Differences in Cognitive and Emotional Processes Between Persecutory and Grandiose Delusions

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Background: **Cognitive models propose that cognitive and emotional processes, in the context of anomalies of experience, lead to and maintain delusions. No large-scale studies have investigated whether persecutory and grandiose delusions reflect differing contributions of reasoning and affective processes. This is complicated by their frequent cooccurrence in schizophrenia. We hypothesized that persecutory and grandiose subtypes would differ significantly in their associations with psychological processes.** ***Methods:*** **Participants were the 301 patients from the Psychological Prevention of Relapse in Psychosis Trial (ISRCTN83557988). Persecutory delusions were present in 192 participants, and grandiose delusions were present in 97, while 58 were rated as having delusions both of persecution and grandiosity. Measures of emotional and reasoning processes, at baseline only, were employed.** ***Results:*** **A bivariate response model was used. Negative self-evaluations and depression and anxiety predicted a significantly increased chance of persecutory delusions whereas grandiose delusions were predicted by less negative self-evaluations and lower anxiety and depression, along with higher positive self and positive other evaluations. Reasoning biases were common in the whole group and in categorically defined subgroups with only persecutory delusions and only grandiose delusions; however, jumping to conclusions, and belief flexibility were significantly different in the 2 groups, the grandiose group having a higher likelihood of showing a reasoning bias than the persecutory group.** ***Conclusion:*** **The significant differences in the processes associated with these 2 delusion subtypes have implications for etiology and for the development of targeted treatment strategies.**

Key words: psychosis/reasoning/jumping to conclusions/ belief flexibility/affect/schemas

Introduction

It is increasingly recognized that psychosis is complex and multifactorial in origin, resulting from a number of interacting biological, psychological, and social factors.[1] Recent cognitive models of positive psychotic symptoms accept the importance of biological processes but emphasize the contribution of psychological mechanisms, involving emotional and reasoning processes, to the development and persistence of psychosis.[1–4]

However, delusions vary in content, and different types of delusions may reflect distinct psychological processes. Factor analyses of delusions separate persecutory delusions from grandiose delusions, eg, refs.,[5,6] and there is evidence of distinct correlates.[7] Persecutory delusions are the most common type of delusion in schizophrenia, affecting about 80%,[8] and receive the most theoretical and empirical attention, eg, refs.[4,8] However, grandiose delusions are also common in schizophrenia, present in perhaps 25%–50% of people with the diagnosis.[9] These 2 delusional subtypes should therefore cooccur in people with a diagnosis of schizophrenia spectrum psychosis, and only 10%–16% experience grandiose delusions in isolation.[9] Such cooccurrence makes it difficult to disentangle individual effects,[10] and this may result in processes associated with one type of delusion being incorrectly attributed to another.

As predicted by cognitive models, changes in affect and reasoning are linked to paranoia. Thus paranoia is associated with negative emotional states and negative cognitions (low self-esteem, self-critical thinking, and extreme negative beliefs about self and others, eg,[4,8,11]). There is also evidence that disturbed reasoning, in particular the data gathering bias, "jumping to conclusions" (JTC), is associated with paranoia and with persecutory delusions.[4,8,12–14] "Belief flexibility" is a reasoning process

related to JTC. It comprises 3 components—accepting the possibility of being mistaken (PM), identifying an alternative explanation (AE) of experiences to the delusional belief (AE), and changing conviction in response to an imagined contradictory scenario (reaction to hypothetical contradiction, RTHC).[13–16] There is initial evidence that belief flexibility is impaired in paranoia.[8,15,16]

Some authors have proposed that grandiose delusions result directly from mood-congruent mood disorder, specifically mania, eg,[17,18] while others suggest that they arise from the individual's attempts to defend against negative emotional states, eg, Neale[19] (the "delusions as defence" account). However, while manic affect may be associated with the onset of grandiose delusions, there is little to suggest a subsequent role in maintenance.[9] Grandiose delusional beliefs appear to be associated with a reduced exposure to loss events, high self-esteem, and low levels of depression and of negative self-schemas.[20–22] One study, using experience sampling in people with schizophrenia, found that negative emotional states predicted persecutory but not grandiose delusions.[23,24]

There have been few studies of cognition specifically in relation to grandiose delusions. Jolley et al[25] found that patients with grandiose delusions and a diagnosis of schizophrenia showed externalizing and self-serving attributional biases, in contrast to the opposite "depressive" cognitive style associated with persecutory delusions. There is evidence for a specific association between grandiose delusions and JTC,[26] although it is currently inconclusive.[24] Appelbaum and colleagues[7] found that grandiose delusions were associated with the highest levels of conviction, which may indirectly suggest an association with these reasoning biases.

The literature therefore suggests that the 2 subtypes of delusion might relate differently to emotional processes, specifically mood states, self-esteem and extreme evaluations of self and others. It appears that the content is generally mood-congruent in both types of delusions, and they are apparently distinguished by relationships of opposite directions. JTC and impaired belief flexibility do seem to cooccur with both grandiose and persecutory delusions, but the question of whether there are distinguishable patterns of relationship remains open. Clarifying these issues should inform both etiological theories and treatment, assisting the development of targeted interventions.

