Paranoid individuals with schizophrenia show greater social cognitive bias and worse social functioning than non-paranoid individuals with schizophrenia

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ARTICLE INFO

ABSTRACT

Paranoia is a common symptom of schizophrenia that may be related to how individuals process and respond to social stimuli. Previous investigations support a link between increased paranoia and greater social cognitive impairments, but these studies have been limited to single domains of social cognition, and no studies have examined how paranoia may influence functional outcome. Data from 147 individuals with schizophrenia were used to examine whether actively paranoid and non-paranoid individuals with schizophrenia differ in social cognition and functional outcomes. On measures assessing social cognitive bias, paranoid individuals endorsed more hostile and blaming attributions and identified more faces as untrustworthy; however, paranoid and non-paranoid individuals did not differ on emotion recognition and theory of mind tasks assessing social cognitive ability. Likewise, paranoid individuals showed greater impairments in real-world interpersonal relationships and social acceptability as compared to non-paranoid patients, but these differences did not extend to performance based tasks assessing functional capacity and social competence. These findings isolate specific social cognitive disparities between paranoid and non-paranoid subgroups and suggest that paranoia may exacerbate the social dysfunction that is commonly experienced by individuals with schizophrenia.

1. Introduction

Paranoia is the most commonly reported delusion among individuals diagnosed with schizophrenia spectrum illnesses (Bentall et al., 2009) and is evident in almost 50% of individuals seeking initial help for a psychotic disorder (Sartorius et al., 1986; Veling et al., 2007). Despite the high prevalence of this symptom, not all patients experience paranoia, and recent work suggests that there may be important differences in the ways in which paranoid and non-paranoid individuals with schizophrenia process social information. For example, non-paranoid patients have shown better emotion recognition performance than paranoid patients (An et al., 2006; Russell et al., 2007; Williams et al., 2007), perhaps due to a tendency for paranoid patients to inaccurately identify neutral facial expressions as anger (Pinkham et al., 2011a). A number of studies have also demonstrated a link between paranoia and making hostile and blaming attributions for social events both in healthy individuals (Combs et al., 2007; Fornells-Ambrojo & Garety, 2009) and among patients with schizophrenia (Aakre et al., 2009; Combs et al., 2009). Finally, impairments in theory of mind have been shown to significantly relate to increased paranoid ideation (Bentall et al., 2009; Harrington et al., 2005). As these findings suggest, disproportionately greater social cognitive impairment and bias may be important predictors of the maintenance and worsening of paranoid thinking (Bentall et al., 2009; Freeman, 2007; Lysaker et al., 2010).

While the work reviewed above has collectively examined many primary domains of social cognitive processing (i.e. emotion recognition, attributional style, and theory of mind), no study has examined multiple domains within the same sample. Doing so will allow identification of a social cognitive profile that will isolate those areas most influenced by paranoia and that may be useful in forming hypotheses about where and when during the stream of social cognitive processing paranoia plays the greatest role. Given that interventions targeting social cognition seem promising (Kurtz et al., in press), awareness of specific differences between symptom-based

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subgroups will also likely be useful for developing individualized treatments that may provide maximal benefit.

Further, despite the fact that paranoia by definition involves a profound disruption in interpersonal functioning (Bentall et al., 2001) and that paranoia should have considerable consequences for social behavior (Combs & Penn, 2004), little is known about how paranoia affects functional outcomes. These outcomes span a number of areas including the ability to execute activities relevant for daily living (i.e. functional capacity) as well as those that are more highly dependent on social abilities and social involvement (i.e. social competence and real-world functioning) (McKibbin et al., 2004). Numerous studies examining paranoid thinking in the general population have established a link between increased paranoia and poorer social outcomes (Freeman et al., 2011; Martin & Penn, 2001; Olfson et al., 2002; Rossler et al., 2007). However, with the exception of one study by our group showing slightly lower social functioning scores for paranoid relative to non-paranoid patients (Pinkham et al., 2008), there has been no work specifically examining how paranoia relates to functional outcomes among individuals with schizophrenia or whether paranoia may differentially affect these outcomes. As social and functional impairments are well established in schizophrenia (Pinkham et al., 2011b), it is possible that paranoia may exacerbate these difficulties, particularly within areas that require social interaction.

