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Functional exercise capacity is associated with global functioning in patients with alcohol use disorder

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ABSTRACT

This study explored whether the Global Assessment of Functioning (GAF) score is associated with the functional exercise capacity among inpatients with alcohol use disorders (AUD). 45 (32 men) inpatients (41.1 ± 13.2 years, range = 18–70 years) performed a 6-minute walk test (6 MWT), a standing broad jump (muscle strength) and were assessed with several questionnaires. The GAF-score correlated significantly with the 6 MWT-score (Pearson's r = 0.47, p = 0.002). Variance in illness duration (11.1 ± 11.0 years) explained 27.9% of the GAF-score (50.8 ± 8.0) variance. Variance in GAF and muscle strength (148.3 ± 44.8 cm) explained 50.9% of the 6 MWT-score (638.2 ± 77.6 m) variance. Future research should explore whether improving the functional exercise capacity improves global functioning in this vulnerable population.

Introduction

Although pharmacotherapy, cognitive behavioral interventions, motivational interviewing, and the 12-step facilitation treatment are recognized as the mainstay of therapy for alcohol use disorders (AUD) (Berglund, Thelander, & Jonsson, 2003), functional outcomes remain suboptimal. This has led researchers to investigate factors that are associated with poor functional outcome in this population. The functional outcome generally refers to the degree of success that a person has with social connections, vocational pursuits, and degree of independent living (Green, Hellemann, Horan, Lee, & Wynn, 2012). Several determinants with daily life functioning have previously been identified. Research showed that the presence of co-morbid obesity, a negative affect and hazardous drinking patterns may limit one's daily life functioning in people with AUD (Strid, Andersson, & Öjehagen, 2018; Vancampfort et al., 2015a). Previous research in people with mental health problems also indicated that a person's physical activity levels and the use of psychotropic medication influences one's capability to perform daily life activities (Bernard et al., 2015; Vancampfort et al., 2011).

To date, no study has investigated the association of global functioning outcomes with functional exercise parameters in patients with AUD. This is surprising since an impairment in performing everyday physical activities may, for example, result in patients with AUD experiencing reduced autonomy (e.g., by not going to grocery stores, coming for appointments, joining social activities, engaging in vocational activities or following physical activity prescriptions) because the physical demands are unpleasantly high or simply unattainable. An impaired functional exercise capacity is also a risk factor for cardiovascular disease and overall morbidity, disability and mortality (American Thoracic Society, 2002). Taken together, the functional exercise capacity might be an important indicator for (1) global functioning, and (2) nurse-led daily life interventions aiming at functional improvements in patients with AUD. Previous research in people with first-episode psychosis (Rosenbaum et al., 2015), established schizophrenia (Vancampfort et al., 2015b; Vancampfort et al., 2012) and bipolar disorder (Vancampfort et al., 2016) has clearly demonstrated that the functional exercise capacity is an important correlate of global functioning. A potential reason for the lack of data on the association of functional exercise outcomes with global functioning outcomes in patients with AUD might be the lack of awareness of the importance of considering the functional exercise capacity in this population (Hallgren, Vancampfort, Giesen, Lundin, & Stubbs, 2017; Hallgren, Vancampfort, Schuch, Lundin, & Stubbs, 2017). In order to assess the functional exercise capacity a range of different tests are available. Laboratory-based incremental exercise testing protocols using breath-by-breath gas analysis and measuring the maximum level of oxygen consumption are considered the gold standard to determine the aerobic exercise capacity (Vanhees et al., 2005), but their functional validity can be questioned. Since most daily activities are not performed at

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maximal levels of exertion, submaximal exercise tests, and in particular walk tests, may be a more realistic reflection of a patient's functional exercise capacity (American Thoracic Society, 2002) and are therefore labelled as functional exercise tests. However, no data are available considering if the functional exercise capacity measured with the 6-minute walk test (6 MWT) reflects the global functional outcome of people with AUD. The Global Assessment of Functioning (GAF) is one of the scales most often used either in routine clinical practice or in research showing good psychometric properties in patients with severe mental illness (Jones, Thornicroft, Coffey, & Dunn, 1995).

The aim of the present study was to examine the association of the GAF-score with the functional exercise capacity as measured with 6 MWT in inpatients with AUD while taking into account the body mass index (BMI), drinking patterns, affect, psychotropic medication use and physical activity levels.

