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Information processing, social skill, and gender in schizophrenia

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Abstract

The relationships among information processing, social skill, and gender in individuals with chronic schizophrenia were investigated. Although there were no gender differences in information processing, social skill, or negative symptoms, performance on information-processing tasks was related to various indices of social skill (e.g., paralinguistic skill) for female, but not male, inpatients. This pattern of results remained after statistical controls were applied for age, illness chronicity, and positive symptoms.

Keywords: Attention; Cognition; Speech; Social competence; Sex differences

1. Introduction

Establishing a relationship between cognition and behavior is a critical step in the development of cognitive rehabilitation programs; cognitive skills that relate to social functioning should be those targeted for remediation (Penn, 1991; Bellack, 1992; Hogarty and Flesher, 1992; Liberman and Green, 1992). Over the last 5 years, a number of studies have addressed this issue. Performance on laboratory tasks, such as the Span of Apprehension, is associated with the processing of social information (Corrigan et al., 1992; Penn et al., 1993), social skill (Penn et al., 1995), and ward behavior (Spaulding et al., 1995). Executive processing deficits are related to social skill (Penn et al., 1995) and social/occupational adjustment (Jaeger and Douglas, 1992), while poor verbal learning (Kern et al., 1992) and memory (Mueser et al., 1991; Corrigan et al., 1995) are associated with impairments in skill acquisition (i.e., social skill and medication management).

None of the studies cited above, however, examined whether the relationship between cognition and behavior in schizophrenia is similar for males and females. Male and female patients with schizophrenia differ in a number of ways, including course of the disorder (Lewine, 1981; Goldstein, 1988) and social adjustment (Angermeyer and Kuhn, 1988; Mueser et al., 1991). It is therefore a reasonable hypothesis that

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a different cognitive-behavioral pattern may emerge as a function of gender.

This article reports on a reanalysis of findings from a larger data base involving measures of social anxiety, information processing, social skill, and social adjustment in schizophrenia (Penn et al., 1994, 1995). The analyses compared the relationship between performance on a range of information-processing tasks and social skill among male and female inpatients with chronic schizophrenia. Subsequent analyses then examined whether differential associations between cognition and behavior as a function of gender were mediated by chronicity of the illness, age, and positive symptoms.

2. Methods

2.1. Subjects

Thirty-eight patients hospitalized at the Extended Care Unit (ECU) of the Lincoln Regional Center were subjects in the study (21 males, 17 females). The ECU is a psychiatric rehabilitation program from which patients are typically discharged to a less restrictive setting after 12–36 months of treatment. Table 1 summarizes the demographic and clinical characteristics of the subjects. Subjects met *DSM-III-R* criteria (American Psychiatric Association, 1987) for schizophrenia or schizoaffective disorder according to the Structured Clinical Interview for *DSM-III-R* — Patient Version (SCID-P; Spitzer and Williams, 1985). The SCID-P was administered by two research psychiatrists who were unaware of the hypotheses of the study. Schizoaffective patients were included because both family studies and treatment findings suggest that individuals with schizoaffective disorder and schizophrenia are closely related (e.g., they show similar responses to neuroleptic treatment) (Mattes and Nayak, 1984; Levinson and Levitt, 1987; Kramer et al., 1989; Levinson and Mowry, 1991).

The type and severity of symptomatology were assessed with the Positive and Negative Syndrome Scale (PANSS; Kay et al., 1987) by the research psychiatrists who conducted the SCID-P interviews. Raters were trained to administer the SCID-P and PANSS by watching practice interview tapes, rating them independently, and discussing differences in ratings until a consensus rating/diagnosis was obtained. Raters then conducted their own interviews and rated each others'

Table 1
Demographic and clinical characteristics of subjects.