The current study aims to address these limitations by examining differences between paranoid and non-paranoid individuals with schizophrenia across multiple domains and measures of social cognition and functional outcome. Using data from phase 3 of the Social Cognition Psychometric Evaluation Study (SCOPE; Pinkham et al., 2014; Pinkham et al., 2015), we tested the following hypotheses: 1) paranoid individuals will show poorer performance than non-paranoid individuals on emotion processing and theory of mind tasks and will endorse more hostile and blaming attributions, and 2) paranoid individuals will show reduced social competence and real-world functioning relative to non-paranoid individuals but groups will not differ on functional capacity. Given that functional capacity refers to an individual's ability to perform key tasks of daily living that do not rely heavily on social interaction (e.g. paying bills) (Green et al., 2008), we expected that these functional abilities would be intact but that the implementation of these skills in social situations would be impaired in paranoid individuals.

2. Methods

2.1. Participants

Data from the first study visit of 147 individuals with schizophrenia or schizoaffective disorder were analyzed. Participants were recruited from three study sites, Southern Methodist University (SMU), the University of Miami Miller School of Medicine (UM), and the University of North Carolina at Chapel Hill (UNC). SMU participants were recruited from Metrocare Services, a nonprofit mental health services provider for Dallas County, TX, and other area clinics. UM recruitment took place at the Miami VA Medical Center and the Jackson Memorial Hospital-University of Miami Medical Center. UNC individuals were recruited from the Outreach and Support Intervention Services (OASIS) program and Caramore, a structured support program for individuals with severe mental illness. At all sites, diagnoses were confirmed with the Mini International Neuropsychiatric Interview (Sheehan et al., 1998) and Structured Clinical Interview for DSM Disorders Psychosis Module (First et al., 2002).

Symptom severity was assessed with the Positive and Negative Syndrome Scale, and ratings on the suspiciousness/persecution item (P6) were used to divide participants into two groups: paranoid (P-SCZ; n = 81) and non-paranoid (NP-SCZ; n = 66). Individuals

scoring 4 or higher, indicating clinically significant levels of paranoid ideation, were assigned to the P-SCZ group, and those individuals scoring 1 or 2, indicating the absence or only sub-clinical levels of paranoia, were assigned to the NP-SCZ group. Participants from the larger SCOPE database scoring a 3 on this item (n = 56) were not included in the current analyses. This rating indicates the lack of persecutory delusions but the presence of a distrustful attitude with a limited impact, and therefore the presence or absence of paranoia is unclear. Groups did not differ in gender ($\chi^2 = .63$, $p = .43$), race ($\chi^2 = 9.39$, $p = .05$), ethnicity ($\chi^2 = 2.11$, $p = .15$), diagnosis ($\chi^2 = .48$, $p = .49$), age ($t(145) = .50$, $p = .62$), education ($t(145) = 2.26$, $p = .23$), or IQ as estimated by the WRAT-3 Reading subscale ($t(145) = 1.50$, $p = .14$). Groups also did not differ in cognitive abilities as assessed with a subset of the MATRICS Consensus Cognitive Battery (Nuechterlein et al., 2008) that included the following tests: Trail Making Test, Part A; Brief Assessment of Cognition in Schizophrenia: Symbol Coding; Category Fluency: Animal Naming; Letter–Number Span; and the Hopkins Verbal Learning Test-Revised (Wilks' $\lambda = .973$, $F(5, 140) = 0.77$, $p = .58$). Medication type did significantly differ between groups ($\chi^2 = 14.05$, $p = .01$) with more individuals in the P-SCZ group not taking an antipsychotic. Paranoid participants also had greater severity of positive ($t(145) = 10.55$, $p < .001$), negative ($t(145) = 2.11$, $p = .04$), and general symptoms ($t(145) = 6.94$, $p < .001$); however these differences did not remain significant after controlling for paranoia ratings (all $p > .63$). Demographic and clinical characteristics are presented in Table 1.

2.2. Measures

Full descriptions of the social cognitive and functional outcome measures have been published recently (Pinkham et al., 2015). Briefly, the social cognitive measures assessed four general domains. Attritional style/bias was evaluated with the Ambiguous Intentions and Hostility Questionnaire (AIHQ; Combs et al., 2007), which yields scores for a hostility bias, an aggression bias, and a blame score. Emotion recognition was assessed with the Bell Lysaker Emotion Recognition Task (BLERT; Bryson et al., 1997) and the Penn Emotion Recognition Test (ER-40; Kohler et al., 2003). Social perception was measured with the Relationships Across Domains test (RAD; Sergi et al., 2009). Mental state attribution, or theory of mind, was assessed with the Reading the Mind in the Eyes Test (Eyes; Baron-Cohen et al., 2001), the Awareness of Social Inferences Test, Part III (TASIT; McDonald et al., 2003), and the Hinting Task (Hinting; Corcoran et al., 1995). Participants also completed the Trustworthiness Task (Trust; Adolphs et al., 1998), which assesses the ability to make complex social judgments of trustworthiness from facial images but does not fall cleanly into any of the four domains noted above. All of the social cognitive measures are performance-based tasks that are scored as the total number correct with the exception of AIHQ and Trust. These latter two tasks assess social cognitive biases and are indexed by average ratings. For AIHQ, higher scores are indicative of greater bias, and for Trust, lower scores indicate more ratings of untrustworthiness.