The Current Study

The present study reports the first test of hypotheses about reasoning and emotional processes in relation to persecutory and grandiose delusions. It is based on a large sample of people with a diagnosis of schizophrenia spectrum disorder, the 301 participants in the Psychological Prevention of Relapse in Psychosis (PRP) trial (ISRCTN 83557988).[27] As persecutory and grandiose delusions commonly cooccur, we used a method of analysis (bivariate logistic regression) capable of tackling this cooccurrence. Our previous research in this area was restricted to the separate examination of aspects of reasoning and emotional processes and, with one exception,[11] was based on a much smaller sample, the first 100 participants in the trial.[14,16,22,25,28] The analyses presented here were designed before the collection of data in the knowledge that they would require the whole dataset to provide the necessary statistical power.

1. We hypothesized that persecutory and grandiose delusions will significantly differ in their associations with emotional states (depression and anxiety) and with self-esteem and evaluations of self and others; specifically, paranoid delusions would be associated with depression and negative self-schemas, whereas grandiose delusions would be associated with positive self and other schemas.
2. We also tested the hypothesis that persecutory and grandiose delusions will significantly differ in their associations with reasoning biases (JTC and belief flexibility), in that grandiose delusions would be more strongly associated with JTC and poorer belief flexibility.

In addition to testing these specific hypotheses, we investigated whether the severity of psychosis, the level of delusional conviction, and the presence of hallucinations differed by delusion subtype.

Method

Participants

The study sample comprised the 301 patients from the PRP Trial (ISRCTN83557988), a UK multicentre randomized controlled trial of cognitive behavior therapy and family intervention for psychosis,[27] designed to answer questions both about outcome and the psychological processes associated with psychosis. Inclusion criteria were a current diagnosis of nonaffective psychosis (schizophrenia, schizoaffective psychosis, and delusional disorder), age 18–65 years, a second or subsequent episode starting not more than 3 months before consent to enter the trial, and a rating of at least 4 (moderate severity) on at least one positive psychotic symptom in the Positive and Negative Syndrome Scale (PANSS).[29] Exclusion criteria were a primary diagnosis of alcohol or substance dependency, organic syndrome or learning disability, an inadequate command of English, and unstable residential arrangements. This report uses the symptom and psychological assessments carried out at baseline.

Seventy percent of the total PRP sample was male (mean age 37.6 y). Seventy-two percent described themselves as White-British, 8% as Black-Caribbean, 9% as Black-African, and 11% as from other ethnic backgrounds. Two hundred and fifty-seven (85%) had

a diagnosis of schizophrenia, 40 (13%) of schizoaffective disorder, and 4 (2%) of delusional disorder. The mean length of illness was 10.7 years.

Procedure

After providing written informed consent, participants were administered the measures for the current study, while clinical and demographic data were taken from medical notes (age, gender, self-reported ethnicity, and illness length in years). Diagnoses and presence of specific positive symptoms were established using a clinical diagnostic interview, the Schedules for Clinical Assessment in Neuropsychiatry (SCAN),[30] undertaken by fully trained research assessors, who had high levels of interrater reliability.[27]

Measures

Positive Symptom Measures. Scale for the assessment of positive symptoms The Scale for the Assessment of Positive Symptoms (SAPS)[31] is a 35-item 6-point (0–5) rating instrument. Symptoms are rated over the last month. Persecutory or grandiose delusions were defined as present if a response to item 8 (persecutory delusions) or item 11 (grandiose delusions) of between 2 (mild) and 5 (severe), inclusive, was endorsed. Persecutory or grandiose delusions were defined as absent if a response of 0 was endorsed. If 1 (questionable) was endorsed, the presence or absence of the delusion type could not be confirmed.

Positive and negative syndrome scale The PANSS is a 30-item 7-point (1–7) rating instrument of the phenomena associated with schizophrenia. Symptoms are rated over the last 72 hours. The PANSS positive scale score was used in the analysis.

Psychotic symptom rating scales—delusions subscale This is a 6-item 5-point multidimensional measure of delusions.[32] We used the conviction item, scores dichotomized at <50% and >50%.

Scales for assessment in neuropsychiatry Verbal auditory hallucinations were defined as present if a response of 1 (rarely) to 4 (nearly continuously) was endorsed on SCAN item 17.4 (frequency of verbal auditory hallucinations).

Measures of Emotion and Reasoning. Brief core schema scales The Brief Core Schema Scales (BCSS)[28] is a 24-item 5-point self-report rating scale (0–4) assessing evaluative beliefs about the self and others. Four scores are obtained: negative self (6 items), positive self (6 items), negative others (6 items), and positive others (6 items). The BCSS has good reliability and internal consistency, with Cronbach's α coefficients > .78. Principal components analysis revealed a 4-component solution (consistent with the 4 subscale scores), accounting for 57% of the variance.

Beck depression inventory The Beck Depression Inventory (BDI-II)[33] is a 21-item self-report scale rated on a 4-point scale (0–3) of increasing severity, designed to assess symptoms of depression occurring over the past 2 weeks. It has good psychometric properties and has been used in many studies with patients with psychosis. We used the total score.

The Rosenberg self-esteem scale The Rosenberg Self-Esteem Scale (RSES)[34] is a widely used, validated, self-report 10 item 4-point scale (1–4) that assesses current levels of global self-esteem. We used the total score.

Beck anxiety inventory The Beck Anxiety Inventory (BAI)[35] is a self-report 21-item 4-point scale (0–3) for the assessment of anxiety. Anxiety is assessed over the previous week. We used the total score.

