Eur Arch Psychiatry Clin Neurosci (2017) 267:639–650
DOI 10.1007/s00406-017-0772-3

ORIGINAL PAPER

Physical activity in outpatients with mental disorders: status, measurement and social cognitive determinants of health behavior change

Moritz B. Petzold[1] · Sophie Bischoff[1] · Janina Rogoll[1] · Jens Plag[1] · Christina Terán[2] · Ralf Brand[3] · Andreas Ströhle[1]

Received: 4 August 2016 / Accepted: 23 January 2017 / Published online: 13 February 2017

Abstract
Introduction Physical activity (PA) can play an important role in improving the mental and physical health in patients with mental disorders but is not well studied in this population. The aim of this study was to assess the status of PA in outpatients with mental disorders, compare the convergence of self-rating and accelerometer measurement and examine the influence of social cognitive variables from the Motivation-Volition (MoVo) model and clinical measures on PA.
Methods Eighty-four patients were recruited from three psychiatric outpatient clinics and local psychiatrists (Distribution of ICD-10-Diagnoses: F3.x = 59.5%, F4.x = 20.2%, F2.x = 17.9%, F1.x = 2.4%). PA, Self-efficacy, Outcome-expectancies, Intention, Self-concordance, Action- and Coping-planning, Health-related Quality of Life (SF-12) and Psychiatric Symptoms (SCL-27) were assessed through questionnaires. *PA* was assessed objectively by accelerometers.
Results Most of the participants did not reach PA recommendations. Subjective and objective measurement of PA showed good accordance for total PA on group level but lower accordance on individual level. Motivational and volitional determinants of health behavior change showed a similar pattern of correlations with PA as in populations without mental disorders.
Conclusion Outpatients with mental disorders have the ability and are willing to perform PA but a large proportion of our sample did not meet PA recommendations. To assess group levels of PA, subjective and objective measurement seem equally apt, for individual diagnostics, a combination of both should be considered. Social cognitive determinants of health behavior change seem to be as helpful for the design of PA interventions for patients with mental disorders as they are in other populations.

Keywords Physical activity · Mental disorders · Prevalence · Assessment · Health behavior change · MoVo

Introduction

Physical inactivity (PA) is one of the four leading risk factors for global mortality [1], causing 9% of premature mortality worldwide [2]. There is strong evidence that regular PA is effective in the primary and secondary prevention of several physical (e.g., cardiovascular disease, diabetes, cancer, hypertension, obesity and osteoporosis) but also mental diseases (e.g., depression) [3]. People with mental disorders show higher rates of mortality and a lower life expectancy than the general population [4–6]. Therefore, regular PA can play an important role in reducing mortality and increasing life expectancy in patients with mental disorders. But not only can PA help to improve the physical health of people with mental disorders, it also has an effect on mental health and mental disorders itself. Regular physical activity is correlated with improved mental health, feeling of social integration, sense of coherence and reduced stress, anxiety, depression, anger, cynical distrust

✉ Andreas Ströhle
andreas.stroehle@charite.de

[1] Department of Psychiatry and Psychotherapy, Campus Charité Mitte, Charité Universitätsmedizin Berlin, Charitéplatz 1, 10117 Berlin, Germany

[2] Department of Psychiatry, St. Hedwig Klinikum, Große Hamburger Straße 5-11, 10115 Berlin, Germany

[3] Sport and Exercise Psychology, Universität Potsdam, Am Neuen Palais 10, 14469 Potsdam, Germany

and neuroticism in general populations [7–12]. Regular PA is also correlated with a lower prevalence of mood and anxiety disorders in the general population [12–14] and can reduce the incidence of mental disorders [15]. Therefore, higher rates of PA could help to reduce prevalence of mental disorders in the general population [16]. PA can also play an important part in therapy of mental disorders, helping to improve general but also disorder-specific outcomes in several mental disorders (see Zschucke et al. [12] for a detailed overview).

In adults, the American College of Sports Medicine (ACSM) and the World Health Organization (WHO), whose recommendations for PA are based on a broad consensus of international experts and are most commonly used in research (e.g., [2, 17]), both recommend a minimum of 150 min of moderate-intensity PA per week or 60–75 min of vigorous-intensity PA per week, or a combination of both, to improve and maintain physical fitness and health [18, 19].The activity should be performed in bouts of at least 10 min [18]. ACSM recommends that these amounts should be achieved by at least 5 days of at least 30 min of moderate-intensity PA per week or at least 3 days of at least 20 min of vigorous-intensity PA per week or a combination of both achieving a minimum energy exposure of 500–1000 MET minutes (metabolic equivalent of task minutes, a measure that expresses the energy expenditure of physical activities) per week [18]. Both ACSM and WHO recommend additional muscle-strengthening activities on at least 2 days a week, ACSM recommend additional flexibility exercises on at least 2 days a week [18, 19]. Large proportions of the general population in Germany do not meet these recommendations. A large-scale representative study shows that only 39.2% of the German adult population meet the recommendation of the WHO of at least 150 min of moderate to vigorous physical activity (MVPA) per week and only 20.2% meet the recommendation of the ACSM of at least 30 min of MVPA on at least 5 days a week [17].

Prevalence of PA in people with mental disorders is not well studied. Existing studies show that PA levels in people with mental disorders are low (e.g., [20–22]) and studies that compared their activity level to the general population or populations without mental disorders show, that PA levels are lower in people with mental disorders (e.g., [23–29]). But there is also evidence challenging this (e.g., [30, 31]). General conclusions are difficult to draw because of heterogeneous sample sizes, inclusion criteria regarding diagnosis, severity and assessment of PA (various self-report scales vs. accelerometers). Therefore, better knowledge about the levels of PA in patients with mental disorder is needed to assess whether interventions to increase PA could be of benefit for them. In contrast to the general population, little is known about the accordance of subjective and objective measurements (e.g., use of accelerometers) of PA in patients with mental disorders. There are specific illness-related factors (e.g., negativity bias, lower cognitive functioning) that could affect the validity of self-report measurement of PA. For the interpretation of the results of different studies that used different methodology in the assessment of PA (self-report vs. accelerometers) in people with mental disorders and for the design of future studies that assess the prevalence of PA in this population, better knowledge about the convergence of subjective and objective measurement in this population is needed.

