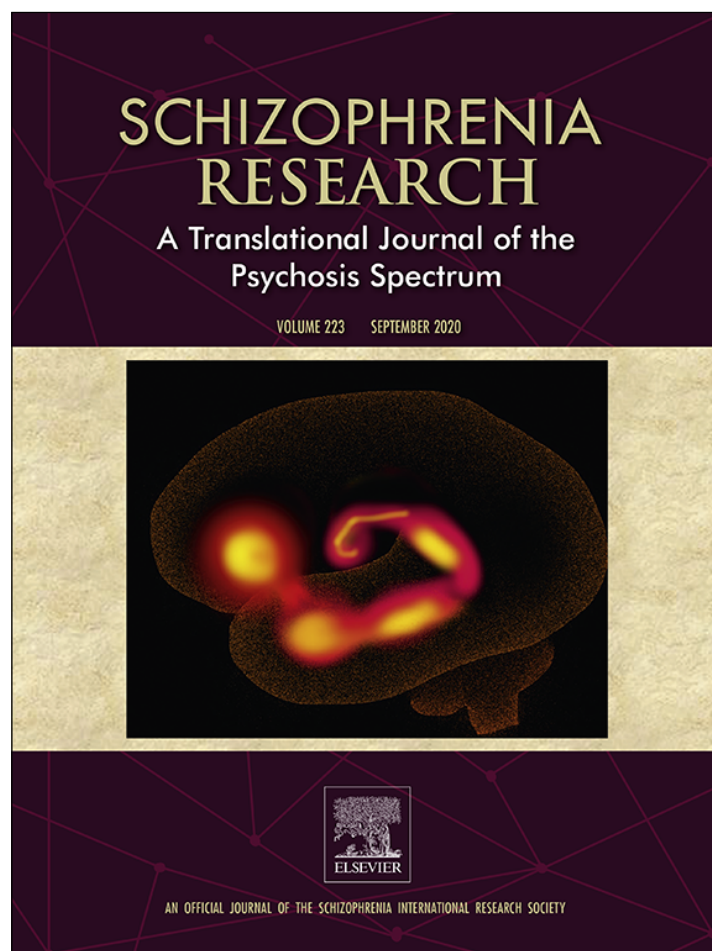


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## Social anhedonia and clinical outcomes in early adulthood: A three-year follow-up study within a community sample

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### ABSTRACT

Social anhedonia has been employed in psychometric high risk studies to identify putative schizotypes. The current study reports three-year longitudinal results from a community study of social anhedonia: the Maryland Longitudinal Study of Schizotypy (MLSS). The initial recruitment for the MLSS involved mailed questionnaire screening of 2434 18-year olds. Baseline and three-year follow-up laboratory assessments were subsequently conducted with individuals identified as being high in social anhedonia ( $N = 79$ ) and a comparison sample ( $N = 79$ ). Across the assessments both groups showed maturational improvement on all clinical symptom measures with declining symptom severity at the follow-up compared to baseline and there were no group differences in personality disorder diagnoses at follow-up. However, compared to the control group, over the three-year follow-up individuals in the social anhedonia group were found to have elevated schizophrenia-spectrum personality disorder (Cluster A) characteristics, greater negative symptom characteristics, and lower global functioning. The social anhedonia group also had lower educational attainment, higher unemployment, and higher rates of mental health service utilization than did the control group. Within the social anhedonia group, social support and family relationships were cross-sectionally related to symptom severity at follow-up, although social support and family variables from baseline were not predictive of clinical symptom outcomes at follow-up. Results indicate that social anhedonia is associated with persistent schizophrenia-spectrum symptoms and functional impairment in early adulthood.

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### 1. Introduction

The reduced capacity to experience pleasure from social activity, social anhedonia, is considered a core feature of schizophrenia (Andreasen, 1982; Meehl, 1962), is elevated in schizophrenia patients and their family members (Gooding et al., 2005b; Horan et al., 2008; Kendler et al., 1996; Linney et al., 2003), and appears to endure over time (Blanchard et al., 2001). Accordingly, social anhedonia is an attractive vulnerability marker for identifying individuals who may be at risk for schizophrenia and related spectrum personality disorders. In support of this notion, a number of cross-sectional studies have found that social anhedonia is associated with “schizophrenia-like” aberrations in social behavior and functioning (Chapman et al., 1994; Gooding et al., 2005a; Kwapil, 1998; Kwapil et al., 2013), deficits in cognitive and perceptual ability (Cohen et al., 2006; Ettinger et al., 2015; Gooding and Tallent, 2003), and psychophysiological abnormalities

(Gooding et al., 2000; Gooding et al., 2005a; Wang et al., 2015). Moreover, longitudinal studies, of 5- and 10-years duration, have found that individuals with elevated social anhedonia go on to develop higher rates of cluster A personality disorders including schizotypy (Gooding et al., 2005b; Kwapil, 1998). Relatedly, social anhedonia has been related to psychosis conversion in clinically high-risk patients (Cannon et al., 2008). In this report, we present findings from the three-year follow-up of the Maryland Longitudinal Study of Schizotypy (MLSS; Blanchard et al., 2011).