JTC—probabilistic reasoning tasks We employed 3 probabilistic reasoning tasks, as previously described.[14] Two neutral tasks (versions of the beads task) utilized colored beads in an 85:15 or 60:40 ratio. Participants were shown 2 jars containing equal and opposite proportions of 2 colors of beads. The jars were hidden from view and beads drawn, one at a time, from just one of the jars. The task-required participants to decide which of the 2 jars had been chosen. In the third task, participants were shown positive and negative words in a 60:40 ratio, ostensibly drawn from a survey of 100 people describing an individual (salient words task). Each task included a memory aid, in which the previous items drawn are shown. We conducted analyses based on a categorical definition of JTC, identified by coming to a decision after seeing fewer than 3 beads.[13,14]

Reasoning/belief flexibility: Maudsley assessment of delusions and the explanations of experiences measure The Maudsley Assessment of Delusions (MADS)[36] is a semi-structured interview assessing the cognitive, affective, and behavioral components of delusions and self-reported evidence for delusions (internal and external events including hallucinations and other anomalous experiences). The MADS has good interrater reliability (mean κ = 0.82).

The belief maintenance section of the MADS enquires about the evidence for the delusion, and 2 of its items have been used to measure aspects of belief flexibility (the PM and the RTHC).[14] The evidence for the delusion cited by participants is sensitively discussed, and they are asked whether it is at all possible for them to be mistaken about their delusional belief. The interviewer then asks how they would react in a hypothetical situation if some new evidence were to be generated, which contradicts the delusion. If they report that this would alter in any way their level of belief, this is recorded as belief flexibility.

The Explanations of Experiences measure[16] is a structured interview designed to assess whether people can envisage AE for the evidence cited for their delusion. Once the evidence for the delusion is established, they are asked "Can you think of any other explanations for the experiences that you have described? Are there any other reasons—other

than (the delusional belief)—that could possibly account for these experiences even if you think they are very unlikely?" The generation of any AE is also taken as an indication of belief flexibility.

Analysis

Analyses were carried out using Stata version 11.[37] We first present descriptive data on the whole sample and display the cognitive and emotional variables in relation to the presence and absence of persecutory and of grandiose delusions. To examine our key hypotheses of differences between persecutory and grandiose delusions in these processes, we used a bivariate response (ie, repeated measures) model,[38] the aim being to test whether the effect of a given predictor is the same on the 2 outcomes. As in many repeated measures analyses, multiple records (in this case, 2) were created for each participant, each corresponding to the value of the within-subject variable distinguishing the repeated measurements. In this case, the binary indicator of persecutory delusions was the first record, and the binary indicator of grandiose delusions was the second. The name of the binary variable indicating the presence of delusions (irrespective of type), "Delusion," was common to both records. A further variable—a within-subject factor (type) was created to indicate whether the record corresponded to persecution (type = 1) or to grandiosity (type = 2). Note that the responses to both types can be 0 (absent) or 1 (present)—giving 4 possibilities (both 0, 0 and 1, 1 and 0, and both 1) but that the responses to the 2 types will be correlated. This data structure (the "long" format in stata) is more frequently encountered in a repeated measures analysis where the with-subject factor is time rather than the qualitative variable, type. The lack of independence between within-subject observations is allowed for by the participant's ID.

Consider, for example, the predictive effect of Sex. Ignoring possible confounders for simplicity, the Stata command to be used, is the following:

logit delusion i.sex i.type i.sex × i.type, cluster (id)

This corresponds to what is called a marginal bivariate logistic regression model, allowing for clustering (correlation) arising through the ID variable. The command automatically generates robust SEs, CIs, and corresponding *P* values. Readers with experience of the more familiar repeated measures analysis (involving time as the within-subject factor) will realize that the key test is that for the sex by type interaction (ie, is the effect of sex the same for the 2 types of delusion?—or, in the analogous situation, is the effect of an explanatory factor the same over time?).

We report the effects adjusted for potential confounding variables. Because unadjusted relationships may be subject to bias by failing to take into account confounding variables (covariates) associated with both predictors and outcome, the presentation of the adjusted effects is considered preferable. The covariates determined a priori as clinically important predictors were age, sex, ethnicity, belief flexibility (possibly mistaken), JTC (85–15); negative evaluations (negative other); positive evaluations (positive other), BDI, and BAI. Due to their considerable collinearity, the mood variables (BDI and BAI) were removed as covariates in favor of the negative and positive evaluation variables (which also contained more complete data). For each predictor, the adjusted model included the main effects of each confounder and the predictor's interaction with type effect. All hypothesis testing was 2-tailed.

We also performed sensitivity analyses, in which we repeated the bivariate logistic analysis twice. Initially, we included all the predictors of interest as covariates in the model. We then applied a principal component regression in order to remove any collinearity present within the clinical and nondemographic variables before including them as covariates. The results were similar. As in most large samples, there were variable amounts of missing data. We used a complete-case analysis and checked whether any demographic or clinical variables were significant predictors of missing data; such predictors turned out to have been flagged as covariates and had already been included in the model.

Results

Presence of Delusion Types in the Whole Sample

Using SAPS ratings, persecutory delusions were rated present in 192 of the 301 participants, while grandiose delusions were present in 97 participants. Fifty-eight participants were rated as having both persecutory and grandiose delusions. There were no missing SAPS data.

Table 1 gives summary data on presence, absence, and questionable ratings of persecutory and grandiose delusions and on the presence of other delusion subtypes and their cooccurrence with persecutory and grandiose delusions (excluding "questionable" ratings). Thirty-two participants were rated as having no delusions of any type (inclusion in the PRP sample required at least one positive symptom, and these participants had hallucinations only). One hundred and eighty-nine participants (65.4%) were recorded as having verbal auditory hallucinations, while 100 (34.6%) did not.