Assessments of functional outcome also covered multiple domains. Functional capacity was evaluated with the UCSD Performance-Based Skills Assessment, Brief (UPSA-B; Mausbach et al., 2007), which measures the financial and communication skills necessary for community living. Social competence was assessed with the Social Skills Performance Assessment (SSPA; Patterson et al., 2001), a role-play measure designed to assess several social skills such as fluency, interest in the conversation, and negotiation ability. Real-world functional outcome was assessed with the informant-rated Specific Levels of Functioning Scale (SLOF; Schneider & Struening, 1983). Informants were high contact clinicians, family members or close friends who reported on the social functioning (interpersonal

Table 1
Participant demographic, clinical, and cognitive characteristics.

Characteristic	NP-SCZ (n = 66)		P-SCZ (n = 81)	
	n	(%)	n	(%)
Male	48	73%	54	67%
Race				
Caucasian	33	50%	31	38%
African American	28	42%	45	56%
Native American	1	2%	0	0%
Asian	0	0%	4	5%
Other	4	6%	1	1%
Ethnicity				
Hispanic	13	20%	9	11%
Non-Hispanic	53	80%	72	89%
Diagnosis				
Schizophrenia	38	58%	42	52%
Schizoaffective	28	42%	39	48%
Medication type* [a]				
Typical	5	8%	11	14%
Atypical	55	83%	47	58%
Combination	2	3%	2	2%
None	4	6%	14	17%
	Mean	SD	Mean	SD
Age (years)	37.98	14.57	39.06	11.70
Education (years)	13.18	1.91	12.77	2.17
PANSS				
Positive Total**	12.32	4.77	20.28	4.37
Negative Total*	13.09	4.99	14.91	5.38
General Total**	27.45	7.42	35.58	6.76
WRAT-3	97.58	16.34	93.58	15.88
MCCB [b]				
Trails A (seconds)	36.85	13.26	41.53	21.88
Symbol Coding	44.45	11.88	44.03	11.51
Animal Naming	19.61	5.89	19.18	5.02
Letter–Number Span	12.45	4.82	11.93	4.31
HVLT-R	21.26	6.39	21.41	6.11

NP-SCZ = non-paranoid individuals with schizophrenia, P-SCZ = paranoid individuals with schizophrenia.

[a] Medication information was missing for 7 individuals, all of whom were in the P-SCZ group.

[b] Raw scores are provided for each test.

* p < .05.
** p < .001.

relationships and social acceptability) and community-living (participation in activities and work skills) of study participants. For all measures, higher scores indicate better functioning, and summary scores were used as the dependent variable.

2.3. Statistical analyses

Group differences in social cognition and functional outcome were assessed with two separate one-way (group: NP-SCZ vs. P-SCZ) MANOVAs. Significant omnibus effects were followed up with univariate tests. Additionally, since the paranoid group showed greater symptom severity, group differences in social cognition and functional outcome were also assessed while covarying for symptom ratings that partialed out the effects of paranoia. To do so, we first computed unstandardized residuals for positive, negative, and general symptoms that provided estimates of these symptom domains while controlling for the influence of paranoia. These residuals were then used as covariates in recalculations of the primary analyses.

3. Results

3.1. Group differences in social cognition

Our first hypothesis that P-SCZ would show greater impairments than NP-SCZ in emotion recognition and theory of mind and more

hostile and blaming attributions was only partially supported. While the multivariate group effect was significant (Wilks' $\lambda = .801$, $F(10, 136) = 3.39$, $p = .001$), univariate analyses revealed that this effect was driven by significant differences on only the Trust task ($F(1, 145) = 10.42$, $p = .002$) and the hostility bias ($F(1, 145) = 8.00$, $p = .005$) and blame score ($F(1, 145) = 7.53$, $p = .007$) of the AIHQ. On the Trust task, P-SCZ rated faces to be less trustworthy than NP-SCZ, and on the AIHQ, P-SCZ showed a greater tendency to interpret ambiguous social situations as hostile and to place blame on other individuals. Groups did not significantly differ on the remaining social cognitive tasks (see Table 2), and these results were unchanged when controlling for greater symptom severity in the paranoid group.

