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The relationship between working memory and expressed emotion in the related caregivers of psychotic patients

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ABSTRACT

Objective: To investigate the relationship between Expressed Emotion (EE) and working memory (WM) capacity in the caregivers of patients with psychosis, controlling for the potential confounds, namely, personality traits, subsyndromal psychotic symptoms, burden of care and the patient's illness severity.

Materials and Methods: The study covered 152 related caregivers of psychotic patients diagnosed with schizophrenia, schizoaffective disorder, or bipolar disorder with a psychotic component. The study continued with 120 participants who met the recruitment criteria. Patients were assessed with a Structured Clinical Interview for Axis I Disorders (SCID-I), the Brief Psychiatric Rating Scale (BPRS), and the Clinical Global Impression Scale (CGI). For related caregivers; SCID-I, Expressed Emotion Scale (EES), Temperament and Character Inventory (TCI); Magical Ideation Scale; Physical Anhedonia Scale; Social Anhedonia Scale; Zarit Caregiver Burden Scale (ZCBS), and Auditory Consonant Trigram Test (ACT) were used. A stepwise regression analysis was employed to analyze the relevant variables that had an independent impact on EES scores.

Results: There was a significant negative relationship between the ACT and EES scores ($r=-.25$, $p<0.01$). The ZCBS score (beta: 0.355, $p<0.01$), Harm Avoidance subscale of the TCI (beta: 0.231, $p<0.01$), and CGI overall improvement subscale (beta: 0.237, $p<0.01$) were independently associated with the EES score.

Conclusions: There have been few studies investigating the biological basis of this clinical characteristic. The present study found no significant relationship between WM and EE in terms of the effect of WM in the caregivers of patients with psychosis.

Keywords: Caregivers, Endophenotype, Expressed Emotion, Psychotic Disorders, Working Memory

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INTRODUCTION

The concurrent use of clinical and neurocognitive measurements is beneficial for identifying risk in individuals who are relatives of patients with psychotic disorders, and this method can improve the likelihood of a timely diagnosis (**1, 2**). The unaffected relatives of patients with schizophrenia or bipolar disorder exhibit cognitive deficits that are similar to those of the patients, which suggests that these deficits can be used as markers of a familial predisposition for psychotic disorders (**3, 4, 5**). Various types of cognitive dysfunction in patients with schizophrenia and bipolar disorder have been evaluated as candidates for the endophenotypes of psychotic disorders (**2**). Attention, verbal memory, and working memory (WM) emerged as crucial factors that meet the criteria for a potential endophenotype, and WM, a primary neurocognitive function that stores limited information for later use in more complex cognitive tasks, appears to be the most critical component (**2, 6, 7**).

Communication, interpersonal relationships, social interaction, problem-solving, and behavioral preferences are information-processing operations that require intact WM (**8, 9**). These functions are the products of the cognitive and emotional processing of social stimuli that precede the choice of a corresponding response (**8, 9**).

The high levels of expressed emotion (EE) exhibited by the relatives of psychotic patients in clinical settings and during laboratory investigations have typically garnered a great deal of attention. This is likely because impairments in the emotions, thought processes, and behaviors of patients diagnosed with a psychotic disorder affect the family as a whole (**10**). On the other hand, tuning of the EE is a complex cognitive process determined by the caregiver individual's cognitive capacity alongside their experience with the patient. As basic cognitive abilities are among the endophenotypes of the disorder, the average caregiving family member with no history of psychosis could also have subtle cognitive deficits that impact the interactions with the patient. To our knowledge, the potential association between the levels of EE and cognitive abilities of the caregiver individuals has not been addressed in a controlled study before.

MATERIAL and METHODS

The present study included psychotic patients and their relatives who act as primary caregivers. All subjects were recruited from among patients who presented to the Schizophrenia and Other Psychotic Disorders Unite of Psychiatry outpatient Clinic in Ankara Oncology Training and Research Hospital and were diagnosed with schizophrenia, schizoaffective disorder, or bipolar disorder with manic–depressive episodes with a psychotic component and whose symptoms had subsided for at least three months. The patients and relatives who agreed to participate in this study were given information about the research, and all provided informed consent. The Ethics Committee of the Ankara Oncology Training and Research Hospital approved (Document No: 8329, Date: 13/06/2012) all aspects of this study. In total, 152 related caregivers of psychotic patients presented to the outpatient unit between June and December 2012 and who met the inclusion criteria were enrolled in this study.

