Assessment of Anhedonia in Adults With and Without Mental Illness
A Systematic Review and Meta-analysis

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Abstract

IMPORTANCE  Anhedonia, a reduced capacity for pleasure, is described for many psychiatric and neurologic conditions. However, a decade after the Research Domain Criteria launch, whether anhedonia severity differs between diagnoses is still unclear. Reference values for hedonic capacity in healthy humans are also needed.

OBJECTIVE  To generate and compare reference values for anhedonia levels in adults with and without mental illness.

DATA SOURCES  Web of Science, Scopus, PubMed, and Google Scholar were used to list all articles from January 1, 1995 to July 2, 2019, citing the scale development report of a widely used anhedonia questionnaire, the Snaith-Hamilton Pleasure Scale (SHAPS). Searches were conducted from April 5 to 11, 2018, and on July 2, 2019.

STUDY SELECTION  Studies including healthy patients and those with a verified diagnosis, assessed at baseline or in a no-treatment condition with the complete 14-item SHAPS, were included in this preregistered meta-analysis.

DATA EXTRACTION AND SYNTHESIS  Random-effects models were used to calculate mean SHAPS scores and 95% CIs separately for healthy participants and patients with current major depressive disorder (MDD), past/remitted MDD, bipolar disorder, schizophrenia, substance use disorders, Parkinson disease, and chronic pain. SHAPS scores were compared between groups using meta-regression, and traditional effect size meta-analyses were conducted to estimate differences in SHAPS scores between healthy and patient samples. This study followed the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines.

MAIN OUTCOMES AND MEASURES  Self-reported anhedonia as measured by 2 different formats of the SHAPS (possible ranges, 0-14 and 14-56 points), with higher values on both scales indicating greater anhedonia symptoms.

RESULTS  In the available literature (168 articles; 16,494 participants; 8,058 [49%] female participants; aged 13-72 years), patients with current MDD, schizophrenia, substance use disorder, Parkinson disease, and chronic pain scored higher on the SHAPS than healthy participants. Within the patient groups, those with current MDD scored considerably higher than all other groups. Patients with remitted MDD scored within the healthy range (g = 0.1). This pattern replicated across SHAPS scoring methods and was consistent across point estimate and effect size analyses.

CONCLUSIONS AND RELEVANCE  The findings of this meta-analysis indicate that the severity of anhedonia may differ across disorders associated with anhedonia. Whereas anhedonia in MDD affects multiple pleasure domains, patients with other conditions may experience decreased

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enjoyment of only a minority of life’s many rewards. These findings have implications for psychiatric taxonomy development, where dimensional approaches are gaining attention. Moreover, the SHAPS reference values presented herein may be useful for researchers and clinicians assessing the efficacy of anhedonia treatments.

Introduction

Mental disorders are a major cause of disability, affecting 16% to 19% of the world’s population or approximately 1 billion people every year.1,2 Traditional diagnostic systems, such as the Diagnostic and Statistical Manual of Mental Disorders and the International Statistical Classification of Diseases, categorize mental disorders according to constellations of symptoms. However, comorbidity is common, suggesting overlap in symptoms between diagnoses. The National Institute of Mental Health’s Research Domain Criteria Initiative3 reconceptualizes psychopathology as varying degrees of impairment across domains and has brought increased attention to transdiagnostic symptoms.

The ability to experience pleasure is essential for well-being,4 but is often reduced in mental illness. Anhedonia is defined as a reduced capacity for pleasure5 and has been described in major depressive disorder (MDD),6,7 bipolar disorder,6 schizophrenia,6,8-11 substance use disorder (SUD),12,13 chronic pain,14,15 and Parkinson disease (PD).16,17 Despite its presence across numerous psychiatric and neurologic disorders, anhedonia is rarely compared across conditions. Whether anhedonia differs in severity between diagnoses is therefore currently unknown.

Anhedonia is commonly measured using questionnaires,18 such as the popular Snaith-Hamilton Pleasure Scale (SHAPS).19 The SHAPS is considered “the gold standard for measuring anhedonia in depression,”18(p27) and is also frequently used to assess anhedonia in other patient groups.13,17,20-33 The SHAPS consists of 14 confirmatory statements about enjoyable situations typically encountered in daily life cross-culturally (food/drink, interests/pastimes, social interactions, and pleasurable sensory experiences). Respondents to the SHAPS indicate their level of agreement (definitely/strongly agree, agree, disagree, and strongly disagree) with each statement based on their recollection of the last few days. This time frame suggests that the SHAPS is meant to measure a relatively stable state of anhedonia. Responses are summed across items to yield a single anhedonia score.

Despite its popularity, reference values for the SHAPS are lacking and there is no standard scoring method for the questionnaire. Originally, disagreement with more than 2 statements served as a cutoff point between normal hedonic tone and anhedonia.19

To compare anhedonia severity across disorders and estimate the threshold for healthy hedonic functioning, we conducted a set of meta-analyses of the numerous publications on studies in which anhedonia symptoms were assessed with the SHAPS. By calculating summary estimates of SHAPS scores (meta-analytic mean and 95% CI) for healthy adults and those with mental illness, we generated reference values for the SHAPS that may guide interpretation of anhedonia severity in future research and clinical settings.

Methods

Search Strategy and Selection Criteria

We limited the data material to all articles citing the original SHAPS report by Snaith et al.19 identified through Web of Science, Scopus, PubMed, and Google Scholar, and made available between 1995 and 2019. Searches were conducted from April 5 to 11, 2018, and on July 2, 2019. We located the original SHAPS report within each database and used the built-in function of the databases to list and download all articles indexed as citing this report. We also included the original report.19 We followed
the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for reporting of systematic reviews. A preregistration of this meta-analysis is available in the PROSPERO register. eAppendix 1 in the Supplement provides the necessary deviations.