Clinical, Emotion, and Reasoning Processes in the Whole Sample

Table 2 shows summary statistics for selected clinical, emotion, and reasoning variables for the whole sample. The sample, which was recruited within 3 months of a psychotic relapse, had, on average, moderate levels of positive and negative symptoms and mild-moderate levels of depressed and anxious mood. They had low

Table 1. Delusion Subtypes in the Whole Sample (*N* = 301)

	Present	Absent	Questionable	Total
Persecutory	192 (64%)	85 (28%)	24 (8%)	301
Grandiose	97 (32%)	177 (59%)	27 (9%)	301
	Persecutory Present %	Absent %	Grandiose Present %	Absent %
Jealousy (*n* = 7)	71	29	0	100
Guilt or sin (*n* = 38)	95	5	30	70
Religious (*n* = 56)	70	30	75	25
Somatic (*n* = 54)	80	20	38	62
Reference (*n* = 174)	84	16	43	57
Being controlled (*n* = 41)	75	25	34	66
Mind reading (*n* = 83)	82	18	43	5
Thought broadcast (*n* = 39)	69	31	41	59
Thought insertion (*n* = 46)	76	24	50	50
Thought withdrawal (*n* = 15)	67	33	46	54

self-esteem and negative views of self and others, typical of a psychosis group. As generally seen in psychosis, approximately 40%–50% of the sample showed the JTC reasoning bias and 50%–76% a lack of belief flexibility.

Table 2. Clinical, Emotional, and Reasoning Variables in the Whole Sample (*n* = 301)

	Mean	SD	Range
Clinical			
PANSS positive	18.15	5.33	7–36
PSYRATS conviction	2.71	1.47	0–4
PANSS negative	13.27	6.03	7–38
Emotional			
BAI	19.86	14.22	0–63
BDI-II	22.12	13.11	0–58
RSES	23.54	6.43	10–40
Negative self	7.19	5.89	0–24
Positive self	10.15	6.48	0–24
Negative other	8.97	6.81	0–24
Positive other	10.43	6.13	0–24
JTC	JTC *n* (%)		Not JTC *n* (%)
85:15 beads task	105 (51.5)		99 (48.5)
60:40 beads task	79 (39.3)		122 (60.7)
Words task	72 (36.9)		123 (63.1)
BF	Evidence of BF		No Evidence of BF
AE	49 (23.8)		157 (76.2)
RTHC	66 (32.2)		139 (67.8)
PM	110 (50.5)		108 (49.5)

Note: AE, alternative explanations; BAI, Beck Anxiety Inventory; BDI-II, Beck Depression Inventory; BF, belief flexibility; PANSS, Positive and Negative Syndrome Scale; PM, possibility of being mistaken; PSYRATS, Psychotic Symptom Rating Scales—Delusions Subscale; RSES, Rosenberg Self-Esteem Scale; RTHC, reaction to hypothetical contradiction; JTC, jumping to conclusions.

Grandiose and Persecutory Delusions and Emotional and Reasoning Processes

The sample was then divided into 4 groups as follows: persecutory delusions only (the "P-group": SAPS P rated > 1 and G < 2), grandiose delusions only (the "G-group": SAPS G rated > 1 and P < 2), both persecutory and grandiose delusions (the "P- and G-group": both P and G > 1), and neither persecutory nor grandiose delusions (the "neither group": both P and G = 0) (where 0 = absent. 1 = questionable. and 2 = present). Twenty-one participants were excluded from these tables (and our subsequent analyses) because we could not use their delusion type data with confidence: they had either 2 questionable (1) ratings or a combination of a questionable and an absent rating. The final sample is consequently *N* = 280, with variable amounts of missing data. Table 3 shows selected demographic and clinical symptom data, and table 4 shows emotion-related and reasoning variables.

Visual inspection of these tables suggests no clearly different associations between the 4 different groupings in either demographic or clinical data (table 3). In table 4, the P-group tended to score highest on negative emotion variables, the G-group lowest, and the P and G-group falls midway. The G-group had notably low, ie, better, self-esteem scores (there are no formal cutoffs on the RSES) and mean scores near to (or only just above) the cutoffs (14/15) for clinical levels of depression and anxiety, respectively.[33,35] Reasoning biases were common in all groups, but the pattern is less clear than for the emotion variables (table 4).

Differences Between Persecutory and Grandiose Delusions

The bivariate logistic regression analysis is the key test of our hypotheses that persecutory and grandiose

Table 3. Demographic, Clinical, and Delusion Types by Subgroupings of Grandiose/Persecutory Delusion Types

	Persecutory Only	Grandiose Only	Persecutory and Grandiose	Neither Persecutory or Grandiose	Total
Gender					
Male	91	31	48	31	201
Female	43	8	10	18	79
Ethnicity					
White	96	32	46	31	205
Black-Caribbean	12	0	1	8	21
Black-African	10	6	4	5	25
Black-other	3	1	2	1	7
Indian	2	0	1	2	5
Other	11	0	4	2	17
Diagnosis					
F20 schizophrenia	119	33	47	45	244
F22 delusional	1	0	1	0	2
Disorder					
F25 schizoaffective disorder	14	6	10	4	34
Grandiose delusions					
Absent	119	0	0	49	168
Present	0	39	58	0	97
Persecutory delusions					
Absent	0	28	0	49	77
Present	134	0	58	0	192

	n	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD
Age	134	37.68	11.05	39	39.33	10.47	58	38.48	11.97	49	34.92	9.76	280	37.59	10.98
PANSS positive	134	18.36	4.26	39	19.64	4.17	58	22.28	5.56	49	12.53	3.63	280	18.33	5.38
PSYRATS conviction	132	3.08	1.05	39	3.28	1.10	56	3.125	1.18	48	0.81	1.48	275	2.72	1.46
PANSS negative	134	13.74	6.20	39	12.46	5.81	58	11.24	4.25	49	14.39	6.82	280	13.16	5.99

