KAISU PAULANTO, PEKKA RAPELI, HENRIK MANNERSTRÖM, NIINA PUUSTINEN, KATINKA TUISKU

THE RELATIONSHIP OF COMPUTERIZED COGNITIVE TEST PERFORMANCE AND RESILIENCE TO WORKING ABILITY AMONG PATIENTS WITH PSYCHIATRIC DISORDERS

ABSTRACT

***Purpose**: We have earlier shown that the ability to work is associated with higher resilience. The aim of this study was to examine whether computerized cognitive test performance distinguishes between clinically defined work ability groups, and how these differences compare to previously established differences in resilience within the same sample. **Methods**: In order to examine these issues in a real-life context, we gathered a sample of 150 consecutive patients between February 2016 and March 2017, who had been referred for a comprehensive psychiatric multidisciplinary assessment of work ability. The subjective, self-rated Resilience Scale and objective, computerized cognitive CANTAB test battery measures of function were compared between three work ability groups: fit for work (28%), partially fit for work (51%) and unfit for work (21%). **Results**: Overall, the unfit group showed the poorest performance on the visual learning task as measured by the Paired Associates Learning (PAL) test, with statistically significant differences observed between the groups. In contrast, the fit for work group displayed significantly higher resilience compared with the partially fit and unfit groups. **Conclusion**: Resilience, rather than objective cognitive test performance, distinguished between patients assessed as fit for work versus those assessed as partially fit or unfit. These findings underscore the importance of addressing resilience within rehabilitation and returntowork interventions. Computerbased neuropsychological test batteries should be interpreted cautiously and used as part of a broader, multidisciplinary assessment when evaluating work ability.*

KEYWORDS: WORK ABILITY, RESILIENCE, CANTAB, COGNITIVE FUNCTION, PSYCHIATRIC DISORDERS

INTRODUCTION

In psychiatric assessments of work ability, the patients' subjective perceptions of their abilities, strengths and symptoms are collected via an interview and often via different structured questionnaires. Self-assessment tools organize the information already gathered and provide information on prognostic self-conceptions and coping resources [1].

The self-evaluation of psychiatric patients is less accurate and varies more than that of the average population. Their responses to subjective questionnaires may reflect fears of returning to work, lack of self-efficacy, lack of insight or expected social secondary gain [2]. Work anxiety may affect their symptom reporting [3]. Depressive patients typically have negative self-expectations [4] and personality disorders often involve difficulties in self-observation [5].

When evaluating psychiatric work ability, data obtained from self-repost measures should be supplemented by other sources of information such as informant reports, observations of behaviour in structured situations and life–outcome data [5]. Standardized cognitive performance tests are also an important source of objective information [6], in addition to anamnestic information on education and work history [7].

In the psychiatric context, the degree and quality of the discrepancy between subjective and objective functional ability is an elementary finding. Although objective findings are essential signs of function, complementary self-assessment tools are helpful in opening the dialogue on the subjective and psychosocial aspects affecting psychiatric rehabilitation and recovery [2]. Psychiatric patients' neuropsychological difficulties are often non-specific and associated with the severity of psychiatric disorders [8] and thus need to be contextualized with other clinical data [7].

Resilience (mental load tolerance, mental flexibility, ability to cope with adversity) has emerged as a psychological concept that is associated with, among other things, depression and recovery from brain injuries [9]. Resilience can be measured using the Resilience scale-14 (RS-14), which has been found suitable for middle-aged patients [10]. Recent scientific literature has found a strong association between resilience and quality of life in people with mental disorders [11].

As a sub-concept of work ability, the term fit for work was originally adopted to change the focus from inability to the remaining ability, considering the specific work of employee [12]. The term work ability is more commonly used in Finland. The idea of residual, or remaining work capacity as well as the fit definitions are quite new [13].

The concept of remaining work ability can also be applied to unemployed persons. The change of paradigm is to assess what the unemployed person can do, or could do with adequate support, rather than focusing on disability. The idea of resource-oriented assessment of work ability is to find out the resources, strengths and remaining work ability [1]. Therefore, in this study we categorized individuals in three groups, fit for work, partially fit and unfit for work according to their work ability apart from their current employment status.

In the previous analysis of this same clinical sample, self-reported resilience (RS-14) was found to be strongly associated with work ability, with significantly higher resilience observed in individuals classified as fit for work compared to those partially fit or unfit [7]. Thus, the association between resilience and work ability in this dataset is already established.

Given that multidisciplinary assessments of work ability already integrate multiple sources of subjective and objective information, it is important to examine the relative contribution of specific assessment methods. Clarifying the role of computerized cognitive testing may help to evaluate its clinical utility as part of a comprehensive assessment process.

