Original Article

Demographic and Clinical Correlates of Social Cognition in Schizophrenia: Observation from India

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ABSTRACT

Purpose: Although deficits in social cognition (SC) had been recognized as a hallmark of schizophrenia, quality data in Indian context were limited. The purpose of the current research was to determine the demographic and clinical correlates of SC in schizophrenia. **Methods:** Between February 2014 and January 2015, a case–control study was conducted in Chhattisgarh, India, among 100 paranoid schizophrenia patients (ICD-10) from two psychiatric hospitals and 100 neighborhood-based healthy (28-item General Health Questionnaire) controls. After obtaining signed consent, SC was assessed among 20–35-year-old, high school or more educated subjects ensuring eligibility for appropriate scales. **Results:** Patients had poorer social knowledge (adjusted-beta-coefficient [AC] = -4.89 [-6.32, -3.45]) and lower predicted mean score for internal attribution of negative event (AC: -0.72 [-1.17, -0.27]). Nonrecognition of facial expressions especially for anger (adjusted-odds-ratio [AOR] = 3.50 [1.17, 10.51]), surprise (AOR = 2.91 [1.36, 6.25]) and fear (AOR = 2.35 [1.11, 5.01]) was more common among cases. Wrong recognition of expressions was less likely among females (for surprise: AOR = 0.35 [0.13, 0.93]) and educated (for sadness: AOR = 0.11 [0.02, 0.58]) but more common among wealthy (for surprise: AOR = 4.58 [1.22, 17.19]) and urban (for fear: unadjusted odds ratios = 4.30 [1.53, 12.03]) subjects. If recognized expressions correctly, females were more likely to perceive higher intensity of anger (AOR = 4.30 [1.80, 10.29]) and happiness (AOR = 4.22 [1.66, 10.72]). Higher intensity was perceived by more educated subjects regarding anger (AOR = 2.57 [1.04, 6.34]) but not for happiness (AOR = 0.09 [0.01, 0.79]). Unmarried/divorced/separated perceived happiness (AOR = 2.86 [1.02, 7.97]) with more intensity while those in joint families perceived sadness (AOR = 2.80 [1.22, 6.41]) and fear (AOR = 2.28 [1.01, 5.16]) with more intensity. **Conclusion:** A significant impairment in SC was observed among paranoid schizophrenia cases in Chhattisgarh, India. Intervention and further research addressing identified issues of SC need to target specific subpopulations, among schizophrenia patients.

Key words: *Attribution, emotion recognition, social cognition, social knowledge*

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INTRODUCTION

Schizophrenia is one of the most devastating mental disorders that impair thinking, language, perception, and sense of self. Recent estimates[1] suggest that worldwide, more than 21 million people (an estimated 1% of the global adult population) are suffering from this disabling disease. Although this is a treatable condition, unfortunately about half of the patients do not have access to specific treatment, of which 90% are from poor-resource settings.[2,3] Moreover, among schizophrenia patients receiving conventional antipsychotic medicines, because of serious side effects, treatment adherence is very poor.[2] Thus, recovery-oriented treatments are currently becoming the cornerstone of management for schizophrenia cases targeting cognitive and other functional improvement. Over the past few years, compared to other mental functions (attention, memory, speed of processing, problem-solving, etc.), impairment of social cognition (SC) gained much importance among investigators studying schizophrenia.[4] Despite this gradually progressive attention, in the context of schizophrenia, SC still remained poorly understood. Critical challenges in this regard included ambiguous and inconsistent definition of SC coupled with inappropriate psychometric tools (either inadequate or unknown) for assessing it.[5]

Given ample disagreement and overlapping, SC is commonly defined as the mental processes, including perception, interpretation, and attribution, by which an individual socially interacts and generates responses to others' intentions, dispositions, and behaviors. SC reflects how people process social information and how they think about themselves along with others in their social environment.[5-8] The three most important domains that are mostly discussed in the field of SC in schizophrenia are emotional perceptions (inferences from various facial expressions/tone), theory of mind (predictions about others' intentions), and attribution style (possible explanations about positive and negative events in life).[8] Impaired SC is one of the consistent deficits reported among schizophrenia patients.[9,10] Another distinctive characteristic is poor social functioning which often affects functional outcomes such as communication skill, education, and employment.[11-13] Researchers have suggested that a possible link may exist between deficit in SC and poor social functioning.[5,11,14,15] Perhaps, the most important point of concern is the higher likelihood of developing the disease later in life among apparently healthy adolescents with some deficits in social functioning compared to those without such deficits as evidenced from previous studies in New York and Israel.[16,17] The negative effects of social dysfunction on quality of life and clinical course of the disease were other major issues. Previous studies emphasized that positive long-term clinical outcomes in patients with schizophrenia were not only dependent on alleviating symptoms alone. Improvements in social functioning also had significant positive prognostic roles.[18-20] Thus, identifying factors associated with social dysfunction in patients with schizophrenia might be useful in achieving greater success regarding treatment adherence, clinical course, and functional outcomes.

Unlike the developed countries, where SC in schizophrenia is being well-studied in recent years, quality data in Indian context are unavailable. Given large sociocultural diversities and lack of general awareness, in India, there still exists a widespread stigma related to mental health problems with a big rural-urban variation.[21] Although the burden of schizophrenia is quite high in this country for years (estimated prevalence = 2.3–2.7/1000 population),[22,23] the unmet need for mental healthcare in the community is huge.

During the last decade, several studies were conducted among schizophrenia patients in India, but owing to several methodological shortcomings, findings from these studies were inconclusive. Alike Western countries, significant cognitive deficits were also noted among these patients, even during remissions,[24-27] but in the absence of a standardized tool, assessment of SC was a challenge. In 2011, Indian researchers designed a new culturally competent tool (keeping the original constructs of tasks intact), SC Rating Tools in Indian Setting (SOCRATIS), validated it, and established its internal consistency. SOCRATIS consisted of four subdomains: theory of mind, social perception, social knowledge, and attribution bias.[28] Despite this development, quality data related to SC are still poor in Indian settings. Given possibility of observing good clinical/functional outcomes by modifying/improving social functions,[29] the present study was conducted with the aim of determining the demographic and clinical correlates of SC in schizophrenia.

METHODS

Study design and recruitment

A case–control study was conducted between February 2014 and January 2015 in Chhattisgarh state of India. In this study, 100 diagnosed (as per ICD-10) paranoid schizophrenia cases (males = 56 and females = 44) were recruited from the inpatient departments of two psychiatric hospitals (Postgraduate Institute of Behavioral and Medical Sciences, Raipur, and Central India Institute of Mental Health and Neurosciences, Durg) in the state. From the neighborhood (residence, youth clubs, community centers, educational institutions, etc., in the

community) of the selected cases, 100 population-based healthy controls (males = 54 and females = 46) were also selected. For eligibility, both cases and controls had to be 20–35 years old and at least high school educated, who could read and write Hindi (local), and provided written informed consent in appropriate manner.[30] The age group criteria were determined based on the most common age of onset for schizophrenia in the Indian context.[31,32] To ensure feasibility of appropriate use of the selected scales, at least high school-level literacy was required.[33] Diagnosed psychiatric patients were excluded. Before recruitment, a 28-item General Health Questionnaire (GHQ)[34] was administered to each of the apparently healthy otherwise eligible controls to rule out any other minor psychiatric ailments. Healthy controls were defined by having GHQ score of 4 or less (out of maximum 28). Before the interview and administration of specific tools, sufficient rapport-building between investigators and the subjects was ensured and the subjects were convinced about the confidentiality of the provided information.