Note: PANSS, Positive and Negative Syndrome Scale; PSYRATS, Psychotic Symptom Rating Scales—Delusions Subscale.

delusions would differ significantly in their associations with emotion and reasoning processes. Table 5 displays the effects for each predictor, adjusted for the set of potential confounders with adjusted ORs, *P* values and 95% CIs for the interactions and corresponding main effects.

In interpreting these results, note that, for continuous scales, the ORs refer to 1-point changes; if the OR for a unit change in the independent variable is, eg, 1.10, then the OR for a 10-point increase is 1.10 raised to the power of 10 (ie, 2.59). Alternatively, if the OR for a 1-point increase in self-esteem score is 0.89, the OR for a 10-point increase is 0.89 to the power of 10, ie, 0.31. For example, the adjusted effect for self-esteem is significant (*P* < .001), and as self-esteem score increases by 1-point (ie, toward poorer self-esteem), the odds increase by 1.10 for persecutory delusions and reduce by 0.90 (1.10 × 0.82 = 0.90) for grandiose delusions. For the categorical variables, the ORs are more easily interpreted. For example, for JTC 85-15, the adjusted odds of showing the JTC bias is 0.31 in the persecutory group and nearly 7.5 times greater at 2.29 (0.31 × 7.39 = 2.29) in the grandiose group.

Nearly, all of the predicted emotion variables showed highly significant effects in the hypothesized directions. Negative self-evaluations and negative mood (depression and anxiety) predicted an increased chance of persecutory delusions. In contrast, grandiose delusions were predicted by less negative self-evaluations, and lower anxiety and depression, along with higher positive self and positive other evaluations. The results for reasoning variables are less consistently strong. The effects of JTC 85-15, and the 3 belief flexibility variables (AE, PM, and RTHC) were significantly different in the 2 groups (*P* values < .001; .05; .03; and .03, respectively); in all these cases, the grandiose group had a higher likelihood of showing the reasoning bias than the persecutory group (respectively, JTC 85:15 was 7.4 times more likely; AE, 6.6 times; PM, 4.5 times; and RTHC, 9 times more likely; note that JTC and belief flexibility variables are scored in opposite directions). However, 2 JTC measures, 60:40 beads and words, were not significantly different. Neither of our measures of symptom severity showed significant effects (PANSS positive score, Psychotic Symptom Rating Scales—Delusions Subscale [PSYRATS] conviction) nor did the presence of hallucinations.

Table 4. Emotional and Reasoning Variables by Presence and Absence of Persecutory and Grandiose Delusions

	Persecutory Only			Grandiose Only			Persecutory and Grandiose			Neither Persecutory or Grandiose			Total		
	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD
Emotional																
BAI	124	23.19	13.76	35	14.43	13.51	53	18.08	12.65	46	17.07	14.9	258	19.86	14.05
BDI-II	130	25.52	12.95	39	16.31	10.25	54	18.91	12.76	49	21.73	12.93	272	22.2	12.98
RSES	118	25.64	5.91	32	18.97	5.53	52	21.83	5.92	43	23.72	6.4	245	23.62	6.37
Negative self	117	8.42	5.75	32	3.94	4.03	46	6.52	6.12	46	6.7	5.98	241	7.13	5.84
Positive self	115	7.9	5.54	31	13.77	6.81	46	12.54	5.6	46	11.09	7.08	238	10.18	6.44
Negative other	117	10.45	6.65	32	7.84	6.31	45	9.36	7.15	45	5.8	6.17	239	9.02	6.81
Positive other	115	9.23	5.87	31	11.48	6	45	11.11	5.96	44	12	6.85	235	10.41	6.17
Reasoning		N (%)			N (%)			N (%)			N (%)			N (%)	
JTC (85:15 beads task)															
Not JTC		45 (52)			5 (20)			23 (50)			19 (54)			92 (48)	
JTC		42 (48)			20 (80)			23 (50)			16 (46)			101 (52)	
JTC (60:40 beads task)															
Not JTC		53 (62)			13 (54)			28 (61)			22 (63)			116 (61)	
JTC		32 (38)			11 (46)			18 (39)			13 (37)			74 (39)	
JTC (word task)															
Not JTC		50 (60)			14 (58)			31 (70)			22 (67)			117 (63)	
JTC		34 (40)			10 (42)			13 (30)			11 (33)			68 (37)	
AE															
No alternatives		83 (75)			23 (79)			39 (78)			8 (89)			153 (77)	
Alternatives		28 (25)			6 (21)			11 (22)			1 (11)			46 (23)	
RTHC															
No change in conviction		70 (64)			23 (74)			37 (76)			4 (57)			134 (68)	
Change in conviction		40 (36)			8 (26)			12 (24)			3 (43)			63 (32)	
Possibly mistaken															
No		48 (42)			16 (52)			33 (63)			5 (56)			102 (49)	
Yes		67 (58)			15 (48)			19 (37)			4 (44)			105 (51)	

Note: AE, alternative explanationsl BAI, Beck Anxiety Inventory; BDI-II, Beck Depression Inventory; JTC, jumping to conclusions; RSES, Rosenberg Self-Esteem Scale; RTHC, reaction to hypothetical contradiction.