The MLSS was intended to address two major knowledge gaps with respect to the study of social anhedonia. First, rather than rely on culturally and socio-demographically homogenous college students as used in prior investigations (Gooding et al., 2005b; Kwapil, 1998), this study recruited a racially diverse community sample so as to broaden the generalizability of results. This is critical as social anhedonia, and its potential effects on functioning, can vary as a function of socio-culture factors (Goulding et al., 2009). Consistent with the extant literature, baseline results of the MLSS (Blanchard et al., 2011) showed that a culturally heterogeneous group comprising individuals with social anhedonia showed elevated schizotypal, schizoid, and paranoid personality

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characteristics as well as elevated trait Negative Affect (NA) (Horan et al., 2007; Kerns et al., 2008; Leung et al., 2010) and lower Positive Affect (PA) (Blanchard et al., 2011). This was also observed in higher ratings of deviant social behaviors during a clinical interview, such as odd speech, constricted facial affect, lack of non-verbal expression, lack of verbal expression and physical anergia (Collins et al., 2005; Leung et al., 2010). In the present study, we sought to determine the longitudinal outcomes of those with elevated social anhedonia and predicted that they would show deteriorations in functioning and increases in schizophrenia-spectrum clinical characteristics. Additionally, we evaluated severity of primary negative symptoms, as these have been related to poor outcome in Clinical High Risk (CHR) and schizophrenia samples more generally (Cannon et al., 2008). Longitudinal assessment is particularly important for understanding outcome, as both CHR (Fusar-Poli et al., 2012) and social anhedonia (Gooding et al., 2005b; Kwapiil, 1998) are associated with highly variable outcome across individuals; with only a minority meeting criteria for schizophrenia-spectrum disorders.

A second knowledge gap concerns whether individual differences in temperament, family environment, and social support contribute to variable outcomes within individuals high in social anhedonia. High trait NA and low trait PA might enhance risk as these traits are abnormal in schizophrenia and related to stress-responsivity and functioning more generally (e.g., Blanchard et al., 2001; Bolger and Zuckerman, 1995; Fowles, 2002; Horan and Blanchard, 2003; Van Os and Jones, 2001; Watson and Clark, 1984). Moreover, family and social support variables mitigate risk and outcome across a broad range of conditions and psychopathologies, including schizophrenia-spectrum disorders (Cohen and Wills, 1985; Stuart and Weinrich, 1998). In the baseline MLSS data, we found that compared to controls, individuals with social anhedonia were abnormal with respect to PA and NA (Blanchard et al., 2011), and also found to report less cohesion and greater conflict in family relationships, poorer social support and overall lower functioning. In the present study, we hypothesized that baseline temperament, family environment, and social support would be predictive of outcome at follow-up.

## 2. Methods

### 2.1. Participant pool and selection

Details regarding the ascertainment and recruitment of research participants are provided elsewhere (Blanchard et al., 2011). Briefly, MLSS participants were recruited from the community using random digit-dialing methods by a survey center affiliated with the University of Maryland College Park. Eighteen-year-olds ( $n = 3498$ ) identified via this method were asked to complete a packet of questionnaires via mailing. Response rate was 70% ( $n = 2434$ ). The screening packets included the Revised Social Anhedonia (RSAS; Chapman et al., 1976), the Magical Ideation (MagId; Eckblad and Chapman, 1983), and Infrequency (Chapman et al., 1976) scales. The PerAb and MagId scales were included to recruit controls who were not deviant on either of these scales; specifically, control participants were excluded if they scored above 0.50 standard deviations above the mean on either of these scales. Eighty six individuals agreed to participate and were eligible for the social anhedonia group, based on scoring at least 1.9 standard deviations above their gender and ethnicity group mean on the RSAS were included ( $n = 72$ ) and/or showing Bayesian probabilities greater than or equal to 0.50 using the taxometric method of maximum covariate analysis (MAXCOV-HITMAX Waller and Meehl, 1998;  $n = 14$ ). A threshold of 1.9 standard deviations has been used in many prior studies (e.g., Chapman et al., 1976) and is consistent with prevalence estimates of schizotypy (e.g., Meehl, 1962). The taxometric method was utilized in order to identify individuals who have a high probability of being within a social anhedonia latent class yet didn't meet the SD

cut-off. The rationale for this procedure is outlined in the original MLSS article (Blanchard et al., 2011).