3.2. Group differences in functional outcomes

Our second hypothesis predicting group differences on social competence and real-world functioning but not functional capacity was also only partially supported. Again, the multivariate effect was significant (Wilks' $\lambda = .928$, $F(3, 138) = 3.57$, $p = .016$), but univariate tests revealed a significant group difference on only real-world functioning as measured by the SLOF ($F(1, 140) = 7.94$, $p = .006$). Across the measure as a whole, individuals in the NP-SCZ group were rated as having better functioning than P-SCZ. Groups did not differ on functional capacity (i.e. UPSA; $F(1, 140) = .01$, $p = .92$) or social competence (i.e. SSPA; $F(1, 140) = .62$, $p = .43$).

Given that the SLOF assess multiple outcomes, we also conducted a post-hoc, exploratory analysis to determine if groups differed across all measured outcomes or if they were limited to specific areas of function. A one-way (group: P-SCZ vs. NP-SCZ) MANOVA on the four SLOF subscales was again statistically significant (Wilks' $\lambda = .894$, $F(4, 139) = 4.10$, $p = .004$). Significant univariate group differences were observed for interpersonal relationships ($F(1, 142) = 9.27$, $p = .003$) and social acceptability ($F(1, 142) = 9.21$, $p = .003$) but not for involvement in activities ($F(1, 142) = 2.57$, $p = .11$) or work skills $F(1, 142) = 1.66$, $p = .20$). As indicated by the means presented in Table 2, P-SCZ received lower ratings than NP-SCZ for both

Table 2
Descriptive statistics for social cognition and social functioning.

	NP-SCZ (n = 66)		P-SCZ (n = 81)		
	Mean	SD	Mean	SD	Cohen's d
Social Cognition					
AIHQ-HB**	2.19	0.61	2.48	0.61	.48
AIHQ-AB	1.81	0.34	1.88	0.36	.20
AIHQ-BS**	7.79	2.56	9.10	3.11	.46
BLERT	13.56	4.69	13.72	3.70	.04
ER-40	29.32	5.90	30.79	4.49	.28
Eyes	21.38	5.24	20.31	5.56	.20
Hinting	14.15	3.93	13.57	3.91	.15
RAD	26.51	6.04	25.26	6.34	.20
TASIT	46.59	8.56	44.83	7.68	.22
Trust**	.20	1.13	-.41	1.15	.54
Social Functioning					
UPSA-B	69.98	15.01	69.73	13.39	.02
SSPA	4.10	0.52	4.17	0.50	.14
SLOF**	4.06	0.61	3.79	0.56	.46
SLOF Subscales					
Interpersonal Relationships**	3.55	0.91	3.09	0.88	.51
Social Acceptability**	4.48	0.48	4.20	0.61	.51
Involvement in Activities	4.40	0.67	4.19	0.87	.27
Work Skills	3.64	0.95	3.44	0.87	.22

NP-SCZ = non-paranoid individuals with schizophrenia, P-SCZ = paranoid individuals with schizophrenia.

* p < .05.
** p < .01.

interpersonal relationships and social acceptability. Consistent with the previous social cognition analyses, the functional outcome results remained the same when accounting for group differences in symptoms other than paranoia.

4. Discussion

Here, we investigated potential differences in social cognition and functional outcome between paranoid and non-paranoid individuals with schizophrenia. Contrary to the previous literature, which suggests disproportionately greater impairments for paranoid individuals across a range of social cognitive domains, we found differences only in attributions and perceptions of trustworthiness such that paranoid individuals made more hostile and blaming attributions and rated fewer individuals as trustworthy. Our findings for functional outcome also revealed specific areas of greater impairment for paranoid individuals. These included interpersonal relationships and social acceptability but did not extend to other domains of functioning such as functional capacity or social competence.

When interpreting the findings for social cognition, it is helpful to consider the distinction between social cognitive capacity and social cognitive bias that has recently been highlighted by Roberts and colleagues (Roberts & Pinkham, 2013; Walss-Bass et al., 2013). They argue that social cognitive capacity refers to the ability to perform an information processing function, whereas social cognitive bias refers to the tendency for information processing functions to produce systematically distorted output. It is noteworthy that groups did not differ on our capacity-based tasks where performance is scored as correct or incorrect and traditional accuracy scores are used (i.e. emotion recognition, social perception, and theory of mind measures). Instead, groups only differed on the tasks that assess biases or tendencies to respond in certain ways. On both the AIHQ and Trust task, paranoid individuals displayed a greater tendency to interpret stimuli in a manner that is consistent with paranoid thinking (e.g. rating more individuals as untrustworthy and blaming other individuals for negative outcomes). This pattern of group differences across social cognitive domains therefore suggests that paranoia is highly related to social cognitive bias but that social cognitive ability is relatively unaffected. Whether paranoia leads to social cognitive bias or vice versa remains to be seen; however, it does appear that paranoid and non-paranoid patients show comparable levels of social cognitive capacity.

