3). Significance level was set at  $P < 0.05$ . SPSS 20.0 was used for data analysis (SPSS Inc, Chicago, IL).

## 3. Results

### 3.1. Participants

A total of 168 Belgian patients with a DSM-IV diagnosis of schizophrenia (American Psychiatric Association, 2000) were initially recruited. Thirty-two patients declined participation and additionally missing data was identified in seven cases. A total of 129 patients (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 patients (55.7%) were outpatients, 16 patients were in their first-episode (13.1%). Patients were classified into a lower ( $n=86$ ) and a higher ( $n=43$ ) educational level groups. No significant differences in demographical variables were found between participants and decliners. Patients with schizophrenia were  $302.8 \pm 218.2$  min per week physically active. Specifically, they walked  $186.0 \pm 144.3$  min per week, did  $83.9 \pm 119.1$  min per week of moderate and  $32.9 \pm 65.7$  min per week of vigorous PA.

### 3.2. Aim 1: validation of the BREQ-2

Table 1 presents the results of the exploratory factor analysis. Based on the eigenvalues, four factors were retained with an eigenvalue above 1 and with 65% of the total variance explained; whereas amotivation, external and introjected regulation items fell

**Table 1**

Exploratory factor analysis on the Behavioral Regulation in Exercise Questionnaire-2 in patients with schizophrenia ( $n=129$ )

Factor	1	2	3	4	$h^2$
<b>(1.) Intrinsic regulation</b>					
4. I do physical activities because it's fun	0.77				0.61
10. I enjoy my physical activity sessions	0.85				0.76
15. I find physical activity a pleasurable activity	0.87				0.79
18. I get pleasure and satisfaction from participating in physical activity	0.86				0.82
<b>(2.) Amotivation</b>					
5. I don't see why I should have to do physical activities		0.72			0.59
9. I can't see why I should bother doing physical activities		0.82			0.69
12. I don't see the point in doing physical activities		0.76			0.66
19. I think doing physical activities is a waste of time		0.61			0.42
<b>(3.) External regulation</b>					
1. I do physical activities because other people say I should			0.77		0.61
6. I do physical activities because my friends/family/partner say I should			0.78		0.60
11. I do physical activities because others will not be pleased with me if I don't			0.81		0.68
16. I feel under pressure from my friends/family to do physical activities			0.67		0.49
<b>(4.) Identified regulation</b>					
3. I value the benefits of physical activity	0.54	-0.44			0.58
8. It's important to me to do physical activities regularly	0.68				0.62
14. I think it is important to make the effort to do physical activities regularly	0.74				0.65
17. I get restless if I don't do physical activities regularly	0.43			0.58	0.57
<b>(5.) Introjected regulation</b>					
2. I feel guilty when I don't do physical activities				0.71	0.66
7. I feel ashamed when I miss my physical activities				0.81	0.74
13. I feel like a failure when I haven't done physical activities in a while				0.75	0.59
Eigenvalue	4.58	2.76	2.65	2.35	-
Factor variance	24.01	14.54	13.93	12.39	-
Total variance	24.01	38.65	52.56	64.95	-
Chronbach's alpha for the obtained structure	0.90	0.77	0.75	0.73	-
Chronbach's alpha for the original structure	0.78-0.90	0.77	0.75	0.75	-

$h^2$  (communality)=the sum of the squared factor loadings; it represents the amount of variance in that variable accounted for by all the factors.

on three different factors, items tapping into “identified regulation” and “intrinsic regulation” loaded on a single factor. Two items (3 and 17) showed cross-loadings of more than 0.40 with other factors. All Cronbach's  $\alpha$  values ranged between 0.73 and 0.90 for the retained factors in the factor solution. Cronbach's  $\alpha$  was also calculated for the original subscales, as suggested by the BREQ-2 and ranged from 0.75 to 0.90. For further analyses, we summed, consistent with SDT and previous studies (e.g., Vansteenkiste et al., 2009), the items tapping into “identified” and “intrinsic regulation” together into an “autonomous regulation” factor, with scores ranging from 0 to 4 (i.e., the mean of the identified regulation factor and the intrinsic regulation factor).