Measurement tools

Sociodemographic information sheet

A face-to-face interview was conducted to collect information on age, gender (male/female), education (school-level/college-level/graduation and above), marital status (currently married/unmarried/divorced/widowed), monthly income (≤5000/5001–10,000/10,001–20,000/>20,000 INR), place of residence (rural/urban), and family type (nuclear/joint).

Attribution style

Attribution style questionnaire[35] was used to assess the individual differences in attribution style. Each participant was given 12 hypothetical events (6 negative and 6 positive events), and the major responses were noted in three subsequent areas: internal versus external, stable versus temporary, and global versus specific attribution of causes, and each response was rated in a 7-point scale. In addition to the three mean predicted scores, composite attribution style index for both negative and positive events was also calculated.

Social knowledge

Among the 5 subtests of the Indian adaptation of Wechsler Adult Performance Intelligence Scale,[36] as per the recommendation,[37,38] picture arrangement test was used for assessing social knowledge. This test contained nine sets of cards, each depicting the sequences of a specific social situation.

Recognition of facial expressions

This test measures individual's ability to correctly recognize facial expressions. Eight photographs showing images of male and female faces suggesting six basic emotions (positive = surprise and happiness; negative = anger, sadness, and disgust; as well as basic instinctive emotion = fear; one each by three male and female faces) and two neutral expressions (one each by a male and a female face) were used, as outlined by Saha.[39] Each response was categorized into two groups: right and wrong. In addition, based on the score, perceived intensity of correctly recognized expressions was categorized into five groups: very low, low, moderate, high, and very high.

Ethics statement

The study content and procedure were reviewed and approved by the Institutional Ethics Committee Pandit Ravishankar Shukla University (Reference No. 038/IEC/PRSU/2014). Written informed consent was obtained from each eligible patient as per the ethics guidelines for seeking consent from schizophrenia patients, their caregiver, and healthy subjects in India.[30]

Statistical analysis

Distributions of sociodemographics and different domains of SC as well as perceived intensity of correctly recognized expressions among cases and controls were determined first. Second, simple and multiple linear regressions were performed to estimate the unadjusted and adjusted associations (expressed as unadjusted coefficient [UC] and adjusted-beta-coefficient (AC) with corresponding 95% confidence interval [CI]) between sociodemographic factors and mean predicted scores for attribution styles. Next, similar logistic regressions were conducted to measure associations (expressed as unadjusted odds ratios [OR] and adjusted odds ratios [AOR] with corresponding 95% CIs) between sociodemographic factors and perceptions, social knowledge, as well as intensity of facial expressions. Finally, we also performed both linear and logistic regressions to determine the associations between SC and schizophrenia. All statistical analyses were conducted using SAS Institute Inc., Cary, NC, USA.

RESULTS

Compared to controls, cases were a bit older (mean age = 25.80 vs. 24.23), less educated (educated ≥ graduation = 16.67% vs. 83.33%), and mostly married (94.74% vs. 5.26%) while distribution of the rest of the sociodemographics was quite similar across cases and controls [Figure 1].

Distributions of different subdomains of attribution style were also observed to be quite similar among cases and controls in our study. Controls had better social knowledge as compared to the schizophrenia

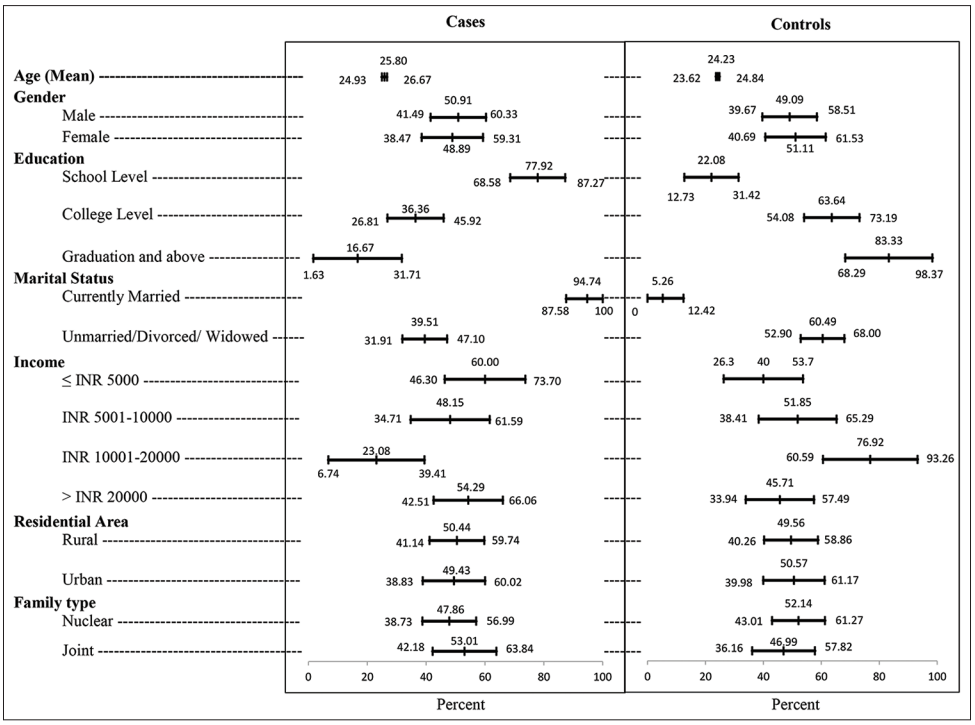

Figure 1: Comparative distribution of sociodemographic factors among cases and control groups

patients (mean score being 13.14 vs. 8.50). Regarding the recognition of facial expressions, among cases, about 60% could not recognize expressions of surprise (58%) and fear (61%) while about a quarter or little less failed to identify negative emotions: anger (24%), disgust (23%), and sadness (18%). Among cases who correctly identified the facial expressions, the perceived intensity varied greatly. Very high intensity was perceived by the majority in case of anger (46%), disgust (43%), surprise (30%), and happiness (57%). Majority perceived high intensity for sadness (33%) and moderate for fear (30%) [Table 1].

With reference to male cases, females had higher mean score for global attribution of negative events (AC = 0.48 [95% CI = 0.05, 0.92]) along with stable (AC = 0.69 [0.21, 1.16]), global (AC = 0.75 [0.27, 1.23]), and composite index for (AC = 1.80 [0.64, 2.96]) attribution of positive events. Compared to school-educated subjects, those who were educated up to college level had lower mean predicted scores for stable (AC = −0.83 [−1.37, −0.29]), global (AC = −0.75 [−1.20, −0.29]), and composite index for (AC = −2.12 [−3.38, −0.87]) attribution of negative events. With the same reference group, participants who were educated up to graduation or above had lower mean score for internal (AC = −2.32 [−3.80, −0.85]), global (AC = −1.35 [−2.50, −0.21]), and composite index for (AC = −5.01 [−8.17, −1.85]) attribution of negative events. With reference to the rural subjects, urban patients had lower mean predicted scores (AC = 0.60 [0.11, 1.08]) for stable attribution of positive events [Table 2].