Our finding of a lack of group differences on social cognitive capacity contradicts previous studies reporting greater impairments for paranoid individuals in emotion recognition and theory of mind. This work however has not been without discrepancies. Within emotion recognition for instance, some studies have reported an advantage for paranoid individuals rather than non-paranoid individuals (e.g. (Chan et al., 2008; Van't Wout et al., 2007), thus raising questions about the true nature of the effect. We explored this specific issue in an earlier investigation and found that paranoid and non-paranoid patients did not differ in overall emotion recognition ability but that paranoid patients displayed a tendency to over attribute anger to neutral expressions (Pinkham et al., 2011a). In many ways, this is consistent with the present findings that isolate the effect of paranoia to bias rather than capacity. Similar discrepancies are also evident in the literature addressing theory of mind. As reviewed by Freeman (2007), links between paranoia and poor theory of mind performance may be better explained by the presence of thought disorder (Greig et al., 2004). Despite the overall greater symptom severity in the paranoid group, an examination of values for a thought disorder factor from the PANSS (Wallwork et al., 2012) showed no difference between our groups ($t(145) = .413, p = .68$), which may explain why our groups also did not differ on theory of mind performance. Finally, it should also be noted that Abu-Akel and Bailey (2000) hypothesize that poor theory of mind performance may be due

either to impaired abilities to generate mental state representations or to the overattribution of mental states to others and that such "hyper-theory of mind" may be most evident in individuals with positive symptoms. Thus, future work should not rule out the possibility that while social cognitive capacities are similar between paranoid and non-paranoid patients, the mechanisms underlying these abilities may differ.

Comparison of functional outcomes also revealed a specific pattern of disproportionately greater impairment in individuals with paranoia. Differences were evident for those outcomes most closely tied to real-world social interaction, namely interpersonal relationships and social acceptability. In contrast, groups did not differ in functional capacity or social competence as measured under well-controlled and idealized conditions (e.g. SSPA roleplays). Taken together, these findings suggest that paranoid individuals possess the same level of functional skill as non-paranoid individuals but that the implementation of these skills in real-world settings is disrupted. Increased paranoid ideation among individuals with schizophrenia has previously been linked to greater incidences of violent behavior (Nestor, 2002; Silverstein et al., 2015), but this is the first time of which we are aware that paranoia has been linked to difficulties with more normative day-to-day function. Paranoia may therefore worsen the social impairments that are generally experienced by individuals with schizophrenia. It is also worth noting that these group differences were found for informant-t-rated behaviors, which indicates that the effects of paranoia are noticeable to others and are not limited to self-perceptions of difficulty.

While the current study demonstrates greater social cognitive bias and poorer social functioning in paranoid individuals with schizophrenia relative to non-paranoid individuals, some limitations should be considered. First, the results are observational and do not provide any indication of whether paranoia may be the cause or the result of the reported group differences. From a theoretical perspective, bi-directional relationships may be most likely such that tendencies to make hostile attributions contribute to paranoid thinking, which in turn leads to more perceptions of threat and feelings of hostility. Longitudinal and experimental studies will be necessary to tease apart these processes. Second, although we assessed multiple domains of social cognition, potentially important areas such as emotion regulation and empathy were not evaluated. Social perception was also assessed with only a single measure that has questionable psychometric properties (Pinkham et al., 2015). More extensive assessment of social cognitive differences is therefore warranted. Third, the racial composition of our paranoid and non-paranoid groups differed. Analyses are underway that examine whether race and other demographic factors are related to social cognitive performance; however, additional work is required to better understand how race is related to clinician ratings of paranoia. Previous research has demonstrated that paranoid/suspicious behavior is more commonly attributed to African American patients relative to non-African American patients (Trierweiler et al., 2000), and questions remain about whether these differences may be related to clinician bias and how much these ratings may reflect cultural (e.g. nonpathological) vs. clinical (e.g. pathological) aspects of paranoia (Sen & Chowdhury, 2006; Whaley, 2004). Notwithstanding these limitations, the current study reinforces the utility of considering paranoia when investigating social cognitive and functioning impairments in individuals with schizophrenia and suggests paranoid individuals may face additional social challenges that may benefit from specialized interventions.

Author Contributions

Statement of Conflicts of Interest

Acknowledgements

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