Eighty-nine individuals agreed to participate and were eligible for the control group, based on scores on RSAS, PerAb and MagId of 0.50 standard deviations below their gender and ethnicity group mean and Bayesian probabilities less than 0.50. Individuals endorsing three or more items in the unexpected direction on the infrequency scale were ineligible for this study.

#### 2.1.1. Participant retention at three-year follow-up

The results presented in the current study include those individuals who provided both baseline and follow-up data. We had low levels of attrition across the three-year period, with a total of 79 participants returning for follow-up in each group. There was no differential attrition across the groups (8.1% in Social Anhedonia, 11.2% in Controls;  $\chi^2 = 0.478$ ,  $p = .489$ ), and there were no differences in any study measure administered at baseline among those who did and did not complete follow-up (all  $p$ 's  $> .05$ ).

### 2.2. Diagnostic and symptom assessment

#### 2.2.1. Structured Clinical Interviews for DSM-IV Axis I Disorders-Research version (SCID-I; First et al., 2002)

Participants were administered the SCID-I to assess Axis I psychopathology by advanced doctoral students. The SCID-I is a semi-structured interview that assesses for current and lifetime disorders. The mood, psychotic, alcohol-, and substance-use disorders modules were administered.

#### 2.2.2. International Personality Disorders Examination (IPDE; Loranger, 2010)

The IPDE was administered by advanced doctoral students to assess categorical and dimensional ratings of Axis II disorders. Each symptom is rated on a 3-point scale (0 = not present; 1 = subthreshold; 2 = threshold). The schizotypal, schizoid, and paranoid personality sections were administered. Scores potentially ranged from 0 to 14, 0 to 14, and 0 to 18 with increasing scores reflecting worse symptoms.

#### 2.2.3. Schedule for the Deficit Syndrome (SDS; Kirkpatrick et al., 1989)

Standardized probe questions were used to assess each SDS domain including restricted affect, diminished emotional range, poverty of speech, curbing of interests, diminished sense of purpose, and diminished social drive. Each domain is rated on a 5-point scale (0 = absent/normal to 4 = severe). The SDS has been shown to have adequate interrater agreement and internal consistency (Kirkpatrick and Galderisi, 2008). Given our use of this measure in a nonclinical sample of young adults, we utilized ratings to obtain a dimensional index of negative symptom characteristics (rather than a dichotomized ratings of presence vs absence of the deficit syndrome) based on the sum of the 6 SDS items (as in Kimhy et al., 2006). Internal consistency of this scale within the full sample was adequate ( $\alpha = 0.70$ ). Scores potentially range from 0 to 24 with increasing scores reflecting worse symptoms.

### 2.3. General functioning

#### 2.3.1. Global Assessment of Functioning (GAF; American Psychiatric Association, 2000)

The GAF provides an overall rating of adjustment ranging from severe psychopathology and impairment to superior functioning. Scores potentially range from 1 to 100 with increasing scores reflecting better functioning. GAF ratings were made at baseline and follow-up.

#### 2.3.2. Social and Occupational Functioning Assessment Scale (SOFAS; American Psychiatric Association, 2000; Goldman et al., 1992)

The SOFAS provides ratings of social and occupational functioning independent from current symptoms. The SOFAS was added to the

MLSS protocol after the baseline assessment had been completed and thus was only available at the three-year follow-up. Scores potentially range from 1 to 100 with increasing scores reflecting better functioning.

2.4. Trait affect

2.4.1. General Temperament Survey (GTS; Watson and Clark, 1992)

The GTS was administered at baseline only to assess trait positive and negative affect. It is a true-false self-report questionnaire assessing three major temperament domains of negative and positive emotionality and disinhibition. The GTS was completed as part of the initial mailed screening. The Negative and Positive temperament scales are highly correlated with other measures of neuroticism/NA and extraversion/PA, respectively (Watson and Clark, 1992). Scores potentially range from 0 to 27 and 28 respectively with increasing scores reflecting more affect.

2.5. Social environment

2.5.1. Social Support Questionnaire (SSQ; Sarason et al., 1983)

The SSQ asks participants to list the number of available others they feel they can turn to in times of need (e.g., “Whom can you really count on to distract you from your worries when you feel under stress?”). The number of social supports is scored by summing the number of unique individuals named by the participant across six items (range of potential scores = 0 to 63). Participants were also asked how satisfied they were with the support in these relationships, forming another subscale of SSQ satisfaction (range of potential scores = 0 to 36). The SSQ has demonstrated excellent internal consistency and convergent validity (Sarason et al., 1983). The SSQ was administered at both baseline and follow-up sessions.