Studies were eligible for inclusion if they (1) included original data, (2) used the complete 14-item questionnaire, (3) used 4-point or 2-point scoring of the SHAPS items, (4) assessed SHAPS at baseline or in a no-treatment condition, and (5) did not perform selective recruitment based on SHAPS score. There were no language restrictions.

We categorized samples as healthy if the participants were described as having no current or recent psychiatric and/or medical conditions. Samples were considered to have mental illness if the patients had a verified diagnosis (eg, by structured clinical interview, by qualified professionals, or as a requirement for admission to treatment) according to established criteria (eg, Diagnostic and Statistical Manual of Mental Disorders and International Statistical Classification of Diseases).

Two researchers examined all the downloaded references using EndNote (Clarivate) (including I.H.), removed duplicates (including I.H.), and evaluated each full-text article independently for inclusion (M.T. and R.M. or I.H.) (Figure 1). Disagreements at this stage were resolved through discussion between the 2 researchers.

Data Analysis
We did not prespecify which groups to include in the meta-analysis, but decided to evaluate all groups for whom data were available from a minimum of 4 separate samples using the same 2- or 4-point scoring method. This threshold allowed us to generate nuanced and reliable reference values while keeping the meta-analysis exploratory.

Figure 1. PRISMA Flow Diagram of the Article Selection Process

SHAPS indicates Snaith-Hamilton Pleasure Scale.
One of us (M.T.) extracted data from all included articles and emailed authors to obtain missing data. For each included sample, the following information was extracted:
1. The total number of participants,
2. The number of female participants,
3. Age (mean and SD),
4. SHAPS information, including scoring method, mean, SD, and the number of participants with anhedonia according to the original cutoff level,
5. Diagnosis,
6. Depression score (mean and SD) as measured by various rating scales (eAppendix 1 in the Supplement),
7. General information about the article, including publication year, language, whether it was published in a peer-reviewed journal, and the country of residence for the participants, and
8. The percentage of patients currently receiving medication (MDD, schizophrenia, and PD only).

To produce reliable and representative SHAPS reference values, we aimed to minimize missing data, verify that the questionnaire was sufficiently similar across samples, and ensure minimal diagnostic overlap between groups. The quality assessment therefore calculated (1) the number of samples assessed with a modified SHAPS, (2) the proportion of published data that could be included per group before and after requesting and receiving missing data, and (3) the number of samples with no or any (≥1 participant) comorbidity with MDD, psychotic symptoms or disorders, SUD, and anxiety disorders.

Since different iterations of 2-point (e.g., 0-1, 1-0) and 4-point (e.g., 1-4, 4-1, 0-3, and 3-0) SHAPS scoring formats have been reported, we recalculated scores from some studies to conform to either a 0 to 1 (1, disagree or strongly disagree) or 1 to 4 scoring method (4, strongly disagree). While the range of possible SHAPS scores differed for the 2-point (0-14) and 4-point (14-56) scales, higher values indicated greater anhedonia symptoms in both cases.

**Statistical Analysis**
All analyses were performed using random-effects models implemented in the metafor package in R statistical software, version 3.5.2. We used the DerSimonian-Laird method for estimating the between-studies variance component ($\tau^2$) in each random-effects model and calculated 95% CIs using the critical z value at $\alpha = .05$. Results were considered statistically significant if $P < .05$, as determined with 2-tailed, unpaired testing. Multiple testing is common yet seldom addressed in meta-analyses, and consensus on how to account for multiple testing is lacking. Results are reported herein without adjustments for multiple testing.

The primary set of meta-analyses produced and compared point estimates of the mean SHAPS scores for each included group. Separate random-effects models were computed for each included group using SHAPS scores of individual samples as input. These meta-analyses were performed separately for studies using 4-point and 2-point SHAPS scoring formats. We used meta-regression to compare groups.

The second set of meta-analyses consisted of traditional effect size meta-analyses of standardized differences in SHAPS scores between healthy groups and those with mental illness. We used Hedges $g$ as the effect size measure and meta-regression to compare effect sizes between groups.

We performed additional meta-regressions to assess the importance of age, sex, general depression severity, medication status (current MDD, schizophrenia, and PD only), and drug use status (SUD only) for SHAPS scores. eAppendix 1 in the Supplement provides more details and analytic considerations, including sensitivity analyses (eTables 1-6 in the Supplement) and a small-scale meta-analysis of individual SHAPS items.

**Results**
The final data material contained 168 studies assessing SHAPS scores in 246 samples (Figure 1; eTable 7 in the Supplement) of healthy participants and patients with current and past MDD, bipolar
disorder, schizophrenia, SUD, PD, and chronic pain (N = 16,494; 8,058 [49%] female; 7,298 [44%] male; 1,138 [7%] missing accurate sex data; and age range, 13-72 years). eTable 8 in the Supplement provides group characteristics. Data on anxiety-related and eating disorders were not included in the meta-analysis owing to limited availability but are presented in eTable 9 in the Supplement.

Quality Assessment
Risk of bias owing to modifications of the SHAPS was low, as the questionnaire was largely invariant across studies. Fifty-three samples (21%) used non-English translations of the SHAPS. Other minimal modifications occurred in only 4 samples (2%) (eAppendix 2 in the Supplement).

Before we contacted authors, necessary SHAPS data were available for only 13% to 80% (mean, 33%) of the identified samples for each included group (Figure 1; eTable 10 in the Supplement). After obtaining missing data, we were able to include 70% to 100% (mean, 75%) of the identified samples. This addition reduced the risk of publication bias and bias due to selective reporting of SHAPS scores.

There was little diagnostic overlap between the MDD, schizophrenia, and SUD groups (eTable 11 in the Supplement). Information about co-occurring psychiatric disorders was often lacking for PD samples, and comorbidity with anxiety disorders was rarely reported for any group. The low comorbidity allowed us to largely isolate the anhedonia severity associated with each diagnosis.

