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Assessment of attachment in psychosis: A psychometric cause for concern

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ABSTRACT

Attachment has recently been proposed as a key developmental construct in psychosis, in particular with respect to interpersonal functioning and social cognition. The current study examined the latent structure of the self-report Psychosis Attachment Measure (PAM) and its relationship to lower-level perceptual and higher-order inferential social cognitive processes. The PAM was administered to 138 psychiatrically stable outpatients with schizophrenia alongside a battery of symptom, social cognitive, and functional measures. PAM responses were analyzed using latent variable measurement models, which did not yield evidence of the coherent two-dimensional structure predicted by previous literature. A unidimensional subscale comprising 6 of the 16 original PAM items possessed the strongest psychometric properties. This subscale was generally uncorrelated with social cognitive measures and showed weak correlations with some symptoms measures and with community functioning. These results suggest that either the PAM may not measure attachment in psychosis or it may measure only attachment anxiety but demonstrate little construct validity in this population. These results tell a cautionary tale regarding making theoretical inferences on the basis of measures without coherent latent structure. Attachment measures with stronger psychometric properties will help clarify putative relationships between attachment and social cognitive processes in psychosis.

1. Introduction

Attachment, the universal human need to form and manage emotional bonds with significant others (Ainsworth, 1979; Bowlby, 1977), has become a central construct, not only for infant and child development, but also for conceptualizing adult psychopathology and interpersonal problems (Danquah and Berry, 2014); attachment may also represent a construct capable of bridging developmental, neurobiological, and interpersonal levels of analysis in psychosis (Gumley et al., 2014; Korver-Nieberg et al., 2014). Developmental attachment bonds contribute to interpersonal security and cognition more broadly (Bowlby, 1977; Fonagy and Target, 2005), and attachment styles persist into adulthood and shape relational models (Fraley, 2002). Although attachment styles were traditionally defined typologically (i.e., secure, avoidant, etc.), taxometric analysis has supported dimensional models of attachment (Fraley and Spieker, 2003); we have adopted Bartholomew's (1990) two-dimensional conceptualization of anxious (fearful and dependent) and avoidant (dismissive and defensive) attachment.

Attachment measures correlate with psychotic phenomena including positive symptoms (Berry et al., 2006), paranoia (Wickham et al., 2014), and distress when hearing voices (Berry et al., 2012). Moreover, attachment measures for individuals with psychosis correlate with attributional bias (Donohoe et al., 2008), mentalizing (MacBeth et al., 2011), social and community functioning (Couture et al., 2007), and interpersonal problems (Berry et al., 2008). For these reasons, social cognition has been proposed as a mediator between insecure attachment and clinical and functional problems psychosis (Korver-Nieberg et al., 2014). Theoretically, attachment styles correspond to self and other representations; since community functioning partly depends upon social decision-making based upon such representations, links between attachment, social cognition, and functioning should be expected.

Of the many self-report and interview measures of attachment (Crowell, Fraley, and Shaver, 2008; Gumley et al., 2014), one

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commonly-used measure for individuals with psychosis is the Psychosis Attachment Measure (PAM; Berry et al., 2006), a 16-item self-report questionnaire about thoughts and feelings regarding close interpersonal relationships. The PAM was based upon previous attachment measures (excluding references to romantic relationships) and designed to assess anxious and avoidant attachment factors (Bartholomew, 1990; Berry et al., 2008, 2006).

Although reported PAM subscale internal consistencies have ranged from acceptable to excellent, studies tend to report few psychometric data (e.g., Picken et al., 2010). We are aware of only two studies investigating the PAM's psychometric structure in clinical samples, each of which derived factors via principle components analysis (PCA) with varimax rotation (Berry et al., 2008; Kvrgic et al., 2011). Because PCA is not generally considered methodologically sound for exploratory factor analysis, factor analytic results from PCA may not be generalizable; more specifically, PCA is a data-reduction technique designed to form linear combinations (composite) with maximum variance. PCA assumes that all variables are measured without error. By contrast, factor analysis attempts to capture latent variables that reflect common variance among the indicators. Factor analysis is considered the correct procedure when evaluating latent variables, their interrelations, and relations with other variables rather than data reduction (Floyd and Widaman, 1995; Schmitt, 2011). Moreover, no confirmatory analyses have tested the hypothesis that the PAM conforms to a two-factor structure.