There are hundreds of studies published in health and exercise psychology providing evidence that motivational and volitional predictors explain and can be used for interventions to increase PA in the general population (see Schwarzer [32] for an overview of different models and variables). Several social cognitive models of health behavior change, among them the MoVo (Motivation-Volition model [33]; an exercise specific advancement of the wider known Health Action Process Approach/HAPA [34]) elaborate on various psychological variables. Integrating one important element of self-concordance theory, MoVo includes the following five psychological factors: (1) goal-intention (the intention to engage in PA), which is influenced by self-efficacy (the extent to which a person believes in his or her own ability to engage in PA) and outcome-expectancies (positive and negative expectations connected with PA engagement), (2) self-concordance of the goal intention (the extent to which the intention is in line with one's personal interests and values), (3) action-planning (the formation of detailed plans how, when, where and with whom a specific activity is to be performed), (4) barrier-management (strategies how to overcome practical and psychological barriers that arise during the volitional process) and (5) outcome-experiences (positive or negative experiences resulting from PA [33]). As other models of health behavior change, MoVo states two different processes that finally lead to the performance of physical exercise: the motivational process (in which intentions of a specific strength and quality are formed; i.e., self-efficacy, outcome-expectancies, goal-intention and self-determination) and the volitional process (in which the previous formed intentions are translated into action; i.e., action-planning and barrier-management [33]).

There is strong evidence that self-efficacy, outcome-expectancies, goal-intention, planning and barrier-planning are important predictors of future PA and that these can be addressed in intervention programs for increasing PA in the general population (e.g., in preventative contexts; e.g., [35–38]). Till now, there are only few studies that investigate the role of social cognitive determinants for PA in people with mental disorders. Therefore, it is unclear whether the factors proposed by these social cognitive models for

the general population are useful for the understanding of the motivational and volitional process that leads to the performance of PA in patients with mental disorders as well. There are specific problems and barriers to PA in persons with mental disorders like mental disorder symptoms (e.g., avolition), medication and resulting weight gain, fear of discrimination, safety concerns, reduced self-efficacy as a result of feeling sad or stressed or low levels of social support [39, 40]. Therefore, it seems possible that, in people with mental disorders, specific disorder-related factors are necessary for the understanding of the motivational and volitions processes that lead to the performance of PA. Nevertheless, in a small study with 25 outpatients with schizophrenia Arbour-Nicitopoulos et al. [41] showed that HAPA and its variables could be of use for the understanding and design of PA interventions in patients with mental disorders as well as they found a pattern of correlations between the variables similar to the pattern found in healthy populations. However, this study solely used self-report to asses PA, so no conclusion of the correlations of social cognitive variables and objective-measured PA can be drawn.

The aims of this study were to (1) describe the level of PA in a sample of outpatients with mental disorders and the extent to which they meet PA recommendations, (2) to examine the accordance of subjective and objective measurement of PA in this population, (3) to examine if social cognitive determinants of health behavior change show similar patterns of correlations for patients with psychiatric diagnoses as they do in the general population, whereby for the first time all of the variables of a social cognitive model of behavior change are examined, and (4) to examine the association between PA and mental health scores in this population.

Our hypotheses in these areas were: (1) large proportions of the sample do not meet the PA recommendations, (2) subjective- and objective measurement of PA shows similar accordance in this population as in the general population, (3) social cognitive determinants of health behavior change show a similar pattern of correlations for patients with psychiatric diagnoses as they do in the general population and (4) there is a negative correlation between mental health and PA in this population.

Method

Design and recruitment

This cross-sectional study took place at the psychiatric outpatient clinics of three hospitals: Department of Psychiatry and Psychotherapy, Charité Universitätsmedizin Berlin, Department of Psychiatry, St. Hedwig Hospital Berlin and Department of Psychiatry, Oberhavel Hospital Henningsdorf, Brandenburg. It was approved by the local ethics committee (EA1/371/13) and registered (ClinicalTrials.gov Identifier: NCT02569619). Recruitment took place from April 2014 to October 2015. Patients were recruited by posters and flyers for a healthy living intervention in the waiting rooms or by information of their doctors at the three psychiatric outpatient clinics and at practices of local psychiatrists in Berlin. Interested patients could contact the researcher and were, if found eligible, invited to an information event at the study center. Eligible participants were men and woman over the age of 18 years with a diagnosis of mental disorders (ICD-10: F1-F4) in outpatient treatment at one of the clinics or at a local psychiatrist in Berlin who wanted to improve their health behavior, did not have contraindications for physical activity, did not have a legal custodian and were able to understand German. After the study was described in detail at the information event, participants gave formal written informed consent and were finally included. Patients released their psychiatrists from confidentiality, information about diagnosis, course of treatment, medication and global assessment of functioning was obtained from them by mail (information request was sent out one day after the information event, the medical record was therefore only connected to the participant codes to protect the identity of the participants). After enrollment, patients filled out the questionnaire, were handed out the accelerometer and instructed how to use it.

Based on previous studies that investigated correlations between self-reported and accelerometer-measured PA (e.g., [20, 31, 42]) and correlations between social cognitive determinants of health behavior change and PA (e.g., [35, 37]), we expected correlations of at least 0.3. With an alpha-level of 0.05 and power of 0.8 (one tailed), power analysis using G*Power [42] indicated that a total sample size of 67 would be sufficient.

Measures

All questionnaires were administered in German, item examples below are translations.

Physical activity

PA was assessed by self-report with the International Physical Activity Questionnaire (IPAQ; [43]) using the short last 7 days self-administered format. This questionnaire asks for the time spent with (a) vigorous activity (b) moderate activity (c) walking and (d) sitting during the last seven days. The IPAQ has been widely used in international research and showed adequate test–retest reliability (Spearman's correlation coefficients around $\rho = 0.76$) and an acceptable criterion validity with accelerometry ($\rho = 0.30$) in previous

studies [43]. MET minutes per week were calculated as recommended by Craig et al. [43] (Walking: 3,3 MET, moderate activity: 4 MET, vigorous activity 8 MET).