With reference to male cases, females had lower odds (AOR = 0.35 [0.13, 0.93]) of wrong recognition of surprise. Patients educated up to college level were less likely (AOR = 0.11 [0.02, 0.58], reference = school-level education) to recognize sadness wrongly. Compared to poor subjects, economically better-off subjects had higher odds (AOR = 4.58 [1.22, 17.19]) of wrong recognition of surprise. With reference to rural patients, those in urban areas had higher likelihood (AOR = 4.30 [1.53, 12.03]) of wrong recognition of fear [Table 3].

Compared to the corresponding reference groups, among cases who correctly recognized facial expressions, odds of perceiving relatively higher intensity was determined. Females had higher odds of perception of more intensity of anger (AOR = 4.30 [1.80, 10.29]) and happiness (AOR = 4.22 [1.66, 10.72]). Those who had college-level education were more likely to perceive higher intensity of anger (AOR = 2.57 [1.04, 6.34]). Subjects with graduation or higher level of education were less likely to perceive higher intensity of happiness (AOR = 0.09 [0.01, 0.79]). Unmarried/divorced/separated had higher likelihood of perception of higher intensity of happiness (AOR = 2.86 [1.02, 7.97]), while odds of perception of higher intensity of sadness (AOR = 2.80 [1.22, 6.41]) and fear (AOR = 2.28 [1.01, 5.16]) were higher among patients

Table 1: Distribution of the domains of social cognition among participating schizophrenics (n^a=100) and controls (n^a=100)

Social cognition	Cases		Controls	
	n	Mean (95% CI)	*n*	Mean (95% CI)
Continuous variables				
Attribution style				
Internal attribution of negative events	100	3.85 (3.58-4.11)	100	4.33 (4.09-4.56)
Stable attribution of negative events	100	3.59 (3.35-3.83)	100	3.32 (3.09-3.55)
Global attribution of negative events	100	4.51 (4.30-4.72)	100	4.25 (4.05-4.44)
Composite index of negative event attribution	100	11.92 (11.34-12.51)	100	11.85 (11.41-12.30)
Internal attribution of positive events	100	5.14 (4.91-5.37)	100	5.11 (4.90-5.32)
Stable attribution of positive events	100	5.13 (4.90-5.36)	100	4.94 (4.72-5.16)
Global attribution of positive events	100	5.30 (5.07-5.52)	100	4.88 (4.66-5.10)
Composite index of positive event attribution	100	15.60 (15.05-16.15)	100	14.98 (14.48-15.49)
Social knowledge				
Picture arrangement	100	8.50 (7.87-9.13)	100	13.14 (12.21-14.07)
Social cognition	**n^b**	**Proportion (95% CI)**	**n^b**	**Proportion (95% CI)**
Categorical variables				
Recognition of facial expression				
Anger: Negative emotion 1				
Wrong	24	24.00 (15.48-32.52)	9	9.00 (3.29-14.71)
Right	76	76.00 (67.48-84.52)	91	91.00 (85.29-96.71)
Disgust: Negative emotion 2				
Wrong	23	23.00 (14.61-31.39)	16	16.00 (8.69-23.31)
Right	77	77.00 (68.61-85.39)	84	84.00 (76.69-91.31)
Sad: Negative emotion 3				
Wrong	18	18.00 (10.34-25.66)	6	6.00 (1.26-10.74)
Right	82	82.00 (74.34-89.66)	94	94.00 (89.26-98.74)
Surprise: Positive emotion 1				
Wrong	58	58.00 (48.16-67.84)	34	34.00 (24.55-43.45)
Right	42	42.00 (32.16-51.84)	66	66.00 (56.55-75.45)
Happiness: Positive emotion 2				
Wrong	9	9.00 (3.29-14.71)	-	-
Right	91	91.00 (85.29-96.71)	100	100.00 (100.00-100.00)
Fear: Survival instinctual emotion				
Wrong	61	61.00 (51.27-70.73)	42	42.00 (32.16-51.84)
Right	39	39.00 (29.27-48.73)	58	58.00 (48.16-67.84)
Perceived intensity of correctly recognized expressions				
Perceived intensity of anger				
Very low	5	5.00 (0.65-9.35)	-	-
Low	8	8.00 (2.59-13.41)	4	4.00 (0.09-7.91)
Moderate	15	15.00 (7.88-22.12)	17	17.00 (9.51-24.49)
High	26	26.00 (17.25-34.75)	51	51.00 (41.03-60.97)
Very high	46	46.00 (36.06-55.94)	28	28.00 (19.05-36.95)
Perceived intensity of disgust				
Very low	7	7.00 (1.91-12.09)	-	-
Low	4	4.00 (0.09-7.91)	3	3.00 (0.00-6.40)
Moderate	12	12.00 (5.52-18.48)	13	13.00 (6.29-19.71)
High	34	34.00 (24.55-43.45)	46	46.00 (36.06-55.94)
Very high	43	43.00 (33.13-52.87)	38	38.00 (28.32-47.68)
Perceived intensity of sadness				
Very low	9	9.00 (3.29-14.71)	1	1.00 (0.00-2.98)
Low	7	7.00 (1.91-12.09)	2	2.00 (0.00-4.79)
Moderate	23	23.00 (14.61-31.39)	14	14.00 (7.08-20.92)
High	33	33.00 (23.62-42.38)	48	48.00 (38.04-57.96)
Very high	28	28.00 (19.05-36.95)	35	35.00 (25.49-44.51)
Perceived intensity of surprise				
Very low	5	5.00 (0.65-9.35)	-	0.00 (0.00-0.00)
Low	14	14.00 (7.08-20.92)	7	7.00 (1.91-12.09)

Contd...

Table 1: Contd...

Social cognition	n^b	Proportion (95% CI)	n^b	Proportion (95% CI)
Moderate	25	25.00 (16.36-33.64)	20	20.00 (12.02-27.98)
High	26	26.00 (17.25-34.75)	50	50.00 (40.03-59.97)
Very high	30	30.00 (20.86-39.14)	23	23.00 (14.61-31.39)
Perceived intensity of happiness				
Very low	2	2.00 (0.00-4.79)	-	-
Low	1	1.00 (0.00-2.98)	-	-
Moderate	11	11.00 (4.76-17.24)	9	9.00 (3.29-14.71)
High	29	29.00 (19.95-38.05)	29	29.00 (19.95-38.05)
Very high	57	57.00 (47.13-66.87)	62	62.00 (52.32-71.68)
Perceived intensity of fear				
Very low	5	5.00 (0.65-9.35)	2	2.00 (0.00-4.79)
Low	16	16.00 (8.69-23.31)	7	7.00 (1.91-12.09)
Moderate	30	30.00 (20.86-39.14)	31	31.00 (21.78-40.22)
High	24	24.00 (15.48-32.52)	45	45.00 (35.08-54.92)
Very high	25	25.00 (16.36-33.64)	15	15.00 (7.88-22.12)

[a]*n* – Number of total subjects in each of study groups (cases and controls); [b]*n* – Number of subjects in respective category of sociodemographic strata. CI – Confidence interval

Table 2: Association between sociodemographic factors and attribution styles among participating paranoid schizophrenics (*n*=100)