Material and methods

Participants and procedure

Over a 5-month period, all inpatients with a DSM 5 diagnosis of AUD (American Psychiatric Association) of the UPC KU Leuven, campus Kortenberg were invited to participate by their treating psychiatrist in the fourth week of admission. Participants were excluded if they had significant cardiovascular, neuromuscular and endocrine disorders, which, according to the American College of Sports Medicine (2013), might prevent safe participation in the study. All participants received a physical examination and baseline electrocardiogram before testing by a specialized physician. Participants were also requested to refrain from eating, drinking coffee or smoking during a two-hour period prior to the walk test All patients completed first the International Physical Activity Questionnaire (Craig et al., 2003), the Positive Affect and Negative Affect Schedule (PANAS) (Watson, Clark, & Tellegen, 1988) and Alcohol Use Disorders Identification Test (AUDIT) (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001), and performed afterwards a first 6 minute walk and standing broad jump test to get used to the test protocol (American Thoracic Society, 2002). The second fitness tests were repeated within 3 days. The study procedure was approved by the Ethical Committee of the UZ Leuven and UPC KU Leuven, campus Kortenberg, Belgium and conducted in accordance with the principles of the Declaration of Helsinki. All participants gave their informed written consent. There was no compensation for participation in the study.

Global assessment of functioning (GAF) score

The GAF (American Psychiatric Association, 2000) combines the evaluation of symptoms as well as relational, social, and occupational functioning on a single axis. The scale runs from one to 100 and is divided into 10 equal parts providing defining characteristics, both symptoms and functioning, for each 10-point interval. A low rating reflects worse symptoms and a poorer level of functioning, whereas a high rating reflects less symptoms and a better level of functioning. The GAF was recorded by one of two (previously trained) treating (and blinded for other assessments) psychiatrists as a single score reporting only the most severe of the symptom and functioning values. The GAF score is known to be a valid measure of global functioning in patients with severe mental illness (Jones et al., 1995).

6-Minute walk test

The 6 MWT was performed according to the American Thoracic Society (2002) guidelines in an indoor hallway with a minimum of external stimuli. Two cones 25 m apart indicated the length of the walkway. Participants were instructed to walk back and forth around the cones during 6 min, without running or jogging. Resting was allowed if necessary, but walking was to be resumed as soon as the participants were able to do so. The protocol stated that the testing was to be interrupted if threatening symptoms appeared, including (a) chest pain, (b) intolerable dyspnea, (c) leg cramps, (d) staggering, (e) diaphoresis, and (f) pale or ashen appearance. The total distance walked in 6 min was recorded to the nearest decimetre. Standardized encouragements were provided at recommended intervals. One mental health physical therapist supervised and measured all 6 MWTs. The 6 MWT has been shown to be a valid and safe exercise test in patients with bipolar disorder (Vancampfort et al., 2016a).

Standing broad jump (Oja & Tuxworth, 1995)

Muscle strength was measured by a standing broad jump, using a tape measure on a foam mat. Participants were asked to stand behind a line drawn perpendicular to the tape measure and jump forward as far as possible using arm swing and knee bending before jumping. The distance jumped was recorded from the take-off line to the farthest point backward of the participant. The best of two attempts was recorded. Higher scores indicate a better muscle strength.

International Physical Activity Questionnaire (IPAQ) - long version (Craig et al., 2003)

A structured format that asked participants to recall activities during 'usual days' before admission and this for morning, afternoon, and evening time periods was used (Craig et al., 2003). On the basis of what activities participants self-reported, the interviewer clarified the perceived intensity of that specific activity. Following the IPAQ protocol a continuous indicator was calculated as a sum of weekly metabolic equivalent (MET)-minutes per week of physical activity.

Positive Affect and Negative Affect Schedule (PANAS) (Watson et al., 1988)

The PANAS is a self-rating scale used to measure positive and negative affect. The instrument consists of 20 adjectives divided into two 10-item scales measuring positive and negative affect, respectively. Positive affect refers to the extent to which a person feels enthusiastic and active, and negative affect the extent to which a person experiences anger or guilt. On a five-point scale (from not at all to very much) the participants are asked to rate the extent to which they have experienced each specific affect "during the past week." Higher scores represent greater endorsement of the construct.

Alcohol Use Disorders Identification Test (AUDIT) (Babor et al., 2001)

To assess risky alcohol consumption patterns, we used the AUDIT (Babor et al., 2001), which was developed by the World Health Organization (WHO) as a simple method of screening for excessive drinking. The AUDIT comprises three domains: hazardous alcohol use (frequency of drinking, typical quantity, and frequency of heavy drinking), dependence symptoms (impaired control over drinking, increased salience of drinking, and morning drinking), and harmful alcohol use (guilt after drinking, blackouts, alcohol-related injuries, and other concerns about drinking). Higher scores indicate greater likelihood of hazardous and harmful drinking. We used the AUDIT as a continuous score.

Smoking behavior

Participants were asked whether they smoked or not, and if so, how many cigarettes they smoke per day on average.

Anthropometric measurements

Body weight was measured in light clothing to the nearest 0.1 kg using a SECA beam balance scale, and height to the nearest 0.1 cm

using a wall-mounted stadiometer.