We report on data from a sample of individuals diagnosed with schizophrenia aimed at evaluating the PAM's psychometric properties and construct validity by assessing its relationship to social cognition using paradigms assessing higher-level inferential processes and lower-level perceptual processes. We hypothesized that (1) the PAM possesses a two-factor structure and (2) greater attachment insecurity would be associated with worse performance on higher-level social cognitive tasks. We also report exploratory analyses of the relationship between attachment and social cognitive tasks (lower-level perceptual processes, attribution bias, and facial affect identification), symptoms, community functioning, and functional capacity.

2. Methods

2.1. Subjects

Participants comprised 146 psychiatrically-stable outpatients with a DSM-IV research diagnosis of schizophrenia, and no evidence of recent alcohol or substance dependence (6 months) or abuse (past month) based on SCID-I/P clinical interview (First et al., 2012). Participants comprised a subset of patients from two performance sites of the larger Social Cognition and Functioning (SCAF) project (Green et al., 2013): 68 from Los Angeles outpatient treatment clinics and the VA Greater Los Angeles Healthcare System, and 78 from mental health clinics in Chapel Hill, NC and the University of North Carolina-Chapel Hill Schizophrenia Treatment and Evaluation Program. Full inclusion criteria are described elsewhere (Kern et al., 2013). The study was described to prospective participants and written informed consent was obtained prior to participation.

2.2. Measures

Attachment was assessed using the PAM, a self-report questionnaire with 16 items rated on a four-point Likert-type scale (0='not at all'; 3='very much').

2.2.1. Social cognition

Social cognition was assessed using four SCAF social neuroscience paradigms and measures of attribution bias and facial affect identification.

SCAF social neuroscience paradigms—tasks adapted from the social neuroscience literature assessing core social cognitive/emotional abilities with reliably identifiable neural substrates—and task variable selection are detailed elsewhere (Green et al., 2013; Kern et al., 2013; Olbert et al., 2013). In brief, high-level inferential tasks comprised (1) self-referential memory, involving assessment of biases in the encoding/retrieval of trait-level information about oneself (Kelley et al., 2002; Macrae et al., 2004); and (2) empathic accuracy, involving real time temporal tracking of others' emotions in videotaped vignettes (Levenson and Ruef, 1992; Zaki et al., 2008). Low-level perceptual tasks comprised (3) basic biological motion, involving visual discrimination of human movement from random motion represented in animated point-light figures (Puce and Perrett, 2003); and (4) emotion in biological motion, involving identifying emotions represented by walking point-light figures (Heberlein et al., 2004).

Attributional bias was assessed with the blame bias subscale of the Ambiguous Intentions Hostility Questionnaire (AIHQ; Combs et al., 2007). Blame bias scores are calculated by summing five self-rated ambiguous second-person interpersonal vignettes on three Likert scale items, two scored from 1 to 5 and one scored from 1 to 6.

A final social cognitive construct, facial affect identification, was assessed via percent accuracy on a computerized test presenting color photos of faces chosen from standardized stimuli (Ekman, 2004) for five seconds; participants voiced aloud whether the face displayed a neutral expression or a happy, sad, angry, afraid, surprised, or disgusted expression.

2.2.2. Symptoms

Symptom severity was assessed using the expanded Brief Psychiatric Rating Scale (BPRS), with total score and positive and depressive subscale scores reported (Kopelowicz et al., 2007; Lukoff et al., 1986). Negative symptoms were assessed with the Scale for the Assessment of Negative Symptoms (SANS), with experiential symptoms (avolition-apathy and anhedonia-asociality) and expressive symptoms (affective flattening and alogia) reported (Andreasen, 1984). Symptom scale raters were trained to a minimum kappa of 0.80 (Kern et al., 2013).