Sociodemographics	Categories	Type of association	Internal attribution of negative events		Stable attribution of negative events		Global attribution of negative events		Composite index of negative event attribution	
			Coeff[a] (95% CI)	*P*	Coeff[a] (95% CI)	*P*	Coeff[a] (95% CIb)	*P*	Coeff[a] (95% CIb)	*P*
Age of the participant		Unadjusted	−0.04 (−0.11-0.02)	0.1519	0.05 (−0.01-0.10)	0.0990	0.01 (−0.04-0.05)	0.8305	0.00 (−0.14-0.13)	0.9664
		Adjusted	−0.05 (−0.13-0.03)	0.2018	0.06 (−0.02-0.13)	0.1225	0.02 (−0.05-0.08)	0.5770	0.04 (−0.14-0.21)	0.6733
Gender (reference = male)	Female	Unadjusted	0.18 (−0.36-0.72)	0.5165	0.09 (−0.40-0.58)	0.7092	**0.48 (0.06-0.89)**	**0.0249**	1.05 (−0.12-2.21)	0.0778
		Adjusted	0.03 (−0.53-0.59)	0.9191	0.21 (−0.31-0.73)	0.4304	**0.48 (0.05-0.92)**	**0.0305**	1.13 (−0.07-2.33)	0.0651
Education (reference = school-level education)	College level education	Unadjusted	−0.26 (−0.79-0.27)	0.3404	**−0.68 (−1.18-−0.18)**	**0.0082**	**−0.48 (−0.91-−0.04)**	**0.0311**	**−1.63 (−2.80-−0.47)**	**0.0065**
		Adjusted	−0.27 (−0.85-0.32)	0.3682	**−0.83 (−1.37-−0.29)**	**0.0031**	**−0.75 (−1.20-−0.29)**	**0.0015**	**−2.12 (−3.38-−0.87)**	**0.0011**
	Graduation and above	Unadjusted	**−2.46 (−3.75-−1.16)**	**0.0003**	−0.57 (−1.79-0.66)	0.3608	−1.02 (−2.08-0.03)	0.0574	**−4.10 (−6.95-−1.24)**	**0.0053**
		Adjusted	**−2.32 (−3.80-−0.85)**	**0.0024**	−1.20 (−2.57-0.17)	0.0840	**−1.35 (−2.50-−0.21)**	**0.0209**	**−5.01 (−8.17-−1.85)**	**0.0022**
Marital status (reference = currently married)	Unmarried/ divorced/ widowed	Unadjusted	−0.07 (−0.63-0.49)	0.8024	−0.27 (−0.78-0.24)	0.2932	−0.16 (−0.60-0.28)	0.4767	−0.47 (−1.69-0.75)	0.4426
		Adjusted	−0.37 (−1.01-0.27)	0.2563	−0.01 (−0.61-0.58)	0.9608	−0.04 (−0.53-0.46)	0.8797	−0.36 (−1.73-1.01)	0.6038
Income (reference = ≤ INR 5000)	5001-10,000	Unadjusted	−0.13 (−0.85-0.59)	0.7177	0.06 (−0.60-0.71)	0.8641	0.27 (−0.29-0.84)	0.3388	0.07 (−1.51-1.64)	0.9348
		Adjusted	−0.07 (−0.80-0.66)	0.8533	0.28 (−0.40-0.95)	0.4203	0.38 (−0.19-0.94)	0.1888	0.42 (−1.14-1.99)	0.5942
	10,001-20,000	Unadjusted	0.40 (−0.80-1.60)	0.5098	0.86 (−0.23-1.95)	0.1192	0.63 (−0.31-1.57)	0.1868	1.45 (−1.17-4.08)	0.2753
		Adjusted	0.52 (−0.68-1.71)	0.3913	0.67 (−0.44-1.78)	0.2322	0.39 (−0.53-1.32)	0.4023	1.01 (−1.55-3.57)	0.4352
	>20,000	Unadjusted	0.24 (−0.41-0.90)	0.4643	0.29 (−0.31-0.88)	0.3431	0.39 (−0.12-0.91)	0.1308	0.72 (−0.71-2.16)	0.3206
		Adjusted	0.65 (−0.06-1.36)	0.0741	0.31 (−0.35-0.97)	0.3465	0.41 (−0.14-0.96)	0.1384	1.02 (−0.50-2.55)	0.1852
Residential area (reference = rural)	Urban	Unadjusted	−0.02 (−0.56-0.52)	0.9442	0.03 (−0.47-0.52)	0.9097	0.31 (−0.11-0.73)	0.1496	0.36 (−0.82-1.55)	0.5449
		Adjusted	−0.05 (−0.61-0.52)	0.8737	0.05 (−0.48-0.57)	0.8644	0.38 (−0.06-0.82)	0.0907	0.53 (−0.69-1.74)	0.3919
Family type (reference = nuclear)	Joint	Unadjusted	0.19 (−0.35-0.73)	0.4870	−0.01 (−0.50-0.48)	0.9720	0.07 (−0.36-0.49)	0.7502	0.18 (−1.00-1.36)	0.7609
		Adjusted	0.14 (−0.44-0.72)	0.6330	−0.22 (−0.76-0.31)	0.4074	−0.03 (−0.47-0.42)	0.9023	−0.28 (−1.52-0.96)	0.6524
Sociodemographics	**Categories**	**Type of association**	**Internal attribution of positive events**		**Stable attribution of positive events**		**Global attribution of positive events**		**Composite index of positive event attribution**	
			Coeff[a] (95% CI)	***P***	**Coeff[a] (95% CI)**	***P***	**Coeff[a] (95% CIb)**	***P***	**Coeff[a] (95%CIb)**	***P***
Age of the participant		Unadjusted	0.02 (−0.03-0.07)	0.4895	−0.01 (−0.06,0.05)	0.8192	0.004 (−0.06,0.05)	0.8826	0.01 (−0.11,0.14)	0.8246
		Adjusted	0.01 (−0.06,0.09)	0.7771	0.002 (−0.07,0.07)	0.9467	−0.01 (−0.08,0.06)	0.7310	0.0007 (−0.17,0.17)	0.9935
Gender (reference = male)	Female	Unadjusted	0.37 (−0.09-0.83)	0.1181	**0.67 (0.22-1.12)**	**0.0036**	**0.80 (0.38-1.23)**	**0.0003**	**1.82 (0.76-2.88)**	**0.0009**
		Adjusted	0.36 (−0.15-0.88)	0.1624	**0.69 (0.21-1.16)**	**0.0053**	**0.75 (0.27-1.23)**	**0.0024**	**1.80 (0.64-2.96)**	**0.0028**

Contd...

Table 2: Contd...