PA was objectively measured using ActiGraph GT1M accelerometers (ActiGraph, Pensacola, FL, USA). The GT1M is a small, portable device that is designed to monitor human activity [44]. It measures the amount of changes in acceleration during a sampling period (epoch) of 60 s summarized as activity counts that quantify the amount of activity during that period. Based on the measured changes in acceleration, estimates of time spent in different activity levels and energy expenditure can be calculated. It has already been successfully used in clinical studies with people diagnosed with mental disorders [45] and shows a good reliability under laboratory [46] and free living conditions [47]. Participants were instructed to wear the device around their hip during wake time for seven consecutive days of measurement. Activity counts were categorized into activity levels using the ActiLife Software [44] into four activity levels: light (less than or equal 1952 counts per minute, equivalent less than 2.99 METs), moderate (1953–5724 counts per minute, equivalent 3.0–5.99 METs), hard (5725–9498 counts per minute, equivalent 6.0–8.99 METs) and very hard (more than 9498 counts per minute, equivalent more than 9.0 METs). Step count was activated. Energy expenditure was estimated using Freedson equation. For calculation of MET minutes per week, moderate activity was counted as 4.5 MET, hard activity as 7.5 MET based on the ActiGraph manual. To identify the wearing period, the total number of hours per day with at least one count were counted as daily wearing hours. Minimal wear requirement for a valid day was 10 h. If the accelerometer was worn less than 10 h per day, data was set to missing. For the computation of level of PA, PA recommendations and correlation of subjective and objective PA levels only datasets with 7 valid days were used. For all other calculations only datasets with at least three valid days were used. Data of participants with less than three valid days was set to missing (see Masse et al. [48] for a discussion of this and other criteria in accelerometer data reduction).

Motivational and volitional determinants of health behavior change

All items measuring self-efficacy, outcome-expectancies, intention, action-planning and coping-planning were answered on 4-point Likert-type scales from 1 (not at all true) to 4 (exactly true).

Self-efficacy was measured using the two items "I am sure that I can be physically active even it is difficult for me" and "I am sure that I can live a physically active lifestyle, even it is difficult for me" as done before by Parschau et al. [49] who reported inter-item correlations between $r = .81$ and 0.84.

Outcome-expectancies were measured with six items from Lippke, Ziegelmann & Schwarzer [50] who reported scale reliabilities between $\alpha = 0.67$ and 0.73. The item stem "If I engage in physical exercise..." was followed by three statements on positive outcome expectancies (e.g., "… then I feel better afterwards") and three on negative outcome expectancies (e.g., "… then I have to perform a lot of organizational tasks").

Intention was measured using the two items "I intend to exercise regularly" and "I intend to exercise several times a week" out of a scale of six items by Sniehotta et al. [37] as done before by Schüz et al. [51], who reported an inter-item-correlation of $r = .90$.

Action-planning was measured using four items from Sniehotta et al. [37], who reported internal consistencies between $\alpha = 0.92$ and 0.95. The item stem "I have made a detailed plan regarding..." was followed by the four statements "…when to exercise", "…where to exercise", "… how to exercise" and "…how often to exercise".

Coping-planning was measured using four items from Renner et al. [52], who reported an internal consistency of $\alpha = 0.94$. The stem "I have made a detailed plan regarding…" was followed by the four statements "…what to do if something intervenes", "…what to do if I have to intermit", "…what I can do in difficult situations to stick to my intention" and "…when to especially watch out to stay committed".

Self-concordance was measured with the self-concordance of sport- and exercise related goals scale (SSK-Scale) by Seelig and Fuchs [53]. This scale consists of 12 items measuring intrinsic, extrinsic, introjected and identified motivation as well as an index value (SSK-Index) for the self-concordance. The internal consistencies of the subscales were between $\alpha = 0.70$ and 0.82 in previous studies [53].

Clinical measures

Psychiatric Symptoms were measured using the Symptom-Checklist-27 (SCL-27; [54]), which is a modification of the widely used Symptom-Checklist-90 Revised (SCL-90-R). It is designed to screen for psychiatric complaints and contains, in addition to the global severity index (GSI-27), subscales for depressive, dysthymic, vegetative, agoraphobic, sociophobic symptoms and symptoms of mistrust. In previous studies, the GSI-27 showed an internal consistency of $\alpha = 0.93$ and all subscales had internal consistencies of α greater than 0.70 [55].

Health-related quality of life was measured using the 12-Item Short-Form Health Survey (SF-12; [56]), which is a modification of the widely used 36-Item Short-Form

Health Survey (SF-36). It was designed to measure a persons perceived health status as an outcome in clinical studies. It measures two separate summary scores for physical (Physical Component Summary, PCS) and mental health (Mental Component Summary, MCS). It shows high correlations with the scores of the SF-36 (R squares of 0.9 for the physical component and 0.93 for the mental component) and shows a two-week retest-reliability of $r = .89$ for the physical and $r = .76$ for the mental component [56].

Participants

167 patients contacted us and were invited to the information event. Figure 1 shows participants flow in the study.

The sample consisted of 60 women and 24 men. See Table 1 for an overview of characteristics of participants.

Data analysis

Average percentage of missing data on item basis was 0.8% for the questionnaire items (maximum 6%) and 6.7% for the accelerometer data (maximum 7.1%). Missing data from the questionnaires was replaced by multiple imputation, which is one of the state-of-the-art procedures of handling missing data [57]. Multiple imputation on item basis was carried out using SPSS 22.0 using a three-step approach as described in Enders [57]. All analyses were conducted using SPSS 22.0 with the imputed datasets ($n = 84$ if not stated elsewhere) and reported values are pooled results from a set of five imputations. For correlations, Pearson's product moment correlation (r) was used. To test the accordance between the achievement of PA recommendations from self-rated and accelerometer-measured data Fisher's exact test with effect size Phi was used. For exploratory analyses we used a t test to assess differences in PA between patients that did or did not take medication. ANOVA with post hoc tests using Bonferroni correction served to assess the influence of diagnosis on PA. Significance level was set to 0.05, using one-tailed tests when theoretical funded hypotheses were available and two-tailed tests for exploratory analyses.

