

# The correlation of patients' anxiety after a liver or kidney transplantation with functional and self-reported work ability

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## Abstract

Organ transplantation has become the treatment of choice for end-stage organ failure, including renal and liver failure. The benefits of patient employment after transplantation are numerous, but factors determining the ability to work among these patients are not clearly defined. The growing interest in these factors has strong practical implications for organizations creating vocational rehabilitation programs. Given the interconnection between psychological and physical functioning in patients after transplantation, the present study examined the impact of anxiety on vocational rehabilitation and its relationship with functional tests. A total of 100 patients after liver or kidney transplantation underwent functional tests, including the 6-minute walking test and 30-second chair stand test (30" CST), and psychological tests, specifically the Inventory of Physical Activity Objectives, Work Ability Index, and State-Train Anxiety Inventory. Working ability was affected by psychological factors. State and trait anxiety exhibited inverse relationships with subjective readiness to occupational activity ( $P < .001$ ,  $r = -.59$  and  $P < .001$ ,  $r = -.56$ , respectively). The level of anxiety was negatively related to the results of the 30" CST. State-Train Anxiety Inventory, State Anxiety subscale and State-Train Anxiety Inventory, State-Trait Anxiety subscale vs 30" CST:  $P < .001$ ,  $r = -.43$   $P < .001$ ,  $r = -.44$ ). Thus, state and trait anxiety influence perceived work ability and partially functional status. These observations may indicate the potential benefits of including psychologists in interdisciplinary teams for physical and especially vocational rehabilitation of patients after liver or kidney transplantation.

**Abbreviations:** 30" CST = 30-second chair stand test, IPAQ = Inventory of Physical Activity Objectives, STAI = State-Train Anxiety Inventory, STAI X1 = State-Train Anxiety Inventory, State Anxiety subscale, STAI X2 = State-Train Anxiety Inventory, Trait Anxiety subscale, Tx = organ transplantation, WAI = Work Ability Index.

**Keywords:** anxiety, occupational health, transplantation, vocational rehabilitation

## 1. Introduction

Organ transplantation is the current treatment of choice in end-stage organ failure, including renal and liver failure. Over the last

few years, as a result of advances in medicine and technology, as well as increasing experience, the percentage of patients surviving the first year after liver transplantation has reached 90%. The long-term life expectancy in these patients could exceed 20 years.<sup>[1]</sup> The 10-year survival rate for kidney transplant recipients varies from 43% to 74% depending on the country.<sup>[2-4]</sup> Organ replacement therapy compensates for the loss of organ function and enables recipients to return to a productive vocational life, despite a life-long immunosuppressive regimen and the side effects of this therapy.<sup>[5]</sup> According to recommendations, after liver transplantation, patients may return to the workforce when the incision has healed and the patient is able to perform activities of daily living; this is usually achieved during the first 6 months after transplantation.<sup>[6]</sup> The benefits of employment after transplantation are numerous, but factors determining the ability to work in this group of patients are not clearly defined.<sup>[1,7-11]</sup>

Psychological factors should always be considered in post-transplantation rehabilitation, especially vocational rehabilitation. Disease and surgical intervention, as well as rehabilitation itself, are stressors related to adaptational stress,<sup>[12]</sup> 30% to 60% of patients may suffer from mood disorders or anxiety disorders.<sup>[13]</sup> Depression and anxiety affect an individual's psychosocial and occupational functioning. Symptoms of anxiety (e.g., extensive worrying) are associated with poor employment outcomes.<sup>[14]</sup> On the other hand, previous studies have suggested that the adaptational potential of patients after transplantation may be the same as in the general population.<sup>[15]</sup> Research on post-transplantation quality of life suggest that the main dimensions of post-transplantation adaptational processes are

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immunosuppressor intake, integration with the local community, higher income/education, occupational possibilities, and older age (for psychological quality of life).<sup>[13]</sup> However, the possible interactions of these factors are not clear.

The aim of the present study was to assess the impact of anxiety on vocational rehabilitation and its relationship with functional tests.

## 2. Methods

### 2.1. Patients

The Ethics Committee of the Medical University of Warsaw, Poland, approved the experimental protocol (No. KB/7/A/2018). During recruitment, every patient provided written consent to participate in the study. The inclusion criteria were: age between 18 and 45 years old, liver or kidney transplantation 1 to 5 years prior and having a disability certificate. The exclusion criterion was the state of health preventing functional tests from being performed. The age range was established to select those of working age. All patients meeting the inclusion criteria and who gave their written consent were included in the study.

