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Relations Among Anhedonia, Reinforcement Learning, and Global Functioning in Help-seeking Youth

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Dysfunction in the neural circuits underlying salience signaling is implicated in symptoms of psychosis and may predict conversion to a psychotic disorder in youth at clinical high risk (CHR) for psychosis. Additionally, negative symptom severity, including consummatory and anticipatory aspects of anhedonia, may predict functional outcome in individuals with schizophrenia-spectrum disorders. However, it is unclear whether anhedonia is related to the ability to attribute incentive salience to stimuli (through reinforcement learning [RL]) and whether measures of anhedonia and RL predict functional outcome in a younger, help-seeking population. We administered the Salience Attribution Test (SAT) to 33 participants who met criteria for either CHR or a recent-onset psychotic disorder and 29 help-seeking youth with nonpsychotic disorders. In the SAT, participants must identify relevant and irrelevant stimulus dimensions and be sensitive to different reinforcement probabilities for the 2 levels of the relevant dimension ("adaptive salience"). Adaptive salience attribution was positively related to both consummatory pleasure and functioning in the full sample. Analyses also revealed an indirect effect of adaptive salience on the relation between consummatory pleasure and both role ($\alpha\beta$ = .22, 95% CI = 0.02, 0.48) and social functioning ($\alpha\beta$ = .14, 95% CI = 0.02, 0.30). These findings suggest a distinct pathway to poor global functioning in help-seeking youth, via impaired reward sensitivity and RL.

Key words: psychosis risk/salience/negative symptoms/depression

Background

Ample evidence suggests that negative symptoms such as anhedonia and avolition relate to poor functional outcome in individuals with schizophrenia-spectrum disorders,[1,2] with research demonstrating that these symptoms typically emerge prior to the onset of psychosis.[3] In youth at clinical high risk (CHR) for psychosis, negative symptom severity is associated with functional impairment across many domains and with increased likelihood of conversion to a formal psychotic disorder.[3–6] Yet, few studies have specifically examined neural and psychological mechanisms of anhedonia across the psychosis continuum.

Prior studies have suggested that the overall anhedonia construct can be understood as having both consummatory and anticipatory aspects (ie, "liking" and "wanting")[7,8] that are each associated with distinct neural mechanisms.[9] While patients with schizophrenia and healthy controls appear to evidence similar patterns of emotional reactivity to pleasant stimuli ("liking"),[10–12] patients tend to show marked deficits in reward anticipation ("wanting") relative to controls.[13–17] These findings suggest that negative symptoms in schizophrenia may reflect difficulties in adaptively attributing incentive value, or salience,

to reward-predicting stimuli (evoking "wanting"),[18] rather than reduced sensitivity to experienced rewards ("liking"). The process of adaptive salience attribution is critical to the ability to adjust expectations and subsequent decision-making.[19,20] This process has been formally described in reinforcement learning (RL) models, and considerable evidence supports the idea that deficits in adaptive salience attribution (via RL mechanisms such as abnormalities in reward prediction error signaling[21]) contribute to decreased motivation and goal-directed behavior observed in schizophrenia and other serious mental illnesses.[22–27]

Less is known about relations between anhedonia, RL, and functioning among younger, help-seeking populations, such as individuals with CHR or very early first-episode psychosis. It is possible that deficits in adaptive salience attribution are an early marker of negative symptoms and also predictive of functional outcome at earlier stages of illness, where affective symptoms are prominent. Roiser and colleagues[28] found evidence of intact adaptive salience attribution in youth at CHR, but our previous work supports the link between adaptive salience attribution and negative symptom severity, as well as impaired functioning in individuals with early psychosis spectrum symptoms or other psychopathologies (a subset of the present sample).[29] We have also found that youth at CHR demonstrate RL deficits and reduced neural responses to rewards, relative to healthy controls.[30] Other studies examining reward responsivity in individuals at CHR have yielded mixed findings, though some have found that these youth display diminished subjective and neurophysiological emotional reactivity to pleasant stimuli,[31] which is subsequently associated with comorbid depression and anxiety, and reduced social functioning.[32] This suggests that in contrast to schizophrenia, where RL and functional deficits seem to emerge from issues with anticipatory pleasure (or "wanting"), individuals with attenuated psychosis symptoms may also experience consummatory pleasure deficits that subsequently impact RL processes and functioning.

