Health damaging behaviors, such as habitual substance use, risky sex, problematic gambling, casual sex, overeating are major causes of preventable death and disability due to chronic disease. Despite public health campaigns informing the population of the dangers of these behaviors and the benefits of health behavior change, many people continue to engage in health-damaging behaviors. Understanding why people engage in health-damaging behaviors may ultimately promote the advancement of effective behavior change interventions.

One explanation why people paradoxically engage in health-damaging behaviors is because they are acute mood-altering agents that act as powerful reinforcers and override concerns about long-term consequences. To address this theory, self-report measures have been developed to assess motivation to engage in substance use and other addictive, health-damaging behaviors in order to alleviate mood disturbance. Research using such measures shows the clinical promise of this approach, as people who report stronger motivation to engage in addictive behavior to alleviate negative affect are at increased risk for more frequent engagement in addictive behavior, and thus, greater health-related consequences.

Methods to measure and understand unhealthy behavior as a means of regulating mood disturbance have primarily focused on motivation to engage in addictive behavior to overcome deficient pleasure. Indeed, mood disturbance can be separated into 2 empirically and etiologically unique dimensions: (1) diminished pleasure, enjoyment and happiness; and (2) heightened displeasure and negative affect. Research shows that anhedonia, the diminished ability to experience pleasure in response to typically-pleasant activities, is associated with substance use, diabetes, cardiovascular disease and other negative health outcomes — to a greater extent than other forms of mood disturbance. Therefore, motivation to engage in unhealthy behavior to overcome deficient pleasure may reflect a unique process that is not captured by existing measures of negative affect regulation. Given the absence of tools to assess the extent to which individuals engage in unhealthy and ad-
dictive behaviors to relieve deficits in pleasure, we developed the Pleasure and Health Behavior Inventory (PHBI). The PHBI instructs individuals to indicate the degree to which they engage in an unhealthy behavior to overcome deficient pleasure (i.e., “Because common healthy activities do not give me enough pleasure to be satisfied, I [engage in unhealthy behavior] as a source of pleasure”), with separate items for individual unhealthy behaviors. While motivation to engage in health-damaging behaviors for pleasure enhancement certainly can exist among individuals simultaneously receiving sufficient pleasure from healthy activities, the PHBI is intended to assess a distinct construct – the conscious motivation to engage in maladaptive health behaviors to overcome deficient pleasure. This subjective ‘self-medication’ of deficient pleasure with addictive, mood-altering unhealthy behaviors is a putatively important mechanism that could underlie maladaptive health behavior patterns and explain why people who experience deficient pleasure from common healthy activities are at greater risk for engaging in health-damaging behaviors.25–32 To assess the psychometric properties of the PHBI, the current study explores the PHBI’s internal consistency, factor structure, relations with convergent validity constructs and other important variables (eg, demographics, depression, anxiety).

Given the preponderance of evidence implicating deficient pleasure and mood regulation motives in cigarette smoking,33–40 this introductory investigation of the PHBI focuses on its convergent and concurrent predictive validity with various smoking-related constructs and characteristics in a sample of daily smokers. Additionally, smokers often engage in multiple addictive unhealthy behaviors,41–49 and motivation to engage in unhealthy behavior to relieve deficits in pleasure likely extends to addictive behaviors beyond smoking. Therefore, we structured the PHBI to include items that assess pleasure motivation for multiple addictive behaviors – smoking, alcohol use, casual sex, drug use, gambling, unhealthy eating and over-eating to explore the convergent validity of the PHBI with relevant non-smoking constructs (eg, alcohol abuse, drug abuse, and body mass index).

Evidence suggests mood-regulation motives for one unhealthy behavior associate with corresponding motivations for other unhealthy behaviors,50–54 and may be captured by a common tendency to engage in multiple unhealthy behaviors to overcome deficient pleasure. At the same time, some specificity may exist whereby individuals who engage in a single unhealthy behavior to overcome deficient pleasure (eg, smoking) do not engage in other unhealthy behaviors to overcome deficient pleasure. The current study explores both possibilities by examining the convergent validity of individual PHBI items that assess pleasure motivation for specific behaviors, as well as a composite PHBI score that incorporates responses to several unhealthy behaviors. We also address this issue with factorial validity analyses of the PHBI’s latent structure.