	Males (n = 21)		Females (n = 17)	
	Mean	SD	Mean	SD
Age (years)	33.7	6.6	39.2	8.4
Prior hospitalizations	3.7	3.9	3.5	3.1
Diagnosis				
Schizophrenia	19		14	
Schizoaffective	2		3	
Chlorpromazine-equivalent dosage (mg/day)	1176.4	1089.9	953.7	987.9
Positive and Negative Syndrome Scale				
Positive symptoms	14.0	4.8	17.9	5.6
Negative symptoms	15.8	6.9	15.1	4.4
Medication (percentage)				
Neuroleptic	95		82	
Anticholinergic	48		58	

Note. Neuroleptic medication converted to chlorpromazine-equivalent dosage according to Baldessarini (1985).

tapes. Rater agreement and reliability were assessed for five randomly selected subjects[1]: SCID-P (% agreement = 0.80), PANSS Positive symptom scale ($r = 0.90$), and PANSS Negative symptom scale ($r = 0.89$).

Both t tests and χ^2 tests were conducted on each of the clinical and demographic variables with gender as the independent variable. Significant differences were found for age, with male patients being significantly younger than female patients ($t = 2.20$, $df = 36$, $P < 0.05$), and positive symptoms, with female patients having significantly higher positive symptoms than male patients ($t = 2.3$, $df = 36$, $P < 0.05$). Male and female patients did not differ in number of previous hospitalizations, chlorpromazine-equivalent dosage (Baldessarini, 1985), negative symptoms, or percentage taking neuroleptic and anticholinergic medication.

2.2. Measures

2.2.1. Cognitive assessment. Information processing was assessed with COGLAB, a computer-based battery of cognitive tests developed for research on cognitive deficits in schizophrenia (Spaulding et al., 1989b). COGLAB is composed of validated test paradigms selected from the experimental psychopathology literature. Tasks include Reaction Time (RT), a concept-manipulation task based on the Wisconsin Card Sorting Test, the Muller-Lyer Illusion, Size Estimation, Backward Masking (MASK), and a combined Continuous Performance/Span of Apprehension (CP/SPAN) task. Because previous studies failed to find that performance on the Muller-Lyer and Size Estimation tasks was significantly related to social functioning (e.g., Penn et al., 1993; Spaulding et al., 1995), data from these cognitive tasks were omitted from subsequent analyses.

The complete battery was administered and scored by an Apple II microcomputer. COGLAB discriminates normal subjects from chronic schizophrenic patients with a degree of overlap <20% (Spaulding et al., 1989a). A full description of the procedure for administering and scoring COGLAB can be found in Spaulding et al. (1989b).

Five summary measures of performance were obtained from COGLAB: RT performance; CP/SPAN performance, as measured by a nonparametric index of signal-detection sensitivity, A' (Davies and Parasuraman, 1982); number of correct identifications across the three MASK conditions (i.e., no mask, 40-ms SOA, and 80-ms SOA); number of perseverative errors on the Card Sorting Task (CARDS-P); and number of tandom errors (i.e., nonperseverative) on the Card Sorting Task (CARDS-R).

2.2.2. Social skill. Social skill was assessed with an unstructured role-play test (i.e., a simulated social interaction). An unstructured role-play format was selected because of evidence suggesting that this format provides a more ecologically valid measure of social skill than briefer, highly structured role plays (Torgrud and Holburn, 1992). Subjects were instructed to have a conversation with a female research assistant, who would play the role of a new volunteer on the ward. Subjects were told that they (i.e., the subject and research assistant) would have 3 min to get to know one another and that they were to respond as if the research assistant were actually a volunteer at the hospital. The confederate was given a list of standard prompt lines (e.g., 'Tell me about yourself') to deliver after 10 s of silence had elapsed.

Behavioral ratings of social skill on the role-play test were made by two research assistants who were unaware of the hypotheses of the study and the performance of subjects on COGLAB. Consistent with previous research on social skill in schizophrenia (e.g., Bellack et al., 1990a), ratings were made of both global and specific components of social competence. The global ratings were made on a 0- to 100-point scale (0 = not at all skilled; 100 = very socially skilled).

Component ratings of social skill were made for the following behaviors: eye contact, speech rate, shaking (in extremities), long pauses (>3 s), rocking, fidgeting (e.g., touching or scratching oneself), restlessness (e.g., foot tapping), facial twitches,

[1] Subjects were randomly assigned to the two raters so that errors would be distributed throughout the sample and study. Reliability was determined for five randomly selected subjects due to logistical limitations and the data-collection schedule.

and speech fluency. All behaviors were rated on 1- to 5-point scales, with shaking, long pauses, rocking, fidgeting, restlessness, and facial twitching being anchored by 'none' and 'excessive'. The anchor points for eye contact, speech rate, and speech fluency, were 'too little/too much', 'too slow/too fast' and 'broken/smooth', respectively. Ratings of global social skill for all subjects were completed first, followed by the component ratings.