2.2.3. Functional measures

Two SCAF measures assessed functional capacity. The USCD Performance-Based Skills Assessment (UPSA; Patterson et al., 2001) employed role-play simulations to assess the ability to negotiate practical tasks such as parsing a utility bill. A total score was computed by summing functional skill areas.

A second role-play task, the Maryland Assessment of Social Competence (MASC; Bellack et al., 1994), assessed the capacity to negotiate common interpersonal difficulties. Confederates used open-ended scripts to prompt participants to generate conversational momentum in four three-minute scenarios such as conversing with a new neighbor. MASC developers or individuals they had certified trained raters to ICC's exceeding 0.85; a total sum score was computed from videotaped role-play ratings.

Community functioning was assessed via total score on the Role Functioning Scale (RFS; McPheeters, 1984), a semi-structured interview probing work functioning, independent living, family network, and social functioning.

2.3. Data analysis

2.3.1. Structural validity

First, we performed basic psychometric analyses for the entire PAM scale and subscales using the *psych* R library (Revelle, 2014) including analyses of response frequencies; means and standard deviations for items and total scale scores; correlations between items, total scale, and putative anxiety and avoidance subscales corrected for item overlap; and Cronbach's alpha internal consistency estimates. Second, we employed a hierarchical clustering algorithm (ICLUST; Revelle, 1979; Schalet et al., 2011) to investigate item-grouping consistency with the PAM's previously-described two-factor structure.[1] Third, we conducted confirmatory factor analysis (CFA) using Mplus software (Muthén and Muthén, 2011) to test whether the two-factor structure adequately modeled observed PAM item response data. Finally, we conducted alternative exploratory analyses to investigate the PAM's latent structure.

CFA specified a two-factor model using a weighted least square means and variance adjusted (WLSMV) appropriate for ordinal data (Brown, 2012). Model fit was estimated using the comparative fit index (CFI) and root-mean-square error of approximation (RMSEA), with values of 0.05 and 0.08 indicating good and poor fit, respectively (MacCallum et al., 1996).

Given poor CFA model fit, exploratory factor analyses were conducted using both parallel analysis and factor analysis using minimum residual (minres) analysis and direct oblimin rotation. Because parallel analysis tends to suggest an inflated number of meaningful latent factors (Wood et al., 1996), we also conducted exploratory factor analyses examining 2- to n-factor solutions, where n specifies the number of latent factors suggested by parallel analysis. To best handle ordinal data, we used a polychoric correlation matrix for all exploratory and hierarchical clustering analyses.

2.3.2. Construct validity

Pearson correlations were used to assess the relationship between PAM items and measures of social cognition, symptoms, functional capacity, and community functioning.

3. Results

3.1. Participants

Data from 138 patients were analyzed; 8 participants were excluded based on invalid responses to the PAM prompt, "In answering [PAM] questions, what relationships were you thinking about?" Examples of responses considered invalid included "me" and "my future child."

Participants were primarily male (n=102) and single (n=106); 8 were married/cohabitating, 23 divorced/separated, and 1 widowed. Most were unemployed (n=81), and only 18 individuals reported at least half-time employment. Participants self-identified their race as White (n=68), Black/African American (n=60), Asian or Pacific Islander (n=5), or more than one race (n=5); 9 participants identified as Hispanic/Latino. Mean participant age was 41.3 years (SD=12.5), and mean years of education was 12.6 (SD=1.8).

[1] Given a correlation matrix produced from a data array (e.g., with the R commands [1] PAM < -read.csv("C:/SCAF/PAM.csv", header=TRUE); [2] RP < -polychoric(PAM, smooth=TRUE)$rho, a hierarchical cluster graph is produced as follows: PAMIC < -ICLUST(RP,2)). Data output in a 'dot' file can be more clearly formatted in a program such as Graphviz: ICLUST.graph(PAMIC, out.file="C:/SCAF/pamgraph").