Sociodemographics	Categories	Type of association	Internal attribution of positive events		Stable attribution of positive events		Global attribution of positive events		Composite index of positive event attribution	
			Coeff[a] (95% CI)	*P*	Coeff[a] (95% CI)	*P*	Coeff[a] (95% CIb)	*P*	Coeff[a] (95%CIb)	*P*
Education (reference = school-level education)	College level education	Unadjusted	−0.01 (−0.50-0.48)	0.9610	−0.29 (−0.78-0.19)	0.2346	−0.04 (−0.52-0.44)	0.8696	−0.60 (−1.77-0.57)	0.3144
		Adjusted	−0.10 (−0.63-0.44)	0.7125	−0.48 (−0.97-0.02)	0.0585	−0.24 (−0.74-0.25)	0.3327	−1.06 (−2.27-0.15)	0.0858
	Graduation and above	Unadjusted	0.07 (−1.13-1.27)	0.9095	−0.20 (−1.39-0.99)	0.7405	−0.07 (−1.24-1.11)	0.9109	−0.33 (−3.20-2.54)	0.8187
		Adjusted	0.13 (−1.23-1.48)	0.8519	0.12 (−1.13-1.37)	0.8495	−0.15 (−1.41-1.11)	0.8144	−0.16 (−3.22-2.90)	0.9194
Marital status (reference = currently married)	Unmarried/ divorced/ widowed	Unadjusted	−0.19 (−0.67-0.29)	0.4249	0.06 (−0.42-0.54)	0.7945	−0.30 (−0.77-0.17)	0.2095	−0.54 (−1.69-0.62)	0.3571
		Adjusted	−0.01 (−0.60-0.58)	0.9754	0.25 (−0.29-0.80)	0.3553	−0.31 (−0.86-0.24)	0.2633	−0.18 (−1.50-1.15)	0.7942
Income (reference = ≤ INR 5000)	5001-10,000	Unadjusted	0.14 (−0.48-0.75)	0.6551	0.02 (−0.61-0.64)	0.9609	0.24 (−0.37-0.84)	0.4419	0.36 (−1.12-1.85)	0.6285
		Adjusted	0.08 (−0.59-0.75)	0.8080	0.04 (−0.58-0.66)	0.9016	0.03 (−0.60-0.65)	0.9328	0.18 (−1.33-1.69)	0.8136
	10,001-20,000	Unadjusted	1.01 (−0.02-2.03)	0.0543	0.57 (−0.47-1.60)	0.2811	0.42 (−0.60-1.43)	0.4157	1.95 (−0.53-4.44)	0.1213
		Adjusted	0.79 (−0.31-1.88)	0.1574	0.32 (−0.69-1.34)	0.5285	0.08 (−0.94-1.10)	0.8797	1.17 (−1.31-3.65)	0.3509
	>20,000	Unadjusted	0.06 (−0.50-0.62)	0.8392	−0.02 (−0.59-0.54)	0.9304	0.34 (−0.21-0.90)	0.2233	0.41 (−0.95-1.76)	0.5535
		Adjusted	−0.05 (−0.70-0.61)	0.8889	−0.09 (−0.69-0.51)	0.7656	0.16 (−0.45-0.76)	0.6053	0.14 (−1.33-1.61)	0.8516
Residential area (reference = rural)	Urban	Unadjusted	0.26 (−0.21-0.72)	0.2733	0.41 (−0.04-0.87)	0.0765	0.34 (−0.11-0.80)	0.1347	0.86 (−0.25-1.97)	0.1255
		Adjusted	0.24 (−0.28-0.76)	0.3550	**0.60 (0.11-1.08)**	**0.0162**	0.36 (−0.12-0.85)	0.1382	1.09 (−0.09-2.27)	0.0693
Family type (reference = nuclear)	Joint	Unadjusted	0.22 (−0.25-0.68)	0.3578	0.45 (0.00-0.91)	0.0514	0.002 (−0.46-0.45)	0.9947	0.69 (−0.42-1.80)	0.2195
		Adjusted	0.16 (−0.37-0.69)	0.5484	0.46 (−0.03-0.95)	0.0647	−0.02 (−0.51-0.48)	0.9495	0.58 (−0.62-1.78)	0.3381

Boldfaced figures refer to the results for which $P<0.05$ (our assumed α). [a]Coeff – Coefficient of regression; CI – Confidence interval; INR – Indian rupee

belonging to joint (reference = nuclear) families [Table 4].

Compared to the healthy controls, patients with paranoid schizophrenia had lower predicted mean score for internal attribution of negative events (AC = −0.72 [−1.17, −0.27]), global attribution of positive events (UC = −0.42 [−0.73, −0.10]), and social knowledge (AC = −4.89 [−6.32, −3.45]). Regarding identification of facial expressions, cases had higher (than controls) odds of wrong recognition of anger (AOR = 3.50 [1.17, 10.51]), sadness (OR = 3.44 [1.30, 9.07]), surprise (AOR = 2.91 [1.36, 6.25]), and fear (AOR = 2.35 [1.11, 5.01]). Among those who correctly recognized facial expressions, cases were less likely to perceive relatively higher (AOR = 0.38 [0.19, 0.73]) intensity of sadness [Table 5].

DISCUSSION

In this case–control study in Chhattisgarh state of India, among 100 diagnosed paranoid schizophrenia cases between 2014 and 2015, significant impairments in different domains of SC were observed. Cases had lower predicted mean score for internal attribution of negative events. Deficit in social knowledge was also relatively higher among patients with schizophrenia compared to healthy controls. Cases had higher odds of wrong recognition of anger, surprise, and fear than controls. Among those who could recognize facial expressions correctly, schizophrenia patients were less likely to perceive relatively higher intensity of sadness.

Consistent with previous studies,[40-42] it was observed that patients with schizophrenia had altered perceptions of facial expression compared to healthy controls. In addition, previous findings revealed that schizophrenia patients significantly performed poorer than healthy controls while recognizing anger, surprise, sadness, and fear.[2,41,43,44] A systemic review and meta-analysis on processing facial emotions revealed that limited/impaired activation of amygdala and temporal-basal ganglia-prefrontal cortex social brain system might be associated with poor processing of facial expressions in schizophrenia cases as compared to normal controls.[45,46] Emotional deficits (expression, experience, and recognition) in schizophrenia, particularly regarding negative real-life emotions, seemed to negatively influence functional outcomes.[47] Recognition of emotions thus considered to be a significant predictor of severity of symptoms in patients with schizophrenia[3] and emotional disjunction appeared to be an essential component of psychopathology in schizophrenia. Although another culturally appropriate scale, TRENDS, was developed and validated in India for assessing emotional expressions, the requirement for further research became evident to understand the psychopathogenesis of schizophrenia in details.

Individual perception regarding positive real-life events and optimistic view for future indicates

Table 3: Association of sociodemographic factors and wrong recognition of emotions through facial expression among participating paranoid schizophrenics (*n*=100)