Medication use

Psychotropic medication use was retrieved from the medical files.

Statistical analysis

Continuous data were assessed for normality using the Shapiro-Wilk test and found to be normally distributed. Descriptive statistics are therefore presented as mean ± standard deviation (SD). The Pearson's correlation test was used to determine the relationship of the GAF-score with the 6 MWT score and other clinical variables. We used the following correlation classification according to Surwillo (1980): 0–39 = low; 40–69 = moderate to substantial; 70–100 = high to very high. Gender differences were explored with unpaired *t*-tests. In order to identify independent predictors of the GAF- and 6 MWT scores, two backward regression analyses were conducted, one with the GAF score as dependent variable and one with the 6 MWT as the dependent variable. To prevent overfitting of the models we only included significant correlates from the univariate tests in the models. To test for multicollinearity, a variance inflation factor was computed for each independent variable in the final model. Values above 3 were used to indicate a multicollinearity problem in the model (Kleinbaum et al., 2013). A priori, a level of significance was set at $p < 0.05$. Statistical analyses were performed using the statistical package SPSS version 25.0 (SPSS Inc., Chicago, IL).

Results

Participants

A total of 60 inpatients with AUD were initially screened. Five persons were excluded as a consequence of a cardiovascular or neuromuscular disorder that might prevent safe participation. Of the 55 eligible persons with AUD, 6 declined to participate (i.e., were not interested), two were not motivated anymore to perform the second test and two were transferred to another hospital following the test trial. In total, 45 participants were included in the final analysis. Within the final sample 32 men (age = 40.8 ± 13.8 years, range = 18–70 years; illness duration = 10.2 ± 10.3 years; body mass index, BMI = 24.8 ± 3.8) and 13 women (age = 41.9 ± 12.1 years, range = 27–60 years; illness duration = 13.7 ± 13.1 years; BMI = 26.3 ± 4.9) were represented. There were no significant differences in age, illness duration and BMI between men and women. All participants were Belgian natives and 27 (60%) of the participants smoked an average of 15 ± 8 cigarettes per day. An overview of the medication use of the entire sample is presented in Table 1. There were 22 prescriptions for antidepressants in 17 persons. Eight persons received benzodiazepines, five antipsychotics, three disulfiram, one a mood stabilizer and one an atomoxetine prescription. Fifteen persons were treated with somatic medication (Table 2).

The GAF and 6 MWT

The mean GAF-score was 50.8 ± 8.0. There was no significant difference in the mean GAF-score between male and female participants (51.1 ± 7.8versus 50.1 ± 8.9, $p = 0.73$). Across the entire sample, the mean 6 MWT score was 638.2 ± 77.6 m. In contrast with the GAF score data, higher 6 MWT scores were observed in male versus female participants (654.8 ± 83.4 m versus 585.8 ± 55.3 m, $p = 0.015$).

Associations with the GAF- and 6 MWT-scores

The GAF-score was significantly (r = 0.47, $p = 0.002$, i.e. a moderate correlation) associated with 6 MWT score. Correlations of the GAF- and 6 MWT scores with other demographical and clinical characteristics are presented in Table 1. Briefly, the GAF score was negatively ($p < 0.05$) associated with increasing age and illness duration and positively associated with total physical activity level and muscle strength (assessed with the standing broad jump). Increasing age and illness duration were negatively ($p < 0.05$) associated with the 6 MWT-score, while total physical activity level and muscle strength (assessed with the standing broad jump) were positively ($p < 0.05$) associated with the 6 MWT-score.

All significant correlates were included in a backward regression analysis with the GAF-and 6 MWT scores as the dependent variables. Within the fully adjusted GAF-model, the unique significant predictor of the GAF-score was illness duration (unstandardized coefficient = −0.40, standard error = 0.10, standardized coefficient = −0.55, t-value = −3.96, $p < 0.001$). The model explained 27.9% of the variance in the GAF-score. Within the fully adjusted 6 MWT-model, the unique significant predictors of the 6 MWT-score were the standing broad jump and the GAF-score. The model explained 50.9% of the variance in the 6 MWT-score.

Table 1
Clinical characteristics and their relation with the Global Assessment of Functioning score and the functional exercise capacity as assessed with the 6 minute walk test (6 MWT).

