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Measuring Anhedonia in Adolescents: A Psychometric Analysis

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Abstract

Anhedonia—the reduced capacity to experience pleasure—is a trait implicated in mental and physical health. Yet, psychometric data on anhedonia measures in adolescents are absent. We conducted an in-depth psychometric analysis of the Snaith-Hamilton Pleasure Scale (SHAPS; Snaith et al., 1995)—a self-report measure of anticipated pleasure response to 14 pleasant experiences—in adolescents. Adolescents (*N*=585; *M* age=14.5) completed the SHAPS and other paper-and-pencil surveys. Item response theory models were used to evaluate the psychometric performance of each SHAPS item. Correlations of the SHAPS with other personality and psychopathology measures were calculated to evaluate construct validity. Results showed that: (1) certain items (e.g., reported pleasure from basic experiences like “seeing smiling faces” or “smelling flowers”) provided more information about latent anhedonia than others; and (2) SHAPS scales exhibited construct-consistent convergent and discriminant validity (i.e., stronger correlations with low positive affect constructs; weaker correlations with negative affect). Reporting diminished pleasure from basic pleasant experiences accurately indicates adolescent anhedonia, which is important for future scale development and understanding the phenomenology of anhedonia in teens. These data support using the SHAPS for assessing anhedonia in epidemiological research and school-based universal prevention programming in general adolescent populations.

Introduction

Anhedonia—the reduced ability to experience pleasure in response to rewarding stimuli—is a cardinal symptom of depression and common feature of psychiatric disorders (APA, 2013). Anhedonia is also often observed as a trait-like dimension with substantial inter-individual variation in the general population (Lyons et al., 1995; Meehl, 2001). Individual differences in anhedonia in general population samples are associated with risk of mood disorder (Loas, 1996), psychotic disorder (Kwapil, 1998), drug use disorder (Leventhal et

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al., 2010), tobacco use (Audrain-McGovern et al., 2012), physical inactivity (Leventhal, 2012), diabetes (Nefs et al., 2012), and cardiovascular disease (Davidson et al., 2010; Doyle, 2010). Hence, variation in anhedonia in the general population has scientific and applied relevance to identifying those at risk for a diverse number of mental and physical health outcomes.

In comparison to a sizeable literature on the causes, consequences, and correlates of anhedonia in adults, there has been much less anhedonia research conducted with adolescents. Nevertheless, the scant published data available suggest that the experience of anhedonia is common in population samples of adolescents (Bennik, Nederhof, Ormel, & Oldehinkel, 2013; Sanchez-Garcia et al., 2014) and is associated with risk of psychopathology and substance use in general population samples (Audrain-McGovern et al., 2012; Thomas, 2011). If an adequately valid measure of anhedonia in a general population sample of adolescents could be identified, this tool could be applied in epidemiologic surveys on the nature, risk factors, and consequences of anhedonia in general population samples of adolescents. Furthermore, an anhedonia measure validated for use in general adolescent population samples might be useful in applied prevention contexts, such as school-based programs for health promotion and psychopathology prevention.

Self-report anhedonia measures typically instruct respondents to rate their usual pleasure response to experiences that are commonly pleasant (e.g., “I would enjoy a beautiful landscape or view”), with lower ratings indicating higher anhedonia. Among the various self-report anhedonia scales, the Snaith-Hamilton Pleasure Scale (SHAPS; Snaith et al., 1995 has been studied extensively in adults, is shorter than other anhedonia measures, utilizes items aimed to be relevant to a wide variety of demographic and cultural populations, and has demonstrated more favorable psychometric properties than other corresponding anhedonia measures in adults (Franken, Rassin, & Muris, 2007; Leventhal, Chasson, Tapia, Miller, & Pettit, 2006; Liu, Wang, Zhu, Li & Chan, 2012; Nakonezny, Carmody, Morris, Kurian & Trivedi, 2010; Snaith et al., 1995). However, there are important questions regarding whether the psychometric properties of the SHAPS demonstrated in adults will generalize to adolescent samples.

For example, certain experiences pertinent to pleasure experiences in adults may be less relevant to the developmental context of adolescence (e.g., leisure reading, at least among some teens); hence, psychometric analysis at the item level would be useful for adolescent applications of the SHAPS. Item response theory (IRT; Thomas, 2011) models can identify the extent to which responses to an individual item effectively discriminates across levels of a latent continuum (i.e., discrimination) and the point on the latent continuum where an item discriminates (i.e., severity/threshold). Furthermore, IRT modeling can evaluate whether, for a particular item, different response levels (e.g., disagree vs. strongly disagree) fail to discriminate effectively from one another, which could suggest the need for a modification of the scoring algorithm that collapses undifferentiable responses into a single scoring category. Such distinctions are important given that different scoring algorithms have been used with the SHAPS regarding whether or not to recode the four response levels for each item into two collapsed scoring categories (Snaith et al., 1995; Franken et al., 2007). In addition, an IRT analysis of discrimination and thresholds for individual SHAPS items may:

(1) inform the types of items that may or may not be useful to incorporate in future efforts to develop new adolescent anhedonia measures; and (2) provide conceptual insights to the phenomenological manifestations of anhedonia in adolescents.