2.5.2. Family Environment Scale (FES; Moos and Moos, 1986)

The FES provides an index of perceived family support across three domains: Cohesion, or the degree of commitment and support within the family; Expressiveness, or the extent to which family members are encouraged to act openly and express their feelings directly; and Conflict, or the extent to which the expression of anger and conflict-laden interactions are characteristics of the family. The FES has demonstrated acceptable internal consistency and good construct validity (Holahan and Moos, 1983; Moos and Moos, 1986). The FES was administered at both baseline and follow-up sessions. Scores potentially range from 0 to 9.

2.5.3. Interpersonal Support Evaluation List (ISEL; Cohen et al., 2012)

The ISEL was used as a general index of perceived social support. Items assess 4 domains: Appraisal (perceived availability of someone to talk about one's problems), Belonging (perceived availability of people with whom one can do things), Tangible (perceived availability of material aid), and Self-esteem (perceived availability of a positive comparison when comparing one's self-worth with others). Given the high inter-correlations of the subscales, the total score was used in all analyses. The ISEL was administered at both baseline and follow-up sessions. Scores potentially range from 0 to 10 with increasing scores reflecting more support.

2.6. Objective indicators of treatment and functioning

At follow-up, participants provided information on whether they had received inpatient and outpatient psychiatric treatment, and whether they had been prescribed psychiatric medications. Participants were also asked about their current employment, educational, and marital status.

2.7. Analyses

First, we compared the social anhedonia and control group at follow-up on demographic characteristics. Second, we examined group differences on Axis I diagnoses, schizophrenia spectrum personality characteristics, and deficit symptom severity. Third, we examined group differences on measures of functioning including clinical interview assessments as well as general indicators of functioning such as employment, educational achievement, and treatment for psychopathology. Fourth, within the social anhedonia group, we examined correlates of symptom severity (baseline and follow-up) and functioning at the three-year follow-up. ANOVA and correlational analyses were used to evaluate these aims. When appropriate, we evaluated effect sizes in terms of small (e.g.,  $r = 0.10$  to  $0.29$ ), medium (e.g.,  $r = 0.30$  to  $0.49$ ) and large (e.g.,  $r = 0.50+$ ) values. For simplicity of interpretation, we did not provide directionality in our predictions and did not control for multiple comparisons.

3. Results

3.1. Demographic characteristics (Table 1)

At follow-up, there were no significant group differences on gender, race, age, marital status or likelihood of having children. Members of the social anhedonia group were less likely to be employed at follow-up (62%) compared to controls (81%) and more likely to drop out of college (17.7%) compared to controls (2.5%).

3.2. Group differences on psychopathology and treatment variables (Tables 2 & 3)

There were no significant group differences in diagnoses for follow-up mood, psychotic or substance use disorders. The social anhedonia group showed lifetime depression rates nearly twice that of the control group (43% versus 22% respectively;  $\chi^2 = 7.34, p < .01$ ).

Contrary to predictions, at follow-up there were no Cluster A personality disorder diagnoses in either group. For the SDS and IPDE paranoid symptoms (see Table 3), there were significant effects of both time (SDS:  $F_{(1,154)} = 18.47, p < .001$ ; paranoid:  $F_{(1,153)} = 16.44, p < .001$ ) and group (SDS:  $F_{(1,154)} = 17.79, p < .001$ ; paranoid:  $F_{(1,153)} = 14.60, p < .001$ ), but no group X time interaction (SDS:  $F_{(1,154)} = 0.003, p = .956$ ; paranoid:  $F_{(1,153)} = 0.449, p = .504$ ). Individuals with high social anhedonia endorsed greater symptoms at both time points, and both groups evidenced symptom decreases over the three-year time period. For IPDE Schizotypal and Schizoid symptoms, there were significant

Table 1  
Demographic characteristics at 3-year follow-up.

	Social anhedonia n = 79	Controls n = 79	Test statistic
Female, % (N)	57.0% (45)	53.2% (42)	$\chi^2 = 0.23, p = .63$
Race, % (N)			$\chi^2 = 1.59, p = .81$
Caucasian	44.3% (35)	46.8% (37)	
African-American	46.8% (37)	39.2% (31)	
Hispanic/Latino	6.3% (5)	8.9% (7)	
Asian	1.3% (1)	2.5% (2)	
Other	1.3% (1)	2.5% (2)	
Age, M (SD)	21.5 (0.50)	21.5 (0.53)	$F = 0.597, p = .44$
Employed, % (N)	62.0% (49)	81.0% (64)	$\chi^2 = 6.99, p = .008$
Have kids, % (N)	3.8% (3)	6.3% (5)	$\chi^2 = 0.527, p = .468$
Ever married, % (N)	2.5% (2)	5.1% (4)	$\chi^2 = 0.693, p = .405$
Education, % (N)			
High school or lower	6.3% (5)	7.6% (6)	$\chi^2 = 10.0, p = .018$
College dropout	17.7% (14)	2.5% (2)	
Enrolled in college	55.7% (44)	65.8% (52)	
College graduate	20.3% (16)	24.1% (19)	