The inclusion criteria for patients diagnosed with a psychiatric disorder were as follows: a diagnosis of schizophrenia, schizoaffective disorder, or bipolar disorder with manic–depressive episodes with a psychotic component (all diagnoses were based on the Structured Clinical Interview for Axis I Disorders [SCID-I] of the Diagnostic and Statistical Manual of Mental Disorders-IV[DSM-IV]); disease symptoms that had subsided for at least three months as the Clinical Global Impression (CGI) scale scores of 1, 2, or 3 were included; not hospitalized at the time of the study (if discharged, the patient must have been monitored regularly for at least one month by the treating physician); aged 18–65 years; not diagnosed with a psychotic disorder based on substance abuse or general medical status; and agreement that their relative may participate in the study. The inclusion criteria for the related caregivers of the patients were as follows: the patient had been diagnosed with schizophrenia, schizoaffective disorder, or bipolar disorder with manic–depressive episodes with a psychotic component; the relative providing primary care for the patient (together at least 35 hours per week); between 18 and 65 years of age; not diagnosed with dementia; agreement to participate; ability to read and write; and not diagnosed with schizophrenia, schizoaffective disorder, a psychotic disorder based on substance abuse or general medical status, or schizophreniform disorder.

For this study, the patients and their related caregivers were invited for a single interview in which the sociodemographic data of the patients and their relatives and the clinical history of the patients were recorded. The pharmacological treatments used by the patients did not interfere with the study objectives. Of the 152 patients included in the present study, 14 decided to resign, and 18 left some of the questions blank or completed the form without a complete understanding of the content (e.g., answering all questions with "yes" or "no"); thus, 32 patients were excluded from the study sample. Of the remaining 120 patients, 85 were diagnosed with schizophrenia or schizoaffective disorder, and 35 were diagnosed with bipolar disorder with psychosis. The sociodemographic and clinical data of the patients and related caregivers who refused to take part in the study or did not complete the forms properly were comparable to those of the patients and related caregivers who participated. As part of the study, the related caregivers were given 1) a sociodemographic data form and the following measures: 2) SCID-I; 3) Expressed Emotion Scale (EES); 4) Temperament and Character Inventory (TCI); 5) Magical Ideation Scale (MIS); 6) Physical Anhedonia Scale (PAS); 7) Social Anhedonia Scale (SAS); 8) Auditory Consonant Trigram Test (ACT); and 9) Zarit Caregiver Burden Scale (ZCBS). The patients were given 1) a sociodemographic data form and the following measures: 2) the Brief Psychiatric Rating Scale (BPRS) and 3) the CGI scale (assessed over the previous three months).

Scales and Measures

Expressed Emotion Scale (EES):

The EES is a 41-item scale (11); includes items regarding how the relatives of patients perceive the patient and themselves. Of the 41 items, 29 identify critical/hostile (CH) behavior, and 12 indicate over-involvement/protective/defensive (OIPD) attitudes. All questions are answered as "True" or "False" and are rated from 0 to 1, with higher scores indicating higher levels of EE. Some items are reverse scored so that the answer "False" is given one point (items 3, 8, 14, 28, 36, 38, 39, 40, and 41). Thus, the total score is between 0 and 41, with CH scores ranging from 0 to 29 and OIPD scores from 0 to 12. Examples of the items measuring CH behavior include "I don't believe he/she is sick" and "His/her presence makes me mad"; examples of the items evaluating OIPD attitudes include "I overindulge him/her" and "I am concerned that he/she will suffer from even minor things." No cut-off point for the scale has been established. The strength of the scale lies in the unique social and cultural characteristics considered when developing the items (**11, 12**).

Temperament and Character Inventory (TCI): The present study employed the 240-item version of the TCI based on the seven-factor personality model of Cloninger (**13, 14**).