**METHODS**

**Participants**

The current paper is a secondary analysis of baseline data from a laboratory study examining the effects of acute tobacco abstinence on withdrawal symptoms in daily smokers.40 Participants (N = 206) were non-treatment seeking smokers recruited from the Los Angeles area between January 2010 and November 2012 via online advertisements and flyers. Inclusion criteria were: at least 18 years of age, regular cigarette smoking for at least 2 years (10 or more cigarettes per day), breath carbon monoxide level ≥ 10 ppm, and fluency in English. Exclusion criteria included: a DSM-IV diagnosis of non-nicotine substance dependence, depression or psychosis, use of psychoactive medications, use of tobacco products other than cigarettes, use of nicotine replacement therapy and pregnancy. Participants were paid $15 to complete the baseline session.

**Procedure**

Following a preliminary telephone eligibility screening, participants attended a baseline session in which they were assessed for eligibility with breath CO analysis and administration of the Structured Clinical Interview for DSM-IV Non-Patient Edition. Eligible participants continued with the remainder of the baseline session and completed all baseline questionnaire measures in paper format described below.

**Measures**

Cronbach’s alpha estimates for all measures can be found in Tables 1 and 2.

**The Pleasure and Health Behavior Inventory (PHBI)** is a 7-item paper-and-pencil questionnaire (Appendix A) which prefaces items with the following instructions:

“For the following questionnaire, the term common activities is used to refer to typical positive activities that many people commonly engage in for pleasure, happiness, and enjoyment that are considered “healthy.” These activities are common across most individuals and do not involve behaviors such as substance use, gambling, casual sex or hookups, or unhealthy eating. For example, common activities might be personal hobbies or interests, conventional social interactions, enjoying beautiful scenery, or the achievement of certain healthy goals.”

The definition of “common activities” was selected to distinguish rare, healthy experiences that are likely to provoke extreme pleasure in the majority of the population (eg, birth of a child, winning the lottery) from routine, more typical pleasant experiences that are unlikely to provide satisfactory plea-
sure for the entire population. Hedonic capacity scales often identify common, moderately pleasant activities such as those described in the PHBI (e.g., hobbies, conventional social interactions, beautiful scenery) to produce between-person variation in pleasure response, an approach we use to assess the PHBI’s target construct.\textsuperscript{55} For each PHBI item, respondents indicate their agreement with a statement reflecting pleasure motivation for an unhealthy behavior (e.g., “Because common activities do not give me enough pleasure, happiness or enjoyment to be satisfied...I engage in behavior as a source of pleasure happiness or enjoyment”). Ratings are made on a 5-point Likert scale with the following anchors: 0 (I don’t ever engage in this behavior), 1 (strongly disagree), 2 (disagree), 3 (agree), 4 (strongly agree). The first 2 response options are both scored as 1 (Appendix B) to avoid confounding between pleasure motivation and the absence of the behavior. Including the first response option (“I don’t ever”) allows the PHBI to be administered in heterogeneous samples that include individuals who do not engage in all of the behaviors being assessed. Each individual PHBI item assesses pleasure motivation for one of 7 different behaviors: smoking cigarettes, drinking alcohol, recreational drug use, gambling, casual sex, eating unhealthy foods and over-eating. A mean score is calculated as an indicator of overall motivation to engage in multiple unhealthy behaviors to overcome deficient pleasure. Additionally, individual scores for each item reflect specificity in engaging in a particular unhealthy behavior for pleasure motivation.

Rather than taking an iterative approach in developing a heterogeneous item pool for the PHBI and then refining the measure, we decided to create a uniform and straightforward measure that captured most addictive unhealthy behaviors. Using this approach, the PHBI is ensured to: (1) have face validity for assessing the target construct of interest – the extent to which individuals engage in unhealthy and addictive behaviors to relieve deficits in pleasure or happiness; and (2) include items for different behaviors that are uniform in wording and can be directly compared with one another.