The means and standard deviations of each BREQ-2 item is added as online [Supplementary material](#).

An overview of the bivariate Pearson's correlations between the four retained motivation types is presented as online [Supplementary material](#). The correlations conformed to a simplex-like pattern with stronger positive correlations between subscales more adjacent on the self-determination continuum (e.g., amotivation and external regulation:  $r=0.35$ ;  $P < 0.001$ ) and less positive and even negative correlations between subscales more distant on the continuum (e.g., amotivation and autonomous regulation:  $r = -0.50$ ,  $P < 0.001$ ).

Aim 2: Associations between the different SDT motivation types and physical activity

As can be noticed in [Table 2](#), multivariate analyses indicated a significant difference in amotivation and autonomous regulation between the three PA categories (i.e., inactive, active, and highly active), irrespective of any age or BMI differences.

Next, to gain more exact insight in the types of PA that are related to motivational subtypes, we performed a set of Pearson's correlations (see [Table 3](#)). The factors “amotivation” and “autonomous regulation” correlated, respectively, negatively and positively with both the total and the separate IPAQ variables; whereas introjected regulation related to none of the IPAQ scores. Finally, the external regulation was unrelated to walking and vigorous PA, but yielded a significant negative association with moderate PA.

3.4. Aim 3: Investigating differences in motivation according to gender, educational level, treatment setting, and disease stage

No significant differences were found in motivation between male and female patients with schizophrenia and between lower and higher educated patients (data are presented as online [Supplementary material](#)). As can be noticed in [Table 4](#), outpatients were significantly more external and introjected regulated than inpatients. No differences were found for amotivation and autonomous regulation.

Lastly, no significant differences were found in motivation between patients with schizophrenia in their first episode and multi-episode patients (are presented as online [Supplementary material](#)).

## 4. Discussion

### 4.1. General findings

The first aim of this study was to investigate the SDT tenets in patients with schizophrenia. A principal component analysis on the BREQ-2 demonstrated that identified and intrinsic regulations load on the same factor which we called “autonomous regulation”, a finding that has emerged in other life domains as well ([De Naeghel et al., 2012](#)). Such findings are not inconsistent with SDT, as both identified and intrinsic regulations represent a more volitional or autonomous type of motivation compared with more controlled types of motivation such as external and introjected regulations. Autonomous regulation therefore comprises both intrinsic motivation and identified regulation in which people have identified with an activity's value and ideally will have

**Table 4**  
Differences in motivation between inpatients and outpatients.

	Inpatients (n=60)	Outpatients (n=69)	P-value
Amotivation	0.5 ± 0.9	0.5 ± 0.73	0.84
External regulation	0.6 ± 0.9	1.0 ± 0.9	0.049*
Introjected regulation	0.7 ± 0.7	1.1 ± 0.9	0.03*
Autonomous regulation	2.6 ± 0.8	2.6 ± 0.9	0.99

\* Unpaired *t*-test with significance level set at  $P < 0.05$ , significant.

**Table 2**  
Differences in motivation across physical activity levels (according to the International Physical Activity Questionnaire procedure; [Craig et al., 2003](#)).

	Inactive (n=45)	Active (n=74)	Highly active (n=10)	Influence of BMI		Influence of age		F-value	P-value
				F	P	F	P		
Amotivation	0.9 ± 0.9 <sup>a,b</sup>	0.3 ± 0.7 <sup>a</sup>	0.07 ± 0.2 <sup>b</sup>	0.8	0.37	0.6	0.43	10.9	< 0.001*
External regulation	1.0 ± 1.0	0.8 ± 1.0	0.3 ± 0.7	4.7	0.03*	0.4	0.54	2.1	0.12
Introjected regulation	1.0 ± 0.9	1.0 ± 0.9	0.4 ± 0.6	0.02	0.88	0.1	0.73	2.2	0.11
Autonomous regulation	2.0 ± 0.75 <sup>a,b</sup>	2.9 ± 0.9 <sup>a</sup>	3.1 ± 0.8 <sup>b</sup>	0.2	0.64	3.7	0.06	17.7	< 0.001*

\* Significance set at  $P < 0.05$ , ANOVA with post-hoc Scheffe (significance level for the sub-analyses:  $P < 0.05$ ).