Sociodemographics	Categories	Type of association	Anger: Negative emotion 1		Disgust: Negative emotion 2		Sadness: Negative emotion 3	
			OR (95% CI)	*P*	OR (95% CI)	*P*	OR (95% CI)	*P*
Age of the participant		Unadjusted	1.00 (0.90-1.11)	0.9914	0.98 (0.88-1.10)	0.7686	0.98 (0.87-1.11)	0.7473
		Adjusted	0.93 (0.79-1.10)	0.3940	0.96 (0.82-1.12)	0.6012	0.98 (0.82-1.16)	0.7937
Gender (reference = male)	Female	Unadjusted	0.43 (0.16-1.17)	0.0979	0.77 (0.30-2.00)	0.5924	0.58 (0.20-1.69)	0.3176
		Adjusted	0.32 (0.10-1.06)	0.0626	0.68 (0.24-1.92)	0.4646	0.55 (0.16-1.91)	0.3469
Education (reference = school-level education)	College-level education	Unadjusted	0.61 (0.231.66)	0.3327	0.72 (0.26-1.99)	0.5317	**0.16 (0.04-0.75)**	**0.0202**
		Adjusted	0.41 (0.13-1.34)	0.1412	0.56 (0.18-1.75)	0.3177	**0.11 (0.02-0.58)**	**0.0094**
	Graduation and above	Unadjusted	-	-	1.00 (0.10-10.35)	1.0000	-	-
		Adjusted	-	-	1.73 (0.12-25.91)	0.6935	-	-
Marital status (reference = currently married)	Unmarried/ divorced/ widowed	Unadjusted	0.92 (0.36-2.38)	0.8606	1.38 (0.51-3.76)	0.5273	1.58 (0.51-4.86)	0.4250
		Adjusted	0.66 (0.18-2.49)	0.5425	1.32 (0.39-4.47)	0.6588	2.05 (0.48-8.75)	0.3310
Income (reference = ≤ INR 5000)	5001-10,000	Unadjusted	0.95 (0.25-3.58)	0.9424	0.99 (0.28-3.42)	0.9819	0.73 (0.18-2.92)	0.6537
		Adjusted	1.10 (0.25-4.91)	0.9010	1.25 (0.32-4.83)	0.7465	1.41 (0.30-6.61)	0.6663
	10,001-20,000	Unadjusted	**8.00 (1.17-54.46)**	**0.0337**	0.66 (0.07-6.61)	0.7217	2.00 (0.29-13.62)	0.4789
		Adjusted	**13.96 (1.32-147.18)**	**0.0283**	0.71 (0.06-8.23)	0.7809	2.38 (0.25-23.10)	0.4533
	>20,000	Unadjusted	1.24 (0.39-3.98)	0.7163	1.02 (0.33-3.15)	0.9730	0.75 (0.22-2.62)	0.6517
		Adjusted	1.59 (0.41-6.17)	0.4993	1.26 (0.34-4.65)	0.7270	1.22 (0.29-5.12)	0.7845
Residential area (reference = rural)	Urban	Unadjusted	2.27 (0.89-5.78)	0.0856	1.62 (0.64-4.13)	0.3133	1.41 (0.51-3.93)	0.5088
		Adjusted	2.60 (0.83-8.12)	0.1002	2.30 (0.79-6.73)	0.1278	2.82 (0.81-9.90)	0.1050
Family type (reference = nuclear)	Joint	Unadjusted	0.56 (0.21-1.45)	0.2305	1.22 (0.48-3.11)	0.6738	1.34 (0.48-3.73)	0.5719
		Adjusted	0.48 (0.15-1.57)	0.2240	1.58 (0.54-4.64)	0.4038	1.34 (0.40-4.53)	0.6353

Sociodemographics	Categories	Type of association	Surprise: Positive emotion 1		Happiness: Positive emotion 2		Fear: Survival instinctual emotion	
			OR (95% CI)	*P*	OR (95% CI)	*P*	OR (95% CI)	*P*
Age of the participant		Unadjusted	1.01 (0.93-1.11)	0.7591	0.89 (0.73-1.07)	0.2042	0.95 (0.86-1.04)	0.2277
		Adjusted	1.02 (0.89-1.17)	0.7915	0.88 (0.67-1.16)	0.3660	0.94 (0.82-1.08)	0.3866
Gender (reference = male)	Female	Unadjusted	0.47 (0.21-1.05)	0.0668	0.61 (0.14-2.59)	0.5026	1.03 (0.46-2.31)	0.9473
		Adjusted	**0.35 (0.13-0.93)**	**0.0360**	0.51 (0.10-2.63)	0.4186	0.95 (0.37-2.43)	0.9117
Education (reference = school-level education)	College-level education	Unadjusted	1.35 (0.58-3.17)	0.4860	0.45 (0.09-2.27)	0.3306	0.98 (0.42-2.28)	0.9568
		Adjusted	1.58 (0.59-4.28)	0.3641	0.36 (0.06-2.34)	0.2851	0.59 (0.22-1.61)	0.3030
	Graduation and above	Unadjusted	0.26 (0.03-2.59)	0.2482	-	-	0.62 (0.08-4.72)	0.6459
		Adjusted	0.13 (0.01-2.29)	0.1625	-	-	0.96 (0.09-10.37)	0.9743
Marital status (reference = currently married)	Unmarried/ divorced/ widowed	Unadjusted	0.57 (0.24-1.33)	0.1899	1.14 (0.27-4.85)	0.8614	1.43 (0.62-3.28)	0.4033
		Adjusted	0.62 (0.21-1.83)	0.3831	0.70 (0.10-4.85)	0.7195	1.25 (0.43-3.65)	0.6818
Income (reference = ≤ INR 5000)	5001-10,000	Unadjusted	**3.33 (1.05-10.63)**	**0.0418**	0.85 (0.17-4.19)	0.8396	1.50 (0.50-4.54)	0.4732
		Adjusted	**4.58 (1.22-17.19)**	**0.0244**	0.93 (0.15-5.57)	0.9323	1.58 (0.45-5.47)	0.4741
	10,001-20,000	Unadjusted	2.00 (0.32-12.62)	0.4608	-	-	0.67 (0.12-3.87)	0.6514
		Adjusted	2.43 (0.33-17.95)	0.3859	-	-	0.54 (0.08-3.86)	0.5427
	>20,000	Unadjusted	1.00 (0.38-2.61)	1.0000	0.36 (0.06-2.12)	0.2596	0.92 (0.35-2.43)	0.8610
		Adjusted	1.61 (0.50-5.17)	0.4279	0.44 (0.07-3.01)	0.4038	0.75 (0.23-2.46)	0.6332
Residential area (reference = rural)	Urban	Unadjusted	0.72 (0.32-1.61)	0.4278	1.07 (0.27-4.24)	0.9269	**2.81 (1.19-6.64)**	**0.0185**
		Adjusted	0.53 (0.20-1.42)	0.2049	1.62 (0.34-7.86)	0.5472	**4.30 (1.53-12.03)**	**0.0056**
Family type (reference = nuclear)	Joint	Unadjusted	1.28 (0.57-2.86)	0.5461	0.61 (0.14-2.59)	0.5026	0.73 (0.33-1.64)	0.4478
		Adjusted	1.12 (0.42-2.96)	0.8245	0.52 (0.10-2.65)	0.4295	0.82 (0.31-2.14)	0.6769

Boldfaced figures refer to the results for which $P<0.05$ (our assumed α). OR – Odds ratio; CI=Confidence interval; INR – Indian rupee

motivational attempt and mental health and probably protective against psychological distress. Consistent with prior studies,[47] we observed gross attribution impairment in schizophrenia patients. Previous studies indicated that impairment in attribution remained a significant predictor of social competence in schizophrenia.[48] Modifications of SC through psychological interventions might be effective in improving functional outcomes with eventual improvement in quality of life.