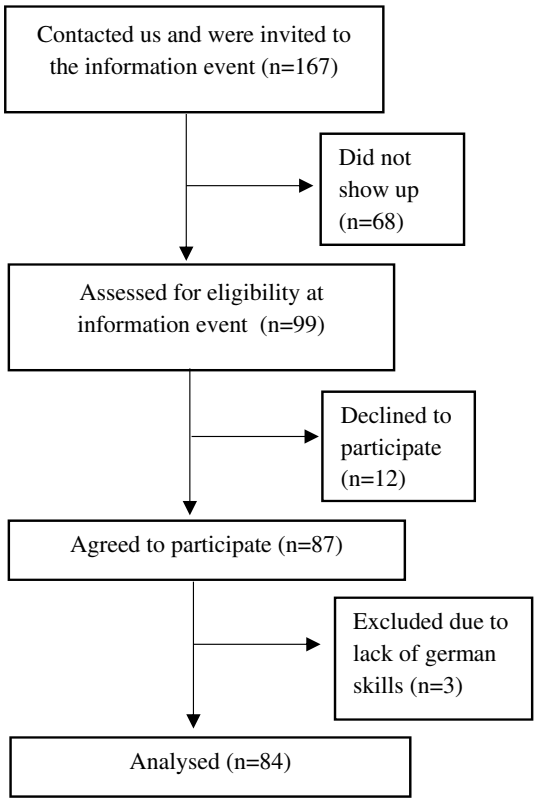

Fig. 1 Flowchart

Results

Prevalence of physical activity

The average self-reported PA was 133.2 min of vigorous physical activity per week (SD = 269.0, range from 0 to 1470), 154.8 min of moderate PA (SD = 215.2, range from 0 to 1200) and 479.8 min of walking per week (SD = 1042.7, range from 0 to 8400). Average sitting time was 422.6 min per day (SD = 213.2, range from 40 to 1169.7). The average of MET minutes per week was 3268.1 (SD = 4666.5, range from 0 to 29,560). 47.6% of the participants performed at least 150 min of MVPA per week, 31.0% were active for at least 30 min per day on at least 5 days per week. 41.7% of the participants met the ACSM recommendation (5 days with 30 min of moderate activity or 3 days with 20 min of vigorous activity or at least 1000 MET minutes per week).

The participants wore the accelerometers on average for 13.1 h per day (SD = 3.8, range from 0.4 to 21.4). The average number of valid days was 5.9 with 94.8% of the participants having at least 3 valid days. Average calculated moderate-intensity PA per week (3.00 to 5.99 METs) was 278.6 min (SD = 170.6, range from 55 to 799), heavy intensity PA per week (6.00–8.99 METs) 5.6 min (SD = 11.8, range from 0 to 52). The average number of measured counts per day was 290818.9 (SD = 104594.3, range from 125223.1 to 560623.6), the average number of calculated steps per day 8148.9 (SD = 3107.6, range from 3452.1 to 17753.0) and the average calculated number of calories burnt per day by activity was 176.2 (SD = 114.0, range from 28.4 to 521.4) per day. 79.6% of the participants performed at least 150 min of MVPA per week. 43.2% were active for at least 30 min per day on at least 5 days per week and 47.7% met the ACSM recommendation.

Table 1 Participants characteristics ($N=84$)

Characteristic	Mean	SD	Range
Age (years)	49.1	11.0	21–74
Weight (kg)	85.1	17.9	46.0–136.5
GAF	56.8	12.6	25–95
GSI-27	1.1	0.7	0.1–3.1
PCS	41.9	9.9	18.1–61.4
MCS	36.7	11.2	18.8–66.4
Number of psychiatric diagnoses	1.8	0.9	1–5
	N	%	
Education level			
University degree	31	36.9	
Higher education entrance qualification	22	26.2	
Subject related entrance qualification	7	8.3	
Secondary school certificate	20	23.8	
Lower secondary school certificate	4	4.8	
Main diagnosis			
Affective disorders	50	59.5	
Neurotic, stress-related and somatoform disoders	17	20.2	
Schizophrenia, schizotypal and delusional disorders	15	17.9	
Substance related disorders	2	2.4	
Psychotropic medication			
Any	63	75.0	
Antidepressants	46	54.8	
Neuroleptics	23	27.4	
Tranquilizers	3	3.6	
Hypnotics	1	1.2	
Mood stabilizers	15	19.9	
Stimulants	1	1.2	
≥2 substances	25	29.8	
≥3 substances	6	7.1	

Table 2 Correlations (r) between self-rated and accelerometer-measured PA ($n=44$)

IPAQ	Accelerometer				
	Moderate PA[b]	Heavy PA[b]	Total MVPA[b]	Steps[a]	Counts[a]
Moderate PA[b]	0.34*	0.26*	0.36**	0.47**	0.40**
Vigorous PA[b]	0.20	−0.05	0.20	0.41**	0.21
Walking[b]	0.57**	0.25	0.57**	0.35*	0.56**
Sitting[a]	−0.19	−0.29*	−0.20	−0.07	−0.32*
Total PA[b]	0.47**	0.15	0.47**	0.53**	0.48**

*Correlation is significant at 0.05 level (one-tailed)

**Correlation is significant at 0.01 level (one-tailed)

[a]Average (minutes) per day

[b]Average minutes per week

Correlation of subjective and objective-measured physical activity

Table 2 shows correlations between self-rated and objective-measured amount of physical activity.

Fisher's exact test revealed no significant relationship between self-rated and accelerometer-measured attainment of the criteria of at least 150 min MVPA per week ($p>.05$, Phi = 0.19, $p>.05$), at least five times per week of at least

30 min of MVPA ($p > .05$, Phi = 0.24, $p > .05$) and the ACSM recommendation ($p > .05$, Phi was 0.13, $p > .05$).

Motivational and volitional determinants and physical activity

Table 3 includes means, standard deviations and correlations between all psychological determinants of PA and their correlation with self-rated and accelerometer-measured PA.

MoVo-variables were found to be moderately correlated as expected but there were only low correlations for the planning variables with subjective and objective PA measures. See Fig. 2 for relevant correlations.

Clinical measures and physical activity

There were no significant correlations between GSI-27 and the self-reported or accelerometer-measured MVPA scores. There was a significant correlation between PCS and accelerometer-measured minutes of MVPA per day ($r = .31$, $p < .01$) but no to the self-reported MVPA score ($r = -.07$, $p > .05$). There were no significant correlations between MCS and the self-reported or accelerometer-measured MVPA scores.

Table 3 Overview of MoVo-variables and their correlations (r) with PA ($n = 84$)

Scale	*M*	SD	Correlation with PA subjective[a]	Correlation with PA objective[b]	Correlation with Steps per day[c]	Correlation with Sitting time[d]
Self-efficacy	2.81	0.75	0.16	0.24*	0.26*	−0.20*
Outcome- expectancies	3.18	0.39	0.21*	0.16	0.20*	−0.07
Intention	3.24	0.64	0.07	0.28**	0.28**	−0.11
Self-concordance (SSK-Index)	2.52	2.43	0.09	0.19	0.05	−0.39**
Action-planning	2.42	0.86	0.21*	0.17	0.13	−0.14
Coping-planning	1.86	0.79	0.16	0.12	0.15	−0.18*

*Correlation is significant at 0.05 level (one-tailed)

**Correlation is significant at 0.01 level (one-tailed)

[a]Total MET minutes per week (IPAQ)

[b]Average minutes of MVPA per day measured by accelerometer, $n = 74$

[c]Average steps per day measured by accelerometer, $n = 74$

[d]Average sitting time per week (IPAQ)