Meta-analyses
With the 1 to 4 scoring format (Figure 2A), SHAPS scores for individuals with current MDD (mean, 33.1 points; 95% CI, 32.0-34.1 points), schizophrenia (mean, 23.3 points; 95% CI, 21.6-24.9 points), SUD (mean, 24.8 points; 95% CI, 23.5-26.1 points), PD (mean, 22.5 points; 95% CI, 21.0-24.1 points), and chronic pain (mean, 24.1 points; 95% CI, 23.4-24.7 points) were significantly higher than those of the healthy group (mean, 20.2 points; 95% CI, 19.7-20.8 points). Table 1 provides group comparisons. These findings suggest that anhedonia occurs in these conditions. Compared with current MDD, SHAPS scores were nevertheless significantly lower in all other types of mental illness. SHAPS scores in remitted MDD (21.2; 95% CI, 20.5-22.0) were comparable to those of healthy samples. Thus, anhedonia severity differed between diagnoses. This pattern was replicated with 0 to 1 scoring (Figure 2B; Table 1) despite no overlap of included samples for any group except chronic pain. On average, healthy individuals disagreed with 1 SHAPS item, patients with MDD disagreed with 6 items, and the groups with other types of illness disagreed with 3 or fewer items. Simplified reference values based on these results are available in Table 2.

Meta-analyses of effect sizes (Figure 2C) were conducted on studies using either scoring method and including data from both patients and healthy controls. Again, SHAPS scores for patients with current MDD were significantly above levels in healthy individuals (Hedges g, 2.2; 95% CI, 2.0-2.4), schizophrenia (Hedges g, 0.6; 95% CI, 0.5-0.8), SUD (Hedges g, 0.8; 95% CI, 0.6-1.0), and PD (Hedges g, 0.4; 95% CI, 0.2-0.7), but not in remitted MDD (Hedges g, 0.1; 95% CI, −0.2 to 0.3). SHAPS scores were significantly higher in current MDD compared with any other group (Table 1). Although no formal subgroup analyses could be performed for the bipolar disorder group, data from both scoring methods and the effect size analysis suggested markedly higher SHAPS scores in individuals with depression (Hedges g, 1.3; 95% CI, 0.8-1.8) compared with mania (Hedges g, −0.6; −1.2 to 0.0) and euthymia (Hedges g, −0.3; 95% CI, −0.9 to 0.3).

Neither age nor sex ratio could explain the observed differences in SHAPS scores between healthy groups and those with mental illness in most of the analyses (eTable 12 and eTable 13 in the Supplement). Results from meta-regressions adjusting for general depression severity varied across scoring methods and analyses (eTable 14 in the Supplement), consistent with the notion that anhedonia in schizophrenia, SUD, PD, and chronic pain is unlikely to result solely from comorbid depression.

Within groups, age and sex differences in SHAPS scores were generally small and/or nonsignificant (eTable 15 and eTable 16 in the Supplement). SHAPS scores in current MDD, schizophrenia, and PD did not significantly vary with the percentage of patients receiving medications at the time of assessment (eTable 17 in the Supplement). Moreover, SHAPS scores in
Figure 2. Sets of Meta-analysis of Snaith-Hamilton Pleasure Scale (SHAPS) Scores Across Groups

A, SHAPS scores from studies using 1- to 4-point scoring showing significantly higher anhedonia in all patient groups compared with healthy individuals. B, SHAPS scores from studies using the original 0- to 1-point scoring method replicates the pattern found in studies using 4-point scoring. Note that except for chronic pain, there was no overlap between studies included in A and B. C, Effect sizes based on studies reporting scores from patients and controls, according to both scoring methods. Diamonds indicate mean and 95% CI. White dots indicate individual sample means. \( I^2 \) indicates the amount of variation between samples that is due to heterogeneity rather than chance; Q, Cochran Q test; and T, estimated between-samples SD.

\( a P < .001. \)
\( b P < .01. \)
\( c P < .05. \)

JAMA Network Open. 2020;3(8):e2013233. doi:10.1001/jamanetworkopen.2020.13233 (Reprinted) August 13, 2020 6/14

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SUD samples categorized as currently abstinent (n = 258) were comparable to scores in individuals currently using substances (n = 429; B = −0.19; SE, 0.27; P = .48).

**Discussion**

To our knowledge, it has not been possible previously to compare the degree of anhedonia symptom load across diagnoses, despite the extensive data available in the literature. We used a meta-analytic approach to generate suggested reference values for the level of anhedonia in adults with and without mental illness based on SHAPS scores from 16,494 people. While anhedonia scores were significantly increased in current but not remitted MDD, schizophrenia, SUD, PD, and chronic pain compared with healthy participants, we found evidence for substantially higher anhedonia in ongoing MDD compared with other types of illness. This pattern replicated across scoring methods for the SHAPS and was consistent across point-estimate and effect size analyses.

Our findings apparently support the clinical association between anhedonia and schizophrenia, SUD, PD, and chronic pain. The observed variability in anhedonia severity across conditions is

| Table 1. Between-Groups Comparisons Using Meta-regression |
|----------------------------------------------------------|
| **Comparison**                                           |
|                                                         |
| Healthy vs MDD                                          |
| Current                                                 |
| 12.83 (0.54) 23.72 <.001                                 |
| Remitted                                                |
| 0.99 (0.95) 1.04 .30                                     |
| MDD (remitted) vs MDD (current)                         |
| 11.84 (1.24) 9.55 <.001                                 |
| Healthy vs SCZ                                          |
| 3.01 (0.85) 3.55 <.001                                  |
| SCZ vs MDD (current)                                    |
| 9.78 (1.12) 8.74 <.001                                  |
| Healthy vs SUD                                          |
| 4.64 (0.96) 4.81 <.001                                  |
| SUD vs MDD (current)                                    |
| 8.17 (1.26) 6.47 <.001                                  |
| Healthy vs PD                                          |
| 2.50 (1.21) 2.06 .04                                     |
| PD vs MDD (current)                                     |
| 10.22 (1.56) 6.55 <.001                                 |
| Healthy vs chronic pain                                 |
| 4.00 (0.97) 4.11 <.001                                  |
| Chronic pain vs MDD (current)                           |
| 8.82 (1.25) 7.04 <.001                                  |