Discussion

This is the first study to examine differences in the emotional and cognitive processes characteristic of persecutory and grandiose delusions in a large sample of people with a diagnosis of schizophrenia spectrum psychosis. Appropriate analysis must take account of the fact, confirmed in our sample, that most patients with grandiose delusions also have delusions of persecution. Simple examination or separate regressions of the mean scores of groups with one of these delusion types (a commonly employed method) masks the effects of the cooccurring delusion, especially when these are in opposite directions. Comparing people with pure persecutory and pure grandiose delusions has the further limitation of comparing unusual and extreme groupings. We therefore based our main analysis on bivariate logistic regression, which permits the examination of the differential prediction of delusion type in a single analysis.

The findings indicated clearly that there were significant differences in the processes associated with these 2 delusion subtypes. As hypothesized, persecutory and grandiose delusions were differentially associated with emotional states and extreme evaluations of self and others: the odds of delusions of persecution increased with negative emotions, negative self and other evaluations, and lower self-esteem, while the odds of grandiose delusions increased with higher positive evaluations of self and others and lower depression and anxiety.

The results concerning reasoning biases are novel and intriguing. The findings, while less consistent than those for the emotional variables, showed that grandiose delusions were significantly more likely than persecutory delusions to be associated with poor belief flexibility and with JTC 85:15, with relative odds ranging from approximately 4.5 to 9 times higher. This has not previously been shown and warrants further investigation and replication. If replicated, the findings would have important

Table 5. Bivariate Logistic Regression

	Adjusted Effects		
	OR	*P* Value	CI
Clinical			
PANSS positive	1.09	.12	0.98–1.21
Type	0.01	.01	0.00–0.35
Type × PANSS positive	1.14	.12	0.97–1.33
Psyrats conviction (>50%)	0.38	.44	0.03–4.30
Type	0.02	.007	0.01–0.36
Type × PSYRATS conviction	7.07	.17	0.44–112.7
Auditory hallucinations (present)	1.12	.84	0.38–3.25
Type	0.16	.002	0.05–0.52
Type × auditory hallucinations	0.75	.7	0.17–3.24
Emotional			
BAI	1.07	.003	1.02–1.12
Type	0.83	.76	0.25–2.72
Type × BAI	0.92	.003**	0.86–0.97
BDI-II	1.04	.04	1.00–1.08
Type	1.45	.59	0.38–5.51
Type × BDI-II	0.91	.000***	0.86–0.96
RSES	1.1	.02	1.01–1.20
Type	19.43	.03	1.27–297.3
Type × self-esteem	0.82	.000***	0.73–0.91
Negative self	1.18	.009	1.04–1.35
Type	0.74	.6	0.25–2.24
Type × negative self	0.79	.001***	0.68–0.91
Positive self	0.93	.07	0.86–1.01
Type	0.02		0.01–0.07
Type × positive self	1.26	.000***	1.11–1.42
Negative other	1.07	.07	0.99–1.15
Type	0.26	.03	0.08–0.86
Type × negative other	0.94	.25	0.85–1.04
Positive other	0.95	.23	0.86–1.04
Type	0.04		0.01–0.17
Type × positive other	1.14	.03*	1.01–1.29
Reasoning			
85:15 beads task (JTC)	0.31	.04	0.10–0.94
Type	0.05		0.02–0.13
Type × 85:15 beads task	7.39	.004**	1.87–29.3
60:40 beads task (JTC)	1.5	.46	0.51–4.43
Type	0.15		0.06–0.35
Type × 60:40 beads task	1.04	.96	0.23–4.62
Words task (JTC)	0.76	.59	0.27–2.08
Type	0.13		0.05–0.33
Type × JTC words	1.41	.65	0.32–6.19
AE (alternatives)	3.66	.1	0.78–17.2
Type	0.19		0.09–0.43
Type × AE	0.15	.05*	0.02–1.01
RTHC (change)	3.33	.15	0.64–17.2
Type	0.24	.001	0.10–0.54
Type × hypothetical contradictions	0.11	.03*	0.02–0.82
Possibly mistaken (yes)	1.73	.29	0.63–4.71
Type	0.3	.009	0.12–0.73
Type × possibly mistaken	0.22	.04*	0.05–0.91

Note: AE, alternative explanations; BAI, Beck Anxiety Inventory, BDI-II, Beck Depression Inventory; PANSS, Positive and Negative Syndrome Scale; PSYRATS, Psychotic Symptom Rating Scales—Delusions Subscale; RSES, Rosenberg Self-Esteem Scale, RTHC, reaction to hypothetical contradiction; JTC, jumping to conclusions.
*$P \le .05$, ** $P \le .01$, *** $P \le .001$

implications for etiological theories of grandiose delusions and for treatment. It is not clear why these findings relate to only 1 of our 3 indicators of JTC. We know from other analyses of the PRP sample, that the 3 indicators are related and form 1 clear factor.[13,14]

The absence of any other symptomatic differences is also of interest. The differences found here between persecutory and grandiose delusions therefore cannot be attributed to differential influences of auditory hallucinations, levels of delusional conviction, or overall positive symptom severity.