Research assistants were trained to make ratings by viewing practice tapes, discussing scoring criteria, and arriving at a consensus rating. Training was conducted on the first 10 subjects, and interrater reliability was assessed for the next 28 subjects. Pearson correlation coefficients for the two raters on indices of social competence were as follows: global social competence ($r = 0.85$), eye contact ($r = 0.79$), speech rate ($r = 0.78$), shaking ($r = 0.95$), long pauses ($r = 0.90$), fidgeting ($r = 0.93$), restlessness ($r = 0.94$), facial twitches ($r = 0.90$), and speech fluency ($r = 0.72$).

An exploratory factor analysis was conducted to reduce the number of specific behaviors for subsequent analyses. The factor analysis used a principal component extraction procedure and a varimax rotation. Two factors were found to account for 43% of the variance in the model. Factor 1 (paralinguistic skills) encompassed speech rate, long pauses, and speech fluency; Factor 2 (nonverbal skills) comprised eye contact, shaking, fidgeting, restlessness, and facial twitches. These categories are similar to those rated by Bellack et al. (1990a). Composite indices were computed for the factors by summing standardized scores (i.e., z scores) from this sample for each specific behavior.

3. Results

The data analysis proceeded in four stages: (1) Because correlational analyses form the primary method of testing the study's hypotheses, scores for the cognitive and social variables across each gender were evaluated for violations of variance homogeneity. (2) Gender differences were evaluated on information-processing and social-skill variables. (3) Correlations were computed between information processing and social skill within each gender. Finally, correlational analyses were repeated after controlling for chronicity of the disorder, positive symptoms, and patient age.

3.1. Variance of information-processing and social-skill variables as a function of gender

Table 2 summarizes the performance of male and female subjects on the COGLAB and role-play tasks. To test for violations in homogeneity of variance, the Brown-Forsythe test (Brown and

Table 2
COGLAB summary scores and global social competence within each gender.

Task	Males		Females	
	Mean	SD	Mean	SD
RT (ms)	395.9	97.1	423.2	113.7
CP/SPAN (A')	0.95	0.03	0.94	0.05
MASK (hits)[1]	33.6	9.6	28.3	8.0
CARDS-R (errors)	17.6	13.7	24.1	24.2
CARDS-P (errors)	20.6	23.1	24.4	16.6
Nonverbal[2]	−1.9	3.2	−2.2	2.8
Paralinguistic[2]	−0.43	1.8	0.56	2.4
Global[3]	41.6	15.1	48.7	17.2

Note. RT, Reaction Time; CP/SPAN, signal detection sensitivity on the Continous Performance/Span of Apprehension; MASK, total hits on backward masking; CARDS-R, random errors on Wisconsin Card Sorting Test; CARDS-P, perseverative errors on Wisconsin Card Sorting Test; Nonverbal, nonverbal social skill; Paralinguistic, paralinguistic social skill; Global, global social skill. [1]Range = 0–60. [2]Standardized z scores. [3]Range = 0–100.

Forsythe, 1974; Keppel, 1991) was performed on each set of COGLAB and social-skill variables. The multivariate effect was not significant for either the COGLAB ($F = 0.32$, $df = 5,30$, NS) or social-skill variables ($F = 0.63$, $df = 3,33$, NS). Therefore, there were no variance differences on the COGLAB and role-play tasks between male and female subjects.

3.2. Information processing and social skill as a function of gender

Two multivariate analyses of variance were conducted on the COGLAB summary scores and the three indices of social skill with gender as the independent variable. The multivariate effect was not significant for either the COGLAB ($F = 0.63$, $df = 3, 30$, NS) or social-skill variables ($F = 0.70$, $df = 3, 33$, NS). Thus, there were no gender differences in information processing or social skill.