Table 1
Psychosis attachment measure scale items and descriptive psychometrics.

Item	Mean (SD)	Subscale[a]	Item-Total r[b]	Item-Subscale r[b]
1	1.68 (1.04)	Avoidance	0.31	0.37
2	1.41 (1.01)	Avoidance^R	0.13	0.32
3	1.56 (1.10)	Anxiety	0.46	0.47
4	1.33 (1.01)	Avoidance^R	0.27	0.39
5	1.73 (1.14)	Anxiety	0.34	0.40
6	1.52 (1.08)	Anxiety	0.42	0.39
7	1.32 (1.06)	Anxiety	0.53	0.55
8	1.30 (1.10)	Avoidance	0.40	0.33
9	0.90 (0.93)	Avoidance^R	0.20	0.41
10	1.18 (1.14)	Anxiety	0.46	0.47
11	1.93 (1.14)	Avoidance	0.29	0.50
12	1.63 (1.07)	Anxiety	0.56	0.53
13	2.23 (0.87)	Avoidance	0.25	0.44
14	1.49 (1.15)	Anxiety	0.62	0.65
15	1.78 (1.03)	Anxiety	0.49	0.48
16	1.30 (1.11)	Avoidance	0.53	0.34

[a] Theoretically expected subscale. Superscript 'R' indicates a reverse-scored item.
[b] Item correlations with the scale or subscale with the row item removed.

3.2. Structural validity

3.2.1. Basic descriptive psychometrics

Item means and standard deviations as well as correlations between items and both total scale and subscales are shown in Table 1. Item-test correlations ranged from 0.13 to 0.62. Although some item-test correlations were strong, 5 of 16 items (notably, all belonging to the avoidance subscale) had item-test correlations below 0.3, suggesting little relation to a possible general factor. Item-subscale correlations ranged from 0.32 to 0.65, although 5 items had lower item-subscale correlations than item-test correlations.

Internal consistency was adequate for the aggregate scale, α=0.73 (95% CI [0.65, 0.81]), $\bar{r}$=0.14, and the anxiety subscale, α=0.72 (95% CI [0.62, 0.82]), $\bar{r}$=0.24. Avoidance subscale internal consistency was poor, α=0.57 (95% CI [0.44, 0.71]), $\bar{r}$=0.15. Inter-item correlations (Table 2) were generally small to moderate ($-0.19 \le \rho \le 0.53$), and the average inter-item correlation was weak ($\bar{\rho}$=0. 17), partly because 21 of 120 inter-item correlations were negative, mostly (19 of 21) in cases involving reverse-scored items (19 of 45 possible correlations involving these 3 items were negative).

3.2.2. Hierarchical clustering

Fig. 1 displays two-cluster *iclust* results. Figure numbers represent correlations between either two items joined to form a cluster or between cluster scores derived by aggregating items within cluster (see http://personality-project.org/r/r.ICLUST.html). The algorithm yielded a primary cluster (eigenvalue=3.3) comprising 12 of 16 items and a secondary cluster (eigenvalue 1.6) comprising the 3 reverse-scored items from the avoidance scale (items 2, 4, and 9). Hence, four of eight items (items 1, 11, 13, and 16) expected to cluster into an avoidance grouping instead clustered with the eight items (items 3, 5, 6, 7, 10, 12, 14, and 15) expected to cluster into an anxiety grouping, and one avoidance item (item 8) did not cluster with other items.