Therefore, the aim of this study was to examine whether computerized cognitive test performance (CANTAB) distinguishes between clinically defined work ability groups, and how these differences compare to previously established differences in resilience (RS-14) within the same sample.

METHODS

STUDY FRAME AND ETHICS

We collected data as part of a clinical assessment in the Outpatient Clinic for Assessment of Ability to Work at Helsinki University Hospital (HUS), Finland. The study sample consisted of patients referred to a tertiary-level outpatient unit in specialized psychiatric care specifically for psychiatric work ability assessment. The patients had a prolonged and/or severe disability and their functional status or work ability was contradictory. We obtained ethical approval for the study from the Ethics Committee of Helsinki University Hospital (HUS/81/2017 § 265).

PARTICIPANTS AND PROCEDURE

From February 2016 to March 2017, a total of 248 referrals to the Outpatient Clinic for Assessment of Ability to Work at HUS from occupational health services (37%), public sector specialized care (40%), private practice (9%) or other (14%). The sample (n=150) consisted of Finnish-speaking patients, who completed a profound multidisciplinary clinical assessment and who were able to complete computerized cognitive tests CANTAB (*Figure 1*).

The judgement about being fit, partially fit or unfit for work was based on the following assessment protocol. The psychiatric specialized unit team collected subjective and objective information on the patients. The subjective measures included a lifespan interview conducted by a nurse, various self-report symptom scales and structured SCID I [14] and SCID II [15] diagnostic interviews by psychiatrists, under the supervision of the deputy Chief Psychiatrist. A social worker subsequently collected objective information on the patient's education and employment history. When a more detailed and objective evaluation of functional capacity was indicated, assessments were undertaken by a clinical psychologist, neuropsychologist, occupational therapist or through multidisciplinary collaboration among these professionals, as appropriate. Furthermore, the patient's close ones were interviewed to get information about their daily life and functioning at home. Our clinical protocol included collaboration with occupational healthcare, workplace and employment services (*Table 1*). The assessment period lasted from one to two months and was followed by conclusions of the patient's work ability, as well as a re-evaluation of diagnosis, illness severity, comorbidity and rehabilitation planning with the patient.

Figure 1. Research procedure in the psychiatric specialized unit for assessment of work ability at HUS