Social knowledge reflects specific societal norms, roles, and goals that predict social interactions. Social knowledge is also closely related with social perceptions.[49] Compared to other domains of SC, little has been yet established regarding social

Table 4: Association between sociodemographic factors and relatively higher intensity of perceived emotions among participating paranoid schizophrenics (*n*=100)

Sociodemographics	Categories	Type of association	Anger		Disgust		Sadness	
			OR[a] (95% CI[b])	*P*	OR[a] (95% CI[b])	*P*	OR[a] (95% CI[b])	*P*
Age of the participant		Unadjusted	0.97 (0.89-1.05)	0.4112	0.97 (0.90-1.06)	0.5349	0.97 (0.89-1.05)	0.4286
		Adjusted	1.05 (0.93-1.19)	0.3986	1.00 (0.89-1.13)	0.9400	0.96 (0.86-1.08)	0.4881
Gender (reference = male)	Female	Unadjusted	**3.26 (1.51-7.05)**	**0.0027**	1.64 (0.78-3.42)	0.1899	1.59 (0.78-3.26)	0.2017
		Adjusted	**4.30 (1.80-10.29)**	**0.0010**	1.90 (0.84-4.29)	0.1231	1.38 (0.63-3.03)	0.4274
Education (reference = school-level education)	College-level education	Unadjusted	1.98 (0.90-4.35)	0.0905	1.72 (0.79-3.75)	0.1703	0.91 (0.43-1.91)	0.8010
		Adjusted	**2.57 (1.04-6.34)**	**0.0400**	1.84 (0.79-4.32)	0.1592	0.97 (0.43-2.20)	0.9406
	Graduation and above	Unadjusted	0.76 (0.12-4.71)	0.7717	0.85 (0.14-5.37)	0.8658	0.59 (0.10-3.58)	0.5629
		Adjusted	0.55 (0.07-4.44)	0.5771	1.10 (0.14-8.89)	0.9270	1.09 (0.14-8.40)	0.9359
Marital status (reference = currently married)	Unmarried/ divorced/ widowed	Unadjusted	1.31 (0.62-2.78)	0.4814	1.48 (0.70-3.15)	0.3058	0.70 (0.33-1.46)	0.3375
		Adjusted	1.95 (0.75-5.02)	0.1688	1.59 (0.64-3.99)	0.3204	0.78 (0.32-1.91)	0.5861
Income (reference = ≤ INR 5000)	5001-10,000	Unadjusted	1.49 (0.56-3.97)	0.4276	0.76 (0.29-2.01)	0.5820	2.11 (0.81-5.51)	0.1284
		Adjusted	1.19 (0.40-3.55)	0.7491	0.61 (0.21-1.74)	0.3527	2.33 (0.82-6.61)	0.1132
	10,001-20,000	Unadjusted	1.04 (0.21-5.22)	0.9581	0.52 (0.11-2.56)	0.4193	1.18 (0.24-5.72)	0.8358
		Adjusted	0.62 (0.11-3.55)	0.5908	0.42 (0.08-2.26)	0.3105	1.37 (0.26-7.29)	0.7155
	>20,000	Unadjusted	1.01 (0.42-2.44)	0.9747	0.85 (0.35-2.08)	0.7284	0.96 (0.41-2.27)	0.9326
		Adjusted	0.60 (0.22-1.70)	0.3388	0.64 (0.23-1.78)	0.3930	1.36 (0.51-3.66)	0.5407
Residential area (reference = rural)	Urban	Unadjusted	0.83 (0.40-1.72)	0.6148	1.34 (0.64-2.80)	0.4316	0.72 (0.35-1.46)	0.3574
		Adjusted	0.63 (0.27-1.46)	0.2802	1.15 (0.51-2.61)	0.7355	0.81 (0.36-1.78)	0.5942
Family type (reference = nuclear)	Joint	Unadjusted	1.48 (0.71-3.08)	0.2994	1.22 (0.59-2.54)	0.5925	**2.56 (1.23-5.33)**	**0.0120**
		Adjusted	1.56 (0.66-3.67)	0.3135	1.32 (0.57-3.03)	0.5185	**2.80 (1.22-6.41)**	**0.0151**
Sociodemographics	**Categories**	**Type of association**	**Surprise**		**Happiness**		**Fear**	
			OR (95%CI)	***P***	**OR (95%CI)**	***P***	**OR (95%CI)**	***P***
Age of the participant		Unadjusted	0.94 (0.87-1.02)	0.1258	0.99 (0.91-1.08)	0.8609	0.98 (0.90-1.06)	0.6101
		Adjusted	0.99 (0.89-1.11)	0.9048	1.14 (1.00-1.30)	0.0547	0.98 (0.88-1.10)	0.7740
Gender (reference = male)	Female	Unadjusted	1.62 (0.79-3.30)	0.1860	**2.57 (1.15-5.76)**	**0.0217**	1.45 (0.71-2.95)	0.3031
		Adjusted	1.53 (0.70-3.36)	0.2850	**4.22 (1.66-10.72)**	**0.0024**	1.36 (0.62-2.98)	0.4377
Education (reference = school-level education)	College-level education	Unadjusted	1.29 (0.61-2.70)	0.5084	1.46 (0.64-3.34)	0.3676	0.88 (0.42-1.85)	0.7381
		Adjusted	0.95 (0.42-2.14)	0.9018	1.23 (0.49-3.11)	0.6586	0.76 (0.34-1.72)	0.5101
	Graduation and above	Unadjusted	0.30 (0.05-1.85)	0.1937	0.33 (0.05-2.08)	0.2348	**0.15 (0.02-0.95)**	**0.0434**
		Adjusted	0.23 (0.03-1.81)	0.1625	**0.09 (0.01-0.79)**	**0.0303**	0.20 (0.02-1.60)	0.1278
Marital status (reference = currently married)	Unmarried/ divorced/ widowed	Unadjusted	2.03 (0.97-4.24)	0.0616	1.25 (0.57-2.77)	0.5756	1.27 (0.61-2.63)	0.5274
		Adjusted	2.08 (0.85-5.09)	0.1103	**2.86 (1.02-7.97)**	**0.0449**	1.20 (0.49-2.92)	0.6901
Income (reference = ≤ INR 5000)	5001-10,000	Unadjusted	1.58 (0.62-4.05)	0.3432	2.06 (0.71-5.98)	0.1866	0.69 (0.27-1.78)	0.4460
		Adjusted	1.56 (0.57-4.30)	0.3912	2.13 (0.67-6.81)	0.2004	0.83 (0.30-2.28)	0.7145
	10,001-20,000	Unadjusted	1.38 (0.29-6.62)	0.6881	1.68 (0.29-9.94)	0.5664	0.54 (0.11-2.62)	0.4476
		Adjusted	1.40 (0.27-7.29)	0.6924	1.15 (0.17-7.81)	0.8849	0.42 (0.08-2.20)	0.3023
	>20,000	Unadjusted	1.55 (0.66-3.66)	0.3178	0.99 (0.40-2.47)	0.9876	1.16 (0.49-2.73)	0.7399
		Adjusted	1.36 (0.51-3.64)	0.5419	0.63 (0.21-1.86)	0.3978	1.45 (0.54-3.92)	0.4591
Residential area (reference = rural)	Urban	Unadjusted	1.58 (0.77-3.23)	0.2095	1.14 (0.53-2.48)	0.7359	1.47 (0.72-3.00)	0.2878
		Adjusted	1.46 (0.66-3.23)	0.3447	0.97 (0.40-2.36)	0.9446	1.85 (0.83-4.10)	0.1318
Family type (reference = nuclear)	Joint	Unadjusted	0.80 (0.39-1.62)	0.5360	1.12 (0.52-2.43)	0.7706	2.06 (1.00-4.22)	0.0492
		Adjusted	0.93 (0.42-2.07)	0.8570	0.88 (0.35-2.18)	0.7766	**2.28 (1.01-5.16)**	**0.0477**

Boldfaced figures refer to the results for which $P<0.05$ (our assumed α). OR – Odds ratio; CI – Confidence interval; INR – Indian rupee

knowledge in the context of schizophrenia although researchers speculated that patients with schizophrenia were likely to suffer from gross deficits in social knowledge.[5,49-52] We also observed similar deficits among our recruited paranoid schizophrenia patients. A different concept emerged from the analysis of the Australian Schizophrenic Research data, which revealed that judgments of social behaviors were affected by deficits in theory of mind though patients' basic social knowledge remained intact.[11] However, a 21-year follow-up study (the longitudinal Madras Study) revealed that social deficits in Indian patients were relatively less severe as compared to developed countries.[53] Probably, some deficits even in the general Indian population minimized the contrast.