3.2.3. Confirmatory factor analysis

The two-dimensional CFA model fit produced a SB chi-square=274 (df=103, $p<0.01$), CFI=0.66, RMSEA=0.11 (90% CI [0.094, 0.13]); CFI and RMSEA values both indicate inadequate model fit (Hu and Bentler, 1999; Schmitt, 2011). Each anxiety subscale item loaded greater than .4; however, three avoidance subscale items loaded less than 0.3. A unidimensional solution also

Table 2
Psychosis attachment measure inter-item polychoric correlations.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1																
2	0.04															
3	0.35*	−0.01														
4	−0.19	0.27*	0.15													
5	0.24*	0.02	0.34*	−0.01												
6	−0.13	0.14	0.27*	0.18	0.26*											
7	0.03	0.07	0.45*	0.26*	0.22	0.30*										
8	0.20	−0.04	0.12	−0.01	0.01	0.21*	0.26*									
9	−0.14	0.40*	0.06	0.50*	−0.03	0.29*	0.17	0.05								
10	0.26*	−0.08	0.18	0.06	0.05	−0.04	0.41*	0.23*	−0.15							
11	0.18	−0.10	0.09	−0.13	0.05	0.08	0.19	0.49*	−0.12	0.15						
12	0.13	0.08	0.12	0.16	0.22*	0.34*	0.25*	0.34*	0.15	0.44*	0.19					
13	0.33*	−0.17	0.17	−0.15	0.07	0.19*	0.04	0.12	−0.11	0.19	0.30*	0.20*				
14	0.30*	−0.03	0.28*	0.29*	0.39*	0.14	0.38*	0.12	0.05	0.53*	0.12	0.47*	0.18			
15	0.12	0.18	0.30*	0.22	0.24	0.31*	0.25*	0.25*	0.15	0.22*	0.07	0.30*	0.07	0.43*		
16	0.21*	−0.02	0.19	−0.02	0.22	0.26*	0.26*	0.26*	−0.07	0.48*	0.31*	0.42*	0.26*	0.46*	0.30*	

* $p < 0.05$.