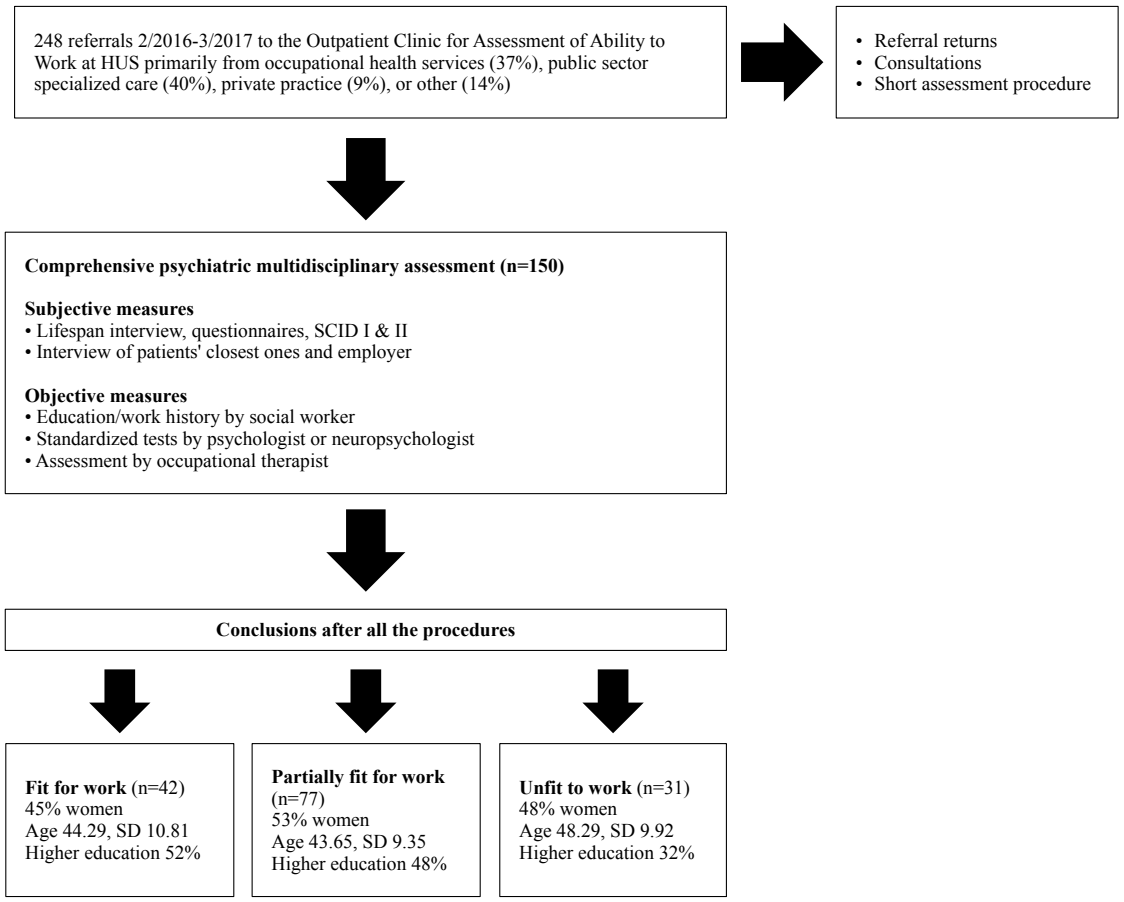


Table 1. Subjective and objective measures of function in psychiatric work ability assessment

	Subjective measures of function	Objective measures of function
Structured situation	Questionnaires Self-assessment tools	The standardized tests of psychologist or neuropsychologist (for example CANTAB)
Half-structured situation	Anamnesis by patient A lifespan interview An interview with the patient´s relative, spouse or employer	Education, work history An assessment of occupational therapist Patient´s behaviour SCID I, SCID-II + Clinical perceptions of psychiatric status

All the patients were diagnosed in accordance with the ICD-10 system [16]. Based on the conclusions following the assessment procedures, the patients were classified into three work ability groups by the consensus of multiprofessional team assessment with network collaboration: fit for work (28%, the "Fit" group, whose psychiatric illness does not affect their ability to work), partially fit for work (51%, the "Partially fit" group, who can be rehabilitated for working life) and unable to work (21%, the "Unfit for work" group, who are permanently unable to work). There were no statistically significant differences in terms of age, sex or education (X^2=5.60; df=4; p=.23) among the three work ability groups in this dataset. *Table 2* presents the psychiatric patients' diagnosis groups and work ability.

MEASURES

Objective ability was assessed using selected CANTAB tests [17,18], which are described below:

Attention Switching Task (AST) measures cued attentional set shifting. The participant is cued to react according to stimulus features or stimulus position, and part of the time the response rule is switching between the two. We considered the % correct responses (bigger is better).

Paired Associates Learning (PAL) is a visual learning task where the participant must learn to associate a visual stimulus with a specific location. The task proceeds relentlessly and becomes incrementally harder as the number of stimuli increases. We considered total errors summed over all trials (smaller is better).

Rapid Visual Information Processing (RVP) requires sustained and divided attention, processing speed and working memory to simultaneously detect three target sequences from background noise in a fast-paced task. We considered measure A, which is a single-variable measure of how well the participant is detecting the target sequences and rejecting non-targets (bigger is better) and total false (smaller is better).

Spatial Working Memory (SWM) requires retention of visuospatial information in a search task and manipulation of remembered items in working memory to avoid repeating past actions. There is no time pressure, but as a self-ordered task it requires formation of a heuristic strategy. We considered the number of between-search errors (smaller is better) and the ability to employ a heuristic strategy (smaller is better).

In addition to cognitive tests the patient's subjective resilience was measured using the Resilience questionnaire, the RS-14. The RS-14 questionnaire includes 14 questions and 5 subcategories: purpose, perseverance, equanimity, self-reliance and existential aloneness (authenticity). The maximum score is 98 points and the lowest 14. Scores in the 14– 56 range are classified as very low, 57–64 as low and 65–73 at the low end. Moderate scores range between 74 and 81 [10]. The psychometric properties of the RS-14 have been found to be good: internal consistency reliability, .87 [9]. Full description of methods is presented in a previous publication [7].

Both the RS-14 and Cambridge Cognition tests CANTAB were supervised by the author, neuropsychologist K.P.