Construct validity analysis is also critical for determining the precision of anhedonia measures. A key aspect of the anhedonia construct is deficiency in pleasure, positive emotion, and reward and differentiation from excesses in negative emotions and other forms of psychiatric distress (e.g., vegetative symptoms; Fiorito & Simons, 1994; Franken & Muris, 2006; Leventhal et al., 2006; Leventhal et al., 2008a). Hence, an anhedonia measure should demonstrate construct-relevant patterns of convergent validity (i.e., stronger correlations with other measures of anhedonia, low positive affect, and low reward) and discriminant validity (i.e., weaker correlations with measures of distress and negative affect).

The current study examined the psychometric properties of the SHAPS in a general adolescent high school sample. We utilized IRT modeling to examine the psychometric performance of individual SHAPS items. We also examined the construct validity of the SHAPS in this adolescent sample by investigating relations to convergent and discriminant constructs. By yielding detailed psychometric data on a widely-used anhedonia measure, this study may inform anhedonia assessment in adolescents from the general population as well as shed light on the nature of anhedonia in adolescence.

Method

Participants and Procedures

Participants were 9th grade students enrolled in two public high schools in the Los Angeles metropolitan area who were invited to take part in a study of emotion and health. Approximately 40 public high schools were invited to participate in this study, and of these, 10 schools agreed to participate. Of the 10 schools who agreed to participate, two schools were selected for this study based on their adequate representation of diverse demographic characteristics of the general population of the Los Angeles area (see Table 1). An indicator of income level of students within a school is proportion of students who are eligible for government provided free lunch, which is based on whether a student's parental income is equal or lower than 185% of the national poverty level adjusted for household size. The proportions of students eligible for free lunch within the participating schools were 14% and 19%. All students not enrolled in special education (e.g., severe learning disabilities) or English as a Second Language Programs (N=807) were eligible. Of the 689 (85%) students who assented to participate, 585 (82%) provided active written parental consent and completed the study surveys. A paper-and-pencil survey was administered on-site in spring of 2013 during two separate, in-class 40-minute survey administrations separated by no more than two weeks. Data collectors informed students that their responses would be confidential and not shared with teachers, parents, or school staff. Each participating school was compensated $1500 for their general activity fund; students were not individually compensated for participating. The study protocol was approved by the University of Southern California Institutional Review Board.

Measures

All measures had adequate internal consistency in this sample (see Table 3 for each measure's Cronbach's α).

Snaith-Hamilton Pleasure Scale (SHAPS; Snaith et al., 1995)—The SHAPS is a 14-item questionnaire with self-statements of pleasure in response to hypothetical typically pleasant experiences that span sensory stimuli, social activities, and hobbies (see items in Table 2). Each item is rated on four response categories 0 ("*Strongly Agree*") to 3 ("*Strongly Disagree*"). A higher total score indicates higher levels of anhedonia. In the original scoring algorithm, Snaith et al. (1995) proposed to recode each item as dichotomous (Definitely Agree or Agree = 0; Disagree or Definitely Disagree = 1). Recent approaches have used an updated scoring algorithm that codes the four response categories as separate scores (ranging 0–3) and sums the total, in order to generate greater dispersion of the data (Franken et al., 2007; Leventhal et al., 2006). In prior studies of adults, the psychometric properties of the updated scoring algorithm have been supported, as reflected by the unidimensional factor structure, high internal consistency, strong test-retest reliability, convergence with related constructs, and discrimination from negative affect and other constructs (Franken et al., 2007; Leventhal et al., 2006; Liu et al., 2012; Nakonezny et al., 2010).

Convergent Validity Instruments—We administered the following measures that tap convergent constructs of anhedonia, pleasure, and other positive-mood characteristics.

Pleasant Events Schedule (PES; MacPhillamy and Lewinsohn, 1976)—We used a modified version of the PES for use in adolescents based on prior work (Audrain-McGovern, Rodriguez, Rodgers, & Cuevas, 2011). Participants rate 42 different typically pleasant activities (e.g., shopping, going to a movie) for both frequency of engagement (Never = 0, 1 – 6 times = 1; 7 or more times = 2) and pleasure (not pleasurable = 0; somewhat pleasurable = 1; very pleasurable = 2) in the past 30 days. The primary outcome is the sum of each item's cross-product (engagement frequency × pleasure).

Tripartite Pleasure Inventory (TPI; Leventhal, 2010, 2012)—The TPI is a self-report measure for which participants rate 12 commonly pleasant experiences that span interest/pastimes, social interaction, sensory, and goals/mastery (e.g., "Eat tasty food"). Participants make three separate ratings on 5-point for each experience: (1) responsivity (i.e., "how much pleasure, happiness, or enjoyment do you usually have when you…"; on a scale from 1 ("*No enjoyment*") to 5 ("*Very high enjoyment*"); (2) engagement (i.e., "how often do you usually…" on a scale from 1 ("*Less than once per month*") to 5 ("*More than 4 times per week*"); and (3) desire (i.e., "how much do usually you want to…"on a scale from 1 ("*Not at all*") to 5 "*Very much*"). Each of the three response categories can be computed as three separate average subscale scores.

The Early Adolescent Temperament Questionnaire—Revised: Pleasure Sensitivity Subscale (EATQ-R; Ellis & Rothbart, 2001)—The EATQ-R assesses temperament by instructing respondents to rate self-statements on a 5-point scale, from 1 ("*Almost always untrue*") to 5 ("*Almost always true*"). It has 104 items and 12 subscales that

assess a range of traits reflecting affective, social, and behavioral functioning. The 5-item Pleasure Sensitivity Subscale assesses enjoyment of pleasant sensory experiences (e.g., "I like to feel a warm breeze flowing on my face") and has demonstrated good internal consistency (Ellis & Rothbart, 2001).