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Physical Anhedonia Scale (PAS), Social Anhedonia Scale (SAS), and Magical Ideation Scale (MIS): PAS (15), the SAS (15, 16), and the MIS (17) assesses individual dimensions of schizotypy and evaluates an individual's risk of psychosis.

Auditory Consonant Trigram Test (ACT): The ACT measures short-term memory, split attention, and information-processing capacity in adults (18, 19) as well as verbal processing memory.

Zarit Caregiver Burden Scale (ZCBS): The ZCBS is used to measure the stress experienced by the caregivers of patients (20).

Statistical analysis

For all descriptive statistics, the mean ± standard deviation (SD) was used for variables with a normal distribution, and the median (min-max) was used for variables with a non-normal distribution. For nominal variables, the n and the percentages are presented. Significant differences between mean group values were assessed using Student's t-test, and significant differences between median group values were analyzed using the Mann–Whitney U-test. Pearson's Correlation test was used to evaluate the relationship between two continuous variables if the distribution was normal, and Spearman's Correlation test if it was non-normal. A stepwise regression analysis was employed to analyze the relevant variables that had an independent impact on EES scores. Statistical significance for all tests was set at $p < 0.05$.

RESULTS

Of the 120 patients included in the present study, 59 (49.2%) were female, and 61 (50.8%) were male; their mean age was 30.00±10.32 years, and mean time since diagnosis was 6.00±6.98 years. Of the patients, 95 (79.2%) were single, 17 (14.2%) were married, and 8 (6.7%) were divorced or widowed. There were no significant differences in the sociodemographic and clinical characteristics between patients with schizophrenia/ schizoaffective disorder and patients with bipolar disorder.

Of the relatives providing primary care included in the present study, 77 (64.2%) were female, and 43 (35.8%) were male; their mean age was 50 ± 11.141 years.

Their relationships to the patients were as follows: 52 (43.3%) were the patient's mother; 27 (22.5%) were the patient's father; 34 (28.3%) were a sibling of the patient, and seven (5.8%) were a child of the patient. There were no significant differences in the sociodemographic and clinical characteristics between the relatives providing primary care for patients with schizophrenia/schizoaffective disorder and those providing care for patients with bipolar disorder (**Table 1**).

When the mean scores of all scales were analyzed for caregivers, related caregivers of the patients with schizophrenia/schizoaffective disorder exhibited higher EES scores compared with the related caregivers of patients with bipolar disorder (p=0.02). However, the groups did not show any other significant differences except on ZCBS sub-factor 4 (Economic Burden) (p=0.01) and on the Harm Avoidance-1 subscale (p=0.00), the Harm Avoidance total score (p=0.01), the Self-Directedness-2 subscale (p=0.03), and the Self-Directedness total score (p=0.04) on the TCI.

Comparisons of the EES scores and sociodemographic characteristics of the related caregivers and the relationships among these factors: For relatives providing care to patients with bipolar disorder, the time from the emergence of symptoms to the presentation of the disorder (r = 0.56, p=0.00), the previous history of psychiatric disorders (p=0.03), and the marital status (p=0.01) of the patient were significantly related to the EES score. The age of the patient (r=0.29, p=0.00) and regularity of medication (p=0.00) in patients with schizophrenia/schizoaffective disorder were significantly related to the EES score of their related caregivers.

Analyses of the correlations of the EES scores with the age of the patient, time from the emergence of symptoms to the presentation of the disorder, and scores on the BPRS, CGI, ACT, MIS, SAS, PAS, ZCBS, and TCI are provided (**Tables 2**). There was a significant negative relationship between the ACT and EES scores for the entire group (r=-.25, p=0.00). When siblings were removed from the sample to obtain a group with greater genetic similarity and the analysis was repeated using only parent and child caregivers (n=86), the relationship between the ACT and EES scores was no longer statistically significant (r=-0.89, p=0.414). Similarly, there was no longer a significant relationship between the ACT and EES scores for the genetically first-degree relative caregivers from the schizophrenia/schizoaffective disorder group (r=-0.360, p=0.091) and the bipolar disorder group (r=0.022, p=0.0864).