**Table 2. SHAPS Reference Values**

| Group                      | Scoring, mean (SD) [range] | Anhedonia mean (range), % | Effect size, mean (SD) [range] |
|----------------------------|----------------------------|---------------------------|--------------------------------|
| Healthy                    | 20.2 (2.1) [15.4-27.4]     | 14 (0-15)                 | NA                             |
| Major depressive disorder  |                            |                           |                                |
| Current                    | 33.1 (2.7) [28.2-39.5]     | 62 (35-87)                | 2.2 (0.6) [0.9-5.1]            |
| Remitted                   | 21.2 (0.3) [20.4-22.9]     | NA                        | 0.1 (0.0) [-0.3 to 0.4]        |
| Schizophrenia              | 23.3 (2.3) [19.6-29.2]     | 23 (NA)                   | 0.6 (0.2) [-0.4 to 1.1]        |
| Substance use disorders    | 24.8 (1.3) [22.3-26.8]     | 31 (19-55)                | 0.8 (0.0) [0.6-1.0]            |
| Parkinson disease          | 22.5 (1.2) [21.4-26.8]     | 25 (5-46)                 | 0.4 (0.3) [-0.1 to 1.6]        |
| Chronic pain               | 24.1 (0.5) [23.4-25.1]     | 23 (14-34)                | NA                             |

Abbreviations: NA, not applicable; SHAPS, Snaith-Hamilton Pleasure Scale. Higher scores indicate greater anhedonia. Model-based percentile cutoffs for healthy participants in the 1- to 4-point scoring format: 15.3 (1st), 18.8 (25th), 20.2 (50th), 21.6 (75th), and 25.1 (99th). Model-based percentile cutoffs for healthy participants in the 0- to 1-point scoring format: 0.0 (1st), 0.3 (25th), 0.6 (50th), 0.9 (75th), and 1.8 (99th). These percentile cutoffs indicate which SHAPS scores a certain percentage of healthy participants score below.

Anhedonia indicates the percentage of people scoring above the original SHAPS cutoff (>2 with 0-1 scoring) in the small subset of samples for which this information is available (healthy: n = 3, major depressive disorder [current]: n = 3, schizophrenia: n = 1, substance use disorders: n = 7, Parkinson disease: n = 8, and chronic pain: n = 5).

Effect sizes (Hedges g) indicate the standardized difference between the healthy group and a patient group and allow for comparisons with other measurements.
Figure 3. Exploratory Item-Level Meta-analysis

| SHAPS item | SHAPS item score (95% CI) |
|------------|--------------------------|
| I would enjoy my favorite television or radio program | |
| Healthy | 1.56 (1.49-1.63) |
| Chronic pain | 1.68 (1.63-1.74) |
| MDD | 2.58 (2.39-2.76) |
| I would enjoy being with my family or close friends | |
| Healthy | 1.38 (1.27-1.50) |
| Chronic pain | 1.61 (1.52-1.70) |
| MDD | 2.27 (2.11-2.42) |
| I would find pleasure in my hobbies and pastimes | |
| Healthy | 1.39 (1.27-1.51) |
| Chronic pain | 1.95 (1.87-2.02) |
| MDD | 2.73 (2.55-2.92) |
| I would be able to enjoy my favorite meal | |
| Healthy | 1.37 (1.30-1.45) |
| Chronic pain | 1.79 (1.72-1.86) |
| MDD | 2.48 (2.28-2.69) |
| I would enjoy a warm bath or refreshing shower | |
| Healthy | 1.50 (1.37-1.63) |
| Chronic pain | 1.73 (1.61-1.84) |
| MDD | 2.38 (2.18-2.57) |
| I would find pleasure in the scent of flowers or the smell of a fresh sea breeze or freshly baked bread | |
| Healthy | 1.62 (1.27-1.97) |
| Chronic pain | 1.77 (1.67-1.86) |
| MDD | 2.50 (2.31-2.69) |
| I would enjoy seeing other people’s smiling faces | |
| Healthy | 1.47 (1.29-1.64) |
| Chronic pain | 1.69 (1.57-1.81) |
| MDD | 2.61 (2.44-2.78) |
| I would enjoy looking smart when I have made an effort with my appearance | |
| Healthy | 1.64 (1.57-1.71) |
| Chronic pain | 1.86 (1.77-1.95) |
| MDD | 2.60 (2.40-2.81) |
| I would enjoy reading a book, magazine, or newspaper | |
| Healthy | 1.87 (1.41-2.32) |
| Chronic pain | 1.94 (1.86-2.02) |
| MDD | 2.97 (2.78-3.16) |
| I would enjoy a cup of tea or coffee or my favorite drink | |
| Healthy | 1.51 (1.36-1.67) |
| Chronic pain | 1.66 (1.60-1.72) |
| MDD | 2.33 (2.17-2.49) |
| I would find pleasure in small things, eg bright sunny day, a telephone call from a friend | |
| Healthy | 1.55 (1.25-1.86) |
| Chronic pain | 1.73 (1.62-1.81) |
| MDD | 2.64 (2.45-2.83) |
| I would be able to enjoy a beautiful landscape or view | |
| Healthy | 1.42 (1.23-1.61) |
| Chronic pain | 1.66 (1.59-1.73) |
| MDD | 2.36 (2.15-2.57) |
| I would get pleasure from helping others | |
| Healthy | 1.43 (1.28-1.58) |
| Chronic pain | 1.58 (1.50-1.66) |
| MDD | 2.36 (2.18-2.54) |
| I would feel pleasure when I receive praise from other people | |
| Healthy | 1.48 (1.32-1.63) |
| Chronic pain | 1.70 (1.52-1.89) |
| MDD | 2.50 (2.29-2.71) |