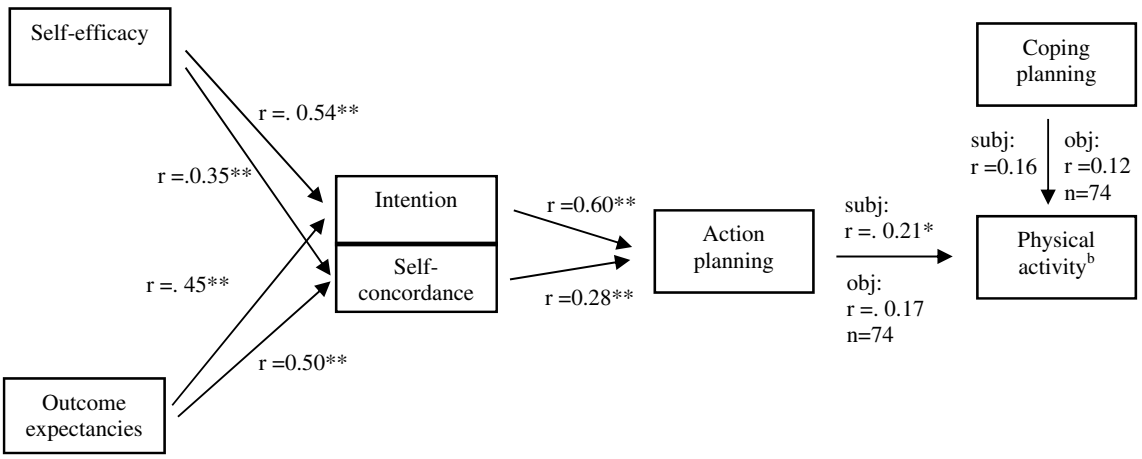

Fig. 2 MoVo-Model with correlations (r) for relevant paths ($n = 84$)[a]. *significant at 0.05 level (one-tailed) **significant at 0.01 level (one-tailed) [a]directions of *arrows* are indicating the directions of influences that are theoretically proposed by the model, although reported values are correlations, that cannot be interpreted causal [b]objective (obj): average minutes of mvpa per day measured by accelerometer, subjective (subj): total MET minutes measured by IPAQ

Exploratory analyses

There were no significant correlations between age or sex and self-reported or accelerometer-measured minutes of MVPA. There were no significant differences in self-rated or objective minutes of MVPA per day/week between participants that did or did not receive psychopharmacotherapy. Nevertheless, the intake of antidepressants was significantly negatively correlated with accelerometer-measured minutes of MVPA per day ($r_{pb} = -0.31$, $p > .01$) but not with self-reported minutes of MVPA per week ($r_{pb} = -0.02$, $p > .05$). There were no significant correlations between the intake of neuroleptics and accelerometer-measured minutes of MVPA per day ($r_{pb} = 0.13$, $p > .05$) or self-reported minutes of MVPA per week ($r_{pb} = 0.18$, $p > .05$). ANOVAs revealed no significant influence of main diagnosis on self-reported or accelerometer-measured minutes of MVPA per week/day. Table 4 shows the means in self-reported and accelerometer-measured minutes of MVPA per day for the different groups of main diagnoses. Post hoc tests showed that there are no significant differences between the groups.

Agoraphobic symptoms subscale from SCL-27 was significantly negatively correlated with self-reported walking minutes per week ($r_{pb} = -0.28$, $p < .05$).

Discussion

Prevalence of physical activity

The first aim of this study was to describe the level of PA in the population of outpatients with mental disorders. Average MVPA per week was fairly high with 288.0 min measured by IPAQ and 284.1 min measured by accelerometer. These values are similar to those found in a study by Chapman et al. [31] with 142 outpatients with mental disorders in Australia where the median of self-reported MVPA was 4.5 h per week and the median of accelerometer-measured MVPA per day was 26 min and to those found in a study by Helgadóttir et al. [21] with 165 participants with mild to moderate depressive and/or anxiety symptoms in Sweden where accelerometer-measured MVPA per day was 41.6 min. Studies focusing on patients with serious mental illnesses (SMI), schizophrenia or bipolar disorder found lower levels of physical activity [20, 22, 24]. Therefore, it seems like the PA levels are lower in some, but not all mental disorders. However, comparisons of the results of different studies remain difficult due to different methods in the assessment of PA (various self-report questionnaires and different accelerometer techniques as well as differences in accelerometer data reduction).

The results of this study show that the percentage of participants that reach PA recommendations strongly depends on the use of measurement (self-report vs. objective measurement) and the exact way of calculation (with percentages ranging from 31.0 to 79.6% of the participants that reach the PA recommendation). In the literature, the most widely used recommendation is at least 5 days per week with at least 30 min of MVPA. Based on the self-report 31.0% of the patients reached this recommendation, based on the accelerometer measures, 43.2% of the patients reached this recommendation. The higher percentage based on the accelerometer-measured could be explained by the fact that the criterion that the activity should be performed in bouts of at least 10 min could not be assessed for the accelerometer-measures in this study. These values are lower than in the study of Chapman et al. [31] (self-reported: 52%) and similar to the study of Helgadóttir et al. [21] (accelerometer-measured: 34%). Studies with patients with SMI find lower levels [20, 24]. However, this study consistently with the other studies shows that only a small proportion of patients with mental disorders reaches the PA recommendations with their activity level.

Table 4 Means of MVPA per day for different main diagnosis

Main diagnosis	Minutes of MVPA per day objective[a]		Minutes of MVPA per day subjective[b]	
	Mean	*N*	Mean	*N*
F1	19.5	2	10.0	2
F2	51.7	13	61.2	15
F3	37.0	44	39.0	50
F4	42.0	15	33.5	17

[a]Minutes of MVPA per day as calculated from accelerometer measurement

[b]Minutes of MVPA per day (IPAQ)

Accordance of subjective and objective measurement of physical activity

The second aim of this study was to examine the accordance of subjective- and objective-measured PA in this population. On group level, the self-report and accelerometer-measure are strongly consistent with 288 and 284 min of MVPA per week. This shows that self-report-measurement using the IPAQ and accelerometer measurement are equally apt to measure group levels of MVPA for studies with patients with mental disorders. This changes when it becomes necessary to differentiate MVPA into the different intensities moderate and vigorous. The self-reported average minutes of moderate PA per week are a lot lower than the accelerometer-measured (154.8 vs. 278.6). Contrary the self-reported average minutes of vigorous PA per week are much higher than the accelerometer-measured (133.2 vs.