It is also possible that diminished response to reward, along with associated impairments in RL and functioning, is not specific to youth at CHR but is instead associated with depression and/or other comorbid, nonpsychosis-related mental health concerns that may impact reward-related processes across a broader spectrum of help-seeking youth. Individuals at CHR represent a heterogenous group who often present with nonpsychosis-related psychopathology,[33] with most not developing threshold psychosis.[34] Given the apparent clinical overlap between youth at CHR and youth with other psychiatric conditions, it may be informative to examine anhedonia and related constructs across diagnoses and classifications.

This study sought to better understand potential factors contributing to functional impairment in help-seeking youth by examining relations among anhedonia, RL, and global functioning across a continuum of psychosis risk to early psychosis symptoms. We predicted that poorer performance on experimental measures of adaptive salience attribution would be associated with: (1) greater clinician-rated negative symptom severity, (2) decreased self-reported consummatory and/or anticipatory pleasure, and (3) poorer global functioning in a combined sample of youth with CHR or very early first-episode psychosis and help-seeking youth with nonpsychotic disorders (mainly depressive, anxiety, and behavioral disorders). Given the transdiagnostic nature of symptoms across these groups and evidence of RL abnormalities in affective illness,[35] we did not anticipate significant differences between those at CHR/EP versus help-seeking youth with nonpsychotic disorders. However, we explored whether relations between self-reported pleasure, adaptive salience attribution, and global functioning found in the full sample would be present when controlling for important clinical and demographic covariates (ie, dysphoric mood, age, and clinical status). Finally, we conducted exploratory analyses to test whether self-reported pleasure would have an indirect effect on global functioning through adaptive salience attribution.

Methods

Participants

Participants were recruited through the Strive for Wellness clinic, affiliated with the YouthFIRST laboratory at the University of Maryland, Baltimore County, and with the Division of Child and Adolescent Psychiatry at the University of Maryland School of Medicine. Participants were referred to the study for either potential signs of early psychosis (EP) or other psychiatric concerns through various sources, including community providers and clinics in Maryland. From a larger, ongoing study on psychosis risk, 66 help-seeking individuals consented to behavioral and neuroimaging procedures that included an experimental measure of salience attribution (results from other experimental measures have been reported elsewhere[29,30]). In addition to individuals at CHR (n = 28), the current study included those with EP (n = 6) and help-seeking youth with nonpsychotic disorders who did not meet CHR or psychotic disorder criteria (n = 32), to better represent the dimensional nature of the psychosis spectrum.

The few participants with EP included in analyses represented youth who were initially referred for psychosis risk-related or general mental health concerns but were not suspected to have crossed a diagnosable threshold for psychosis. Rather, these participants were ultimately determined as meeting criteria for full psychosis via their study participation and were very early in their first episode of psychosis. We opted to include these individuals in the current sample as various qualities (e.g., being specialty-treatment naïve, early in the course of symptom progression, and similar in age; see supplementary table S1) suggest that these youth are likely more qualitatively similar to their peers at CHR in terms of clinical presentation and phenomenology than they are distinct.

General Procedures

Following the consent process, all participants completed a series of self-report questionnaires, clinician-administered psychodiagnostic interviews, and the computerized Salience Attribution Test (SAT). All assessments were administered by graduate-level staff. All procedures were approved by the Institutional Review Boards at the University of Maryland, Baltimore County, and the University of Maryland School of Medicine.

Measures

The Structured Interview for Psychosis-Risk Syndromes. The Structured Interview for Psychosis-Risk Syndromes (SIPS)[36] was administered by trained raters with strong interrater reliability (intraclass correlation coefficient > .80) to determine clinical status (ie, CHR, EP, or help-seeking youth with nonpsychotic disorders) and to measure overall positive and negative symptom severity.[36] The SIPS assesses for the presence of 3 separate psychosis risk syndromes and threshold-level psychosis.[36] The SIPS symptom items are divided into positive, negative, disorganized, and general symptom subscales. Each symptom is rated on a scale of 0–6, with higher scores reflecting greater severity. Participants meeting criteria for any of the 3 psychosis risk syndromes were classified as at CHR, whereas the SIPS Presence of Psychotic Symptoms (POPS) criteria were used to determine EP status (see supplementary materials for additional details).