To determine which of the factors that were found to be related to EE independently predicted EES score, the EES values for all caregivers were used as dependent variables in a stepwise regression analysis. The ZCBS score (beta: 0.355, p<0.01), Harm Avoidance subscale of the TCI (beta:0. 231, p<0.01), and CGI overall improvement subscale (beta: 0.237, p<0.01) were independently associated with the EES score.

Figure1. The relationship between ACT scores and EES scores. R2 Linear= 0.06

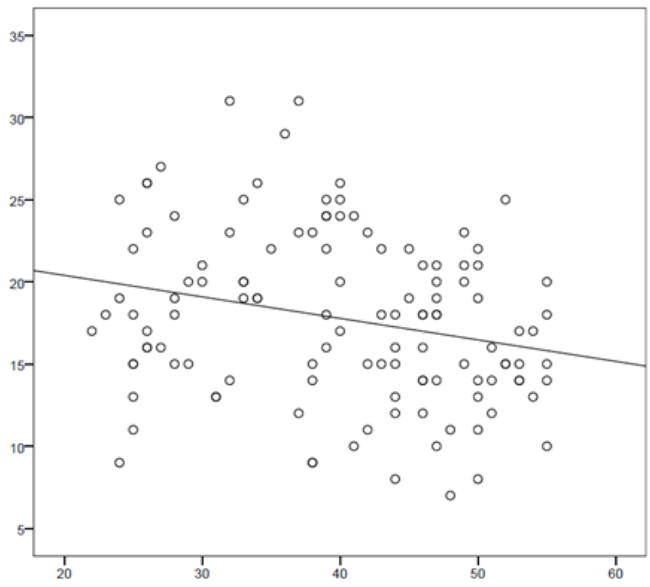

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Table 1. Sociodemographic and clinical characteristics of relatives providing primary care for patients with schizophrenia/schizoaffective disorder or patients with bipolar disorder.

	Overall group (*n*=120)	Bipolar disorder (*n*=35)	Schizophrenia/Schizoaffective üdisorder (*n*=85)	*P*-values
	mean ± SD (min–max) *n* (%)			
Age	50.00 ± 11.14 (18–68)	48.00 ± 11.43 (19–59)	50.00 ± 10.86 (18–68)	0.097
Sex[§] (Male/Female)	43/77 (35.8/64.2%)	11/24 (31.4/68.6%)	32/53 (37.6/6.4%)	0.518
Type of relationship[§]				
Mother	52 (43.3%)	12 (34.3%)	40 (47.1%)	0.534
Father	27 (22.5%)	8 (22.9%)	19 (22.4%)	
Sibling	34 (28.3%)	12 (34.3%)	22 (25.9%)	
Child	7 (5.8%)	3 (8.6%)	4 (4.7%)	
Education[§]				
Primary/secondary school	60 (50.0%)	13 (37.1%)	47 (5.3%)	0.145
High school	39 (32.5%)	13 (37.1%)	26 (30.6%)	
University and higher	21 (17.5%)	9 (25.7%)	12 (14.1%)	
Marital status[§]				
Single	28 (23.3%)	12 (34.3%)	16 (23.3%)	0.104
Married	82 (68.3%)	22 (62.9%)	60 (70.6%)	
Divorced/widowed	10 (8.3%)	1 (2.9%)	9 (10.6%)	
Occupation[§]				
Student	6 (5.0%)	3 (8.6%)	3 (3.5%)	0.064
Civil servant/worker	40 (33.3%)	14 (40.0%)	26 (30.6%)	
Housewife/unemployed	49 (40.8%)	8 (22.9%)	41 (48.2%)	
Retired	25 (20.8%)	10 (28.6%)	15 (17.6%)	
Currently employed[§]				
Employed	37 (30.8%)	13 (37.1%)	24 (28.2%)	0.337
Unemployed	83 (69.2%)	22 (62.9%)	61 (71.8%)	
Average income[§]				
≤minimum wage	34 (28.3%)	9 (25.7%)	25 (29.4%)	0.683
>minimum wage	86 (71.7%)	26 (74.3%)	60 (70.6%)	
Time from patient's symptoms to presentation (yr)[ε]	4.00 ± 13.77 (0.1–60.0)	3.00 ± 12.87 (0.1–36.0)	6.00 ± 14.19 (0.1–60.0)	0.656
Place lived[§]				
Metropolis/City	108 (90.0%)	30 (85.7%)	78 (91.8%)	0.329
Village/Town/District	12 (10.0%)	5 (14.3%)	7 (8.2%)	
Time spent with patient/week (hours)	168.00 ± 44.94 (40–168)	168.00 ± 46.33 (50–168)	168.00 ± 44.24 (40–168)	0.146
Past psychiatric disorder[§]				
Yes	31 (25.8%)	5 (14.3%)	26 (30.6%)	0.064
No	89 (74.2%)	30 (85.7%)	59 (69.4%)	