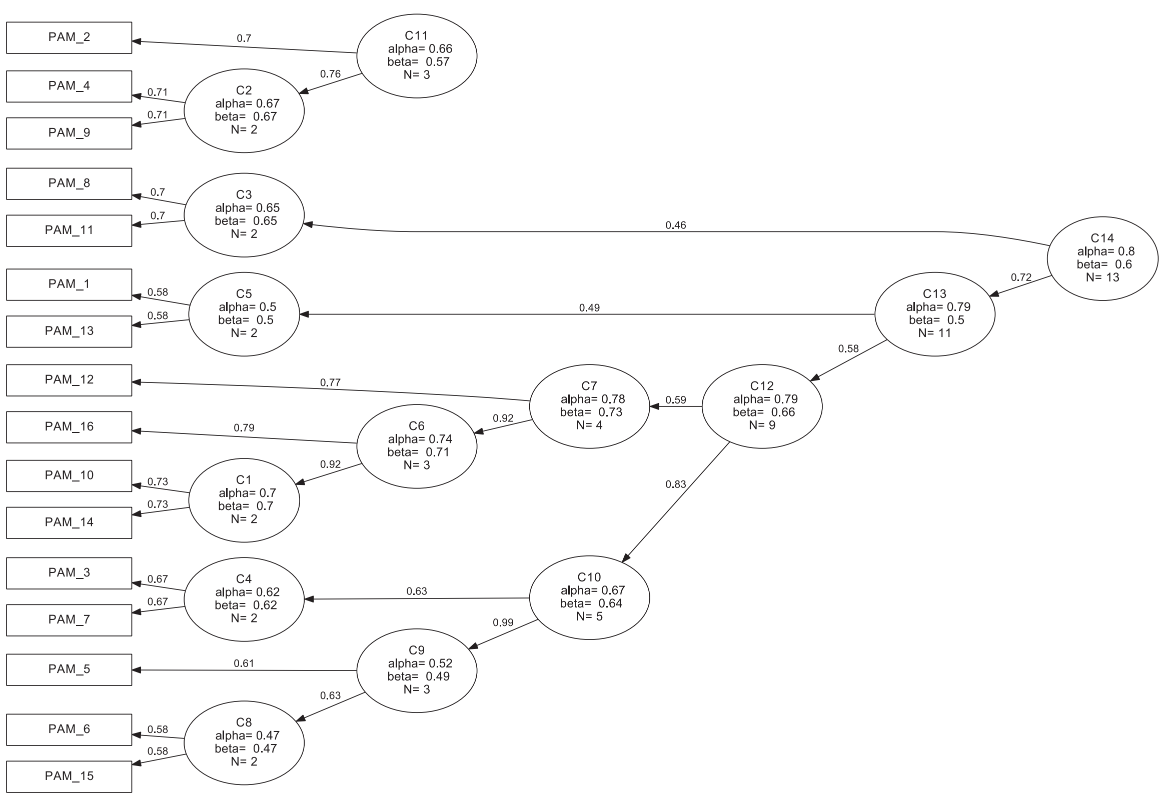

Fig. 1. Hierarchical clustering results with two-cluster solution specified; line numbers represent correlations between either two items joined to form a cluster or between cluster scores derived by aggregating items within clusters. Alpha and beta (minimum possible split-half reliability) values indicate internal consistency within clusters.

failed to provide an adequate fit, SB chi-square=276 (df=104, $p < 0.01$), CFI=0.66, RMSEA=0.11 (90% CI [0.09, 0.13]), and four items loaded less than 0.3.

3.2.4. Exploratory factor analysis

Parallel analysis indicated five nonrandom factors (eigenvalues 3.94, 2.29, 1.39, 1.26, and 1.05). Extracting five factors (minres) with oblimin rotation produced two poorly-defined factors, one with two items (3 and 7) and one with a single item (10). In a previous analysis, item 10 cross-loaded on both anxiety and avoidance principle components (Kvrgic et al., 2011), and items 3 and 7 pertain to angry and upset feelings. The remaining three factors (items 1, 2, 4, and 9; 6, 8, 11, and 13; and 5, 12, 14, 15, and 16) each contained items from both anxiety and avoidance subscales. The third factor item content appears to represent help-seeking behaviors; four items on the fifth factor reflect worry. Hence, although some factors were poorly defined, the items appear to cluster meaningfully by content.

Loadings for exploratory factor solutions are shown in Table 3. The two-factor exploratory model, like the two-factor hierarchical clustering model, bears little resemblance to the predicted theoretical structure of the PAM, with 12 items loading onto the primary factor. None of the exploratory models fit the data well (all RMSR > 0.05), and several items had substantial cross-loadings (≥ 0.20, but frequently ≥ 0.30) in each analysis. As expected, confirmatory models based upon the exploratory solutions proved inadequate judged against the standard benchmarks of RMSEA ≤ 0.06 and CFI ≥ 0.95 (Hu and Bentler, 1999).

Table 3
Factor loadings for Psychosis Attachment Measure models.