Consistent with prior studies,[25,26,54] we also observed gender difference in all three domains of SC among

Table 5: Association between social cognition and schizophrenia

Social cognition (continuous measures)	Paranoid schizophrenia cases (reference=controls)		
	Association	Coefficient (95% CI)	*P*
Attribution styles			
Internal attribution of negative events	Unadjusted	**0.48 (0.13-0.83)**	**0.0077**
	Adjusted	**−0.72 (−1.17-−0.27)**	**0.0018**
Stable attribution of negative events	Unadjusted	−0.27 (−0.60-0.06)	0.1125
	Adjusted	0.08 (−0.34-0.49)	0.7118
Global attribution of negative events	Unadjusted	−0.27 (−0.55-0.02)	0.0675
	Adjusted	0.12 (−0.24-0.48)	0.5232
Composite index of negative event attribution	Unadjusted	−0.07 (−0.80-0.66)	0.8506
	Adjusted	−0.58 (−1.49-0.34)	0.2159
Internal attribution of positive events	Unadjusted	−0.03 (−0.34-0.28)	0.8592
	Adjusted	0.03 (−0.37-0.43)	0.8955
Stable attribution of positive events	Unadjusted	−0.19 (−0.51-0.13)	0.2425
	Adjusted	0.14 (−0.25-0.54)	0.4715
Global attribution of positive events	Unadjusted	**−0.42 (−0.73-−0.10)**	**0.0095**
	Adjusted	0.37 (−0.04-0.77)	0.0746
Composite index of positive event attribution	Unadjusted	−0.62 (−1.36-0.13)	0.1032
	Adjusted	0.39 (−0.55-1.33)	0.4120
Social knowledge			
Picture arrangement	Unadjusted	**−4.64 (−5.76-−3.52)**	**<0001**
	Adjusted	**−4.89 (−6.32-−3.45)**	**<0001**
Social cognition (categorical measures)	**Association**	**OR (95% CI)**	***P***
Wrong recognition of facial expression (reference = right)			
Anger: Negative emotion 1	Unadjusted	**3.19 (1.40-7.28)**	**0.0058**
	Adjusted	**3.50 (1.17-10.51)**	**0.0254**
Disgust: Negative emotion 2	Unadjusted	1.57 (0.77-3.19)	0.2137
	Adjusted	1.59 (0.64-3.98)	0.3187
Sad: Negative emotion 3	Unadjusted	**3.44 (1.30-9.07)**	**0.0126**
	Adjusted	3.04 (0.82-11.30)	0.0966
Surprise: Positive emotion 1	Unadjusted	**2.68 (1.51-4.76)**	**0.0008**
	Adjusted	**2.91 (1.36-6.25)**	**0.0061**
Fear: Survival instinctual emotion	Unadjusted	**2.16 (1.23-3.80)**	**0.0075**
	Adjusted	**2.35 (1.11-5.01)**	**0.0264**
Intensity of perceived facial expression			
Higher intensity of anger (negative emotion 1)	Unadjusted	1.29 (0.77-2.15)	0.3316
	Adjusted	1.87 (0.97-3.71)	0.0621
Higher intensity of disgust (negative emotion 2)	Unadjusted	0.95 (0.57-1.59)	0.8519
	Adjusted	1.08 (0.55-2.10)	0.8227
Higher intensity of sadness (negative emotion 3)	Unadjusted	**0.48 (0.28-0.80)**	**0.0048**
	Adjusted	**0.38 (0.19-0.73)**	**0.0041**
Higher intensity of surprise (positive emotion 1)	Unadjusted	0.71 (0.43-1.17)	0.1787
	Adjusted	0.80 (0.42-1.52)	0.4916
Higher intensity of happiness (positive emotion 2)	Unadjusted	0.77 (0.44-1.33)	0.3467
	Adjusted	0.83 (0.41-1.69)	0.6041
Higher intensity of fear (survival instinctual emotion)	Unadjusted	0.77 (0.48-1.30)	0.3532
	Adjusted	0.75 (0.39-1.42)	0.3763

Boldfaced figures refer to the results for which $P<0.05$ (our assumed α). CI – Confidence interval; OR – Odds ratio

patients with schizophrenia. Compared to females, males were more likely to suffer from poor SC according to our findings. Differences in sex hormones, neurodevelopment, and psychosocial factors might be some of the possible explanations for the observed variations across gender.[55]

We observed a strong negative association between higher educational level of the participants with stable attribution of negative and positive events. Similar findings were also reported in earlier research.[56,57] A prior study at Schizophrenia Research Foundation in Chennai reported that patients with good education performed better on all tests of cognitive functions as opposed to their less-educated counterparts.[25]

We found that unmarried/divorced/separated had higher likelihood of perception of higher intensity

of happiness than currently married cases. Although marriage appeared to play a protective role in this regard in developed countries, Indian context revealed a different scenario. Here, marriage seemed to be an option for caregiving, and thus, psychiatric patients with cognitive impairment were often forced to marry[58] resulting in the potential for reverse association. However, researchers argued that risk of schizophrenia and associated cognitive impairment was found to be higher among unmarried individuals if the onset of disease was below 25 years of age.[59]

We found that compared to urban, schizophrenia patients in rural areas had higher odds of wrong recognition of fear. Although previous studies documented higher prevalence of schizophrenia in rural India,[60,61] need for further research was thus established to elucidate the relationship between SC and schizophrenia in rural areas of India.

There were some major limitations. In this hospital-based case–control study, voluntary participation might have affected the representativeness of the study sample. Thus, extrapolation of results beyond the sample should be attempted with caution. Selection bias could well be a possibility alike any hospital-based case–control study if controls did not represent the source population and participation got influenced by exposure (different levels of SC) or disease severity. Residual confounding by education was also a possibility as we probably missed some severe cases having poor literacy. Further, that the universality of facial expressions used in this study and their recognition is well known, we want to state that the validity of the test which we used for "facial recognition" has not been established in other cultural context; hence, again, one may take it as the limitation of this study and can validate the test as well as corroborate the findings using standardized test in the future study. Despite these limitations, by virtue of recruiting a substantial number of schizophrenia cases, ensuring homogeneity of symptoms by selecting only one subtype, robust methodology, and advanced statistical analyses, we believe that this study has generated useful insights into the issues pertaining to SC among schizophrenia patients and their correlates in Indian context.

CONCLUSIONS

Significant impairment in SC was observed among paranoid schizophrenia cases in Chhattisgarh, India. Given the important role of SC in functional prognosis of schizophrenia, developing targeted intervention, management protocol, and further research policy addressing the specific needs of the community for improving SC among schizophrenia patients seemed to be the need of the hour.

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Conflicts of interest
There are no conflicts of interest.

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