An overall positive symptom score was computed by summing the 5 SIPS positive symptom items (unusual thought content, suspiciousness, grandiosity, perceptual abnormalities, and disorganized communication). An overall negative symptom score was computed by summing the SIPS social anhedonia, avolition, "expression of emotion," "experience of emotions and self," and "ideational richness" items. The remaining SIPS negative symptom item, occupational functioning, was not included in the score due to potential conflation with the outcome variables. Dysphoric mood was assessed using the SIPS "dysphoric mood" item within the general symptom subscale, which measures feelings of depression, irritability, anxiety, and/or other instances of affective dysregulation.

Salience Attribution Test. The SAT is a computerized speeded response task which measures behavioral, or implicit (based on reaction times) and self-reported, or explicit (based on visual analogue scale ratings) measures of adaptive and aberrant salience.[26,37] During the task, participants were presented with an experimental stimulus consisting of one of 4 categories (blue animals, red animals, blue household objects, and red household objects) which varied along 2 dimensions (color and form). Participants were then instructed to respond as quickly as possible to a probe (a green square around the stimulus) before receiving feedback. Feedback was provided in the form of points (5–100 points) on 50% of trials, with more points being awarded for faster responses. The probability of reward varied along one of the stimulus dimensions (task-relevant dimension, eg, color, with blue stimuli rewarded 87.5% of the time and red stimuli rewarded 12.5% of the time), but not for the other (task-irrelevant dimension, eg, object category, with both animal and household stimuli rewarded 50% of the time). *Explicit* measures of adaptive salience were derived by computing the difference between participants' subjective estimates of reward frequency for the high- versus low-probability levels of the relevant (eg, color) dimension. Similarly, explicit measures of aberrant salience were derived by computing the difference between subjective estimates for high- versus low-probability levels of the irrelevant (eg, object category) dimension. *Implicit* measures of adaptive and aberrant salience were derived by computing the difference between participants' mean reaction times to stimuli from the high- versus low-probability levels of the relevant and irrelevant dimensions, respectively (see figure 1 for details).

Temporal Experience of Pleasure Scale. Self-reported pleasure was assessed using the Temporal Experience of Pleasure Scale (TEPS), a brief, 18-item self-report questionnaire designed to assess trait anticipatory (10 items) and consummatory (8 items) pleasure in both healthy and clinical populations.[38] Items are rated on a 6-point Likert scale ranging from 1 (very false) to 6 (very true), with higher scores reflecting greater pleasure (after reverse scoring is applied to one item). The TEPS demonstrated good reliability in our sample ($\alpha = .80$).

Global Functioning Social and Role Scales. Global functioning was assessed using the Global Functioning-Social and Role Scales (GF-S and GF-R), clinician-rated measures designed to assess social activities and role performance in youth at CHR.[39] Each scale is rated from 1 to 10, with higher scores reflecting better functioning. The GF-S and GF-R have demonstrated good psychometric properties, with high interrater reliability (≥.75) and acceptable convergent and discriminant validity.[39,40]

Statistical Analyses

From the initial sample of 66 help-seeking participants, 4 were excluded due to missing data on the SIPS, TEPS, and/or functioning variables. The final analysis sample included 62 participants (27 CHR, 6 EP, and 29 help-seeking youth with nonpsychotic disorders) with complete data sets, of which 26 participants performed 2 experimental sessions (64 trials each) and 36 participants performed one experimental session of the SAT. Given the relatively small number of participants with EP, this group was combined with the CHR group to represent a group of early-course individuals with a broader spectrum of positive symptom