[§]Chi-square analysis; [ε]Mann–Whitney *U*-Test

Table 2. Analysis of the correlations between EES scores and BPRS, CGI, ACT, MIS, SAS, PAS, ZCBS, and TCI scores.

	ACT	EES
MIS	*r* = -.23.; *p* = 0.00	*r* = .12; *p* = 0.18
SAS	*r* = -.34; *p* = 0.00	*r* = .21; *p* = 0.01
PAS	*r* = -.19; *p* = 0.03	*r* = .11; *p* = 0.22
ZCBS-F1	*r* = -.10; *p* = 0.25	*r* = .49; *p* = 0.00
ZCBS-F2	*r* = -.05; *p* = 0.56	*r* = .44; *p* = 0.00
ZCBS-F3	*r* = -.16; *p* = 0.07	*r* = .43; *p* = 0.00
ZCBS-F4	*r* = -.22; *p* = 0.01	*r* = .49; *p* = 0.00
ZCBS-F5	*r* = -.09; *p* = 0.32	*r* = .43; *p* = 0.00
ZCBSTOTAL	*r* = -.12; *p* = 0.19	*r* = .53; *p* = 0.00
TCI-NSTOTAL	*r* = .01; *p* = 0.86	*r* = -.09; *p* = 0.29
TCI-HATOTAL	*r* = -.31; *p* = 0.00	*r* = .34; *p* = 0.00
TCI-RDTOTAL	*r* = .00; *p* = 0.94	*r* = -.22; *p* = 0.01
TCI-SDTOTAL	*r* = .23; *p* = 0.00	*r* = -.22; *p* = 0.01
TCI-COTOTAL	*r* = .20; *p* = 0.02	*r* = -.08; *p* = 0.34
TCI-STTOTAL	*r* = -.17; *p* = 0.055	*r* = .04; *p* = 0.61
TCI-PS	*r* = .10; *p* = 0.24	*r* = .13; *p* = 0.15
BPRS	*r* = -.02; *p* = 0.78	*r* = .24; *p* = 0.00

ACT, Auditory Consonant Trigram Test; **EES,** Expressed Emotions Scale; **BPRS,** Brief Psychiatric Rating Scale; **MIS,** Magical Ideation Scale; **PAS,** Physical Anhedonia Scale; **SAS,** Social Anhedonia Scale; **TCI,** Temperament and Character Inventory (**NS**, Novelty seeking; **HA**, Harm Avoidance; **RD**, Reward dependence; **SD**, Self-Directedness; **CO**, Cooperativeness; **ST**, Self-transcendence; **PS**, Persistence); **ZCBS**, Zarit Caregiver Burden Scale (**Factor 1**: Mental strains and impaired private life, **Factor 2**: Nervousness and restrictedness, **Factor 3**: Impaired social relationships, **Factor 4**: Financial burden, **Factor 5**: Dependency).

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DISCUSSION

Relatives providing primary care to patients with schizophrenia, schizoaffective disorder, or psychosis bipolar disorder who have been in remission for at least three months were included in this study. The primary goal of this study was to investigate the relationship between EE and WM in related caregivers that is independent of the care burden, personality traits, and subsyndromal psychotic symptoms of the related caregivers and the psychotic symptoms of the patients. The present findings revealed a negative correlation between scores on the ACT score, which assesses WM, and scores on the EES, which measures EE. This correlation disappeared when parent and child caregivers (groups with higher genetic similarity) were only analyzed.