5.6). Given that the IPAQ and GT1M-accelerometer have similar definitions of the categories moderate (IPAQ: 4 METs, GT1M: 3–6 METs) and vigorous (IPAQ: 8 METs, GT1M: 6–9 METs), it seems that the participants tend to overrate some of their moderate activity as vigorous activity. The very high accordance of self-report and accelerometer-measures of MVPA on group level gets lower if looked upon on individual level. There is a moderate correlation (0.47) between self-reported PA and accelerometer-measured PA. This is consistent with the study by Chapman et al. [31] where a correlation of 0.44 was found and a study by Faulkner et al. [20] with 35 US-american outpatients with schizophrenia where a correlation of 0.37 was found. The correlation found in this study was higher than the correlation between IPAQ and accelerometry found in a large-scale reliability and validity study of the IPAQ where a pooled correlation from different subsamples of 0.33 was found [43]. This shows that the IPAQ seems to be as valid for people with mental disorders as in the general population. When it comes to the assessment whether a participant reaches PA recommendations, no significant relationship between self-report and accelerometer-measure was found. This could be explained by the before mentioned difficulties to differentiate between moderate and vigorous activity in the self-rating. Therefore, it is strongly recommended to use a combination of self-report and accelerometer measurement when individual levels of PA are assessed.

Cognitive determinants and physical activity

The third aim of this study was to examine whether the social cognitive variables of health behavior change as used in MoVo show similar patterns of correlations among themselves and with PA for patients with psychiatric diagnoses as they do in populations without mental disorders. To our knowledge this is the first study that specifically addressed this question and measured all the social cognitive determinants of health behavior change as used in MoVo in this population. As expected, there were significant moderate correlations between the MoVo-variables. This indicates that for patients with mental disorders, the formation of behavioral intentions of a certain strength and quality is strongly affected by self-efficacy and outcome-expectancies and the formation of behavior plans is strongly affected by the behavioral intentions as this can be observed in other populations. The sizes of the correlations are comparable to those in other studies that focused on the effect of these variables in connection to PA (e.g., [35, 37]). If it comes to the planning variables, action-planning was significantly correlated to self-reported PA but not accelerometer measured PA and coping-planning was not significantly correlated to self-reported or accelerometer-measured PA. These findings are similar to those by Arbour-Nicitopoulos et al. [41] where the HAPA-Model was evaluated in a small sample of outpatients with schizophrenia in Canada. They also found a pattern of significant moderate to high correlations between the social cognitive variables as expected, but there were only low non-significant correlations between the planning variables and PA. This indicates that the social cognitive variables of MoVo play an important role in the motivational and volitional process that leads to the formation of PA intentions and planning for PA for patients with mental disorders. The finding that the planning variables show lower correlations to PA than the social cognitive variables of the model between themselves is not specific to the population of patients with mental disorders, as other studies with participants, who do not have mental disorders show similar results (e.g., [35, 37]). However, the fact that there were only low and partly non-significant correlations of the planning variables with PA reflects the existence of other important barriers to PA in this population. A qualitative study of McDevitt et al. [39] with 34 outpatients with serious and persistent mental disorders from the USA focuses on the special barriers that people with mental disorders encounter. The identified barriers were (a) symptoms of mental disorders, where especially avolition and lack of initiative seem to be important influences, (b) medication and their side-effects, where sedation seems to play a key-role, (c) weight gain as a result of medication, (d) the fear of discrimination, especially when PA is performed in public and (e) safety concerns as being attacked by other people in public. A review by Roberts & Bailey [58] examines the evidence for special barriers to lifestyle interventions in patients with mental disorders but comes to the conclusion that there is a lack of studies that specifically explore these. For further research mixed methods studies that identify barriers in a first step and then evaluate their correlations with PA in a second step could be of great benefit. These specific barriers then could be integrated into models of prediction and modification of PA in this population.

Clinical measures and physical activity

The fourth aim of this study was to examine the associations between PA and mental health in this population. The positive correlation between PCS and accelerometer-measured PA indicates that perceived physical health has a positive effect on the ability to perform PA. We expected a negative correlation between severity of mental disorder and PA as found in other studies (e.g., [21]) but did not find significant correlations between perceived mental health as measured by MCS or the self-reported severity of mental disorders as measured by GSI-27 and subjective- or objective-measured PA. Exploratory analyses showed that also within different groups of diagnoses (F1.x, F2.x, F3.x, F4.x) there was no significant correlation between MCS or

GSI-27 and PA. This indicates that research should focus on different specific factors within mental disorders that act as barriers to PA rather than seeing severity of mental disorder in general as a barrier to PA.

Exploratory analyses

There were no significant differences between participants with and without psychopharmacotherapy treatment in their level of PA. This is not surprising, as most of the participants were receiving pharmacotherapy treatment. There was a significant negative correlation between intake of antidepressants and accelerometer-measured minutes of MVPA per day. Together with the fact that there was no significant negative correlation between depressive symptoms subscale from SCL-27, this could be interpreted as negative effect of antidepressant medication on PA. However, from clinical experience this seems unlikely and one would rather expect that the negative correlation is caused by the effect of depressive symptoms, especially avolition, on the ability to perform PA. This interpretation is supported by a longitudinal study of Luo et al. [59] with nursing home residents in Hong Kong, where depressive symptoms did not correlate with activities of daily living at baseline but with later decline in such and antidepressant pharmacotherapy was partly able to prevent a decline in activities of daily living later on.

Strengths and limitations

Compared to other studies on PA in patients with mental disorders this study investigated a fairly large and heterogeneous sample of outpatients with mental disorders from hospital outpatient departments and local psychiatrists which increases generalizability. Another strength is the assessment of PA by self-report and objective measurement at the same time, which allows to compare the validity of these kinds of measurement. To our knowledge this is the first study that systematically investigates the cross-sectional influence of the social cognitive variables of health behavior change as used in MoVo on PA in outpatients with mental disorders. Nevertheless, there are some limitations. We examined only patients that were interested to take part in a healthy living intervention. Therefore, these patients might not be representative for the population of outpatients with mental disorders. Representativeness is also limited by the fact that over 70% of our sample were women. As prevalence of PA in Germany is higher in males than in females [19], our findings may underestimate the level of PA on outpatients with mental disorders. On the other hand, there was no significant correlation between sex and PA level in our sample. This might be explained by the fact that we only included participants who wanted to improve their health behavior. Another limitation is the fact that we were not able to calculate the accumulation of activity in bouts of 10 min in the accelerometer-measures, as recommended in the most PA guidelines. This might explain the comparatively high proportion of patients meeting the PA recommendations measured by accelerometer. If activity bouts would be taken into account we would expect the measured levels of PA and the proportion of participants that reaches the recommendations to drop. Another limitation is the fact that we did not asses medication other than psychotropic medication. We did not expect relevant influences of these substances on our study result but anyway were not able to explore possible influences of this medication on PA. In this study, the number of participants was not high enough to compare the activity levels of subgroups with different diagnosis. This could be very interesting for further research as specific interventions for specific groups of patients with different diagnoses of mental disorders could be thought of.