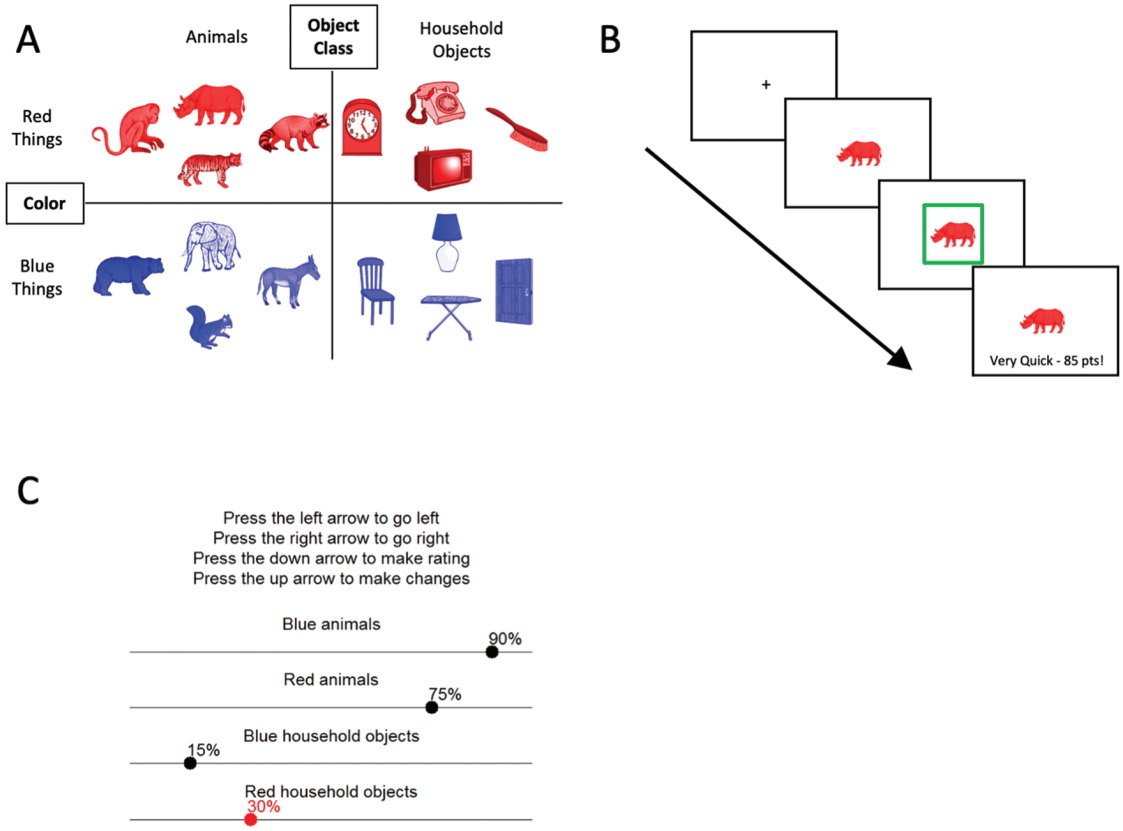

Fig. 1. Schematic of the Salience Attribution Test (SAT). (A) Example of experimental stimuli. (B) Participants viewed a fixation cross for 1 s, before a stimulus was presented for 3.5–4.5 s. Participants then responded as quickly as possible to a probe, which was displayed for a short window, before feedback was presented for 1.5–2.5 s. (C) After runs of the task, participants estimated reward probabilities for the different stimulus classes using visual analog scales.

severity (CHR/EP). Participants ranged in age from 12 to 23 years old (M = 16.60, SD = 3.27), and were approximately 60% female (n = 37). Approximately 42% of participants identified as Black or African American (n = 26), 36% as White (n = 22), 11% as Asian (n = 7), and 11% as biracial or multiracial (n = 7).

Independent samples t-tests were used to examine between-group differences in the constructs of interest, and Pearson correlation and multiple regression analyses were used to test for systematic relations among measures in the full sample. Based on the results of these analyses, we then examined several possible indirect effect pathways using the bootstrapping technique via Hayes' PROCESS macro for SPSS.[41] All variables used in the analyses of indirect effects were treated as continuous and met assumptions of normality (defined as skewness and kurtosis values < 2).[42]

Results

Between-Group Differences in Symptom Severity, SAT Performance, Pleasure Ratings, and Global Functioning

Although the CHR/EP group presented with greater overall clinician-rated positive and negative symptom severity than did help-seeking youth with nonpsychotic disorders, the 2 groups did not significantly differ in levels of self-reported consummatory or anticipatory pleasure, social or role functioning, or dysphoric mood (table 1). There were also no significant between-group differences on any of the SAT measures, including both implicit and explicit measures of adaptive salience (all t-values <1.2; supplementary figure S1A and B] .