\textbf{The Mood and Anxiety Sensitivity Questionnaire–Short Form} (MASQ-SF)\textsuperscript{56} is a 62-item self-report measure of emotional symptoms experienced during the previous week on a Likert scale from 1 (not at all) to 5 (extremely). The MASQ contains 4 symptom subscales: (1) the anxious arousal (AA) subscale focuses on somatic tension and arousal specific to anxiety (17 items); (2) the general distress–anxiety (GDA) subscale assesses anxious/tense mood and other nonspecific anxiety symptoms (11 items); (3) the general distress–depression (GDD) subscale assesses depressed/sad mood and other nonspecific depressive symptoms (11 items); (4) the anhedonic depression (AD) subscale assesses low interest, pleasure, and positive affect specific to depression (22 items). Previous studies have shown good discriminant validity among these scales and convergent validity with related emotional disturbance measures in non-clinical samples.\textsuperscript{57}

\textbf{The Fagerström Test of Nicotine dependence (FTND)}\textsuperscript{58} is a well validated\textsuperscript{59} and widely used 6-item self-report measure that assesses nicotine dependence severity on a scale of 0–10 with higher scores indicating higher levels of dependence.

\textbf{The Smoking Abstinence Questionnaire} (SAQ)\textsuperscript{60} assesses the extent to which participants expect to experience consequences after quitting smoking. We examined 2 SAQ subscales in this study, expectation of abstinence-related withdrawal symptoms (7 items) and weight gain (3 items). Items are rated on a 7-point Likert scale ranging from 0 (not likely at all) to 6 (extremely likely). The SAQ is well validated in diverse populations.\textsuperscript{61}

\textbf{The Michigan Nicotine Reinforcement Questionnaire} (MNRQ)\textsuperscript{62} includes 2 psychometrically validated\textsuperscript{63} subscales that measure the extent to which participants smoke for positive reinforcement and negative reinforcement motivation. Participants indicate their level of agreement with statements (e.g., “I crave a cigarette to provide pleasure”) on a 4-point Likert scale from 1 (Never) to 4 (Always).

\textbf{The Smoking Consequences Questionnaire} (SCQ)\textsuperscript{64} assesses beliefs about the effects of tobacco use, with separate subscales measuring expectations of smoking-related positive reinforcement and sensory satisfaction (15 items), negative reinforcement and negative affect reduction (12 items), negative consequences (18 items) and appetite-weight control (5 items). Items are rated on a 7-point Likert scale ranging from 1 (not true of me at all) to 7 (very true of me). The measure is well-validated and widely-used in diverse populations.\textsuperscript{65-67}

\textbf{The Smoking History Questionnaire} (SHQ)\textsuperscript{68} includes items assessing smoking characteristics (e.g., cigarettes per day) and history – whether individuals have made at least one serious quit attempt. The subset of participants who reported making at least one serious quit attempt (N = 180) completed follow-up items assessing duration of abstinence during past quit attempts and the proportion of quit attempts that lasted less than one day and less than one week. The severity of 7 different withdrawal symptoms experienced during the most recent quit attempt (i.e., cravings, irritability, nervousness, difficulty concentrating, physical symptoms, difficulty sleeping and loss of interest or pleasure) were each rated separately on a 5-point response scale.\textsuperscript{69}

\textbf{The Alcohol Use Disorders Identification Test} (AUDIT)\textsuperscript{70} was used to assess alcohol use problems. The AUDIT consists of 10-items scored for frequency on a 5-point Likert scale 0 (never) to 4 (6 times a week or more) with a total sum score ranging from 0 to 40. Items include: “How many drinks did you have on a typical day when you were
drinking in the past year?” and “How often did you have 6 or more drinks on one occasion in the past year?” The AUDIT is correlated with self-report alcohol screening tests and biochemical measures of drinking, and has demonstrated strong indices of internal consistency.

The Drug Abuse Screening Test (DAST)\textsuperscript{72} is a well validated\textsuperscript{73} 10-item screening instrument to assess non-alcohol, non-nicotine drug use and dependence. It consists of 10 yes/no self-report measures concerning drug use, such as: “Do you abuse more than one drug at a time?” that yield a total sum score.

Body Mass Index (BMI) was calculated using self-reported height and weight.

An author-constructed questionnaire (see Supplemental Materials, page 663) was used to assess demographic variables (sex, age, race, income, employment and education) and characteristics.