Our results are consistent with the increasing weight of evidence for the role of negative emotion and negative self-concept in persecutory delusions.[4,11] However, our finding that reasoning biases are less prominent in persecutory than in grandiose delusions has not been previously shown. This should not, however, be taken to imply that they do not apply at all to persecutory delusions—table 4 is instructive: it shows that about 50% of the sample with persecutory delusions only (P-Group) jumped to conclusions on the 85:15 task, and appreciable proportions showed poor belief flexibility. Grandiose delusions were characteristically associated with less negative emotions and a more positive self-concept, also supporting the emotion-consistent model discussed above.[9] However, they were more likely than persecutory delusions to be associated with reasoning biases, suggesting etiological differences between these delusion types. The absence of differences in conviction suggested that this factor does not account for the observed differences.

There is currently no theoretical model of grandiose delusions, which adequately addresses reasoning processes. We tentatively speculate that, in the absence of depressed affect and a negative self-concept, the aberrant experiences of psychosis are more likely to be appraised as personally significant and to acquire grandiose (positive) content when a person's style of reasoning shows a tendency to adopt an explanation of events and experiences on the basis of limited data and with limited generation of AE or review of evidence. It is apparent that there is a need for the development of a more elaborate model of grandiose delusions, incorporating both reasoning and emotional processes. This should then be tested in empirical studies.

The present study had some limitations. First, we chose to focus on the processes associated with 2 common delusions and in doing so, we have not been able to consider other cooccurring delusion subtypes. These are many and various, as show in table 1 (though in relatively small numbers), and we do not know how each subtype contributes to this emerging picture. Secondly, we set a low threshold for including the presence of grandiose and persecutory delusions. Thus we included ratings of mild delusions (scoring 2 on the SAPS), (although the mean PSYRATS conviction scores indicate that, in general, the group had high conviction). This was because

we were interested in testing for associations with the occurrence, rather than with the severity, of delusion type. Thirdly, this was a cross-sectional study, which cannot identify the direction of effects. Fourthly, the analysis involved multiple testing because we wished to examine a number of measures in a single study; the reasoning results should therefore be treated with some caution, particularly those with P values nearing .05. It is important that these findings be replicated in a large independent sample. Finally, there were missing data, in varying amounts for each measure. We took account of this in the analysis, and for the bivariate logistic regression, we were able to conduct a complete-case analysis, minimizing, as far as possible, the effect of missing data.

Our findings have significant clinical implications. The importance of emotional processes specific to these delusion types is clear and in line with recent work on developing psychological treatments for paranoia.[39] Our results suggest a need for further theoretical development and treatment innovation on emotion-congruent processes for both types of delusion.[8,9] However, the reasoning results suggest a new emphasis. For people with grandiose delusions, it is recognized that psychological therapy may be especially challenging because of the positive mood and self-esteem associated with these delusions and the consequently low motivation for change. Our findings further indicate that important reasoning biases may go under recognized. The reasoning biases of JTC and belief flexibility are relatively difficult to change, and work is underway to develop more targeted therapeutic approaches, eg, refs.[15,40] There is a clear need to develop and tailor therapeutic strategies more specifically to these delusion subtypes and their associated emotional and reasoning biases.

References

1. Garety PA, Bebbington P, Fowler D, Freeman D, Kuipers E. Implications for neurobiological research of cognitive

models of psychosis: a theoretical paper. *Psychol Med.* 2007; 37:1377–1391.

2. Garety PA, Kuipers E, Fowler D, Freeman D, Bebbington PE. A cognitive model of the positive symptoms of psychosis. *Psychol Med.* 2001;31:189–195.

3. Freeman D, Garety PA, Kuipers E, Fowler D, Bebbington PE. A cognitive model of persecutory delusions. *Br J Clin Psychol.* 2002;41:331–347.

4. Bentall RP, Rowse G, Shryane N, et al. The cognitive and affective structure of paranoid delusions: a transdiagnostic investigation of patients with schizophrenia spectrum disorders and depression. *Arch Gen Psychiatry.* 2009;66:236–247.

5. Kimhy D, Goetz R, Yale S, Corcoran C, Malaspina D. Delusions in individuals with schizophrenia: factor structure, clinical correlates, and putative neurobiology. *Psychopathology.* 2005;38:338–344.

6. Peralta V, Cuesta MJ. Dimensional structure of psychotic symptoms: an item-level analysis of SAPS and SANS symptoms in psychotic disorders. *Schizophr Res.* 1999;38:13–26.

7. Appelbaum PS, Robbins PC, Roth LH. A dimensional approach to delusions: comparison across delusion types and diagnoses. *Am J Psychiatry.* 1999;156:1938–1943.

8. Freeman D. Suspicious minds: the psychology of persecutory delusions. *Clin Psychol Rev.* 2007;27:425–457.

9. Knowles R, McCarthy-Jones S, Rowse G. Grandiose delusions: a review and theoretical integration of cognitive and affective perspectives. *Clin Psychol Rev.* 2011;31:684–696.

10. Menon M, Addington J, Remington G. Examining cognitive biases in patients with delusions of reference [published online ahead of print June 07, 2011]. *Eur Psychia.* doi: 10.1016/j.eurpsy.2011.03.005.

11. Fowler D, Hodgekins J, Garety PA, et al. Negative cognition, depressed mood, and paranoia: a longitudinal pathway analysis using structural equation modelling [published online ahead of print April 7, 2011]. *Schizophr Bull.* doi:10.1093/schbul/sbr019.