Associations Between Measures

Correlation analyses primarily revealed significant relations between explicit adaptive salience, consummatory pleasure, and both role and social functioning (table 2; figure 2A–D). Specifically, poorer explicit adaptive salience attribution was associated with both decreased consummatory pleasure and poorer social and role functioning in the full sample. Relations among explicit adaptive salience, consummatory pleasure, and global functioning remained significant even after controlling for potential effects of dysphoric mood, age, and clinical status in linear regression models predicting (1) explicit adaptive salience from consummatory pleasure, and (2) social and role functioning from explicit adaptive salience, respectively (supplementary tables S5–S7).

Table 1. Demographic, Clinical, Functional, and Self-report Data From Help-seeking Youth With Nonpsychotic Disorders Groups

	Help-seeking Youth With Nonpsychotic Disorders (N = 29)	CHR/EP (N = 33)		
	Mean (SD/%)	Mean (SD/%)	Inferential Statistic	P
Age	15.27 (2.63)	17.76 (3.37)	$t_{60} = -3.20$	.002
IQ	104.05 (16.08)	105.48 (13.80)	$t_{43} = 0.32$	.750
Diagnosis				
Depressive disorder	12 (41%)	18 (55%)	$\chi^2 = 1.36$	.243
Bipolar spectrum disorder	3 (10%)	5 (15%)	$\chi^2 = 0.37$	.544
Anxiety disorder	10 (34%)	22 (67%)	$\chi^2 = 6.40$	.011
Behavioral disorder	22 (76%)	15 (45%)	$\chi^2 = 5.93$	.015
Trauma- and stressor-related disorder	7 (24%)	13 (39%)	$\chi^2 = 1.64$	.200
Other disorder	8 (28%)	11 (33%)	$\chi^2 = 0.24$	.624
SIPS				
Positive symptom total	4.55 (2.32)	12.55 (5.11)	$t_{60} = -7.74$	<.001
Negative symptom total	6.52 (4.09)	10.58 (6.11)	$t_{60} = -2.95$	.004
Dysphoric mood	3.00 (1.64)	3.33 (1.73)	$t_{58} = -0.76$	.450
TEPS				
Anticipatory pleasure	3.66 (1.05)	4.00 (1.01)	$t_{60} = -1.30$	.199
Consummatory pleasure	4.60 (0.80)	4.19 (1.10)	$t_{59} = 1.64$	.106
Global functioning				
Role	6.69 (1.71)	7.03 (1.65)	$t_{60} = -0.80$	.429
Social	7.07 (1.56)	6.55 (1.23)	$t_{60} = 1.48$	.144

Note: CHR = clinical high risk; EP, early psychosis; TEPS, Temporal Experience of Pleasure Scale. The Kiddie Schedule for Affective Disorders and Schizophrenia—Present and Lifetime (K-SADS-PL; Kaufman et al[43]) was used to assess for nonpsychosis-related mental health diagnoses. Anxiety disorders included general anxiety disorder (n = 15), social anxiety disorder (n = 10), separation anxiety disorder (n = 5), and panic disorder (n = 3). Behavioral disorders included oppositional-defiant disorder (n = 12), conduct disorder (n = 2), and attention-deficit hyperactivity disorder (n = 27). Other disorders included eating disorders (n = 8), tic disorders (n = 2), and obsessive-compulsive disorder (n = 8). The K-SADS-PL diagnoses were not mutually exclusive, and many participants had more than 1 diagnosis. N = 45 (22 help-seeking youth with nonpsychotic disorders and 23 CHR/EP participants) for all analyses involving the IQ variable.

Table 2. Correlations Between SAT Measures and Symptom Measures Across the Full Sample of Help-seeking Youth

	Explicit Adaptive Avg	Implicit Adaptive Avg	Positive Symptom Total	Negative Symptom Total	Dysphoric Mood	Consummatory Pleasure	Anticipatory Pleasure	Role Functioning
Positive symptom total	−.05	.01						
Negative symptom total	−.16	−.07	.49**					
Dysphoric mood	.01	−.02	.29*	.54**				
Consummatory pleasure	.38**	−.01	.00	−.14	−.04			
Anticipatory pleasure	−.19	.07	−.25	−.04	−.11	.24		
Role functioning	.38**	−.03	−.17	−.50**	−.36**	.19	−.16	
Social functioning	.31*	.11	−.24	−.70**	−.31*	.19	.02	.51**

Note: Avg = average score. N = 62. N = 60 for all correlations involving the negative symptom total and dysphoric mood variables.
*P < .05, **P < .01.