Subjective Happiness Scale (SHS; Lyubomirsky & Lepper, 1999)—The SHS is a 4-item measure of trait global happiness and enjoyment from life. Participants rate items on 7-point scales, ranging from 1 ("*Not at all*") to 7 ("*A great deal*"). Sample items include "Some people enjoy life regardless of what is going on…To what extent does this describe you?" A mean composite score is calculated across the items. Responses on the SHS exhibit good internal consistency, stability, convergent validity, and discriminant validity from composite depressive symptom indexes and negative emotionality (Lyubomirsky & Lepper, 1999; Neff, Rude & Kirkpatrick, 2007).

Center for Epidemiologic Studies Depression: Anhedonia Subscale (CESD; Radloff, 1977)—The CESD is a 20-item measure of depressive symptoms over the past week that are rated on a 4-point Likert scale, ranging from 0 ("*Rarely or None of the time*; 0 – 1 days") to 3 ("*Most or all of the time*" 5 – 7 days"), for which a total scale involving the sum of responses for all 20 items can be computed. Factor analyses of the CESD consistently yield 4-factor structure of the CESD (Shafer, 2006), which separates items into unique factors indicative of anhedonia, negative affect, somatic features, and interpersonal disturbance with each item loading prominently onto a single factor without cross-loading onto multiple factors. The four items that prominently load onto the anhedonia factor assess enjoyment and happiness (e.g., "I enjoyed life"). Based on the factor analytic findings, researchers have computed an anhedonia subscale within the CESD based on mean score of ratings for these four items, which has exhibited good convergent, factorial validity and reliability in prior work in adolescents and adults (Leventhal, Ramsey, Brown, LaChance & Kahler, 2008b; Leventhal, Ray, Rhee & Unger, 2011).

Mood Questionnaire: Positive Affect Subscale (MQ; Diener & Emmons, 1984)—The MQ is a 9-item measures which has subscales of positive and negative affect, which instructs respondents to rate the degree to which they are feeling affective adjectives (e.g., "enjoyment") on a 7-point scale, ranging from 1 ("*Not at all*") to 7 ("*Extremely*").. The 4-item positive mood scale is based on the mean score across the respective items and has demonstrated good psychometric properties and discrimination from negative affect (Diener and Emmons, 1984).

Pleasantness Rating Task (PRT; Leventhal, Martin, Seals, Tapia, & Rehm, 2007)—Participants rate the pleasantness of developmentally-appropriate pictures selected from the International Affective Picture System (IAPS; Lang, Bradley & Cuthbert, 2001) on a 7-point scale, ranging from 1 ("*Unpleasant*") to 7 ("*Pleasant*"). Based on mean ratings on affect valence (negative to positive) and arousal (low to high arousal) of the pictures in the normative sample for the IAPS, pictures were selected for each of the following categories: (1) those rated in the normative sample to be highly positive in valence and high arousal (e.g., picture of person skiing; 10 pictures), (2) 10 affectively-positive low arousal pictures

(e.g., flowers in a meadow; 10 pictures), and (3) neutral in valence and arousal (e.g., furniture; 20 pictures). Each of the 40 pictures was rated once. Two difference scores are yielded by subtracting the high-arousal and low-arousal pleasant picture mean rating from the neutral picture mean rating as indexes of affective responsiveness to high and low arousal pleasant stimuli, respectively. PRTs exhibit good convergence with anhedonia surveys and discriminant validity from overall depression (Leventhal et al., 2006; Leventhal et al., 2007)

Discriminant Validity Instruments—We administered the following measures of negative emotions and other form of psychological distress conceptually distinct from anhedonia.

CESD-Negative Affect and Somatic Features Subscales—The CESD is a 20-item measure of depressive symptoms over the past week on a 4-point Likert scale, ranging from 0 (“*Rarely or None of the time, 0 – 1 days*”) to 3 (“*Most or all of the time, 5 – 7 days*”), Based on the 4-factor structure of the CESD described above (Shafer, 2006), the CESD also yields subscales that tap negative affect (e.g., “felt sad,” 7 items) and somatic features (e.g., “appetite was poor,” 7 items) assess negative emotional and vegetative/cognitive facets of depressive symptoms, respectively, which are computed based on the mean response for the items within each subscale. These subscales have demonstrated factorial validity and reliability in prior work in adolescents and adults (Leventhal et al., 2008b; Leventhal et al., 2011).

Revised Children's Anxiety and Depression Scale (RCADS; Chorpita, Moffitt & Gray, 2005)—Respondents report the frequency of *DSM-IV* based symptoms for separate mood and anxiety syndromes on a 4-point scale, ranging from 0 (“*Never*”), to 2 (“*Always*”). We included the following subscales, for which a total sum score is computed across the items that constitute each syndrome domain: Major Depression (10 items), Generalized Anxiety (6 items), Panic Disorder (9 items), and Social Phobia (9 items).

MQ-Negative Affect Subscale (Diener & Emmons, 1984)—This 5-item negative affect subscale counterpart (e.g., “frustrated”) to the MQ has demonstrated good psychometric properties (Diener & Emmons, 1984).