3.3. Correlations between information processing and social skill

To evaluate the relationship between information and social functioning, Pearson correlational analyses were conducted between COGLAB summary scores and the three indices of social skill within each gender (Table 3). One-tailed significance tests were used because it was expected that better performance on COGLAB would be associated with greater social skill.

To determine whether the cognitive and social skill variables were significantly related to each other, an omnibus test of the correlation matrix was performed (Cohen and Cohen, 1983). This test was significant for female patients ($\chi^2 = 54.70$, $df = 15$, $P < 0.05$), but not for male patients, ($\chi^2 = 9.63$, $df = 15$, NS). These results indicate that the set of COGLAB summary scores is related to the set of social-skill variables for the female but not the male patients.

Among females, greater global social skill was related to faster RT, more hits on the MASK, and better performance on the CP/SPAN. Better nonverbal skills were associated with fewer random (i.e., nonperseverative) errors on CARDS. Finally, better paralinguistic skills were related to fewer random and perseverative errors on CARDS.

Table 3
Intercorrelations between COGLAB summary scores with social skill measures within each gender

COGLAB	Social skill measures		
	Global	Nonverbal	Paralinguistic
Males			
RT	−0.03	−0.26	−0.40*
CP/SPAN	0.39*	0.14	0.18
MASK	0.19	0.04	0.04
CARDS-R	−0.07	−0.06	−0.04
CARDS-P	−0.07	0.00	0.04
Females			
RT	−0.68**	−0.22	−0.38
CP/SPAN	0.57**	0.21	0.30
MASK	0.45*	0.15	0.28
CARDS-R	−0.39	−0.56*	−0.54*
CARDS-P	−0.32	−0.40	−0.63**

Note. RT, Reaction Time; CP/SPAN, signal detection sensitivity on the Continous Performance/Span of Apprehension; MASK, total hits on backward masking; CARDS-R, random errors on Wisconsin Card Sorting Test; CARDS-P, perseverative errors on Wisconsin Card Sorting Test; Nonverbal, nonverbal social skill; Paralinguistic, paralinguistic social skill; Global, global social skill. *$P < 0.05$; **$P < 0.01$.

Due to the nonsignificant omnibus test of the correlation matrix for male subjects, significant bivariate correlations should be interpreted cautiously. Thus, among males, greater global social skill was associated with better performance on the CP/SPAN, while better paralinguistic skills were related to faster RT.

3.4. Correlations between information processing and social skill after controlling for illness chronicity, patient age, and positive symptoms

The effects of illness chronicity, patient age, and positive symptoms on the cognition-behavior correlations were controlled for two reasons: (1) Previous research demonstrating gender differences in chronicity of the disorder (e.g., Lewine, 1981) and (2) analyses from the present study indicating that males were significantly younger than female patients and had significantly lower positive symptoms. To determine if these variables mediated the observed relationship between cognition and behavior, correlations were computed between

chronicity, patient age, and positive symptoms with COGLAB and social-skill variables. Significant correlates were then regressed onto COGLAB and social-skill variables (e.g., regressing age onto MASK performance) with the residual representing variance independent of chronicity, patient age, and positive symptoms. Correlations between cognition and behavior within each gender were then repeated with the residualized COGLAB and social-skill variables.

Patient age was correlated with performance on the CP/SPAN ($r = -0.33$, $P < 0.05$) and MASK tasks ($r = -0.36$, $P < 0.05$). Number of previous hospitalizations was related to global social skill ($r = -0.54$, $P < 0.05$). Positive symptoms were negatively associated with performance on the CP/SPAN ($r = -0.37$, $P < 0.05$) and MASK tasks ($r = -0.34$, $P < 0.05$). The correlational analyses with the residualized variables paralleled the pattern from the original analyses: Again, the omnibus test was significant for females ($\chi^2 = 46.04$, $df = 15$, $P < 0.05$), but not for males ($\chi^2 = 20.10$, $df = 15$, NS). Furthermore, the significant bivariate correlations among female patients remained stable, with the exception of the relationship between MASK performance and global social skill ($r = 0.40$, $P < 0.06$). Thus, the relationships between cognition and behavior within each gender cannot be explained by chronicity, patient age, or positive symptoms.