Data Analysis

Data were analyzed using IBM SPSS Statistics for Windows Version 21 (IBM Corp., Armonk, NY). Preliminary analyses examined the M(SD) and correlations of the PHBI item ratings as well as the PHBI mean composite score and correlations with demographic characteristics and emotional symptoms (Table 1). Primary analyses examined the PHBI's: (1) internal consistency by calculating Cronbach’s $\alpha$ across the 7 items; (2) factorial validity of responses on the 7 items using principal components analysis (PCA) and Velicer’s MAP test;

<table>
<thead>
<tr>
<th>Table 1 Correlations of PHBI, Mood and Demographic Characteristics</th>
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<tbody>
<tr>
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<tr>
<td>1. PHBI Mean</td>
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<tr>
<td>2. PHBI Smoke</td>
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<td>3. PHBI Alcohol</td>
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<td>4. PHBI Drugs</td>
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<td>5. PHBI Gamble</td>
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<td>6. PHBI Sex</td>
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<td>7. PHBI Unhealthy Foods</td>
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<td>8. PHBI Over-eat</td>
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<tr>
<th>Correlations with sample characteristics</th>
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<tr>
<td></td>
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<tr>
<td>MASQ-Anhedonic Depression</td>
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<tr>
<td>MASQ-Anxious Arousal</td>
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<tr>
<td>MASQ-General Distress: Anxiety</td>
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<tr>
<td>MASQ-General Distress: Depression</td>
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<tr>
<td>Sex (Female)</td>
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<tr>
<td>Age</td>
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<tr>
<td>Race/Ethnicity (African-American vs All Other Ethnicities)</td>
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<tr>
<td>Income (&lt;$15k vs. 15k or more)</td>
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<tr>
<td>Employment (Unemployed vs All Other Employment Status)</td>
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<tr>
<td>Education (Did Not Attend College vs Attended Some College or Higher)</td>
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$^a$ p < .0001. *** p < .01. ** p < .05. * p < .10. – correlation coefficients non-significant at trend level (p > .10)

Note.  
\[ a = \text{Pearson’s or point-biserial } r \]  
\[ b = \text{Spearman’s } \rho \]  
N = 204 – 206.  
PHBI = Pleasure and Health Behavior Inventory; MASQ = Mood and Anxiety Symptoms Questionnaire.
and (3) convergent and concurrent predictive validity by computing correlations of the PHBI items and mean composite to convergent constructs (eg, smoking for negative and positive reinforcement) and behavioral outcomes (ie, nicotine dependence, alcohol problems, drug problems, body mass index [BMI]), respectively. For multi-item scales, composite sum/mean scores were used in all correlational analyses for each scale or subscale. Convergent validity analyses were re-run using partial correlations to control for demographic variables (age, sex, ethnicity, employment, income and education) to examine the extent to which relations involving the PHBI were incremental to demographic factors. Significant bivariate correlations that were non-significant in partial correlations controlling for demographic variables are noted with a symbol in Table 2. In convergent and predictive validity analyses, bivariate relations between 2 continuous variables (ie, correlation of PHBI mean composite to BMI) utilized Pearson’s r, bivariate relations between one binary and one continuous variables used point-biserial correlations (eg, correlation of PHBI mean composite to sex), and bivariate relations involving ordinal variables (eg, correlation of PHBI individual item ratings to all outcomes) utilized Spearman’s ρ. The PHBI mean composite score reflects an amalgamation of the 7 PHBI items, and thus, was modeled continuously. Because the individual PHBI items have only 4 levels and are not normally distributed, they were modeled as ordinal variables with Spearman’s correlations. Because this is the first examination of the PHBI, and we did not want to overlook any potentially meaningful results that could be examined in future work, alpha was set at .05 for all analyses without correcting significance level for multiple tests. We interpreted marginally significant effects (p < .10) with caution, as they could reflect suggestive trends.

RESULTS

Preliminary Analyses
Sample descriptive characteristics can be found in the left-hand columns of Tables 1 and 2. On average, the sample was two-thirds male, overweight (mean BMI = 27.5), comprised of moderate-to-heavy smokers with medium levels of nicotine dependence and had mild alcohol and drug problems. The sample was middle aged (mean age = 44.5, SD = 11.3), ethnically diverse (African American 49%, White 37%, Hispanic 8%, Multiracial 3%, American Indian/Alaska Native 2%, Asian 1%) and participants varied in education level (less than high school 13%, high school graduate 30%, some college 47%, college graduate 10%), income (<15K 58%, 15K-30K 21%, 30K-45K 9%, 45K-60K 7%, 60K-75K 3%, >75K 2%) and employment status (unemployed 59%, retired/disability 20%, part time employment 16%, full time employment 5%). On average, participants rated minimal to low motivation to engage in unhealthy behaviors to offset deficient pleasure as indicated by the mean scores for the item responses and composite in Table 1. However, there was meaningful variability across participants, as indicated by the magnitude of standard deviations and sizeable portion of participants endorsing greater ratings (Table 3, Supplemental Materials). Correlations among the individual PBI items ranged from .12 to .66, and correlations of PHBI item ratings and composite scores with measures of anxiety and depression ranged in magnitude from .11 to .36. The PHBI mean composite score, which reflects higher ratings of engaging in multiple unhealthy behaviors to offset deficient pleasure, was significantly positively correlated with each PHBI item rating, each index of anxiety and depression, and with male sex, African-American race/ethnicity and lower education at the trend level.