Working memory can be considered as the basis of all cognitive functioning because it plays an active role in interpersonal communication, relationships, socializing, problem-solving skills, and the choice of behaviors, and it is required for the cognitive and emotional processing of social stimuli (**21**).

Therefore, it can be expected that impaired WM in a caregiver may interfere with that individual's communication and/or relationship with the patient. Impairments in WM are commonly observed among schizophrenic patients and their first-degree relatives and are thought of as a core deficit that contributes to other manifestations of the disorder (**22, 23, 24**). Additionally, WM deficits have been described as a key endophenotype in patients with schizophrenia (**25, 26, 27**). Schizophrenic patients from families with high EE levels perform better on cognitive function tests than patients from families with low EE levels (**28, 29, 30**).

To date, no studies have investigated the relationship between cognitive functioning and EE in caregivers. The present study identified a significant negative correlation between the ACT score, which assesses WM, and the EES score, which evaluates EE. However, of the variables that were correlated with EES, only the ZCBS total score, the Harm Avoidance subscale of the TCI, and the overall improvement subscale on the CGI were independently related with EES scores.

The present findings also revealed a positive correlation between EE and caregiving burden, which supports the findings of several studies that observed a high caregiving burden in the high-EE relatives of schizophrenic patients (**31, 32, 33**). Levels of EE and caregiving burden may or may not be causally related; our findings or those from previous studies do not allow us to conclude the direction of potential causality. In the present study, an overall improvement over the course of the disease was positively correlated with the EE of caregivers independent of other factors.

The Harm Avoidance subscale of the TCI correlated with the EES score in the present study has been proposed as an endophenotype candidate because the relatives of patients with schizophrenia and bipolar disorder exhibit high subscale scores. Considering that temperament is at least partially inherited (**34, 35**), the existence of a relationship between the harm-avoidance component of temperament and EE supports the hypothesis that EE possesses a neurobiological origin. On the other hand, the relationship between EE and WM, another endophenotype candidate, was not significant.

Additional studies using cognitive functioning tests, an additional endophenotype candidate, will contribute to the further characterization of these relationships.

There are several limitations to the present study. The fact that a majority of the related caregivers included in this study were mothers may have influenced the results. Furthermore, the number of relatives caring for patients with bipolar disorder was lower than the number of relatives caring for those with schizophrenia/ schizoaffective disorder. Moreover, the patients with bipolar disorder who were included in this study were required to have a history of psychosis, which precludes the extrapolation of these findings to all types of bipolar disorder. Studies using larger populations of patients with bipolar disorder are needed. Another limitation of the present study was that the included patients with schizophrenia had relatively favorable CGI scores compared with the general schizophrenia population because the former consisted of patients who had been treated on an outpatient basis and who had received continuous psychosocial support in a unit specializing in psychosis. The large number of scales and the number of questions in the scales was another limitation because the reliability of the responses may have been compromised considering the significant time necessary to complete them. However, this was considered, and the ACT, which measures WM, was the first scale administered due to its primary importance in this study.

One of the strengths of the present study is that no previous studies have investigated the relationship between EE and WM in related caregivers of patients with psychotic disorders. However, some studies have evaluated temperament, personality traits, schizotypy, care burden associated with these traits, cognitive functioning, and EE in patients with psychotic disorders.

CONCLUSIONS

Expressed emotion is a clinical characteristic that clinicians have monitored for a significant period and has been shown to negatively affect the course of a disorder. However, there have been few studies investigating the biological foundations of this clinical characteristic. The present study assumed EE to be associated with the mental processes that support WM. Working memory is involved in the basics of cognitive functioning and is thought to be one of the strongest candidates for an endophenotype of psychotic disorders because it is a fundamental cognitive ability in the basic components of the thought process. The present study found no significant relationship between WM and EE in terms of the effect of WM on the course of a disorder. However, the present findings indicate that EE in the related caregivers of psychotic patients is associated with disease severity, caregiver burden, and caregiver temperament rather than the patient's cognitive capacity.

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