12. Startup H, Freeman D, Garety P. Jumping to conclusions and persecutory delusions. *Eur. Psychia.* 2008;23:457–459.

13. So SH, Freeman D, Dunn G, et al. Jumping to conclusions, a lack of belief flexibility and delusional conviction is psychosis: A longitudinal investigation of the structure, frequency, and relatedness of reasoning biases. *J Abnorm Psychol.* 2012;121:129–139.

14. Garety PA, Freeman D, Jolley S, et al. Reasoning, emotions and delusional conviction in psychosis. *J Abnorm Psychol.* 2005;114:373–384.

15. Waller H, Dunn G, Freeman D, Jolley S, Garety P. Targeting reasoning biases in delusions: a case series study of the Maudsley Review Training Programme for individuals with persistent, high conviction delusions. *Behav Ther Exp Psychiatry.* 2011;42:414–421.

16. Freeman D, Garety PA, Fowler D, Kuipers E, Bebbington P, Dunn G. Why do people with delusions fail to choose more realistic explanations for their experiences? An empirical investigation. *J Consult Clin Psychol.* 2004;72:671–680.

17. Smith N, Freeman D, Kuipers E. Grandiose delusions: an experimental investigation of the delusion-as-defence hypothesis. *J Nerv Ment Dis.* 2005;193:480–487.

18. Lake CR. Hypothesis: grandiosity and guilt cause paranoia; paranoid schizophrenia is a psychotic mood disorder; A review. *Schizophr Bull.* 2008;34:1151–1162.

19. Neale JM. Defensive functions to manic episodes. In: Oltmanns T, Maher B, eds. *Delusional Beliefs.* New York, NY: John Wiley & Sons; 1998:138–156.

20. Raune D, Bebbington P, Dunn G, Kuipers E. Event attributes and the content of psychotic experiences in first-episode psychosis. *Psychol Med.* 2006;36:221–230.

21. Moritz S, Vecjenstedt R, Randjbar S, Vitzthum F, Karow A, Lincoln TM. Course and determinants of self-esteem in people diagnosed with schizophrenia during psychiatric treatment. *Psychosis.* 2010;2:144–153.

22. Smith B, Fowler D, Freeman D, et al. Emotion and psychosis: direct links between schematic beliefs, emotion and delusions and hallucinations. *Schizophr Res.* 2006;86:181–188.

23. Ben-Zeev D, Ellington K, Swendsen J, Granholm E. Examining a cognitive model of persecutory ideation in the daily life of people with schizophrenia: a computerised experience sampling study [published online ahead of print April 28, 2010]. *Schizophr Bull.* doi: 10.1093/schbul/sbq041.

24. Ben-Zeev D, Morris S, Swendsen J, Granholm E. Predicting the occurrence, conviction, distress, and disruption of difference delusional experiences in the daily life of people with schizophrenia [published online ahead of print June 19, 2011]. *Schizophr Bull.* doi:10.1093/schbul/sbq167.

25. Jolley S, Garety PA, Bebbington P, et al. Attributional style in psychosis—the role of affect and belief type. *Behav Res Ther.* 2006;44:1597–1607.

26. Jolley S. Reasoning attribution and illness appraisal in psychosis. PhD thesis, London, UK: Institute of Psychiatry, King's College; 2010.

27. Garety PA, Fowler D, Freeman D, Bebbington P, Dunn G, Kuipers E. A randomised controlled trial of cognitive behavioural therapy and family intervention for the prevention of relapse and reduction of symptoms in psychosis. *Br J Psychiatry.* 2008;192:412–423.

28. Fowler D, Freeman D, Smith B, et al. The Brief Core Schema Scales (BCSS): psychometric properties and associations with paranoia and grandiosity in non-clinical and psychosis samples. *Psychol Med.* 2006;36:749–759.

29. Kay SR, Fiszbein A, Opler LA. The positive and negative syndrome scale (PANSS) for schizophrenia. *Schizophr Bull.* 1987;13:261–276.

30. World Health Organisation. *SCAN Schedules for Clinical Assessment in Neuropsychiatry.* Geneva, Switzerland: World Health Organization; 1992.

31. Andreasen NC. *Scale for the Assessment of Positive Symptoms (SAPS).* Iowa City; IA: University of Iowa; 1984.

32. Haddock G, McCarron J, Tarrier N, et al. Scales to measure dimensions of hallucinations and delusions: the psychotic symptom rating scales (PSYRATS). *Psychol Med.* 1999;29:879–889.

33. Beck AT, Steer RA, Brown GK. *BDI-II Manual. The Psychological Corporation.* San Antonia, TX: Psychological Corporation; 1996.

34. Rosenberg M. *Society and the Adolescent Self-Image.* Princeton, NJ: Princeton University Press; 1965.

35. Beck AT, Epstein N, Brown G, Steer RA. An inventory for measuring clinical anxiety: psychometric properties. *J Consult Clin Psychol.* 2008;56:893–897.

36. Wessely S, Buchanan A, Reed A, et al. Acting on delusions (1): prevalence. *Br J Psychiatry.* 1993;163:69–76.

37. StataCorp. *Stata Statistical Software: Release 11.* College Station, TX: StataCorp LP; 2009.

38. Dunn G. *Statistics in Psychiatry.* London, UK: Arnold; 2000.

39. Foster C, Startup H, Potts L, Freeman D. A randomised controlled trial of a worry intervention for individuals with persistent persecutory delusions. *Behav Ther Exp Psychiatry*. 2010;41:45–51.

40. Moritz S, Woodward TS. Metacognitive training in schizophrenia: from basic research to knowledge translation and intervention. *Curr Opin Psychiatry*. 2007;20: 619–625.