Primary Analyses

Internal consistency. The PHBI composite internal consistency was adequate (Cronbach’s α = .74). Factor structure. Bartlett’s test of sphericity (χ² = 321.97, df = 21, p < .0001) and Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO = .75) confirmed the appropriateness of the PHBI item covariance matrix for factor analysis. The PCA yielded one primary factor that explained 39.4% of the variance (eigenvalue = 2.76) and several secondary factors that explained the remainder of the variance (eigenvalues = 1.23, 0.93, 0.63, 0.54, 0.50, 0.41). Given the non-linearity in the distribution of eigenvalues, and apparent break in the distribution between the first factor and the others in the scree plot of the eigenvalues, we interpret this pattern as supportive of a single-factor solution. To confirm this single factor solution, we conducted Velicer’s MAP test. The averaged squared correlation coefficient in the original 7-by-7 matrix was .10; after partialling out the averaged squared partial correlation coefficient matrix, the first component was .06, and successive steps adding additional components further increased the averaged squared partial coefficients (.14 -.44). Given that the average partial correlation coefficient was lowest at the first step, which partialed out the primary component, the MAP test supports a single-factor solution. The item loadings on this factor were moderately sized across the items (smoke = .35, alcohol = .67, drugs = .71, gamble = .73, sex = .68, unhealthy foods = .59, overeating = .64) with the primary factor explaining 39.4% of the variance.

Convergent validity. Validity coefficients are reported in Table 2. The PHBI mean composite score was significantly positively correlated with several smoking-related constructs, including greater motivation to smoke for expectation of mood modulating effects (MNRIQ-Negative Reinforcement, SCQ-Positive Reinforcement, SCQ-Negative reinforcement). The PHBI unhealthy eating and over-eating item ratings were both statistically significant and...
Table 2

<table>
<thead>
<tr>
<th>Table 2 Correlations of PHBI and Smoking Characteristics</th>
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<tr>
<td></td>
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<tr>
<td>Cigarettes smoked per day 16.7 (6.9) – – -.17&quot;¥ – – -.14&quot; – –</td>
</tr>
<tr>
<td>FTND .58 5.3 (1.9) – .20*** – – – – –</td>
</tr>
<tr>
<td>SHQ – Proportion of quit attempts ending in relapse within one day of quitting .29 (.36) – .19** – – .12* – – .12&quot;¥</td>
</tr>
<tr>
<td>SHQ – Proportion of quit attempts ending in relapse within one week of quitting .54 (.4) – .16** – – – – – –</td>
</tr>
<tr>
<td>MNRQ Negative Reinforcement .80 1.2 (.6) .20*** .27† – – – – .17** .17&quot;¥</td>
</tr>
<tr>
<td>MNRQ Positive Reinforcement .75 1.6 (.64) – .26† – – – – –</td>
</tr>
<tr>
<td>SAQ Withdrawal concerns .87 3.77 (1.4) .20*** .28† – – – – .17** .11*</td>
</tr>
<tr>
<td>SAQ Weight gain .86 1.84 (3.2) .19*** .18&quot;¥ – – – – .22*** .29†</td>
</tr>
<tr>
<td>SCQ Negative Consequences .91 4.8 (1.16) .11* .11* – – – – .12* –</td>
</tr>
<tr>
<td>SCQ Negative Reinforcement .96 4.3 (1.7) .33† .43† .17** – – – .26† .21**</td>
</tr>
<tr>
<td>SCQ Positive Reinforcement .88 4.5 (1.2) .25† .32† .21*** – – – .13* –</td>
</tr>
<tr>
<td>SCQ Weight Control .96 1.01 (2.05) .32† .20*** .19*** .14* .17** .21*** .18** .23***</td>
</tr>
<tr>
<td>SHQ – Craving in prior quit attempts 3.7 (1.0) – – – – – – -.12* –</td>
</tr>
<tr>
<td>SHQ – Irritability in prior quit attempts 2.9 (1.2) – .14* – – – – -.16&quot;¥ .22*** .13*</td>
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<tr>
<td>SHQ – Nervousness in prior quit attempts 2.5 (1.2) .12* .12* – – – – .16** –</td>
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<tr>
<td>SHQ – Difficulty Concentrating in prior quit attempts 2.5 (1.2) .14* – – – – – .20*** .18**</td>
</tr>
<tr>
<td>SHQ – Physical symptoms in prior quit attempts 1.9 (1.1) .12* – – .16** – – .12* .20&quot;¥</td>
</tr>
<tr>
<td>SHQ – Difficulty sleeping in prior quit attempts 2.2 (1.3) – .12* – – – – .16** .18&quot;¥</td>
</tr>
<tr>
<td>SHQ – Loss of pleasure in prior quit attempts 2.0 (1.1) .20*** .24*** – – – – – .24*** .22***</td>
</tr>
<tr>
<td>AUDIT .85 3.5 (4.8) .22*** – .56† .19* .28† .19** – –</td>
</tr>
<tr>
<td>DAST .91 2.0 (3.7) .29† .11&quot;¥ .20*** .37† .21** .24*** .20*** .16**</td>
</tr>
<tr>
<td>BMI 27.5 (5.3) .15&quot;¥ – .17* – – – – .11* .27†</td>
</tr>
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</table>