	One factor	Two factors		Three factors			Four factors			
	F1	F1	F2	F1	F2	F3	F1	F2	F3	F4
1	0.34	***0.40***	*−0.28*	***0.33***	*−0.27*	*0.14*	*0.20*	***−0.31***	*0.08*	*0.31*
2	0.03	−0.05	**0.46**	−0.09	**0.47**	0.00	−0.09	**0.43**	−0.01	0.00
3	0.44	**0.43**	0.11	**0.29**	0.12	0.17	0.07	0.05	0.08	**0.47**
4	0.21	0.10	**0.67**	*0.22*	***0.64***	*−0.16*	0.18	**0.72**	−0.13	−0.03
5	0.39	**0.38**	0.03	**0.40**	0.00	0.01	−0.05	−0.10	−0.07	**0.72**
6	0.36	*0.30*	***0.34***	*0.03*	***0.40***	*0.37*	*−0.22*	*0.32*	***0.36***	***0.36***
7	0.54*	***0.50***	*0.23*	***0.34***	*0.24*	*0.25*	***0.32***	*0.26*	*0.19*	*0.17*
8	0.38	**0.40**	−0.04	−0.04	0.06	**0.69**	0.08	0.04	**0.70**	−0.10
9	0.08	−0.05	**0.73**	−0.09	**0.77**	−0.04	−0.15	**0.73**	0.07	−0.02
10	0.62*	**0.65**	−0.16	**0.60**	−0.17	0.13	**0.87**	−0.05	0.07	−0.11
11	0.31	***0.36***	*−0.24*	0.00	−0.17	**0.61**	*0.03*	*−0.20*	***0.61***	*0.00*
12	0.62*	**0.60**	0.12	***0.41***	*0.16*	*0.33*	***0.38***	*0.19*	*0.31*	*0.13*
13	0.30	***0.36***	*−0.26*	*0.17*	*−0.21*	***0.30***	*0.08*	*−0.25*	***0.27***	*0.20*
14	0.74*	**0.72**	0.10	**0.93**	0.03	−0.09	***0.60***	*0.12*	*−0.09*	*0.41*
15	0.52*	***0.47***	*0.25*	***0.38***	*0.25*	*0.17*	*0.17*	***0.24***	*0.14*	*0.33*
16	0.63*	**0.66**	−0.13	***0.46***	*−0.10*	*0.34*	***0.41***	*−0.08*	*0.29*	*0.21*

Note. Within each line, for each analysis, boldface indicates the factor with the highest loading for that item. Italicized items exhibited substantial cross-loadings (≥ 0.20) on multiple factors.

In summary, these analyses failed to demonstrate a coherent multidimensional structure for the PAM. Although some items from the avoidance scale tended to cluster together in many analyses (items 2, 4, and 9; and items 8, 11, and 13), these findings do not support the existence of a well-defined avoidance factor in these data.

3.2.5. Subscale construction

Given the poor structural validity results, we attempted to salvage a latent construct by identifying items with strong adjusted item-total correlations ($r_{adj} > 0.5$; items 7, 10, 12, 14, 15, and 16). A reduced PAM scale of six items possessed adequate internal consistency, $\alpha = 0.74$ (95% CI [0.63, 0.84]), and an adequate unidimensional factor solution, RMSR=0.05, with item loadings from 0.47 to 0.77. Five of six items belonged to the original anxiety subscale and one (item 16) to the avoidance subscale. This reduced 6-item subscale was strongly correlated with PAM total scale score, $r = 0.87$, $p < 0.01$.

3.3. Construct validity

We report correlations between other measures and the 6-item PAM reduced subscale (see Table in Supplemental data) because the analyses suggest the 10 excluded PAM items with the lowest adjusted item-total correlations contribute little psychometrically meaningful information about attachment in individuals with schizophrenia. The 6-item PAM was not significantly associated with any of the social cognitive measures. Higher PAM scale scores were associated with somewhat more severe BRPS depressive symptoms ($r = 0.26$, $p < 0.01$) and modestly lower RFS community functioning ratings ($r = -0.24$, $p < 0.05$). Higher PAM scores were also associated with somewhat worse experiential negative symptoms ($r = 0.19$, $p < 0.05$). Finally, PAM scores were not significantly correlated with expressive negative symptoms or with MASC or UPSA functional capacity.

4. Discussion

The primary aim of this study was to examine the structure of the PAM. Hierarchical clustering algorithms and both exploratory and confirmatory factor analyses were inconsistent with the hypothesis that the PAM possesses two factors of anxious and avoidant attachment in this sample. Exploratory factor analyses did not yield a coherent factor structure. A reduced six-item scale was highly correlated with and had comparable internal consistency to the PAM total scale, suggesting that 10 of 16 PAM items contribute little psychometrically meaningful information. Five of six reduced scale items derived from the originally-specified anxiety factor and one from the originally-specified avoidance factor. Thus, although PAM items appear to adequately measure attachment anxiety, the data did not yield evidence of a separate avoidance factor.