**Table 2**  
SCID axis I diagnosis in social anhedonia versus controls at 3-year follow-up.

	Social anhedonia (N = 79)	Controls (N = 79)	Test statistic
	% (N)	% (N)	
Lifetime mood disorder	43.0% (34)	22.8% (18)	$\chi^2 = 7.3^{**}$
Mood disorder since baseline	20.3% (16)	17.7% (14)	$\chi^2 = 0.2$
Lifetime psychotic disorder	2.5% (2)	3.8% (3)	$\chi^2 = 0.2$
Psychotic disorder since baseline	1.3% (1)	0 (0%)	$\chi^2 = 1.0$
Lifetime substance use disorder	22.8% (18)	26.6% (21)	$\chi^2 = 0.3$
Substance use disorder	15.2% (12)	15.2% (12)	$\chi^2 = 1.0$

\*\*  $p < .01$ .

**Table 3**  
Clinical ratings and self-report questionnaires at baseline and 3-year follow-up.

	Social anhedonia		Controls	
	n = 79		n = 79	
	M (SD)		M (SD)	
	Baseline	3-year	Baseline	3-year
<b>Clinical ratings</b>				
SDS	2.1 (2.8)	1.4 (2.4)	1.0 (1.6)	0.2 (0.9)
IPDE schizotypal	1.2 (1.5)	0.5 (0.9)	0.4 (0.89)	0.1 (0.5)
IPDE schizoid	1.4 (1.9)	0.8 (1.2)	0.3 (0.75)	0.1 (0.5)
IPDE paranoid	1.2 (1.8)	0.7 (1.0)	0.5 (1.1)	0.2 (0.6)
GAF	70.6 (16.4)	73.7 (13.5)	81.4 (13.2)	82.8 (11.0)
SOFAS <sup>a</sup>	–	74.6 (13.0)	–	84.4 (9.5)
<b>Self-report social</b>				
ISEL total	25.3 (6.1)	29.3 (6.7)	32.8 (3.4)	35.4 (3.7)
FES cohesion	4.7 (2.8)	5.7 (2.7)	6.1 (2.6)	7.3 (1.9)
FES express	4.1 (1.8)	4.9 (2.0)	4.5 (1.9)	5.5 (1.9)
FES conflict	4.4 (2.5)	4.0 (2.6)	3.5 (2.4)	2.7 (2.0)
SSQ number	17.6 (9.8)	19.5 (9.1)	24.3 (11.4)	30.2 (12.5)
SSQ satisfaction	29.3 (5.4)	30.2 (5.7)	32.8 (3.4)	33.4 (3.9)

Note. SDS = Schedule for the Deficit Syndrome; IPDE = International Personality Disorders Examination; GAF = Global Assessment of Functioning; SOFAS = Social and Occupational Function Scale. ISEL = Interpersonal Support Evaluation List; FES = Family Environment Scale; SSQ = Social Support Questionnaire.

<sup>a</sup> SOFAS was only administered at the 3-year follow-up.

effects of group (schizotypal:  $F_{(1,153)} = 23.58, p < .001$ ; schizoid:  $F_{(1,153)} = 28.88, p < .001$ ), time (schizotypal:  $F_{(1,153)} = 29.30, p < .001$ ; schizoid:  $F_{(1,153)} = 19.21, p < .001$ ), and a significant group X time interaction (schizotypal:  $F_{(1,153)} = 5.73, p < .05$ ; schizoid:  $F_{(1,153)} = 5.29, p < .05$ ). As with paranoid symptoms and the SDS, the social anhedonia group were rated as having higher levels of symptoms at both time points, and both groups improved over time. The group X time interaction suggested the social anhedonia group improved to a greater degree over the three-year time period compared to controls, causing the two group means to be closer together at the three-year time point. Even with the declining symptoms severity over time, follow-up group differences were at medium effect sizes for all IPDE ratings (schizotypy,  $d = 0.58$ ; schizoid,  $d = 0.71$ ; paranoid,  $d = 0.61$ ) and negative symptom ratings ( $d = 0.63$ ).

With regard to treatment history, the social anhedonia and control groups significantly differed on prior history of both inpatient (8.9% versus 1.3% respectively;  $\chi^2 = 4.74, p < .05$ ) and outpatient (35.4% versus 19.0% respectively;  $\chi^2 = 5.40, p < .05$ ) psychiatric treatment. Group differences on history of psychiatric medication were not significant, with 26.6% of the social anhedonia group compared to 15.2% of the control group endorsing medication use ( $\chi^2 = 3.10, p = .078$ ).