† p < .0001; ** p < .01; *** p < .05; * p < .10. – correlation coefficients non-significant at trend level (p > .10). ¥ correlation with p-value that was marginally-significant or lower (p < .10) in unadjusted analysis but was not significant in partial correlations controlling for demographics (sex, age, race/ethnicity, income, employment, education).

N = 180 – 206.

Note.

a = Pearson’s or point-biserial r
b = Spearman’s ρ. Behavior-concordant correlations between individual PHBI items that assess pleasure motivations for specific behaviors and outcomes related to the same respective behavior are reflected in bold face font (e.g., PHBI Alcohol item with AUDIT, PHBI Over-eat item with BMI; PHBI smoking item with AUDIT would not reflect such a behavior-concordant relation).

PHBI = Pleasure and Health Behavior Inventory; FTND = Fagerström Test for Nicotine Dependence; MNRQ = Michigan Nicotine Reinforcement Questionnaire; SAQ = Smoking Abstinence Questionnaire; SCQ = Smoking Consequences Questionnaire; SHQ = Smoking History Questionnaire; AUDIT = Alcohol Use Disorder Identification Test; DAST = Drug Abuse Screening Test; BMI = Body Mass Index.
positively correlated with beliefs that smoking aids in weight control (SCQ) and smoking abstinence produces weight gain (SAQ).

**Concurrent predictive validity.** Item-level analyses of the PHBI generally showed behavioral-specificity regarding relations between pleasure motivation for a specific behavior and a conceptually relevant behavioral outcome. Behavior-specific correlations between individual PHBI items and external variables (eg, PHBI-alcohol items and AUDIT alcohol problems) are noted in bold type in Table 2. For example, PHBI smoking item ratings were significantly positively correlated with all of the smoking behavior measures except for number of cigarettes smoked per day and difficulty concentrating, craving and physical symptoms in prior quit attempts. PHBI alcohol item ratings were significantly positively correlated with alcohol problem severity (AUDIT), and PHBI drug item ratings were significantly positively correlated with drug problem level (DAST). Ratings on the over-eating item were significantly positively correlated with BMI, and ratings on the PHBI unhealthy-eating item were positively correlated with BMI at a trend level. The mean PHBI score also was positively correlated with more serious alcohol and drug problems and higher BMI, though the relation to BMI was eliminated in analyses adjusting for demographics (p > .10).