4. Discussion

The results from this study indicate that gender mediates the relationship between information processing and social skill among patients with chronic schizophrenia. Although there were no gender differences in information processing, social skill, or negative symptoms, performance on an information-processing battery was significantly associated with three indices of social skill for female, but not male, inpatients with schizophrenia. This differential correlational pattern remained even when the effects of illness chronicity, patient age, and positive symptoms were taken into account.

This study extends the findings of Mueser et al. (1995), who reported in two samples a significant association between memory (especially visual memory) and social skill for female, but not male, patients with schizophrenia. The convergence of findings is noteworthy given the many differences between the two studies: Mueser et al. (1995) assessed social skill with two different structured role-play tasks, while we used an unstructured format; there was no overlap in the cognitive measures across the two studies (i.e., Mueser et al. focused on memory, while this study examined information-processing measures); the subjects in the study of Mueser et al. had recently experienced an acute exacerbation of symptoms, while our subjects were stabilized, chronically ill inpatients. The consistent pattern across these studies underscores the robustness of the findings.

What could account for the gender effects observed in this study? Mueser et al. (1995) raise the possibility that a sampling bias could have produced the differential pattern of correlations: Since males have an earlier onset of schizophrenia, the lack of differences between male and female patients in illness chronicity (both in our study and in that of Mueser et al.) could result in a more severely ill sample of female patients (relative to those in the general population of females with a diagnosis of schizophrenia) included in the study. Some support for this argument is garnered by the presence of higher positive symptoms in the female patients compared with the male patients. However, the association between information processing and social skill remained after controls were applied for positive symptoms. Furthermore, male and female patients did not differ on most of the clinical and demographic variables. Therefore, severity of illness, per se, does not appear to mediate the gender effect. However, if the continuum of illness severity differs across gender (i.e., the psychopathology of very ill females compared with less ill females is greater than in their male counterparts), then this may lend support for the sampling bias hypothesis (see Perlick et al. [1992] for a related discussion of this issue) and would be consistent with findings indicating that male and female patients may have different forms of schizophrenia (Goldstein, 1988; Goldstein and Link, 1988; Goldstein et al., 1989, 1990; Murray, 1991; Shtasel et al., 1992; Castle et al., 1993).

An alternative interpretation is that the findings reflect cognitive-behavioral patterns found in

nonclinical samples. Females tend to have superior nonverbal, social perception skills relative to males (Hall, 1984), with these skills being associated with higher ratings of social competence (Costanzo and Archer, 1989). In the unstructured role-playing task used in the present study, performance quality may be especially dependent on apprehension of numerous subtle cues about the nature and context of an interaction. Females may show a greater tendency to use such information to construct more detailed cognitive representations of the social situation. In contrast, males may tend to activate and perform social-role behaviors based on a less detailed and/or more perfunctory schematization of the situation, resulting in less 'on-line' processing of social information. Males' behavior would, in this sense, be more determined by performance of a particular role and its associated scripts and action programs, and less by subtle cues and nuances arising from the interaction itself. If so, cognitive impairments may have less impact on social information processing for males relative to females with schizophrenia.

The pattern of findings suggests that better performance on the CP/SPAN task is associated with better overall social skill for both males and females with schizophrenia. Recent research indicating that performance on a similar task can be improved with monetary reinforcement and instructional cues (Kern et al., 1995) may have implications for social skills training; remediation of deficits on the CP/SPAN task could serve as a springboard to improvement in global social skill. Relatedly, the association between errors on CARDS and paralinguistic social skill in females suggests a behavioral outcome measure that should be assessed in future work on improving performance on the Wisconsin Card Sorting Test (e.g., Bellack et al., 1990b).

The current findings, if alternative hypotheses are eliminated and results replicated, could have important treatment implications. Cognitive rehabilitation may have a greater effect on social skill acquisition for females with schizophrenia than for males. This prediction is consistent with previous outcome research demonstrating that treatment tends to be more effective for females than males with schizophrenia (e.g., family psychoeducational treatment: Haas et al., 1988; Spencer et al., 1988). For males, treatment strategies could focus on more 'molar' aspects of functioning, such as social skills and matching a given role to a specific class of situations. Thus, the differential role of cognition in the social functioning of males and females with schizophrenia should be taken into account in the design of treatment and rehabilitation plans with individual patients.

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