UPPS Impulsive Behavior-Revised (UPPS) Negative Urgency Subscale (Cyders et al., 2007; Whiteside &Lynam, 2001)—The 12-item UPPS-Negative Urgency subscale instructs respondents to rate level of agreement on a 4-point scale for self-statements indicative of the tendency to act rashly while experiencing negative mood states (e.g., “when I am upset, I often act without thinking”). The UPPS-Negative Urgency Scale has shown good construct validity and internal consistency in prior work (Cyders et al., 2007; Whiteside and Lynam, 2001).

Analyses

Preliminary analyses involved reporting descriptive statistics of sociodemographic variables and their associations with SHAPS scores and intraclass correlation (ICC) values for

SHAPS scores to assess the impact of clustering by school. Prior to modeling the SHAPS item responses using methods based in IRT, we examined whether item responses could be characterized by a single construct of hedonic capacity, (i.e. unidimensionality), the strength of inter-item relationships after accounting for relationships with levels of hedonic capacity (i.e. local independence), and whether increasing levels of hedonic capacity were associated with monotonic increases of observing each of the increasing item options (i.e. monotonicity). For evaluation of unidimensionality, we present three indices for testing the fit of the model: the Comparative Fit Index (CFI; Bentler, 1990), the Tucker Lewis Index (TLI; Bentler & Bonnett, 1980), and the Root Mean Square Error of Approximation (RMSEA; Steiger, 1990). Suggested cut-offs for model fit are CFI ≥ 0.96, TLI ≥ 0.95, and RMSEA ≤ 0.05 (Yu, 2002). Browne and Cudeck (1993) proposed that RMSEA ≤ 0.05 indicate a 'close fit', values between 0.05 and 0.09 indicate 'reasonable fit', and values of 0.10 and greater demonstrate 'poor fit.' We used a non-parametric kernal smoothing method (Ramsay, 2000) to examine relations between increasing levels of anhedonia and the probability of endorsing each of the SHAPS item options. This analysis indicates whether, for a particular item, different response levels (e.g., disagree vs. strongly disagree) fail to discriminate effectively from one another, which is important because it suggests the need for a modification of the scoring algorithm that collapses undifferentiable responses into a single scoring category. Item options that did not provide unique information were collapsed prior to fitting more restrictive parametric models. With satisfaction that assumptions of unidimensionality, local independence, and monotonicity were met, we then used a graded item response model (Samejima, 1969) for the multiple item response categories. We then took the raw scores and scores derived from IRT-based scaling and explored their correlates with convergent and discriminant constructs. We used R© statistical software (Team, 2013) and packages *KernSmoothIRT* (Mazza, Punzo & McGuire, 2013) and *ltm* (Rizopoulos, 2006).

Results

Preliminary Analyses

Table 1 reports descriptive statistics for sample demographic characteristics. Clustered variability in SHAPS score accounted for by school membership was low (ICC = .025), suggesting that nesting of the data did not substantially impact patterns of variability (results from models nested by school are available upon request to the first author; AML). Based on recommended age and gender normed cutoffs from the RCADS (Chorpita et al., 2005), the proportions of participants who surpassed borderline clinical and full clinical thresholds for each subscale were as follows: Generalized Anxiety (borderline: 19%, clinical: 12%), Major Depression (22%, 16%), Panic Disorder (17%, 11%), Social Phobia (16%, 19%). Ethnicity was the only sociodemographic variable that was associated with SHAPS full scale scores (Table 1). Table 1 lists descriptive statistics for raw scores of each SHAPS item, which showed adequate internal consistency (Cronbach's α = .87). To test unidimensionality, we examined fit to a single factor using a confirmatory factor analysis and robust weighted least squares estimator that treated the four response options as ordered categorical variables. Fit to a single factor was acceptable (CFI =0.98; TLI=0.97; RMSEA=0.09) and is consistent with prior work supporting a single-factor model for SHAPS items in adults (e.g.,

Nakonesky et al., 2010). Local independence was estimated using the standardized LD X^2 index (Chen & Thissen, 1977) which reflects the strength of remaining inter-item associations after modeling a primary single factor. All LD values ranged from 1.33 to 7.56 and were within acceptable limits in support of a single latent construct underlying SHAPS responses.

Non-parametric Item Response Models

We examined assumptions that the probability of selecting each of the four options increased as levels of anhedonia increased. The option characteristic curves (OCC) reflect the probability of observing each response with increasing levels of anhedonia (i.e., greater disagreement with statements reflecting pleasure). In Figure 1 the OCC are plotted as a function of levels of anhedonia and are standardized (M=0, SD=1). Examination of OCC suggested that in all but three items (scents/smells [#6], small things [#11], landscape/view [#12]), we did not observe OCC that provided clear distinction among the 'Disagree' and 'Strongly Disagree' options (see Figure 1). For example, in item 1 (television/radio), the 'Disagree' option (coded trace line '3' in Figure 1) was never uniquely more likely to be observed than any other option, suggesting that disagreeing with "I would enjoy my favorite television or radio program" did not necessarily indicate a clear increment in levels of anhedonia. In comparison, for item 6 (scents/smells), the response options were more clearly distinguished, with each option more likely to be endorsed than other options within non-overlapping regions of anhedonia. We next re-examined the remaining options across all items and were satisfied that the 'Strongly Agree' and 'Agree' options (See Figure 1 options '1' and '2') provided clear intersections and thus unique information about levels of anhedonia. We observed sufficient separation on all four options for three SHAPS items (scents/smells [#6], small things [#11], landscape/view [#12]) and did not collapse scoring options for these items. This lack of separation for other items in this sample suggested that, when scoring the instrument, recoding the two 'Strongly Disagree' and 'Disagree' options into a single scoring category might be considered for the other 11 items.