<sup>a</sup> Inactive versus active.

<sup>b</sup> Inactive versus highly active, BMI=body mass index.

**Table 3**  
Pearson correlations between physical activity and motivation (n=129).

	IPAQ walking	IPAQ moderate PA	IPAQ vigorous PA	IPAQ total
Amotivation	-0.34**	-0.29*	-0.20*	-0.44**
External regulation	-0.16	-0.22*	-0.14	-0.28**
Introjected regulation	0.05	-0.14	-0.07	-0.07
Autonomous regulation	0.47**	0.29**	0.35**	0.57**

IPAQ=International Physical Activity Questionnaire, PA=physical activity.

\*  $P < 0.01$ .

\*\*  $P < 0.001$ .

integrated it into their sense of self. When patients with schizophrenia are autonomously motivated, they experience volition, or a self-endorsement of their actions which on its turn is associated with more physical activity participation. Controlled motivation, in contrast, consists of both external regulation, in which one's behavior is a function of external contingencies of reward or punishment, and introjected regulation, in which the regulation of action has been partially internalized and is energized by factors such as an approval motive, avoidance of shame, and contingent self-esteem. When patients with schizophrenia are controlled, they experience pressure to think, feel, or behave in particular ways which on its turn is associated with less physical activity participation.

It should be noted that two items (item 3 "I value the benefits of physical activity" and item 17 "I get restless if I don't do physical activities regularly") crossed the distinction between controlled and autonomous motivation and were found to yield cross-loadings. These kind of cross-loadings have been observed in general population studies as well (Verloigne et al., 2011). An underlying reason might be that the difference between controlled and autonomous types of motivation does not represent a sharp line, but rather represents a gradual change away from inner pressures to personal convictions. Cross-validation scores could also be due to the fact that 129 patients with schizophrenia is a relatively small sample to investigate the factor structure of a questionnaire with 19 items as it is suggested to have ten participants per questionnaire item or to have at least 190 participants (Gorsuch, 1983). A possible strategy to deal with such cross-validation scores is to exclude those specific items from the subscale calculation. However, since BREQ-2 is strongly validated in other populations (Ingledeu and Markland, 2008; Verloigne et al., 2011) and since BREQ-2 has been used for the first time in a population of patients with schizophrenia, it was preferred to use the current classification with the exception of combining all the identified and intrinsic regulations to one factor.

The second part of the present study shows a clear association between more self-determined types of motivation and the amount of walking as well as moderate and vigorous intensity PA in patients with schizophrenia. Interestingly, the association with autonomous regulation was the strongest for the amount of walking, which is perhaps the stepping stone towards more intense physical activities. Notably, it might be that intrinsic motivation alone is not enough to sustain long-term regular engagement in PA (Mullan and Markland, 1997; Edmunds et al., 2006). Maintaining a physically active lifestyle especially requires a high degree of effort among patients with schizophrenia who are confronted with significant mental and physical health barriers (Vancampfort et al., 2012d). Therefore, understanding and fully endorsing the personal value of PA may be equally important for these patients as being physically active for enjoyment. Since healthcare providers typically focus on PA and exercise in terms of health-related outcomes rather than in terms of the intrinsic satisfactions, the primary source of self-determined motivation among patients may be derived from personally valuing of these outcomes (Daley and Duda, 2006). In other words, it might have been the case that the more physically active participants with schizophrenia were more able to identify themselves with questions in the BREQ-2 related to the benefits of PA ("I value the benefits of physical activity") because this is how PA is promoted to them. These patients might well find PA to be intrinsically enjoyable, but an equally important source of self-determined motivation comes from the outcomes that may be obtained from participation in PA.