3.3. Group differences on functioning (Table 3)

GAF scores showed a trend to modestly improve over time ( $F_{(1,156)} = 3.79, p = .053$ ). There was a significant group effect ( $F_{(1,156)} = 29.29, p < .001$ ) indicating that individuals with social anhedonia were rated as having poorer functioning at both time points. The group X time interaction was not significant ( $F_{(1,156)} = 0.515, p = .474$ ). Similarly, the one-way ANOVA on the SOFAS at three-year follow-up indicated individuals with social anhedonia were functioning more poorly than controls ( $F_{(1,157)} = 28.88, p < .001$ ). Group differences in functioning at follow-up represented medium effect sizes (GAF,  $d = 0.74$ ; SOFAS,  $d = 0.86$ ).

For the ISEL total score (general social support), there was a significant effect of group ( $F_{(1,151)} = 98.49, p < .001$ ) and time ( $F_{(1,151)} = 57.47, p < .001$ ), but no group X time interaction ( $F_{(1,151)} = 1.33, p = .251$ ). The significant group effect suggested individuals with social anhedonia had lower ISEL ratings, compared to controls, at both time points, and the significant effect of time indicated that both groups improved on social support ratings over the three-year time period. At follow-up group differences on the ISEL yielded a large effect size ( $d = 1.13$ ).

For all three family environment subscales (FES Cohesion, Expressiveness, and Conflict), there were significant group (Cohesion:  $F_{(1,155)} = 18.91, p < .001$ ; Expressiveness:  $F_{(1,155)} = 4.05, p < .05$ ; Conflict:  $F_{(1,155)} = 10.32, p < .01$ ) and time (Cohesion:  $F_{(1,155)} = 33.4, p < .001$ ; Expressiveness:  $F_{(1,155)} = 38.61, p < .001$ ; Conflict:  $F_{(1,155)} = 13.86, p < .001$ ) effects but no interactions (Cohesion:  $F_{(1,155)} = 0.502, p = .480$ ; Expressiveness:  $F_{(1,155)} = 0.648, p = .422$ ; Conflict:  $F_{(1,155)} = 1.02, p = .314$ ), which again indicated the social anhedonia group reported worse family functioning and support at both time points relative to controls, but that both groups' ratings improved over time. At follow-up the FES scales showed variable effect sizes with the largest obtained for Cohesion ( $d = 0.69$ ) and Conflict ( $d = 0.56$ ) and a smaller effect size for Expressiveness ( $d = 0.31$ ).

For the SSQ, there were different results for the number of social supports versus satisfaction with support. For number of supports, there were significant effects of time ( $F_{(1,152)} = 25.98, p < .001$ ), group ( $F_{(1,152)} = 36.03, p < .001$ ), and a significant time X group interaction ( $F_{(1,152)} = 4.21, p < .05$ ). The significant effect of group indicated individuals with social anhedonia reported lower levels of support at both time points relative to controls, and the significant effect of time indicated both groups improved by three-year follow-up. However, in contrast to the symptom results, the group X time interaction suggested the control group improved to a greater degree over time than the social anhedonia group. For SSQ satisfaction, there was a significant effect of group ( $F_{(1,137)} = 24.13, p < .001$ ) indicating individuals with social anhedonia were less satisfied with their support at both time points, but

**Table 4**  
Correlations between symptoms, functioning, and social support at 3-year follow-up in social anhedonia (N = 79).

	SDS	Schizotypal	Schizoid	Paranoid
GAF	–0.49**	–0.47**	–0.40**	–0.39**
SOFAS	–0.43**	–0.42**	–0.40**	–0.38**
ISEL total	–0.27*	–0.28*	–0.33**	–0.33**
FES cohesion	0.02	–0.26**	0.01	–0.18
FES express	0.03	–0.07	–0.06	–0.12
FES conflict	–0.01	0.10	–0.03	0.30**
SSQ number	–0.27*	–0.27*	–0.28*	–0.12
SSQ satisfaction	–0.15	–0.34**	–0.14	–0.28*

Note. SDS = Schedule for the Deficit Syndrome; GAF = Global Assessment of Functioning; SOFAS = Social and Occupational Function Scale. ISEL = Interpersonal Support Evaluation List; FES = Family Environment Scale; SSQ = Social Support Questionnaire.

\*  $p < .05$ .  
\*\*  $p < .01$ .

there was only a trend ( $p = .073$ ) for the groups to improve over time. Effect sizes for the group comparison at follow-up were robust (SSQ Number,  $d = 0.98$ ; SSQ Satisfaction,  $d = 0.66$ ).