Graded Response Model

We fit the graded response model to the 3 four-level items and 11 three-level SHAPS items. Table 1 includes the discrimination for each item and the threshold parameters for all of the examined options. Figure 2 displays the option characteristic curves (OCC). At the intersection of each OCC for this graded response model, the expected score on each item across levels of anhedonia can be estimated using the sum of the weighted probabilities of scoring in each of the possible categories (k) for the item.

Several of the items shared a similarly strong relationship with the latent anhedonia dimension. Items 1 (television/radio) and 9 (reading) had the weakest associations and lowest corresponding discrimination (range: 0.87–1.17). Five 3-option items (television/radio [#1], smiling faces [#7], drink [#10], helping others [#13], receive praise [#14]) provided somewhat overlapping information and thresholds that marked similar levels of anhedonia (b_1 [Agree, Disagree, or Strongly Disagree vs. Strongly Agree] range from −0.27 to −0.37; b_2 [Strongly Disagree/Disagree vs. Agree or Strongly Agree] range from 1.47 to 2.58). Within this set of five items, 'helping others' and 'smiling faces' discriminated at the

lower end of the anhedonia continuum in comparison to the other three items which discriminated at a comparatively higher end of the continuum. Additional overlap in threshold estimates was observed among items 2–5 and item 8.

Among the four-option items (scents/smells [#6], small things [#11], landscape/view [#12]), we also observed similarly strong relationships with levels of anhedonia and some overlap among the threshold estimates (b_1 [Agree, Disagree, or Strongly Disagree vs. Strongly Agree] range −0.60 to −0.94; b_2=0.62 to 1.19; b_3 to 1.94–2.32).

Concurrent Validity

The SHAPS raw scores were highly correlated with the scores generated by the item response model (r = .98). The SHAPS demonstrated moderately-sized correlations with each of the proposed convergent constructs related to pleasure, happiness, and positive affect ($|r|$s = .12 to .55; ps < 0.01; Table 3). The SHAPS demonstrated weaker correlations with each of the discriminant constructs related to negative affect and distress ($|r|$s < .11, ps > 0.05; Table 3), with the exception of an unexpected significant inverse relation between SHAPS and social phobia.

Discussion

In item-level psychometric analyses, IRT modeling suggested that the 14 items that comprise the SHAPS corresponded with latent anhedonia in a non-uniform fashion. For instance, items assessing pleasure from “reading a book, magazine, or newspaper” and a “television or radio program,” were the least discriminating, which is not entirely surprising given that reading for pleasure is not particularly common in adolescents, as electronic media (e.g., websites) is a more frequent outlet for entertainment than traditional print media or television/radio programming in current culture (Madden et al., 2013; Nippold, Duthie & Larsen, 2005). By contrast, other items that reflected basic sensory and social experiences (e.g., “bath/shower,” “scents/smells,” “seeing smiling faces,” “small things,” “landscape/view,” “helping others”) provided more robust information regarding where teens fell along the latent anhedonia continuum. Hence, future efforts to develop novel anhedonia scales for adolescents might consider incorporating items addressing sensory or social experiences that are basic in nature and less basic experiences that are currently culturally relevant.

Threshold estimates indicated that certain items differentiated disparate points along the anhedonia continuum, which sheds light on the phenomenology of adolescent anhedonia. Variation in pleasure response to certain experiences (e.g., “scents/smells,” “smiling faces,” “helping others”) differentiated towards lower end of the anhedonia continuum, which may distinguish adolescents with very high hedonic capacity from those with moderate levels. By contrast, responses to other experiences (e.g., “small things,” “landscape/view,” “bath shower”) provided information at comparatively higher ends of the anhedonia continuum, suggesting that the failure to affectively respond to such experiences might reflect more severe manifestations of anhedonia.

Results also showed that although the “Strongly Disagree” and “Disagree” responses did not meaningfully distinguish latent anhedonia for several items, the “Agree” and “Strongly

Agree" responses were adequately discriminatory from one other and both "disagree" responses for all items. Hence, these results do not support the original scoring recommendations in Snaith et al. (1995) to recode the four possible responses into two scoring categories, and instead suggest the use of three or four level scoring categories for each item response (e.g., Franken et al., 2007).

Concurrent validity analyses yielded findings consistent with theory and data in adults suggesting that anhedonia specifically reflects deficits in positive emotion and reward and is distinct from other aspects of psychiatric distress (Fiorito & Simons, 1994; Franken & Muris, 2006; Leventhal et al., 2006; Leventhal et al., 2008a). Indeed, there were stronger correlations with convergent measures of anhedonia, positive affect, and reward, and weaker correlations with discriminant measures of distress and negative affect in this sample. Hence, the anhedonia construct (as measured by the SHAPS) appears to operate similarly across adolescents and adults.