**DISCUSSION**

This study provides initial evidence in support of the validity of the PHBI – a novel measure of motivation to engage in addictive, health-damaging behaviors for pleasure enhancement when healthy, common activities do not provide sufficient pleasure. The prior literature has primarily focused on measuring and understanding the reasons why individuals engage in unhealthy behaviors to alleviate negative affect, whereas the current study concentrates on a distinct affective process – behavior aimed at offsetting deficient pleasure. In contrast with previous work that considers only an individual behavior within a single scale, we extend the literature by focusing on multiple addictive, health-damaging behaviors within a common measure. This approach affords: (1) comparison of pleasure enhancement motivation across multiple behaviors; and (2) identification of shared traits that potentially underlie the engagement in multiple addictive health-damaging behaviors for the common reason of counteracting deficient pleasure.

Factorial, convergent, and concurrent predictive validity analyses indicated important variance at both the multi-item composite level and the individual (behavior-specific) item level. Evidence supported a single-factor solution, and loadings on this factor were generally consistent across items. The smoking item’s factor loading was modest in size, which suggests that smoking to overcome deficient pleasure may be less reflective of the tendency to engage in multiple unhealthy and addictive behaviors to relieve deficits in pleasure (quantified by the composite score) than the other health behaviors (ie, PHBI items). Because the sample was composed entirely of moderate-to-heavy smokers, it is unclear whether this factor-loading pattern would be concordant in a sample with more diverse levels of smoking. In less circumscribed samples, it is possible that between-person variation in motivational tendencies across all unhealthy behaviors (including smoking) may converge. Broadly, the loadings were sufficient in size and generally consistent in magnitude to warrant computation of a composite index based on the mean of each individual ratings, which may tap a common latent dimension. The mean PHBI composite score correlated positively with criterion variables that spanned multiple unhealthy behaviors and outcomes, indicating that the composite score could reflect a common tendency to engage in multiple unhealthy behaviors for pleasure regulation. From a content validity perspective, the PHBI comprehensively assesses the content domain it is intended to measure by including 7 items that reflect a broad range of unhealthy, addictive and mood-altering behaviors.

At the same time, the primary factor accounted for a moderate percentage of the total variance (39.4%) in PHBI item ratings. Correspondingly, Cronbach’s α for the PHBI composite was adequate (.74) but not highly robust, which is to be expected given that: (1) the primary factor was moderate in magnitude; thus, inter-item correlations are not expected to consistently reach high magnitudes; and (2) the scale includes only 7 items, and measures with more items tend to have higher Cronbach α coefficients. Furthermore, item-level criterion validity analyses revealed more consistent relations for correlations that were behavior-concordant (eg, PHBI alcohol item and alcohol use disorder) than behavior-discordant (eg, PHBI alcohol item and BMI). In summary, the PHBI may assess both common and behavior-specific tendencies to engage in unhealthy addictive behaviors to override deficient pleasure. Until further evaluation of the measure, we suggest the PHBI be used for both item-level and mean composite score-level analysis. We recommend researchers analyze the individual PHBI item ratings to test hypotheses regarding pleasure regulation motives for specific unhealthy behaviors and use the PHBI mean composite score to assess common mechanisms of multiple health-risk behaviors.

**Limitations**

The sample consisted entirely of smokers – eligibility criteria excluded individuals with nicotine substance dependence and there were no external correlates for some health behaviors (eg, gambling), thereby necessitating the need of further validation of this measure and extension to other populations. Because there are no existing convergent variables or measures that tap the tar-
get construct of interest (ie, motivation to engage in unhealthy behavior to overcome deficient pleasure), we included measures that assess related constructs closely linked to the PHBI’s target construct (eg, smoking for negative affect reduction) such as the MRNQ-Negative Reinforcement and SCQ-Positive Reinforcement as convergent validity variables. However, because no such “gold standard” convergent measure of the target construct exists, we cannot ascertain full understanding of the extent to which the PHBI possesses construct validity. Furthermore, eligibility criteria required smoking at least 10 cigarettes per day, which likely restricted the range of variance on smoking and smoking-level variables. It is unclear whether null relations of the PHBI mean score and smoking item with cigarettes smoked per day and other smoking outcomes were due to attenuation of power due to range restrictions. As a result of our modest sample size, we were unable to utilize item response theory (IRT) based modeling to examine the difficulty, discriminability, and consistency of each PHBI item. In future research, IRT modeling of PHBI individual items could help determine differential item functioning across meaningfully distinct subgroups. Due to the cross-sectional design, we could not examine the stability of the PHBI. The lack of corresponding measures of engaging in multiple health-damaging behaviors for negative affect regulation precludes determinations of whether the PHBI has incremental predictive validity over and above other affect regulatory processes. However, convergent and predictive validity analyses that adjusted for demographic variables suggest incremental validity over and above demographic factors that increase risk of unhealthy behavior.74-80