Conclusions

Outpatients suffering from mental disorders are able and willing to perform PA, but large proportions do not meet the recommendations with their level of PA. Therefore, it seems reasonable to develop and evaluate interventions that could help these patients to increase their level of PA. Psychological theories of health behavior should be taken into account for reaching this goal. Subjective and objective measurements of PA show good consistency if group levels of PA are estimated. On individual level, this consistency is much lower and patients especially tend to overrate their moderate activities as vigorous activities. Therefore, the combination of subjective and objective measurements for individual diagnostics is highly recommended. The cognitive variables of the MoVo model seem to be able to explain the motivational and volitional processes leading to PA similar for patients with mental disorders as they do for the general population. Nevertheless, there seem to be specific disorder-related barriers to physical activity in people with mental disorders that should be further investigated.

Acknowledgements This study has been approved by the local ethics committee, and has therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. All participants gave formal written informed consent prior to their inclusion in the study.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

References

1. World Health Organization (2009) Global health risks—mortality and burden of disease attributable to selected major risks. Geneva
2. Lee IM, Shiroma EJ, Lobelo F, Puska P, Blair SN, Katzmarzyk PT (2012) Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. Lancet 380(9838):219–229
3. Warburton DER (2006) Health benefits of physical activity: the evidence. Can Med Assoc J 174(6):801–809
4. Fok MLY, Hayes RD, Chang CK, Stewart R, Callard FJ, Moran P (2012) Life expectancy at birth and all-cause mortality among people with personality disorder. J Psychosom Res 73(2):104–107
5. Hannerz H, Borgå P, Borritz M (2001) Life expectancies for individuals with psychiatric diagnoses. Public Health 115(5):328–337
6. Laursen TM (2011) Life expectancy among persons with schizophrenia or bipolar affective disorder. Schizophr Res 131(1–3):101–104
7. Hassmén P, Koivula N, Uutela A (2000) Physical exercise and psychological well-being: a population study in Finland. Prev Med 30(1):17–25
8. Kim YS, Park YS, Allegrante JP, Marks R, Ok H, Cho KO, Garber CE (2012) Relationship between physical activity and general mental health. Prev Med (55): 458–463
9. de Moor M, Beem A, Stubbe J, Boomsma D, Geus E de (2006) Regular exercise, anxiety, depression and personality: a population-based study. Prev Med 42(4):273–279
10. Park S, Cho MJ, Cho SJ, Bae JN, Lee JY, Park JI (2011) Relationship between physical activity and mental health in a nationwide sample of korean adults. Psychosomatics 52(1):65–73
11. Ströhle A (2009) Physical activity, exercise, depression and anxiety disorders. J Neural Transm 116(6):777–784
12. Zschucke E, Gaudlitz K, Ströhle A (2013) Exercise and physical activity in mental disorders: clinical and experimental evidence. J Prev Med Pub Health 46(Suppl 1):12–21
13. Goodwin RD (2003) Association between physical activity and mental disorders among adults in the United States. Prev Med 36(6):698–703
14. Ten Have M, Graaf R, Moonshouwer K (2011) Physical exercise in adults and mental health status—findings from the Netherlands Mental Health Survey and Incidence Study (NEMESIS). J Psychosom Res 71:342–348
15. Ströhle A, Höfler M, Pfister H, Müllker AG, Hoyer J, Wittchen HU, Lieb R (2007) Physical activity and prevalence and incidence of mental disorders in adolescents and young adults. Psychol Med 37(11):1657–1666
16. Meng X, D'Arcy C (2013) The projected effect of increasing physical activity on reducing the prevalence of common mental disorders among canadian men and women: a national population-based community study. Prev Med 56(1):59–63
17. Robert Koch- Institut (RKI) (2014) Körperliche Aktivität. Faktenblatt zu GEDA 2012: Ergebnisse der Studie "Gesundheit in Deutschland aktuell 2012". Berlin
18. Garber CE, Blissmer B, Deschenes MR, Franklin BA, Lamonte MJ, Lee IM (2011) Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults. Med Sci Sports Exerc 43(7):1334–1359
19. World Health Organization (2010) Global recommendations on physical activity for health. Geneva
20. Faulkner G, Cohn T, Remington G (2006) Validation of a physical activity assessment tool for individuals with schizophrenia. Schizophr Res 82(2–3):225–231
21. Helgadóttir B, Forsell Y, Ekblom Ö (2015) Physical activity patterns of people affected by depressive and anxiety disorders as measured by accelerometers: a cross-sectional study. PLoS One 10(1):e0115894
22. Jerome GJ, Rohm Young D, Dalcin A, Charleston J, Anthony C, Hayes J, Daumit GL (2009) Physical activity levels of persons with mental illness attending psychiatric rehabilitation programs. Schizophr Res 108(1–3):252–257
23. Daumit GL, Goldberg RW, Anthony C, Dickerson F, Brown CH, Kreyenbuhl J (2005) Physical activity patterns in adults with severe mental illness. J Nerv Ment Dis 193(10):641–646
24. Janney CA, Fagiolini A, Swartz HA, Jakicic JM, Holleman RG, Richardson CR (2014) Are adults with bipolar disorder active? Objectively measured physical activity and sedentary behavior using accelerometry. J Affect Disord 152–154: 498–504
25. Lindamer LA, McKibbin C, Norman GJ, Jordan L, Harrison K, Abeyesinhe S, Patrick K (2008) Assessment of physical activity in middle-aged and older adults with schizophrenia. Schizophr Res 104(1–3):294–301
26. Northey A, Barnett F (2012) Physical health parameters: comparison of people with severe mental illness with the general population. Br J Occup Ther 75(2):100–105
27. Nyboe L, Lund H (2013) Low levels of physical activity in patients with severe mental illness. Nord J Psychiatry 67(1):43–46
28. Roick C, Fritz-Wieacker A, Matschinger H, Heider D, Schindler J, Riedel-Heller S, Angermeyer MC (2007) Health habits of patients with schizophrenia. Soc Psychiatry Psychiatr Epidemiol 42(4):268–276
29. Vancampfort D, Probst M, Scheewe T, Maurissen K, Sweers K, Knapen J, Hert M de (2011) Lack of physical activity during leisure time contributes to an impaired health related quality of life in patients with schizophrenia. Schizophr Res 129(2–3):122–127
30. Cairney J, Veldhuizen S, Faulkner G, Schaffer A, Rodriguez MC (2009) Bipolar disorder and leisure-time physical activity: results from a national survey of canadians. Ment Health Phys Act 2(2):65–70
31. Chapman JJ, Fraser SJ, Brown WJ, Burton NW (2015) Physical activity and sedentary behaviour of adults with mental illness. J Sci Med Sport 19(7):579–584
32. Schwarzer R (2008) Modeling health behavior change: how to predict and modify the adoption and maintenance of health behaviors. Appl Psychol Int Rev 57(1):1–29
33. Fuchs R (2013) Das Motivations-Volitions-Konzept. Public Health Forum 21(79):32–34
34. Schwarzer R, Luszczynska A (2008) How to overcome health-compromising behaviors. Eur Psychol 13(2):141–151
35. Schwarzer R, Schüz B, Ziegelmann JP, Lippke S, Luszczynska A, Scholz U (2007) Adoption and maintenance of four health behaviors: theory-guided longitudinal studies on dental flossing, seat belt use, dietary behavior, and physical activity. Ann Behav Med 33(2):156–166
36. Scholz U, Sniehotta FF, Schwarzer R (2005) Predicting physical exercise in cardiac rehabilitation: the role of phase-specific self-efficacy beliefs. J Sport Exerc Psychol 27(2):135–151
37. Sniehotta FF, Schwarzer R, Scholz U, Schüz B (2005) Action planning and coping planning for long-term lifestyle change: theory and assessment. Eur J Soc Psychol 35(4):565–576
38. Ziegelmann JP, Lippke S (2007) Planning and strategy use in health behavior change: a life span view. Int J Behav Med 14(1):30–39