### 2.2. Measures

This study used a cross-sectional study survey design. Patients underwent functional tests and completed standardized questionnaires. The functional tests included the 6-minute walking test, which is widely used as a test of functional exercise capacity<sup>[16,17]</sup> and the 30-second chair stand test (30" CST), which is a reliable method for assessing lower extremity strength.<sup>[18,19]</sup> Both functional tests were conducted in accordance with the guidelines described in the literature. The standardized questionnaires used in the study were the Inventory of Physical Activity Objectives (IPAO), Work Ability Index (WAI), and State-Trait Anxiety Inventory (STAI). The IPAO is a new method for measuring motives for physical activity and sport and is characterized by good psychometric properties (Cronbach  $\alpha$  reliability coefficient reached 0.78). The IPAO questionnaire consists of 16 questions which distinguishes the following scales: motivational value, time management, persistence in action, and motivational conflict. The scores were calculated by summing the results of individual questions and converting them into sten value according to the instructions from authors.<sup>[20]</sup> The IPAO scores were calculated considering 1 to 3 as low, 4 to 6 as average, and 7 to 10 as high. The WAI was created to measure the perceptions of workers regarding their physical, mental, and social health and their ability to cope with job demands. It is the most used and well-accepted instrument for measuring work ability, as demonstrated by its availability in 21 languages. The WAI is a summary measure of 7 items. The total score is in the range between 7 and 49 points. The score below 27 points is defined as "bad work ability", between 28 and 36 is defined as "moderate work ability", between 37 and 43 as a "good work ability", and more than 44 points as a "very good work ability".<sup>[21]</sup> The STAI was designed to evaluate anxiety in 2 dimensions. State anxiety is a temporary emotional state, whereas trait anxiety is an aspect of personality connected mainly to a personal tendency to worry. The 20-item state anxiety subscale (X1) and 20-item trait anxiety subscale (X2) represent 2 different dimensions of anxiety. Each item on the X1 and X2 is measured on a 4-point Likert scale. The total score is in the range

between 20 and 80 points. The scores were interpreted according to standards for patients after hospital rehabilitation. The results between 20 and 29 on the X1 scale and between 20 and 37 on the X2 scale were interpreted as "low level of anxiety", results between 30 and 40 on X1 scale and between 38 and 45 on X2 scale as "average level of anxiety" and between 41 and 80 on X1 scale and 46 and 80 on X2 scale as "high level of anxiety".<sup>[22]</sup>

The investigation was performed between February and October 2018 in the outpatient clinic of the Department of Immunology, Transplantology, and Internal Diseases, Medical University of Warsaw, and the Department of General, Transplant, and Liver Surgery, Medical University of Warsaw.

### 2.3. Statistical analysis

Data collected in the study were calculated using R package version 3.4.3. Categorical variables were described by count and percentage, whereas continuous variables were described by median, first and third quartile, minimum, maximum, and arithmetic mean with standard deviation (SD). The non-parametric Mann-Whitney *U* test was used to compare continuous variables between groups of patients after liver and kidney transplantation. Numerical data were inspected visually on scatter plots, revealing rather linear relations, so the Pearson correlation coefficients were calculated. A  $P \leq .05$  was considered significant. The size of correlation coefficient was interpreted as follows: .90 to 1.00 (−.90 to −1.00) – very high positive (negative) correlation; .70 to .90 (−.70 to −.90) – high positive (negative) correlation; .50 to .70 (−.50 to −.70) – moderate positive (negative) correlation; .30 to .50 (−.30 to −.50) – low positive (negative) correlation; .00 to .30 (.00 to −.30) – negligible correlation.<sup>[23]</sup>

## 3. Results

The cohort consisted of 100 patients (39 females and 61 males) who underwent kidney Tx (organ transplantation) ( $n=72$ ) or liver Tx ( $n=28$ ) 1 to 5 years prior. All of the patients were between 18 and 45 (mean  $35 \pm 6.7$ ) years of age and had a disability certificate at the time of recruitment.

### 3.1. Patients after kidney Tx

The average number of points on STAI X1 and X2 corresponds to the average level of anxiety. On the STAI X1 scale 29.2% of patients after kidney Tx had a low level of anxiety, 43.1% an average level of anxiety and 27.7% a high level of anxiety. On the STAI X2 scale 51.5% of patients after kidney Tx had a low level of anxiety, 28.8% an average level of anxiety, and 19.7% a high level of anxiety.