Table 2. Diagnosis groups and work ability of the psychiatric patients

Diagnosis group (primary)	**Fit for work (n=42)**	**Partially fit (n=77)**	**Unfit for work (n=31)**
Mood disorders	9 (21.43%)	57 (74.03%)	17 (54.84%)
Anxiety disorders	13 (30.95%)	10 (12.99%)	4 (12.90%)
Psychosis spectrum	1 (2.38%)	4 (5.19%)	6 (19.35%)
Substance abuse	2 (4.76%)	1 (1.30%)	1 (3.23%)
Personality disorders [a]	9 (21.43%)	1 (1.30%)	2 (6.45%)
Other psychiatric	8 (19.05%)	4 (5.19%)	1 (3.23%)
Total	**42 (100%)**	**77 (100%)**	**31 (100%)**

[a] Primary personality disorder had 12 patients. Comorbid personality disorder had 52 patients

DATA ANALYSIS

The outcomes were analysed with the R statistical program using parametric and non-parametric tests. The continuous outcomes RS-14, RVP A and AST were analysed using the non-parametric Mann–Whitney U-test (Wilcoxon rank-sum test). The U-test was chosen because of small group sizes and non-normal data. The count-based outcomes PAL, RVP total false, SWM between-search errors and SWM strategy were analysed with negative binomial regression. Count-based outcomes are discrete, bounded from below at zero and positively slanted, all of which makes the negative binomial regression a better choice than the U-test.

The non-parametric analysis proceeded in two stages: first, the overall null hypothesis of any differences between the groups was tested with the Kruskal–Wallis test. If the null hypothesis was rejected, all pairwise differences were tested with U-tests and the p-values were Bonferroni corrected. Likewise, the parametric negative binomial regression analysis was performed by first testing the overall null hypothesis with an analysis of variance (ANOVA) as implemented in the MASS package (Venables). If a statistically significant difference was found, Tukey's HSD test was used to analyse all pairwise differences. As 42.7% of the sample had a personality disorder, we also examined their resilience separately.

RESULTS

THE RELATIONSHIP BETWEEN COGNITIVE TEST PERFORMANCE AND WORK ABILITY

For most of the cognitive tests no statistically significant differences between the groups were found. These included Attention Switching task (AST), Rapid Visual Information Processing (RVP) A, Spatial Working Memory (SWM), both between-search errors and strategy.

The Paired Associates Learning (PAL, See *Table 3*) score showed a statistically significant group effect ($p<0.001$). The pairwise comparisons revealed significant differences between Unfit vs. Fit ($p<0.05$) and Unfit vs. Partially fit ($p<0.01$). Patients with better work ability performed better on the PAL test. The difference between Fit and Partially fit was not statistically significant. RVP total false had a statistically significant group effect ($p<0.01$) but none of the pairwise differences reached the statistical threshold.

RESILIENCE AND PERSONALITY DISORDER

As noted before, the fit group had better resilience than the two other groups [7]: Fit for work group (M=72.93), Partially fit (M=56.14), Unfit group (M=52.61). The pairwise tests revealed statistically significant differences between the Fit and the Partially fit ($p<0.001$) as well as the Fit and the Unfit ($p<0.001$).

In our sample 64 (42.7%) of the patients had a primary (12 patients) or comorbid (52 patients) personality disorder: Fit for work group (n=20, 48%), Partially fit (n= 32, 42%) and Unfit group (n=12, 39%). Patients with a primary or comorbid diagnosis of a personality disorder also evaluated their resilience as very low (M=53.03; SD=17.8), which differed highly significantly from those who did not have a personality disorder (M=65.38; SD=17.5) ($p<0.001$).

DISCUSSION

The aim of this study was to examine whether computerized cognitive test performance distinguishes between clinically defined work ability groups, and to compare these findings with previously established differences in resilience within the same sample.

The results showed that the Unfit for work group demonstrated poorer performance compared to the other groups, but only one cognitive variable, visual learning as measured by the Paired Associates Learning (PAL) test, differed significantly between the work ability groups.

Previous findings from this sample, resilience (RS-14) showed the clearest and most consistent differences between the groups. Individuals classified as fit for work reported significantly higher resilience than those classified as partially fit or unfit [7]. As 42.7% of the sample had a personality disorder, we also examined their resilience separately. Patients with a primary or comorbid diagnosis of a personality disorder also evaluated their resilience as very low.

Resilience emerged as the key factor differentiating those fully capable of working from others. The particularly low resilience among depressive patients or patients with a personality disorder, despite sometimes milder objective deficits, may reflect negative self-evaluations [4] or difficulties in self-observation [5].

Across different diagnoses, the severity of symptoms is often more decisive for work ability than the specific psychiatric diagnostic category. While psychotic disorders frequently involve disabling cognitive deficits [19], depression can also include enduring moderate impairment in executive functioning and attention between episodes [20].