None of the SAT measures, including adaptive salience attribution, correlated significantly with clinician-rated negative symptom severity or self-reported anticipatory pleasure in the full sample, though greater negative symptom severity was correlated with poorer social and role functioning (table 2). Additional analyses suggested that the relations observed among (1) explicit adaptive salience, consummatory pleasure, and functioning, and

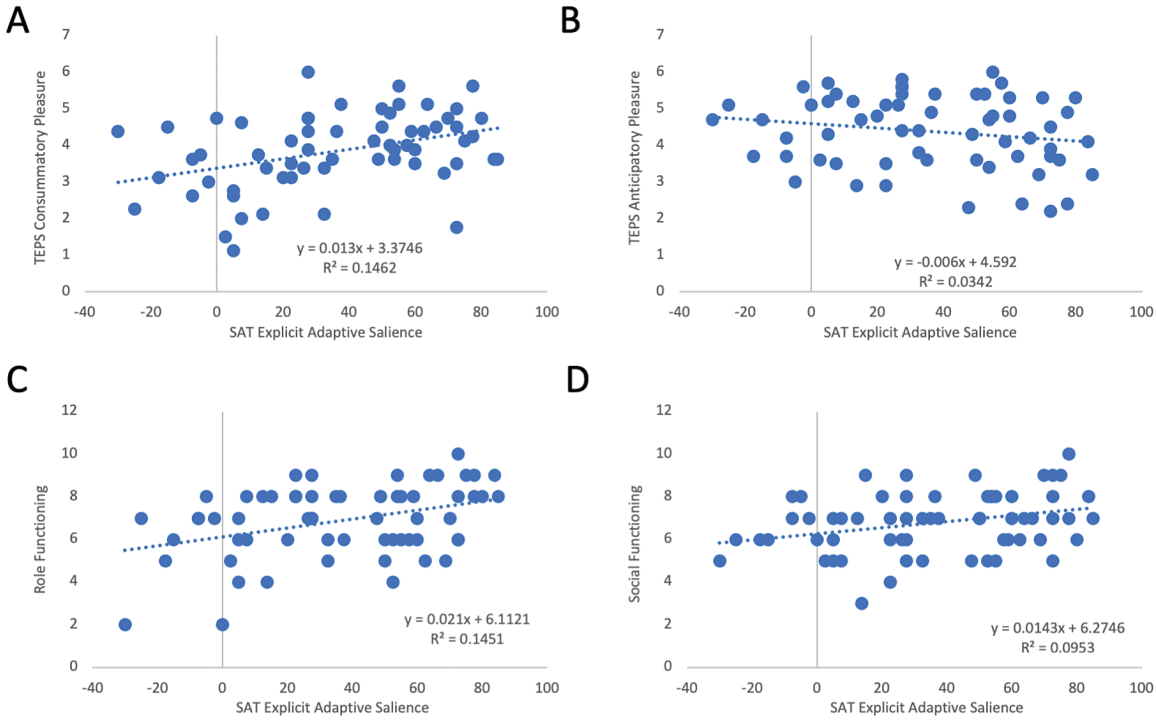

Fig. 2. Scatter plots illustrating significant relations between the explicit adaptive salience measure and (A) consummatory pleasure scores, (B) anticipatory pleasure scores, (C) role functioning scores, and (D) social functioning scores.

(2) clinician-rated negative symptoms and functioning, were not likely driven by any one particular group of participants (eg, EP individuals). As can be seen in supplementary tables S2–S4, similar patterns of findings were observed within the separate samples of CHR/EP, CHR only, and help-seeking youth with nonpsychotic disorders. Relations among explicit adaptive salience, consummatory pleasure, and role functioning were also not attributable to the effects of psychotropic medications (see supplementary tables S8–S11 for more information on differences in study variables by medication type)