Certain study limitations warrant discussion. We used a general community sample of 9th grade high school students in the Los Angeles area, using a non-random sampling technique. Hence, generalizability to the larger population, other locations, older or younger ages, non-students, and individuals with more severe forms of psychiatric illness (who may otherwise not be attending school) is limited. Future work in clinical samples is warranted before applying the SHAPS in clinical settings. Furthermore, the sample was sociodemographically diverse and had a large proportion of Hispanics. Hence, it is unclear whether the findings reflect patterns of reporting pleasure that generalize across populations. Indeed, we found that Hispanic students reported less pleasure overall on the SHAPS, which raises questions whether: (1) Hispanic adolescents tend to be experience less pleasure in response to a universe of possible rewarding experiences than non-Hispanic adolescents; or (2) the SHAPS may be culturally biased and does not adequately sample the range of rewarding experiences that Hispanic teens might find pleasurable. Future work exploring the psychometric properties of other anhedonia measures that assess a wider range of experiences as well as differential item functioning analyses across ethnicities clarify such questions. Although the measurement battery was broad, all measures were self-report, leaving unclear the extent to which mono-method biases affected the findings. Applying behavioral measures and clinician ratings of anhedonia and other constructs will be valuable for future validation of the SHAPS (Ameli et al., 2014; Pizzagalli, Jahn, & O'Shea, 2005). The study was cross-sectional and, therefore, could not provide data on the SHAPS's predictive validity and stability over time in adolescents, which are important unanswered questions. Although suitable for IRT modeling in the overall sample, the sample size was insufficient to examine differential item functioning across meaningful subgroups who may express anhedonia differentially (e.g., gender, ethnicity), which should be addressed in future work. This is important, given that Hispanic participants reported higher anhedonia on the SHAPS than other ethnic groups and it is not clear whether these findings reflect differential psychometric properties of the SHAPS by ethnicity or perhaps genuine ethnic differences in latent anhedonia.

To the best of our knowledge, the current study is the first in depth psychometric analysis of anhedonia in adolescents. The findings provide sufficient evidence to warrant use of the

SHAPS to assess anhedonia in: (1) epidemiologic research of the distribution, predictors, correlates, and consequences of anhedonia in youth; and (2) school-based universal health promotion programming. Given that anhedonia may reflect a transdiagnostic trait that plays a role in various psychopathologies (Cohen, Najolia, Brown & Minor, 2011; Bandelow, Schmahl, Falkai & Wedekind, 2010; Watson & Naragon-Gainey, 2010; Meinzer, Pettit, Leventhal & Hill, 2012; Kashdan, Elhai & Frueh, 2006) and several health behaviors and outcomes (Leventhal et al., 2010; Leventhal, Piper, Japuntich, Baker & Cook, 2014; Leventhal, 2012; Nefs et al., 2012; Davidson et al., 2010; Doyle, 2010), the SHAPS may be a useful tool with broad-spanning uses across various age groups.

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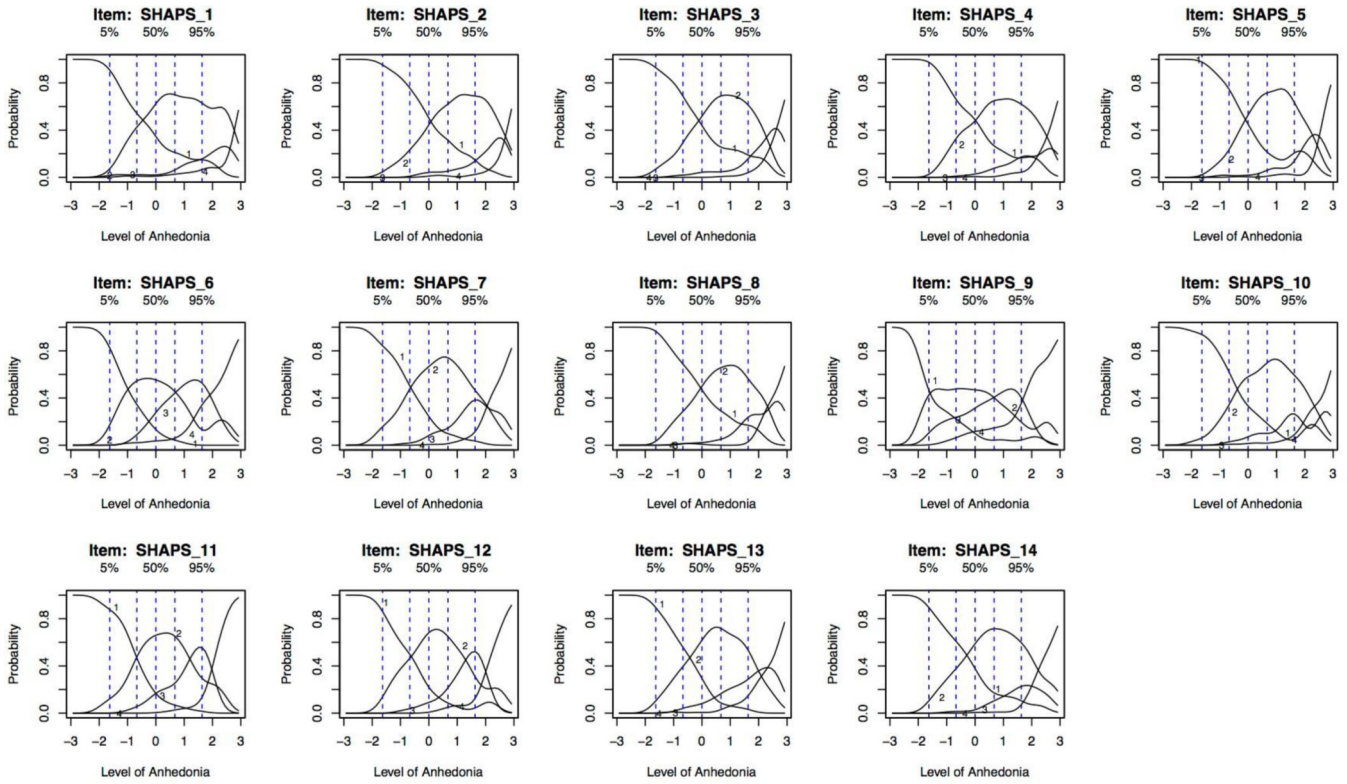