To test whether patients with a specific mental health diagnosis typically experience anhedonia for the same subset of pleasures, we conducted an exploratory meta-analysis of raw, item-level data from 376 healthy volunteers, 64 patients with major depression, and 487 chronic pain patients (for details, see eAppendix 1 in the Supplement). Item-level data for other groups were not available to us at the time of writing. Diamonds indicate mean and 95% CI. SHAPS indicates Snaith-Hamilton Pleasure Scale.
consistent with Research Domain Criteria’s dimensional approach to mental disorders. Anhedonia in some conditions may be qualitatively as well as quantitatively distinct from anhedonia during major depression. The high SHAPS scores support the hypothesis that anhedonia in MDD affects multiple domains of pleasure (eg, food/drink, pastimes/hobbies, social, and physical). Patients with MDD reported that they would not enjoy, on average, 6 of the 14 listed everyday rewards. In contrast, healthy participants reported, on average, 1 unenjoyable SHAPS item, and the groups with other types of mental illness all averaged below 3 of the items.

An item-level meta-analysis of available data from individuals with MDD, chronic pain, and healthy volunteers showed that this pattern appears to be consistent (Figure 3), with modest increases in anhedonia for all items in chronic pain. Similarly, patients with MDD scored consistently higher on every SHAPS item. Thus, at the group level, we found no support for the notion that anhedonia in patients with chronic pain or MDD is associated with specific impairments, such as anosmia. Instead, MDD and chronic pain may uniformly dampen people’s enjoyment of life.

Despite reported behavioral and neural reward impairments in remitted MDD, 50-53 we found no demonstrable anhedonia in this group. Instead, people with remitted MDD reported projected enjoyment of rewards that is comparable to that of healthy individuals. Similarly, mania and euthymia states in bipolar disorder were associated with markedly lower SHAPS scores than depressed states, consistent with the presence of hyperhedonia (increased enjoyment of rewards54) during nondepressed stages. Together, these cross-sectional data support the view of anhedonia as a relatively stable yet reversible state in depression and suggest that anhedonia fluctuates together with some other symptoms of depression. Longitudinal data are needed to explore phase dependencies of anhedonia in depression and evaluate which other depression symptoms are temporally associated with anhedonia.

The indications of reversibility suggest its utility for the development of therapies for anhedonia, which is often considered a difficult symptom to treat.55,56 New psychotherapies focusing on savoring and increasing positive affect are emerging, 57 with demonstrable effects on brain reward processing.58 Initial studies reported antianhedonic effects of antidepressant medications, as discussed by Cao et al,59 yet better-controlled investigations, such as that conducted by Krystal et al,60 are needed. The reference values provided herein may be useful when the efficacy of new and existing treatments of anhedonia is assessed.

Anhedonia is a key symptom thought to differentiate depression from anxiety disorders.51 While there were insufficient data to include anxiety disorders in the current meta-analyses, the 3 available studies on posttraumatic stress disorder reported SHAPS scores comparable to severe anhedonia levels in current MDD.62-64 Only modest anhedonia as measured by the SHAPS has been reported in individuals with obsessive-compulsive disorder.65,66 Despite theoretical interest in the role of anhedonia and reward functioning for eating disorders, 67-69 we could retrieve SHAPS scores from only 2 studies. These scores were consistent with mild anhedonia in anorexia nervosa.70,71 Dysfunction in the mesolimbic dopamine system and its interactions with the endogenous opioid system have been proposed as a central mechanism underlying anhedonia.12,72 Recent evidence suggests that there are similarities in the genetic and neural underpinnings of anhedonia across multiple disorders.73 It is unclear whether differences in anhedonia severity across conditions observed herein with the SHAPS reflect different physiologic pathways or distinct levels of disruption of the same underlying mechanisms.

Limitations
This study has limitations. The SHAPS literature consists primarily of smaller-scale studies of patients without comorbidities and is therefore likely not representative of the entire patient populations. Accordingly, bias in representativeness was not formally assessed.74 Conversely, these reference values may be more indicative of the levels of anhedonia specifically associated with each disorder in isolation, and therefore useful in improving discriminant validity of psychiatric taxa in taxometric investigations and future nosologic efforts. Large-scale epidemiologic studies are needed to produce
anhedonia severity estimates that generalize to the larger patient populations in which diagnostic comorbidity is more common. This meta-analysis operationalized anhedonia as scores on the SHAPS and results may not generalize to other anhedonia questionnaires or other facets of reward processing outlined in the Research Domain Criteria framework.

Reference values for some of the smaller groups (eg, schizophrenia, SUD, and PD) may be less reliable than those for the larger groups (healthy and current MDD). However, the similar pattern of results found across the independent samples scored with the 2- and 4-point formats speaks to the stability, generalizability, and statistical coherence of the present results.

Smoking is common in patients with mental illness75 and has bidirectional associations with anhedonia.76,77 Owing to limited data and inconsistent reporting across studies, we were unable to evaluate potential moderating effects of smoking behavior on SHAPS scores. For the same reason, we were able to assess the effect of medication status on anhedonia only in MDD, schizophrenia, or PD and not the effects of specific drugs. Moderating effects of age and sex were estimated as modest.

Conclusions

The results of this meta-analysis suggest that anhedonia, as measured by the SHAPS, differs quantitatively across conditions typically associated with this symptom. While modest anhedonia was seen in patients with schizophrenia, SUD, PD, and chronic pain, studies have consistently reported more severe anhedonia in patients with current MDD. We recommend that, for clarity and ease of comparison across samples, researchers and clinicians report SHAPS scores using both the 2- and 4-point scoring methods applied here, taking care to ensure that higher scores indicate anhedonia.
Research Council and the South-Eastern Norway Regional Health Authority during the conduct of the study. No other disclosures were reported.

**Funding/Support:** This project was supported by funds from the South-Eastern Norway Regional Health Authority (project No. 2018035) to Dr Eikemo and the European Research Council under the European Union's Horizon 2020 research and innovation program (grant agreement No. 802885) to Dr Leknes.