In the IPAO questionnaire the motivational value was low in 60% of patients after kidney Tx, average in 38% of patients, and high in 2% of patients. The persistent in action value was low in 68% of patients after kidney Tx, average in 26% of patients, and high in 6% of patients. The time management value was low in 72% of patients after kidney Tx, and average in 28% of patients. The motivational conflict value was low in 18% of patients after kidney Tx, average in 47% of patients, and high in 35% of patients.

The results for working ability in the kidney Tx group were as follows: low, 16.7%; average, 35.7%; good, 40.5%; and very good, 7.1%.

### 3.2. Patients after liver Tx

On the STAI X1 scale 17.9% of patients after liver Tx had a low level of anxiety, 35.7% an average level of anxiety, and 46.4% a high level of anxiety. On the STAI X2 scale 44.4% of patients after liver Tx had a low level of anxiety, 29.6% an average level of anxiety, and 25.9% a high level of anxiety.

The motivational value was low in 34% of patients after liver Tx, average in 54% of patients, and high in 3% of patients. The persistent in action value was low in 71% of patients after liver Tx, average in 25% of patients, and high in 4% of patients. The time management value was low in 68% of patients after liver Tx, and average in 32% of patients. The motivational conflict value was low in 11% of patients after liver Tx, average in 50% of patients, and high in 39% of patients.

The results for working ability in the liver Tx group were as follows: low, 33.3%; average, 42.9%; and good, 23.8%.

### 3.3. Comparison between kidney Tx group and liver Tx group

The results of the psychological and functional tests and the differences between the last 2 transplant groups are given in Table 1. There were no differences between study groups in all parameters tested, with the exception of the 30" CST ( $P=.012$ ).

Due to the lack of differences between study groups in most parameters tested, the correlations between the results of the STAI X1 and STAI X2 and other investigated parameters were calculated for both examined groups together. They are given in Table 2. The results of both state and trait anxiety subscale were moderate negatively correlated with working ability and low negatively correlated with persistence in action and number of repetitions in 30" CST.

The distance in the 6-minute walking test significantly correlated with the number of repetitions in the 30" CST ( $P=.002$ ;  $r=.32$ ). No significant relationships were found between STAI X1 and X2 and other factors assessed by the IPAQ.

### 4. Discussion

The results obtained in this study indicate that working ability is affected by psychological factors. In addition to a better material situation and higher self-esteem<sup>[9]</sup> research indicates that patients employed after transplantation have better quality of life than patients who are unemployed.<sup>[7]</sup> Full-time employment at the time of renal transplantation and 1 year post-transplant is also associated with a lower risk for graft failure and recipient mortality.<sup>[8]</sup> Therefore, complex vocational rehabilitation should be considered in the post-transplantation treatment. However, designing an appropriate rehabilitation program is still challenging due to factors determining work ability in this group of patients not being clearly defined. The results obtained in this study indicate that state and trait anxiety exhibit inverse relationships with subjective readiness to occupational activity. This outcome is consistent with the evolutionary function of anxiety of preparing for possible danger and processing information that may be important to avoid adverse outcomes.<sup>[24]</sup> The relationship between psychological factors and returning to work of patients after long-term illness is confirmed by previous studies. Stendardo et al found that a lower value of depression score increase the probability of a quicker return to work in patients after acute myocardial infarction.<sup>[25]</sup> Van der Kemp et al showed that depressive symptoms were associated with return to work after mild-to-moderate stroke.<sup>[26]</sup>

Anxiety influences decision-making, leading to a more detailed analysis of the task/situation.<sup>[27]</sup> As a result, anxious subjects may

**Table 1**  
The results of psychological and functional test in the investigated group, and among patients after kidney or liver transplantation and the differences between the last two groups.

Test	Total (n=100)	Kidney Tx (n=72)	Liver Tx (n=28)	P	
STAI X1	37.5±9.9	36.5±9.4	39.6±10.6	.167	
STAI X2	38.8±9	38.4±9.7	39.6±7.2	.433	
IPAQ	Persistence in action	9.1±2.8	9.2±2.9	8.8±2.5	.673
	Motivational value	26.9±5.6	26.4±5.8	28.1±5.1	.829
	Time management	13.6±4.1	13.5±4.2	13.8±4.1	.61
	Motivational conflict	6.6±2.1	6.4±2.2	7.1±1.9	.314
WAI	30.2±6.8	31±6.9	28.5±6.2	.124	
6MWT, m	539±114	534.5±90.5	550.3±160	.828	
30" CST, number of repetitions	18.7±5.2	19.4±4.5	17.1±6.52	.012	

Data are presented as mean points± standard deviation unless otherwise noted.