	Mean ± SD	Correlations	
		GAF-score	6 MWT-score
Age (years)	41.1 ± 13.2	−0.41**	−0.36*
Illness duration (years)	11.1 ± 11.0	−0.57***	−0.60***
BMI (kg/m^2)	25.2 ± 4.1	−0.21	−0.23
AUDIT score	27.1 ± 6.3	0.05	−0.18
PANAS positive affect score	28.6 ± 7.1	0.22	0.39*
PANAS negative affect score	26.8 ± 7.7	0.06	0.07
Standing broad jump (cm)	148.3 ± 44.8	0.37*	0.73***
IPAQ (MET-min/week)	837.2 ± 597.3	0.43**	0.48***

Pearson correlation coefficients: *p < 0.05, **p < 0.01, ***p < 0.001; BMI = body mass index, AUDIT = Alcohol Use Disorders Identification Test, PANAS = Positive Affect and Negative Affect Schedule, IPAQ = International Physical Activity Questionnaire, MET = metabolic equivalent.

Table 2
Final backward stepwise regression model with the mean 6 MWT-score as the dependent variable.

Variables[a]	B	95% CI		SE	β	t	p
(Constant)	359.7	266.0	507.5	59.7	/	6.0	< 0.001
GAF score	2.3	1.0	4.0	1.2	0.2	1.9	0.047
SBJ score (cm)	1.1	0.7	1.7	0.2	0.6	4.9	< 0.001

[a] Only significant correlates (i.e. age, gender, illness duration, total physical activity level, muscle strength standing broad jump score and GAF) were included in the model, CI = confidence interval, B = unstandardized coefficient, SE = standard error, β = standardized coefficient, 6 MWT = 6 minute walk test, GAF = Global Assessment of Functioning, SJB = standing broad jump.

Discussion

General findings

To our knowledge, the present study is the first to demonstrate that the functional exercise capacity, captured by the 6 MWT, is associated with global functioning among inpatients with AUD. In addition, in the fully adjusted model, the GAF-score score was one of the two significant predictors of the functional exercise capacity among our sample with AUD. When one considers that the functional exercise capacity is an essential requirement for all activities of daily living, the importance of

promoting interventions targeting the functional exercise capacity in people with AUD is clearly clinically relevant. Our findings therefore add further credence to the notion that the promotion of physical activity and interventions targeting the functional exercise capacity might be clinically relevant among inpatients with AUD. The promotion of physical activity could also focus on important functional goals, such as walking to the local shops instead of taking the bus, which might also offer an opportunity to gain the benefits of an active lifestyle while also achieving functional tasks.

The current data also demonstrate that in inpatients with AUD, muscle strength is associated with functional exercise capacity. It is well established that chronic alcohol abuse results in muscular weakness (Ekbom, Hed, Kirstein, & Astrom, 1964). Excessive chronic alcohol consumption inhibits muscular strength through multiple pathways. First, it results in a protracted imbalance in protein homeostasis of the muscle, which manifests itself as a decrease in muscle mass and a decrease in cross-sectional area (CSA) of type II fiber-rich muscle leading to the development of progressive proximal myopathy (Pacy, Preedy, Peters, Read, & Hallidy, 1991). Chronic alcohol intake also impairs the functioning of existing protein synthetic molecules (Steiner & Lang, 2015), while significant decreases in the anabolic hormone insulin-like growth factor (IGF)-I have been observed. Reduced IGF-1 levels are associated with a decrease in muscle protein synthesis and development of alcohol myopathy. It is known that both low and high resistance exercise have the ability to increase levels of IGF-1 (Vega, Knicker, Hollmann, Bloch, & Strüder, 2010). Therefore, future research should explore in more detail whether resistance training in patients with severe levels of alcohol dependence improves muscle strength, specifically by acting through underlying IGF-1 pathways and whether such improvements are related to improvements in daily life functioning.

Practical implications

Present findings indicate that the 6 MWT can be recommended in inpatient settings as a measure of proxy for a patient's global functioning. Because the 6 MWT is easy to perform, can be performed by trained nurses, is safe and cheap, it can be used at a larger scale in research studies and in mental health care settings.

Methodological limitations and future research

The findings of the present study need to be interpreted in conjunction with a number of methodological limitations. First, although the GAF score is known to be a valid measure of global functioning in other mental health populations, its inter-rater reliability in a routine clinical context has been questioned (Jones et al., 1995). Second, we did not include parameters such as socio-economic status and educational level in order to increase the external validity. Third, due to the cross-sectional nature of the study we were not able to investigate mediating factors between the functional exercise capacity and global functioning. Longitudinal research is needed to make any firm conclusions.

Conclusions

Although with limitations, the current study demonstrates that the functional exercise capacity of inpatients with AUD might be associated with a patient's global functioning. Future longitudinal research is required to disentangle the directionality of these relationships and interventions should be developed to see if physical activity interventions targeting functional exercise capacity result in better daily functioning and quality of life improvements in this vulnerable population. Nurses should therefore assess the functional exercise capacity in order to measure the physical health consequences of AUD and its treatment.

Declaration of competing interest

The authors declare that there is no conflict of interest to report.

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