**Role of the Funder/Sponsor:** The funding organizations had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

**Meeting Presentations:** Preliminary results have been reported in Mr Trøstheim’s master’s thesis and presented at the European Behavioural Pharmacology Society Biannual Meeting; August 28-31, 2019; Braga, Portugal; and at Vettreseminaret; November 14-15, 2019; Lillestrøm, Norway.

**Additional Contributions:** Sigurd Alnes, MS (University of Bern), helped to conduct the literature search and Paul Hamilton, PhD (Linköping University), commented on preliminary results. Neither received financial compensation outside of salary. We are grateful to the many researchers who provided information and data.

**REFERENCES**

1. Steel Z, Marnane C, Iranpour C, et al. The global prevalence of common mental disorders: a systematic review and meta-analysis, 1980-2013. *Int J Epidemiol*. 2014;43(2):476-493. doi: 10.1093/ije/dyu038

2. James SL, Abate D, Abate KH, et al; GBD 2017 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet*. 2018;392(10159):1789-1858. doi: 10.1016/S0140-6736(18)32279-7

3. Morris SE, Cuthbert BN. Research Domain Criteria: cognitive systems, neural circuits, and dimensions of behavior. *Dialogues Clin Neurosci*. 2012;14(1):29-37.

4. Berridge KC, Kringelbach ML. Pleasure systems in the brain. *Neuron*. 2015;86(3):646-664. doi: 10.1016/j.neuron.2015.02.018

5. Ribot TA. *La Psychologie des Sentiments*. Félix Alcan; 1896.

6. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 5th ed. American Psychiatric Association; 2013.

7. World Health Organization. *International Classification of Diseases*. 11th ed. World Health Organization; 2018.

8. Kraepelin E. *Dementia Praecox and Paraphrenia*. Chicago Medical Book Co; 1919.

9. Kirkpatrick B, Fenton WS, Carpenter WT Jr, Marder SR. The NIMH-MATRICS consensus statement on negative symptoms. *Schizophr Bull*. 2006;32(2):214-219. doi: 10.1093/schbul/sbj053

10. Meehl PE. Schizotaxia, schizotypy, schizophrenia. *Am Psychol*. 1962;17(12):827-838. doi: 10.1037/h0041029

11. Rado S. Dynamics and classification of disordered behavior. *Am J Psychiatry*. 1953;110(6):406-416. doi: 10.1176/ajp.110.6.406

12. Hatzigiakoumis DS, Martinotti G, Gianantonio MD, Janiri L. Anhedonia and substance dependence: clinical correlates and treatment options. *Front Psychiatry*. 2011;2:10. doi: 10.3389/fpsyt.2011.00010

13. Garfield JBB, Lubman DI, Yücel M. Anhedonia in substance use disorders: a systematic review of its nature, course and clinical correlates. *Aust N Z J Psychiatry*. 2014;48(1):36-51. doi: 10.1177/0004867413508455

14. Baliki MN, Petre B, Torbey S, et al. Corticostriatal functional connectivity predicts transition to chronic back pain. *Nat Neurosci*. 2012;15(8):1117-1119. doi: 10.1038/nn.3153

15. Horan WP, Trøstheim M, Eikemo M, Ernst G, Leknes S. Anhedonia in chronic pain and prescription opioid misuse. *Psychol Med*. 2019;1-12. doi: 10.1017/S0033291719002010

16. Loas G, Krystkowiak P, Godefroy O. Anhedonia in Parkinson’s disease: an overview. *J Neuropsychiatry Clin Neurosci*. 2012;24(4):444-451. doi: 10.1176/appi.neuropsych.11100332

17. Assogna F, Cravello L, Caltagirone C, Spalletta G. Anhedonia in Parkinson’s disease: a systematic review of the literature. *Mov Disord*. 2011;26(10):1825-1834. doi: 10.1002/mds.23815

18. Rizvi SJ, Pizzagalli DA, Sproule BA, Kennedy SH. Assessing anhedonia in depression: potentials and pitfalls. *Neurosci Biobehav Rev*. 2016;65:21-35. doi: 10.1016/j.neubiorev.2016.03.004

19. Snaith RP, Hamilton M, Morley S, Humayan A, Hargreaves D, Trigwell P. A scale for the assessment of hedonic tone: the Snath-Hamilton Pleasure Scale. *Br J Psychiatry*. 1995;167(1):99-103. doi: 10.1192/bjp.167.1.99

20. Horan WP, Kring AM, Blanchard J.J. Anhedonia in schizophrenia: a review of assessment strategies. *Schizophr Bull*. 2006;32(2):259-273. doi: 10.1093/schbul/sbj009
21. Franz M, Lemke MR, Meyer T, Ulferts J, Puhl P, Snaith RP. Deutsche version der Snaith-Hamilton-Pleasure-Scale (SHAPS-D). Erfassung von Anhedonie bei schizophrenen und depressiven Patienten [German version of the Snaith-Hamilton-Pleasure Scale (SHAPS-D): anhedonia in schizophrenic and depressive patients]. *Fortschr Neurol Psychiatr*. 1998;66(9):407-413. doi:10.1055/s-2007-995279

22. Liu WH, Wang LZ, Zhu YH, Li MH, Chan RCK. Clinical utility of the Snaith-Hamilton-Pleasure scale in the Chinese settings. *BMC Psychiatry*. 2012;12(1):184. doi:10.1186/1471-244X-12-184

23. Loas G, Dubal S, Perot P, Tirel F, Nowaczkowski P, Pierson A. Study of the validity and reliability of the French version of the Snaith-Hamilton pleasure scale (SHAPS) in 208 healthy subjects and 103 schizophrenics and depressives [in French]. *Encephale*. 1997;23(6):454-458.