### 3.4. Concurrent relationships between symptoms and functioning in social Anhedonia at follow-up (Table 4)

At follow-up, greater clinical symptom severity was associated with poorer GAF and SOFAS ratings, ranging from  $-0.38$  to  $-0.49$ . Perceptions of greater social support (ISEL scores) were associated with lower symptom severity across domains, ranging from  $-0.27$  to  $-0.33$ . Greater family Cohesion was related to lower schizotypal symptoms ( $r = -0.26$ ) while greater family Conflict was associated with more severe paranoid symptoms ( $r = 0.30$ ), but no other correlations with family environment scales were significant. Greater numbers of social support relationships (SSQ) was associated with lower severity in deficit, schizotypal and schizoid symptoms, but not paranoid symptoms. Finally, satisfaction with social support (SSQ) satisfaction was associated with schizotypal and paranoid symptoms, but not the SDS or schizoid symptoms.

### 3.5. Prospective relationships between baseline symptoms, trait affect and social environment with symptoms and functioning at three-year follow-up in social Anhedonia (Table 5)

With regard to Cluster A ratings, generally high stability was evident for schizotypal ( $r = 0.48$ ), Schizoid ( $r = 0.58$ ) and Paranoid ( $r = 0.45$ ) characteristics. Similarly, deficit symptom ratings were highly correlated across the assessments ( $r = 0.46$ ) as were GAF rating ( $r = 0.50$ ). Overall the pattern of inter-correlations indicates that baseline clinical ratings of symptom severity and functional impairment are predictive of later clinical severity at three-year follow-up.

A different picture emerged with the self-reported trait and social environment variables. Unlike the cross-sectional findings, longitudinal analyses indicated that none of these baseline measures was correlated with follow-up symptom severity. With regard to functional outcomes, only family cohesion from the FES and social support (from the ISEL) were modestly related to three-year follow-up functioning on the GAF.

**Table 5**

Relationship between baseline clinical and self-report measures and 3-year follow-up assessments in Social Anhedonia Group.

	Schizotypal	Schizoid	3-year paranoid	Deficit	GAF
Baseline clinical					
Schizotypal	<b>0.48**</b>	0.37**	0.24**	0.38**	-0.30**
Schizoid	0.24**	<b>0.58**</b>	0.28**	0.34**	-0.40**
Paranoid	0.33**	0.16	<b>0.45**</b>	0.05	-0.22*
Deficit	0.18*	0.34**	0.08	<b>0.46**</b>	-0.33**
GAF	-0.28**	-0.27**	-0.31**	-0.27**	<b>0.50**</b>
Baseline self-report					
PA	-0.06	-0.17	-0.07	-0.19	0.20
NA	0.11	-0.16	0.08	-0.20	-0.15
SSQ number	-0.19	-0.01	-0.05	-0.01	0.21
SSQ satisfaction	0.05	-0.07	-0.08	0.11	0.21
FES cohesion	-0.18	-0.14	-0.15	0.03	0.25*
FES expressive	-0.01	-0.15	0.10	-0.02	0.09
FES conflict	0.11	0.13	0.13	-0.04	-0.19
ISEL total	-0.21	-0.19	-0.16	-0.07	0.40**

Note. GAF = Global Assessment of Functioning; PA = Positive Affect; NA = Negative Affect; SSQ = Social Support Questionnaire; FES = Family Environment Scale; ISEL = Interpersonal Support Evaluation List. Stability correlations are in bold.

\*  $p < .05$ .

\*\*  $p < .01$ .

### 3.6. Role of depression

Given group differences in rates of mood disorders, we conducted post-hoc analyses eliminating all participants with past or present mood disorders and re-analyzed the main study findings. The pattern of results was equivalent, with the exception of prior psychological or psychiatric treatment history, which was no longer significant.

## 4. Discussion

This study reported findings from the three-year follow-up of the MLSS (Blanchard et al., 2011). There were three major findings. First, with regard to clinical diagnoses, the social anhedonia and control groups were relatively similar at follow-up, though the former showed overall higher rates of mood disorders at baseline. Second, for both groups, functioning and symptom severity improved over time, however, the group differences that were observed at baseline persisted over time. The social anhedonia group was elevated in dimensional ratings of schizophrenia-spectrum pathology, they reported fewer social supports and less perceived social support, and described their families as less cohesive, less supportive, and as having greater conflict. Third, baseline symptoms, but not social or functioning variables, were important for understanding functioning at the three-year follow-up. There was no evidence that the present results were confounded by depression. In sum, these results help clarify the functional trajectories associated with social anhedonia over time, and factors that mitigate (and don't mitigate) them.