Table 3. Demographic characteristics, Resilience (RS-14), Attention shifting task (AST), Paired Associates Learning (PAL), Rapid Visual Information Processing (RVP) and Spatial Working Memory (SWM) of the work ability groups

Variable	Fit for work		Partially fit		Unfit for work	
Group size (n)	42		77		31	
Female %	45		53		48	
University %	52		48		32	
	Mean	SD	Mean	SD	Mean	SD
Age	44	11	44	9.3	48	9.9
RS-14*	72.93	14	56.14	17	52.61	19
AST % correct	94	7.6	93	7.4	89	11
PAL total errors**	20	26	18	22	37	41
RVP A	0.87	0.058	0.88	0.047	0.86	0.056
RVP total false	1.8	3.6	2.4	9	5.1	7.5
SWM errors	28	22	31	20	39	20
SWM strategy	34	6.2	34	6.2	37	6

Note. RVP A n=148, RVP total false n=149, SWM errors and strategy n=149
*significant differences between the Fit and the Partially fit ($p<0.001$) as well as the Fit and the Unfit ($p<0.001$)
**significant differences Unfit vs. Fit ($p<0.05$) and Unfit vs. Partially ($p<0.01$)

STRENGTHS AND LIMITATIONS

A key strength of this study is that data were collected in a naturalistic, realworld setting by a multidisciplinary team. Both resilience and CANTAB data were gathered systematically. Although the database is eight years old, the core clinical issues encountered in psychiatric work ability evaluations remain largely unchanged, supporting the continued clinical relevance of these findings.

Limitations include unequal group sizes and the exclusion of four individuals unable to complete the cognitive tests, meaning the very lowest functioning patients were not represented. The patients of our study had a prolonged or severe disability and/or their functional status or work ability was contradictory, limiting full generalizability to typical occupational health populations with mild psychiatric symptoms. In a naturalistic study design there are always confounding factors, and therefore the results should be interpreted with caution. The analyses used only indicate that differences exist between the groups with respect to the variables examined. The group characteristics show that the group with impaired work ability was the oldest, had the lowest level of education and included the highest proportion of individuals with psychotic disorders.

PRACTICAL IMPLICATIONS

Our findings are clinically meaningful despite methodological challenges. Although CANTAB tests are well validated in experimental research, their utility in naturalistic clinical contexts has been questioned due to psychometric limitations [21,22]. This study supports the view that expectations regarding computerbased neuropsychological tests may be optimistic. PAL might be useful as part of broader neuropsychological assessment. For individuals with severe cognitive impairment (e.g. psychotic disorders or significant learning disabilities) or older age, broader neuropsychological assessment is useful. A neuropsychological assessment is particularly important when a decline in cognitive functioning is suspected in some domains. It can also be used to objectively evaluate the severity of a psychiatric disorder, but contribution should be considered

critically and integrated into a broader, multidisciplinary assessment framework (see *Table 1*).

When disability is primarily driven by cognitive impairment, treatment and rehabilitation should target cognitive deficits and their functional impact. Returntowork planning should include work modifications that accommodate permanent limitations.

When low resilience is the main barrier to work, the focus should shift to enhancing psychological resources through psychotherapy and gradual, supportive work reentry. Even when symptoms or deficits cannot be fully resolved, strengthening resilience may improve returntowork outcomes.

Previous followup studies in similar samples have shown that both objective functional findings and subjective perceptions of capability predict work participation, suggesting that both perspectives reveal relevant rehabilitation targets [23,24].

In psychiatric assessment and rehabilitation, discrepancies between subjective and objective functioning are highly informative and should be discussed openly with patients to foster shared understanding and realistic goal setting. While objective findings are essential, selfassessment tools can facilitate conversations about the psychosocial factors influencing recovery [23,24].

Consistent with recent literature, variations in how resilience is defined and measured contribute to conceptual ambiguity [25]. Nonetheless, in psychiatric assessment it remains important to evaluate how patients perceive and manage adversity.

CONCLUSIONS

Our findings underscore the importance of integrating both subjective and objective assessment in psychiatric disability evaluations. While computerbased cognitive tests provide useful information, their clinical utility may be limited, and results should be interpreted within a broader multidisciplinary framework.

As Stephen Hawking, a model of resilience in the face of profound disability, noted: “However difficult life may seem, there is always something you can do and succeed at. It matters that you just don't give up.”

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Conflict of Interest

The authors declare that they have no conflict of interest.

Authors

Kaisu Paulanto[1]
Pekka Rapeli[1]
Henrik Mannerström
Niina Puustinen[1]
Katinka Tuisku[1]

[1]Psychiatry, Helsinki University and Helsinki University Hospital, Helsinki, Finland

Correspondence

Kaisu Paulanto
HUS, Helsinki University Hospital, Outpatient Clinic for Assessment of Ability to work, Maistraatinportti 2 (5th floor), PB 250, 00029 HUS, Finland

E-mail: kaisu.paulanto@hus.fi

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