39. McDevitt J, Snyder M, Miller A, Wilbur J (2006) Perceptions of barriers and benefits to physical activity among outpatients in psychiatric rehabilitation. J Nurs Scholarsh 38(1):50–55
40. Ussher M, Stanbury L, Cheeseman V, Faulkner G (2007) Physical activity preferences and perceived barriers to activity among persons with severe mental illness in the United Kingdom. Psychiatr Serv 58(3):405–408
41. Arbour-Nicitopoulos KP, Duncan M, Remington G, Cairney J, Faulkner GE (2014) Development and reliability testing of a health action process approach inventory for physical activity participation among individuals with schizophrenia. Front Psychiatry 5:1–9
42. Faul F, Erdfelder E, Buchner A, Lang A-G (2009) Statistical power analyses using G*Power 3.1: tests for correlation and regression analyses. Behav Res Methods 41:1149–1160
43. Craig CL, Marshall AL, Sjöström M, Bauman AE, Booth ML, Ainsworth BE (2003) International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports Exerc 35(8):1381–1395
44. ActiGraph (2008) ActiLife Users Manual. ActiGraph, LLC Engineering, Pensacola, Fl
45. Mota-Pereira J, Ribeiro JC, Fonte D, Carvalho S, Pizarro A, Teixeira J (2012) 12 weeks of moderate intensity exercise improves treatment-resistant major depressive disorder (MDD) daily use of accelerometers contributes to 97% adherence. Eur Psychiatry 27:1
46. Silva P, Mota J, Esliger D, Welk G (2010) Technical reliability assessment of the actigraph GT1M accelerometer. Meas Phys Educ Exerc Sci 14(2):79–91
47. Kaminsky LA, Ozemek C (2012) A comparison of the Actigraph GT1M and GT3X accelerometers under standardized and free-living conditions. Physiol Meas 33(11):1869–1876
48. Masse LC, Fuemmeler BF, Anderson CB, Matthews CE, Trost SG, Cattellier DJ, Treuth M (2005) Accelerometer data reduction: a comparison of four reduction algorithms on select outcome variables. Med Sci Sports Exerc 37(Supplement), 544–554
49. Parschau L, Fleig L, Warner LM, Pomp S, Barz M, Knoll N (2014) Positive exercise experience facilitates behavior change via self-efficacy. Health Educ Behav 41(4):414–422
50. Lippke S, Ziegelmann JP, Schwarzer R (2005) Stage-specific adoption and maintenance of physical activity: testing a three-stage model. Psychol Sport Exerc 6(5):585–603
51. Schüz B, Wurm S, Warner LM, Wolff JK, Schwarzer R (2014) Health motives and health behaviour self-regulation in older adults. J Behav Med 37(3):491–500
52. Renner B, Spivak Y, Kwon S, Schwarzer R (2007) Does age make a difference? predicting physical activity of south koreans. Psychol Aging 22(3):482–493
53. Seelig H, Fuchs R (2006) Messung der sport- und bewegungsbezogenen Selbstkonkordanz. Zeitschrift für Sportpsychologie 13(4):121–139
54. Hardt J, Gerbershagen HU (2001) Crossvalidation of the SCL27: a short psychometric screening instrument for chronic pain patients. Eur J Pain 5(2):187–197
55. Hardt J, Egle U, Kappis B, Hessel A, Brähler E (2004) Die Symptom-Checkliste SCL-27: Ergebnisse einer Repräsentativbefragung. Psychotherapie, Psychosomatik, Medizinische Psychologie (54) 214–223
56. Ware JE, Kosinski M, Keller S (1996) A 12-item short-form health survey: construction of scales and preliminary tests of reliability and validity. Med Care 34(3):220–233
57. Enders CK (2010) Applied missing data analysis. The Guilford Press, New York
58. Roberts SH, Bailey JE (2011) Incentives and barriers to lifestyle interventions for people with severe mental illness: a narrative synthesis of quantitative, qualitative and mixed methods studies. J Adv Nurs 67(4):690–708
59. Luo H, Tang JYM, Wong GHY, Chen CCH, Lum TYS, Chi I, Lou VWQ (2015) The effect of depressive symptoms and antidepressant use on subsequent physical decline and number of hospitalizations in nursing home residents: a 9-year longitudinal study. J Am Med Dir Assoc 16(12):1048–1054