The current findings of improved Cluster A symptoms from adolescence to early adulthood, while unexpected, appear to converge with results from other community studies of personality pathology. Among others, Clark (2009) has demonstrated that symptoms of personality disorders are highly variable over short temporal epochs (e.g., a year), but generally decrease throughout the lifespan. These changes are sufficient that DSM-IV personality diagnoses are unstable over time. Despite this decline, impairments in functioning are the rule for personality pathology rather than the exception (Clark, 2009; Skodol et al., 2005). Symptom decline may be particularly evident during early adulthood, a time when personality is forming and individuals are facing significant changes to their environment and roles. For example, Cohen's *Children in the Community Study* (Cohen et al., 2005a, 2005b) has shown that mean PD symptoms overall, and for individual cluster A disorders, are consistently highest in early adolescence and are followed by a linear decline from age 9 to 27. This same pattern emerged in our MLSS data in that despite declines across groups, individuals in the social anhedonia group maintained significantly elevated Cluster A characteristics compared to controls. This highlights an important issue for psychometric risk identification methods using self-reported social anhedonia, as norms should account for age and developmental factors. Future research should address this, and expand the scope of personality pathology beyond Cluster A characteristics. Avoidant Personality characteristics, which converge with social anhedonia in prior research, would be important (Gooding et al., 2007; Bolinsky et al., 2015).

The present findings highlight the deleterious mental health and economic impacts of social anhedonia. Social anhedonia was associated with overall poorer functional outcomes, higher rates of unemployment, and lower educational successes than controls; all issues associated with significant economic costs to individuals, their families, and society at large (Insel, 2008). Compared to controls, individuals with social anhedonia also showed a six-fold increase in psychiatric hospitalization and a two-fold increase in outpatient mental health treatment (with over a third of individuals in this group seeking outpatient treatment). Despite the overall improvements in symptom levels observed over time, individuals with social anhedonia continued to show clinical difficulties. These results complement economic estimates of other sub-clinical schizophrenia spectrum characteristics (Valmaggia et al., 2009;

van Ryn and Burke, 2000) in their potential impact. It is unclear what interventions were provided for these individuals, and what their presenting problems were at the time of treatment. This is important for future research to clarify. If properly understood, economic, staff and interventional resources can be developed and optimized for this population (Bertolote and MCGorry, 2005). As yet, few interventions for these populations exist and their precise needs within the broader psychiatric treatment system is poorly understood.

One goal of the MLSS was to determine if baseline individual differences in temperament and social environment (family and broader social support) would be predictive of clinical outcomes (i.e., symptom severity). The results indicated that self-reported traits of affectivity, family environment, and social support were not predictive of Cluster-A symptom severity at follow-up. Thus, these baseline variables (as least as measured by self-report) do not appear particularly informative in predicting variable outcomes in symptom severity. Follow-up symptom severity appears to be best predicted by baseline symptom severity, at least, of the variables examined in this study. This finding suggests that it might be useful to complement self-report high-risk selection procedures with clinical symptom interviews to identify putative high-risk participants most likely to have persistent clinical symptoms (excluding those who do not evidence such symptoms at an initial assessment) (Cannon et al., 2008). Although self-reported family environment and social support were unrelated to symptoms at follow-up, these variables (in particular baseline Family Cohesion and ratings of social support) were modestly correlated with clinician ratings of global functioning at follow-up. This likely reflects the shared variance tapped by these measures but does indicate that self-reported family environment and social support are predictive of broader social functioning outcomes.

In summary, the results of the MLSS three-year follow-up assessment indicated that individuals high in social anhedonia showed persistently elevated schizophrenia spectrum characteristics compared to controls, but that these symptoms declined over time and did not develop into full personality disorder diagnoses. The present results raise questions about the use of social anhedonia as a sole indicator of vulnerability for schizophrenia-spectrum disorders. However, persistent symptom elevations (both Cluster A characteristics and negative symptoms), enduring social difficulties, lower functional outcomes, higher unemployment, and higher mental health utilization were associated with social anhedonia. Thus, it appears to be a clinically meaningful individual difference variable for understanding social and emotional functioning. The current results extend prior reports based on college student samples to a racially diverse community sample and suggest caution in extending findings across these different populations. Results are limited in that the findings are based on a comparatively short three-year follow-up into early adulthood.

#### Contributors

Jack Blanchard designed the study. Alex Cohen helped manage the protocol, collected data, and contributed to the conception of this study. Alex Cohen and Shannon Couture processed the data. All authors were involved in choosing and interpreting the statistical analyses and writing the manuscript. All authors have approved the final manuscript.

#### Declaration of competing interest

The authors report no conflict of interest.

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