Figure 1.
Kernal smoothed item response models for the fourteen SHAPS items

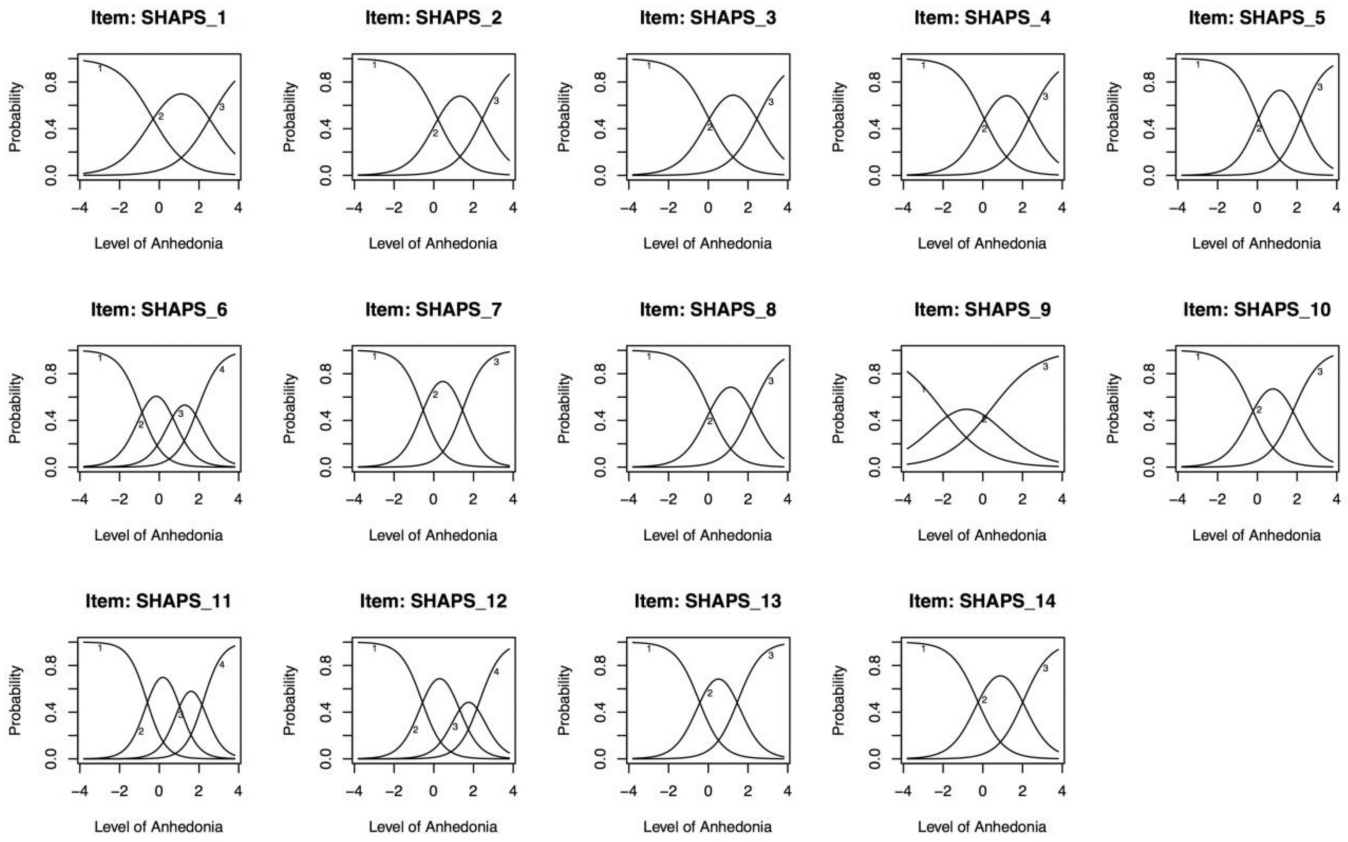

Figure 2.
Graded Response Model for the fourteen SHAPS Items

Table 1

Sociodemographic Characteristics and Associations with SHAPS Scores

Variable	%	*M*(*SD*) by Sociodemographic Strata	Association with Sociodemographic p-value
Gender			.23
Female	51%	25.44 (5.79)	
Male	49%	24.81(6.69)	
Age in years			.67
14	56%	25.37 (6.45)	
15	42%	24.95 (6.01)	
16	2%	25.82 (6.43)	
Ethnicity			.02
Non-Hispanic White	23%	24.39 (6.06)	
Black	2%	23.33 (5.61)	
Hispanic	50%	25.97 (6.06)	
Asian	6%	23.12 (5.20)	
Mulit-ethnic/Other	19%	24.96 (6.23)	
Highest Parental Education			.91
8th grade or less	2%	25.18 (4.41)	
Some high school	4%	25.75 (5.92)	
High school graduate	14%	25.75 (7.33)	
Some college	19%	24.84 (5.55)	
College graduate	22%	24.70 (6.28)	
Advanced degree	11%	23.89 (7.01)	
Unknown	27%	25.84 (5.93)	

Note. $N = 585$, samples range from 569 to 585 across outcomes due to missing data.