A tertiary aim of this study was to examine differences in the different motivation types in male versus female participants, low versus high educated patients, in first-episode versus multi-episode

patients and in inpatients versus outpatients. Significant differences were observed between in- and outpatients, where outpatients experienced significantly more external and introjected regulations. A possible explanation for the difference in motivation could be situated in the environment of outpatients. It might be that outpatients experience more pressure from their family and friends to be physically active while feeling guilty or ashamed when they do not comply with these demands. More research is needed to explore in detail these differences in identified and intrinsic regulation between in- and outpatients.

#### 4.2. Practical implications

Since our study demonstrates that patients with schizophrenia with higher levels of self-determined motivation show higher amounts of PA, clinical practice guidelines that seek to increase self-determined types of motivation might be of added value in multidisciplinary lifestyle programmes with the intention to increase PA participation. According to the SDT, self-determined types of motivation stem from environments that support three psychological needs, that is the need for autonomy (i.e., experiencing a sense of psychological freedom when engaging in an activity), competence (i.e., feeling effective to attain desired outcomes) and relatedness (i.e., being socially connected) (Deci and Ryan, 1985; 2000). Practitioners can support patients' autonomy by offering clear choices, supporting the patients' initiatives, avoiding the use of external rewards, offering relevant information for changing PA behavior and using autonomy supportive language (e.g. "could" and "choose" rather than "should" and "have to") (Ryan et al., 2011). Feelings of competence are also attained when patients with schizophrenia experience success while participating in PA. Activities need to be tailored to the capabilities of the patient and sufficient instructions, practice and positive feedback are needed (Vancampfort et al., 2012d). Also relatedness with the health care provider and other peers is important. Health care providers need to show enthusiasm and interest in their patients. Offering group sessions of PA could increase the feeling of relatedness and decrease the feeling of being isolated (Ryan et al., 2011).

Since patients with schizophrenia were in particular autonomously motivated towards walking, offering walking groups, taking into account the capabilities of the participants, could be a valuable first step program. Previous research in chronic patients with schizophrenia has established that a 16-week walking program might improve physical and mental health (Beebe et al., 2005; 2012).

#### 4.3. Limitations

Notwithstanding the reliability and validity of the IPAQ in patients with schizophrenia (Faulkner et al., 2006), the use of self-report measures should be considered as a limitation (Warren et al., 2010), also in patients with schizophrenia (Soundy et al., 2007). Patients might experience difficulties in ascertaining the frequency, duration and intensity of PA. Second, the study contained no data on medication use and symptom severity and could therefore not determine any relationship between self-determined motivation, physical activity participation and medication use and psychiatric functioning. Third, due to the limited number of first-episode patients we were also not able to make firm conclusion related to the hypothesis whether or not motivation type is a trait-like phenomenon independent of illness course. Forth, we were also not able to examine whether the fact that we did not provide any incentive for participation in the study did affect our results. Lastly, it should be noted that we used a cross-sectional design which limits the strength of any conclusions that can be made.

#### 4.4. Future research

Drawing from our data, we believe that an important future goal is to design physical activity interventions that are aimed at promoting feelings of self-determination for PA in patients with schizophrenia. Grounded within SDT, such interventions should strive to foster perceptions of personal mastery, choice, and relevance, particularly among those in- and outpatients who are not active on a regular basis. In particular research with a longitudinal design and taking into account the recommendations of Bellg et al. (2004) would provide a means of examining the relationship between autonomy support, changes in PA behavior and physical and mental health parameters over time. Future research should also examine which impact a treatment program has on the different types of motivation towards PA. Third, future research should investigate whether the more autonomously motivated patients with schizophrenia undertake a higher level of PA in the long-term. Fourth, future studies should identify significant moderating factors for the role of specific regulations on PA adherence of patients with schizophrenia, such as age, previous health conditions, phase of illness or social norms.

In conclusion, the present study shows that the BREQ-2 can be used in patients with schizophrenia. This study also draws attention to the importance of autonomy when considering PA behavior in patients with schizophrenia. Lastly, the current study provides a sound platform for future research designs testing the relationships between autonomy support, motivational regulations and physical and mental health variables within lifestyle interventions for patients with schizophrenia.

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#### Appendix A. Supporting material

Supplementary material associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.psychres.2013.10.004>.

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