24. Franken IHA, Rassin E, Muris P. The assessment of anhedonia in clinical and non-clinical populations: further validation of the Snaith-Hamilton Pleasure Scale (SHAPS). *J Affect Disord*. 2007;99(1-3):83-89. doi:10.1016/j.jad.2006.08.020

25. Nagayama H, Kubo S, Hatano T, et al; Young Japanese Expert Group for Parkinson's Disease and Movement Disorders: YJ-EXPANDS. Validity and reliability assessment of a Japanese version of the Snaith-Hamilton pleasure scale. *Intern Med*. 2012;51(8):865-869. doi:10.2169/internalmedicine.51.6718

26. Santangelo G, Morgante L, Savica R, et al; PRIAMO Study Group. Anhedonia and cognitive impairment in Parkinson's disease: Italian validation of the Snaith-Hamilton Pleasure Scale and its application in the clinical routine practice during the PRIAMO study. *Parkinsonism Relat Disord*. 2009;15(8):576-581. doi:10.1016/j.parkreldis.2009.02.004

27. Thomas J, Al Ali M, Al Hashmi A, Rodriguez A. Convergent validity and internal consistency of an Arabic Snaith Hamilton Pleasure Scale. *Int Perspect Psychol*. 2012;1(1):46-51. doi:10.1037/a0026919

28. Fresán A, Berlanga C. Translation into Spanish and validation of the Snaith-Hamilton Pleasure Scale (SHAPS) for anhedonia [in Spanish]. *Actas Esp Psiquiatr*. 2013;41(4):227-231.

29. Kesebir S, Yıldız H, Göçmen D, Tezcan E. Snaith-Hamilton Pleasure Scale: validity, reliability, psychometric characteristics in our society [in Turkish]. *Cukurova Med J*. 2015;40(2):252-257. doi:10.17826/cufj.40986

30. Ng CG, Chin SC, Yee AHA, et al. Validation of Malay version of Snaith-Hamilton Pleasure Scale: comparison between depressed patients and healthy subjects at an out-patient clinic in Malaysia. *Malays J Med Sci*. 2014;21(3):62-70.

31. Lönn K, Månhav M. Förmåga Till Njutning—Validering av en Svensk Version av Snaith-Hamilton Pleasure Scale. University of Gothenburg; 2014.

32. Ryu V. Dysfunctional reward learning in bipolar disorder: an event-related potential study [doctoral thesis]. Yonsei University; 2013.

33. Gutkovich Z, Rosenthal RN, Galyonker I, Muran C, Batchelder S, Itskhoki E. Depression and demoralization among Russian-Jewish immigrants in primary care. *Psychosomatics*. 1999;40(2):117-125. doi:10.1016/S0033-3182(99)71257-0

34. Moher D, Liberati A, Tetzlaff J, Altman DG; PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Ann Intern Med*. 2009;151(4):264-269, W64. doi:10.7326/0003-4819-151-4-200908180-00135

35. Trøstheim M, Eikemo M, Hansen I, Alnes S, Leknes S. Anhedonia in clinical and non-clinical populations: an exploratory meta-analysis of studies using the Snaith-Hamilton Pleasure Scale (SHAPS). PROSPERO. 2018:CRD42018109910. National Institute for Health Research. Updated January 14, 2020. Accessed January 14, 2020. http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42018109910

36. Viechtbauer W. Conducting meta-analyses in R with the metafor package. *J Stat Softw*. 2010;36(3):1-48. doi:10.18637/jss.v036.i03
41. DerSimonian R, Laird N. Meta-analysis in clinical trials. Control Clin Trials. 1986;7(3):177-188. doi:10.1016/0197-2456(86)90046-2

42. Imberger G, Vejby AD, Hansen SB, Møller AM, Wetterslev J. Statistical multiplicity in systematic reviews of anaesthesia interventions: a quantification and comparison between Cochrane and non-Cochrane reviews. PLoS One. 2011;6(12):e28422. doi:10.1371/journal.pone.0028422

43. Polanin JR, Piggot TD. The use of meta-analytic statistical significance testing. Res Synth Methods. 2015;6(1):63-73. doi:10.1002/jrsm.1124

44. Bender R, Bunce C, Clarke M, et al. Attention should be given to multiplicity issues in systematic reviews. J Clin Epidemiol. 2008;61(9):857-865. doi:10.1016/j.jclinepi.2008.03.004

45. Higgins JPT, Thomas J, Chandler J, et al.eds. Cochrane Handbook for Systematic Reviews of Interventions, version 6.0. Updated July 2019. Accessed March 11, 2020. https://training.cochrane.org/handbook

46. Hedges LV. Distribution theory for Glass’s estimator of effect size and related estimators. J Educ Stat. 1981;6(2):107-128. doi:10.3102/10769986006002107

47. Miura S, Kida H, Nakajima J, et al. Anhedonia in Japanese patients with Parkinson’s disease: analysis using the Snith-Hamilton Pleasure Scale. Clin Neurol Neurosurg. 2012;114(4):352-355. doi:10.1016/j.clineuro.2011.11.008

48. Young KD, Zotev V, Phillips R, et al. Real-time fMRI neurofeedback training of amygdala activity in patients with major depressive disorder. PLoS One. 2014;9(2):e88785. doi:10.1371/journal.pone.0088785

49. Craske MG, Meuret AE, Ritz T, Treanor M, Dour HJ. Treatment for anhedonia: a neuroscience driven approach. Depress Anxiety. 2016;33(10):927-938. doi:10.1002/da.22490

50. Pizzagalli DA. Depression, stress, and anhedonia: toward a synthesis and integrated model. Annu Rev Clin Psychol. 2014;10:393-423. doi:10.1146/annurev-clinpsych-050212-185606

51. Ellingsen D-M, Wessberg J, Eikemo M, et al. Placebo improves pleasure and pain through opposite modulation of sensory processing. Proc Natl Acad Sci USA. 2013;110(44):17993-17998. doi:10.1073/pnas.1305051110

52. Craske MG, Meuret AE, Ritz T, Treanor M, Dour HJ. Treatment for anhedonia: a neuroscience driven approach. Depress Anxiety. 2016;33(10):927-938. doi:10.1002/da.22490