30" CST = 30-second chair stand test, 6MWT = 6-minute walk test, IPAQ = Inventory of Physical Activity Objectives, STAI X1 = State-Trait Anxiety Inventory, State Anxiety subscale, STAI X2 = State-Trait Anxiety Inventory, Trait Anxiety subscale, Tx = transplantation, WAI = Work Ability Inventory.

**Table 2**  
Correlation between state and trait anxiety and the results of psychological and functional tests.

Test	IPAQ (persistence in action)	WAI	6MWT	30" CST
STAI X 1	$P=.004$ $r=-.3$	$P<.001$ $r=-.59$	$P=.297$ $r=-.11$	$P<.001$ $r=-.43$
STAI X 2	$P=.043$ $r=-.22$	$P<.001$ $r=-.56$	$P=.04$ $r=-.22$	$P<.001$ $r=-.44$

6MWT = 6-minute walking test; 30" CST = 30-second chair stand test, IPAQ = Inventory of Physical Activity Objectives, STAI X 2 = State-Trait Anxiety Inventory, Trait Anxiety subscale, STAI X1 = State-Trait Anxiety Inventory, State Anxiety subscale, WAI = Work Ability Inventory.

be more avoidant, and they are generally prone to treating environmental demands more like dangers than positive challenges.<sup>[28]</sup> Returning to work after surgical intervention may be seen as stressful and environmentally demanding. General theories of stress underline the transaction between perceived coping resources and environmental demands.<sup>[29]</sup> The lower the perceived resources, the higher the expected level of stress. However, the levels reported in the present study indicate that anxious arousal may be logically related to some indicators of physical performance (e.g., 30°CST).

Fears about exercise and avoidance behaviors were common among patients with chronic diseases. Similar observations were made by Farris et al in patients undergoing pulmonary and cardiac rehabilitation; fears and avoidance of exercise were correlated with higher levels of anxiety and depression and stronger beliefs about the utility of anxiety. Practitioners estimated that an average  $47\% \pm 20\%$  of patients experience fear associated with exercise, reporting low feelings of preparedness to address patient anxiety and fear.<sup>[30]</sup> On the other hand Trinderup et al found that high fear avoidance beliefs about work were associated with continuous sick leave after 1 year in patients with chronic low back pain.<sup>[31]</sup> This finding might assist clinicians in choosing targeted treatment strategies in subgroups of working patients with chronic low back pain. These observations indicate the potential benefits of including psychologists in interdisciplinary teams for physical and social rehabilitation after liver or kidney transplantation. It could also be a milestone in the creation of vocational rehabilitation programs in this group of patients. An additional justification for the need to include a psychologist in the rehabilitation team is the motivational value assessed in IPAO test. Although there was no relationship between anxiety and motivational value, this indicator was low or average in the majority of patients in both groups. Only individual patients were highly motivated to engage in physical activity.

Persistence in taking actions is inhibited by anxiety and personality-related readiness to react with anxious states. As mentioned previously, external demands may be appraised as dangers or challenges. When one faces the environmental demand, the level of perceived stress can increase motivation, but when stressful arousal reaches the individual tolerance threshold, the effectiveness of coping can be diminished.<sup>[32]</sup> Subjects with a more constant tendency for avoidant reactions may be suspected of psychological disorders.

To summarize the psychological factors related to work ability, state and trait anxiety influence perceived work ability and functional status. However, anxiety itself can theoretically promote an increase in activity or avoidance, depending on the individual's stress threshold and coping strategies. Further considerations may promote the Job Demands-Resources model<sup>[32]</sup> to better understand work ability in patients after transplantation. Data from the present study indicate psychological factors affecting work ability, such as emotional factors, which can support future usefulness of the Job Demands-Resources model. This possibility should be investigated in future research. Another question that can be addressed pertains to replication of the present study design in a larger sample, which may address the research problem more clearly.

#### 4.1. Limitations

In the present study, authors did not screen for mental disorders; however, subjects with such problems could be involved in both study groups. Both groups can consist of persons for whom

similar levels of anxious arousal can lead to motivation or avoidance. Thus, it may be fruitful to control for stress-coping strategies in further research. Another limitation could be sample size, but the age range of the participants and period after transplantation were established to unify the study group to increase the accuracy of the study.

## 5. Conclusion

State and trait anxiety influence perceived work ability and partially a functional status. These observations indicate the potential benefits of including psychologists in interdisciplinary teams for physical and especially vocational rehabilitation of patients after liver or kidney transplantation.

## Author contributions

**Conceptualization:** Katarzyna Wesolowska-Gorniak, Jacek Gierus, Bożena Czarkowska-Paczek.

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