Indirect Effects

Given that explicit adaptive salience attribution was significantly correlated with consummatory pleasure and social and role functioning, we tested whether consummatory pleasure would have an indirect effect on global functioning through explicit adaptive salience attribution. The ordering of variables in the model was based on theoretically increasing levels of complexity associated with various reward processes, with hedonic experience (ie, consummatory pleasure) representing the most basic process and global functioning representing a more complex process involving the application of various higher order skills. Because tests of indirect effects, in some situations, can be statistically significant even when the total effect is not statistically significant,[44,45] we elected to continue testing for the presence of an indirect effect despite the fact that no overall effect of consummatory pleasure on global functioning was found. As shown in figure 3A, there was a significant indirect effect of consummatory pleasure on role functioning through explicit adaptive salience attribution, as the 95% CI based on 5000 bootstrapped samples did not overlap zero: $\alpha\beta$ = .22, 95% CI = 0.02, 0.48. There was also a significant indirect effect of consummatory pleasure on social functioning through explicit adaptive salience attribution, ($\alpha\beta$ = .14, 95% CI = 0.02, 0.30; figure 3B). Further analyses revealed that these effects remained even after including participant group as a covariate in the models. (To provide further confidence that results were not disproportionately driven by the 6 participants with EP, all between-group, correlation, and indirect effect analyses were also performed excluding these individuals. The pattern of findings remained the same for all analyses.)

Discussion

In this study of anhedonia and global functioning in a sample of help-seeking youth, deficits in task-derived adaptive salience attribution were associated with both decreased consummatory pleasure and impaired role and social functioning. While CHR/EP youth and help-seeking youth with nonpsychotic disorders scored similarly on measures of adaptive salience, self-reported pleasure, and functioning, results revealed an indirect effect of consummatory pleasure on both role and social functioning through adaptive salience attribution in the full sample. This latter finding suggests that

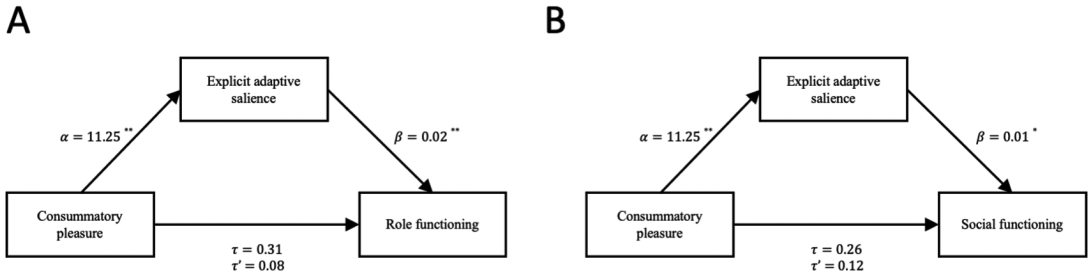

Fig. 3. (A). Indirect effect model illustrating relations among consummatory pleasure, explicit adaptive salience, and role functioning in the full sample. The τ path represents the total effect of consummatory pleasure on role functioning, the α path represents the effect of consummatory pleasure on explicit adaptive salience, the β path represents the effect of explicit adaptive salience on role functioning controlling for consummatory pleasure, and the τ′ path represents the direct effect of consummatory pleasure on role functioning (ie, controlling for explicit adaptive salience). (B). Indirect effect model illustrating relations among consummatory pleasure, explicit adaptive salience, and social functioning. For both panels, $*P < .05$, $**P < .01$.

deficits in the ability to experience pleasure ("liking") may underlie deficits in RL in help-seeking youth, leading ultimately to functional impairment within this population.

As recent studies of reward processing and RL in adults with schizophrenia support the idea that these individuals have intact hedonic *experience* ("liking"),[10,46] and that motivational deficits are more likely to be linked to the reduced *anticipation* of pleasure ("wanting"),[46,47] our finding that consummatory, but not anticipatory, pleasure was associated with RL in help-seeking youth (including those at CHR) suggests that the nature of anhedonia may differ across diagnoses and/or illness stage. This notion has been supported by other studies reporting that consummatory pleasure deficits may be more common among youth at CHR compared to those with chronic schizophrenia, potentially due to the heterogenous nature of the CHR state.[31,33,48] In other words, consummatory pleasure deficits and associated impairments in RL could be due to higher rates of comorbid symptoms such as depression and anxiety among this population relative to individuals with schizophrenia.[49,50] It is therefore possible that consummatory pleasure deficits play a larger role in motivation and behavior at earlier stages of illness or are otherwise associated with symptoms experienced by both youth at CHR and help-seeking youth with nonpsychotic disorders.[51,52]