53. Winer ES, Jordan DG, Collins AC. Conceptualizing anhedonia and implications for depression treatments. Psychol Res Behav Manag. 2019;12:325-335. doi:10.2147/PRBM.S159260

54. Garland EL, Atchley RM, Hanley AW, Zubieta JK, Froeliger B. Mindfulness-Oriented Recovery Enhancement remediates hedonic dysregulation in opioid users: neural and affective evidence of target engagement. Sci Adv. 2019;5(10):eaax1569. doi:10.1126/sciadv.aax1569

55. Krystal AD, Pizzagalli DA, Smoski M, et al. A randomized proof-of-mechanism trial applying the “fast-fail” approach to evaluating κ-opioid antagonism as a treatment for anhedonia. Nat Med. 2020;26(5):760-768. doi:10.1038/s41591-020-0806-7
64. Yuan H, Phillips R, Wong CK, et al. Tracking resting state connectivity dynamics in veterans with PTSD. 
*Neuroimage Clin.* 2018;19:260-270. doi:10.1016/j.nicl.2018.04.014

65. Abramovitch A, Pizzagalli DA, Reuman L, Wilhelm S. Anhedonia in obsessive-compulsive disorder: beyond comorbid depression. 
*Psychiatry Res.* 2014;216(2):223-229. doi:10.1016/j.psychres.2014.02.002

66. Grassi G, Makris N, Pallanti S. Addicted to compulsion: assessing three core dimensions of addiction across obsessive-compulsive disorder and gambling disorder. 
*CNS Spectr.* 2019;1-10.

67. Shankman SA, Katz AC, DeLizza AA, Sarapas C, Gorka SM, Campbell ML. The different facets of anhedonia and their associations with different psychopathologies. In: Ritsner MS, ed. *Anhedonia: A Comprehensive Handbook.* Vol I. Springer; 2014:3-22. doi:10.1007/978-94-017-8591-4_1

68. Harrison A, O’Brien N, Lopez C, Treasure J. Sensitivity to reward and punishment in eating disorders. 
*Psychiatry Res.* 2010;177(1-2):1-11. doi:10.1016/j.psychres.2009.06.010

69. Keating C, Tilbrook AJ, Rossell SL, Ercictott PG, Fitzgerald PB. Reward processing in anorexia nervosa. 
*Neuropsychologia.* 2012;50(5):567-575. doi:10.1016/j.neuropsychologia.2012.01.036

70. Boehm I, Flohr L, Steding J, et al. The trajectory of anhedonic and depressive symptoms in anorexia nervosa: a longitudinal and cross-sectional approach. 
*Eur Eat Disord Rev.* 2018;26(1):69-74. doi:10.1002/erv.2565

71. Kaufmann L-K. "Reshaping" the brain—longitudinal investigation of structural and functional brain alterations during weight gain in anorexia nervosa [doctoral thesis]. University of Fribourg; 2017.

72. Gorwood P. Neurobiological mechanisms of anhedonia. 
*Dialogues Clin Neurosci.* 2008;10(3):291-299.

73. Ward J, Lyall LM, Bethlehem RA, et al. Novel genome-wide associations for anhedonia, genetic correlation with psychiatric disorders, and polygenic association with brain structure. 
*Transl Psychiatry.* 2019;9(1):327. doi:10.1038/s41398-019-0635-y

74. Hoy D, Brooks P, Woolf A, et al. Assessing risk of bias in prevalence studies: modification of an existing tool and evidence of interrater agreement. 
*J Clin Epidemiol.* 2012;65(9):934-939. doi:10.1016/j.jclinepi.2011.11.014

75. Lasser K, Boyd JW, Woolhandler S, Himmelstein DU, McCormick D, Bor DH. Smoking and mental illness: a population-based prevalence study. 
*JAMA.* 2000;284(20):2606-2610. doi:10.1001/jama.284.20.2606

76. Stone MD, Audrain-McGovern J, Leventhal AM. Association of anhedonia with adolescent smoking susceptibility and initiation. 
*Nicotine Tob Res.* 2017;19(6):738-742. doi:10.1093/ntr/ntw177

77. Cook JW, Piper ME, Leventhal AM, Schlam TR, Fiore MC, Baker TB. Anhedonia as a component of the tobacco withdrawal syndrome. 
*J Abnorm Psychol.* 2015;124(1):215-225. doi:10.1037/abn0000016

**SUPPLEMENT.**

**eAppendix 1. Methods**

**eAppendix 2. Results**

**eTable 1.** Effect Size Meta-analyses With the PM Estimator of the Between-Studies Variance

**eTable 2.** Between-Groups Comparisons Using Meta-Regression With the PM Estimator of the Between-Studies Variance

**eTable 3.** Effect Size Meta-analyses With the REML Estimator of the Between-Studies Variance

**eTable 4.** Between-Groups Comparisons Using Meta-Regression With the REML Estimator of the Between-Studies Variance

**eTable 5.** Effect Size Meta-analyses With Random Effect at the Article Level

**eTable 6.** Between-Groups Comparisons Using Meta-Regression With Random Effect Added at the Article Level

**eTable 7.** Sample Details for All Included Groups

**eTable 8.** Group Characteristics

**eTable 9.** Sample Details for the Anorexia Nervosa, Obsessive Compulsive Disorder and Posttraumatic Stress Disorder Groups

**eTable 10.** Completeness of Necessary Data for Each Included Group

**eTable 11.** Reporting of Comorbidity for Clinical Samples

**eTable 12.** Between-Groups Comparisons Adjusting for Age

**eTable 13.** Between-Groups Comparisons Adjusting for Percent Female Participants

**eTable 14.** Between-Groups Comparisons Adjusting for Depression Severity

**eTable 15.** The Contribution of Age to SHAPS Scores

**eTable 16.** The Contribution of Percent Female Participants to SHAPS Scores

**eTable 17.** The Contribution of Percent Medicated Patients to SHAPS Scores

**eReferences.**