SHAPS = Snaith-Hamilton Pleasure Capacity Scale.

Table 2

Summary of SHAPS item distributions and estimates from the graded response model

SHAPS Item		Descriptive Statistics		IRT Statistics				
					Item Thresholds			Area Under IIC
		M	*SD*	a	b_1	b_2	b_3	
1.	I would enjoy my favorite television or radio program.	1.69	0.67	1.17	−0.37	2.58	—	1.44
2.	I would enjoy being with my family or close friends.	1.54	0.64	1.42	0.16	2.49	—	1.84
3.	I would find pleasure in my hobbies or pastimes.	1.59	0.65	1.35	−0.01	2.50	—	1.73
4.	I would be able to enjoy my favorite meal.	1.58	0.66	1.43	0.03	2.37	—	1.91
5.	I would enjoy a warm bath or refreshing shower.	1.58	0.65	1.70	0.04	2.21	—	2.49
6.	I would find pleasure in the scent of flowers or the smell of a fresh sea breeze or freshly baked bread.	2.18	0.89	1.80	−0.94	0.62	1.94	3.77
7.	I would enjoy seeing other people's smiling faces.	1.84	0.73	1.85	−0.56	1.47	—	3.15
8.	I would enjoy looking good when I have made an effort with my appearance.	1.59	0.67	1.55	0.05	2.21	—	2.20
9.	I would enjoy reading a book, magazine, or newspaper.	2.40	0.92	0.87	−2.07	0.43	—	0.93
10.	I would enjoy a cup of tea or coffee or my favorite drink.	1.73	0.72	1.54	−0.27	1.84	—	2.32
11.	I would find pleasure in small things, e.g. a bright sunny day or a telephone call from a friend.	1.96	0.79	2.14	−0.63	0.99	2.22	4.66
12.	I would be able to enjoy a beautiful landscape or view.	1.92	0.79	1.87	−0.60	1.19	2.32	3.72
13.	I would get pleasure from helping others.	1.83	0.76	1.70	−0.47	1.50	—	2.78
14.	I would feel pleasure when I receive praise from others.	1.69	0.69	1.53	−0.27	2.05	—	2.27

Note. A = discrimination parameter. b_1 = threshold for endorsing agree, disagree, or strongly disagree vs. strongly agree; b_2 = threshold for endorsing disagree or strongly disagree vs. agree or strongly agree; b_3 = threshold for endorsing strongly disagree vs. strongly agree, agree, or disagree.

Eleven items included only three response options due to collapsing "Strongly Disagree" and "Disagree" response categories that did not adequately discriminate among anhedonia levels in non-parametric item response models; hence, the b_2 thresholds for these items distinguish endorsing strongly disagree/agree vs. strongly agree or agree. Area Under ICC: Area under the item information curve for a fixed range of anhedonia (−2.5, 2.5), with larger values reflect more item

Table 3

Univariate Associations between SHAPS and Convergent and Discriminant Constructs

Variable	α	Correlations with SHAPS: IRT-Score *a*	Correlations with SHAPS: Raw Score
Convergent Construct			
Pleasant Events Scale Cross-Product	.84	−.34**	−.34**
TPI-Hedonic Responsiveness Subscale	.78	−.55**	−.54**
TPI-Desire for Pleasant Experiences Subscale	.74	−.44**	−.43**
TPI-Engagement in Pleasant Experiences Subscale	.70	−.34**	−.34**
CESD-Anhedonia Subscale	.78	.40**	.41**
Subjective Happiness (SHS)	.82	−.35**	−.35**
EATQ-Pleasure Sensitivity Subscale	.88	−.45**	−.46**
MQ-Positive Affect Subscale	.90	−.30**	−.30**
Affective Responsiveness to Low Arousal Pleasant Pictures (PRT)	.91	−.19**	−.18**
Affective Responsiveness to High Arousal Pleasant Pictures (PRT)	.87	−.14*	−.13*
Discriminant Construct			
UPPS-Negative Urgency Subscale	.87	.09	.10
CESD-Negative Affect Subscale	.87	.09	.10
CESD-Somatic Features Subscale	.72	.07	.08
MQ-Negative Affect Subscale	.84	.10	.10
RCADS-Generalized Anxiety Subscale	.87	−.04	−.02
RCADS-Major Depression Subscale	.91	.09	.11
RCADS-Panic Disorder Subscale	.87	−.03	−.01
RCADS-Social Phobia Subscale	.90	−.13*	−.12*

Note. $N = 585$.

[a] Score based on item response theory-based variable scaling.

SHAPS = Snaith-Hamilton Pleasure Capacity Scale; TPI = Tripartite Pleasure Inventory; CESD = Center for Epidemiologic Studies Depression Scale; MQ = Mood Questionnaire; SHS = Subjective Happiness Scale; PRT = Picture Rating Task (Difference in pleasantness score for pleasant – neutral pictures); RCADS = Revised Child Anxiety and Depression Scale; MQ = Mood Questionnaire; UPPS = Impulsive Behavior Scale; CESD = Center for Epidemiologic Studies Depression Scale.

** $p < .01$,

* $p < .05$