Salience Attribution, Self-reported Anhedonia, and Functional Outcomes in Help-seeking Youth

While not the primary focus of this study, it is noteworthy that, unlike adaptive salience, *aberrant* salience attribution—which has been related to positive symptoms in both adults with schizophrenia[29] and youth at CHR[31]—was not statistically related to self-reported pleasure and global functioning in our sample. In addition, our finding that pleasure and functioning were related to the explicit, but not implicit, measure of adaptive salience attribution is consistent with prior findings from both our group[53,54] and others.[25] Prior research has demonstrated that explicit and implicit measures of adaptive salience may not always align or perform similarly in relation to other constructs, possibly due to different underlying cognitive processes,[55–57] with the explicit measure potentially serving as a more sensitive measure of RL. Barch and colleagues[25] have also suggested that explicit measures of RL in particular may be more closely associated with psychiatric symptoms such as anhedonia.

Although we found a strong positive correlation between clinician-rated negative symptoms and global functioning in our sample, both adaptive salience attribution and self-reported consummatory pleasure were unrelated to overall clinician-rated negative symptom severity. Given that negative symptom ratings are typically meant to capture deficits in motivation and pleasure that would seemingly impact RL processes, these null findings were somewhat surprising (and unlikely to be due to insufficient power to detect effects, as the correlation effect sizes were small). Some have identified a number of potential limitations in using the SIPS to assess negative symptoms, including the fact that it does not distinguish primary from secondary negative symptoms, and the sole anhedonia item does not distinguish between consummatory versus anticipatory aspects of pleasure and may be more sensitive to behavior than internal experience.[3,58,59] Our findings suggest that there may be a mismatch between interview-based and self-report assessments of anhedonia, and/or that conceptualizations of anhedonia operationalized by these 2 measures are not well aligned.[60] Our findings highlight the need for a more thorough interview-based negative symptom assessment for help-seeking individuals at earlier stages of illness.[3,59] Future studies aiming to assess negative symptoms in youth at CHR should consider using the recently developed Negative Symptom Inventory-Psychosis Risk (NSI-PR),[3,59] which accounts for some of the distinctions listed above and was specifically developed for use with younger age groups.

Limitations

Several factors may limit the generalizability of our results. The relatively small samples of participants in each group limited our power to detect small- and medium-sized effects. We did not include healthy controls in this study, limiting our ability to determine the extent to which participants' task performance and clinical presentation deviates from what would be expected in typically developing youth. Additionally, a wide range of general cognitive impairments, including impaired working memory,[61,62] could impact the relations among consummatory pleasure, adaptive salience attribution, and global functioning. Although we did not have adequate data to fully assess this consideration, it is likely that our findings are a result of relations between consummatory pleasure and global functioning through RL, as well as general cognitive impairments. Future work parsing out variance explained by additional cognitive processes in the links between anhedonia, RL, and functioning is warranted. Furthermore, it is difficult to rule out effects of psychotropic medications on the relations observed, outside the context of controlled clinical trials, even when controlling for these variables in post-hoc analyses. Finally, assessing the effects of comorbid conditions would be best accomplished in larger samples, where subsets of youth at CHR and help-seeking youth with nonpsychotic disorders with the same comorbid conditions could be compared.

Conclusions

Across our full sample of help-seeking youth, explicit adaptive salience attribution was related to consummatory pleasure, role functioning, and social functioning, with an indirect effect of consummatory pleasure on functioning through salience attribution. Furthermore, we found that clinician-rated negative symptoms were related to role and social functioning. Our findings suggest that the nature and origins of anhedonia in help-seeking youth, including individuals at CHR, might be different than they are in adults with chronic schizophrenia, possibly due to an influence of mood symptoms such as depression. Specifically, these youth may experience genuine reductions in the *experience* of pleasure ("liking") that contribute to real-world functional deficits. As mood symptoms may be a natural part of the earliest stages of psychosis for many, longitudinal studies are needed to determine the extent to which changes in these symptoms are associated with anhedonia and unique RL impairments over time.

Supplementary Material

Supplementary data are available at *Schizophrenia Bulletin* online.

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