The secondary aim of this study was to examine the PAM's construct validity and to investigate relationships between attachment and social cognition. The psychometrically strongest reduced PAM subscale was essentially unrelated to social cognitive variables. For broader construct validity, the reduced scale showed weak but significant correlations with depressive and experiential negative symptoms as well as community functioning, but was not correlated with positive symptoms, expressive negative symptoms, or functional capacity.

Assuming that attachment comprises anxiety and avoidance dimensions, these results may pose a dilemma for attachment research: either the PAM may not measure attachment in psychosis, or it may only successfully measure attachment anxiety but have little construct validity in this population.

If the PAM fails to measure attachment in psychosis, the null correlations observed between the PAM and social cognition measures are unsurprising. In this case, the meaning of PAM scores would be something of an open question. One possibility is that PAM scores reflect beliefs about attachment and relationships rather than attachment per se. Self-report measures in general reasonably assess implicit attachment processes (Shaver and Mikulincer, 2004), but this may not be the case for individuals with schizophrenia—who typically possess impaired social- and self-perception. Further research using both interview and self-report attachment measures may help clarify the relationship between overt beliefs and implicit processes in this population. Because PAM items derive from existing self-report measures of attachment (Berry et al., 2006), this possibility may raise concerns about the structure of other self-report attachment measures.

If the PAM measures attachment anxiety, it may bear little relation to other key constructs such as functional capacity and social cognition. In this case, these results would call into question the relevance of attachment anxiety in psychosis. The role of attachment avoidance in psychosis would remain an open question given our failure to find a separate avoidance factor.

Given compelling theoretical arguments for the relevance of attachment to psychosis (Berry et al., 2008; Harder, 2014), further scale development and psychometric validation is needed to clarify the structure of attachment in psychosis. A potential avenue for future attachment scale development would be to reduce item complexity. One excluded PAM item reads, "I find it easy to depend on other people for support with problems or difficult situations." Answering this prompt requires judging having difficulties and attempting to rely upon others; hence, a "not at all" response might indicate deficient support-seeking, inadequate support utilization, or both. Item complexity might explain the observed negative inter-item correlations in this study. Given cognitive deficits in this population, simplifying questionnaire items may help reduce measurement error; alternatively, covert attachment or informant-report measures may help circumvent difficulties stemming from cognitive deficits in this population.

This study has a number of limitations. First, we did not direct participants to consider a specific relationship (e.g., a parent or mental health worker) or type of relationship (e.g., family) for PAM responses. Participants likely considered various relationship categories, introducing response heterogeneity. Furthermore, patients did not have a well-established relationship with examiners, which may have inflated response bias in self-report (Berry et al., 2008). We also did not collect PAM data to compare the psychometric structure in healthy controls and patients. Also, it must be acknowledged that these findings may represent sample-specific characteristics, and the PAM's psychometric properties should be tested in other samples to clarify the generalizability of these findings. Finally, we employed some novel measures of social cognition; although novel measures help clarify the scope of potential relationships between attachment and social cognition, they complicate comparisons with previous findings.

Attachment represents an important construct for studying adult psychopathology in general and psychosis in particular. Nevertheless, these psychometric analyses serve as a cautionary note regarding drawing broad theoretical conclusions from measures whose psychometric properties are not known. Future research should further develop and validate self-report attachment measures for use with this population, and self-report measures might be more informative if used in conjunction with interview-based and informant-report measures of attachment to better provide better construct validity and generalizability (Gumley et al., 2014).

Conflict of interest statement

Dr. Green reports having been a consultant to Abbott laboratories (AbbVie), DSP, Forum, Takeda, and Roche; he is a member of the scientific board for Mnemosyne; he receives research support from Forum, and he has received past research funds from Amgen. Dr. Green is also an officer of MATRICS Assessment, Inc. but receives no financial compensation.

The rest of the authors each declare no financial interests or potential conflicts of interest.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.psychres.2016.09.020.

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