The strength of the validity coefficients ranged in magnitude, and robust validity coefficients were uncommon in the results. The lower validity coefficient magnitudes may be due to a combination of the following factors. First, measurement error among the external convergent and predictive validity variables – Cronbach α estimates for multi-item external variables were adequate in most cases (Table 2), suggesting that if measurement error in external validity variables did reduce power to detect relations with PHBI, the error was likely systematic in nature. Second, it is possible that the constructs tapped by the convergent validity external variables are not strongly related to the latent construct tapped by the PHBI; that is, the underlying trait of engaging in unhealthy behavior to overcome deficient pleasure may not tightly couple with other underlying traits reflecting smoking for affect regulation. Third, it is also possible that the modest magnitudes are explained by measurement error within the PHBI.

Conclusions
This paper introduces the PHBI, a brief measure that can be used to examine pleasure motivation to engage in specific health-compromising behaviors (item-level) as well as common tendencies to engage in multiple unhealthy behaviors for deficient pleasure regulation (mean composite score). The PHBI mean composite score (and some of its item-level ratings) were associated with higher levels of anxiety, depression, African-American ethnicity, and a marker of socioeconomic status (ie, education). There are important health disparities in the engagement and consequences of health-damaging behaviors as a function of mental illness, ethnicity, and socioeconomic status.81-83

The PHBI could aid future work exploring mediators of disparities that contribute to unhealthy, addictive behaviors and subsequent health consequences. More generally, the PHBI might aid in elucidating the psychological underpinnings of paradoxical engagement in health-damaging behavior and explicate the functional relationship between deficient pleasure and motivational processes.

Human Subjects Statement
The University of Southern California Institutional Review Board (HS-09-00345) approved this research.

Conflict of Interest Statement
The authors report no conflicts of interest.

References
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Initial Validation of the Pleasure and Health Behavior Inventory


44. Pety NM, Ocken C. Cigarette smoking is associated with increased severity of gambling problems in treatment-seeking gamblers. Addiction. 2002;97(6):745-753.


Appendix A
Pleasure and Health Behavior Inventory (PHBI)

For the following questionnaire, the term common activities is used to refer to typical positive activities that many people commonly engage in for pleasure, happiness, and enjoyment that are considered “healthy.” These activities are common across most individuals and do not involve behaviors such as substance use, gambling, casual sex or hookups, or unhealthy eating. For example, common activities might be personal hobbies or interests, conventional social interactions, enjoying beautiful scenery, or the achievement of certain healthy goals.

Given the information above, which defines “common activities,” indicate whether you agree or disagree with the following statements by marking the appropriate box.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Because common activities do not give me enough pleasure, happiness, or enjoyment to be satisfied… I smoke cigarettes as a source of pleasure, happiness, or enjoyment.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Because common activities do not give me enough pleasure, happiness, or enjoyment to be satisfied… I drink alcohol as a source of pleasure, happiness, or enjoyment.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Because common activities do not give me enough pleasure, happiness, or enjoyment to be satisfied… I use recreational drugs as a source of pleasure, happiness, or enjoyment.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Because common activities do not give me enough pleasure, happiness, or enjoyment, to be satisfied… I gamble as a source of pleasure, happiness, or enjoyment.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Because common activities do not give me enough pleasure, happiness, or enjoyment to be satisfied… I engage in casual sex or hookups as a source of pleasure, happiness, or enjoyment.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Because common activities do not give me enough pleasure, happiness, or enjoyment to be satisfied… I eat unhealthy foods as a source of pleasure, happiness, or enjoyment.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Because common activities do not give me enough pleasure, happiness, or enjoyment to be satisfied… I overeat as a source of pleasure, happiness, or enjoyment.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix B
PHBI Scoring Algorithm

The response for each PHBI individual item should be scored on a 4-point response scale from 1 to 4. The first two response options (“I Don’t Ever” and “Strongly Disagree”) should both be scored as 1 to avoid confounding as a result of the absence of the behavior. A PHBI composite mean score is calculated by taking the mean of the 7 individual PHBI items.

<table>
<thead>
<tr>
<th>Response</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>I don’t ever</td>
<td>1</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>1</td>
</tr>
<tr>
<td>Disagree</td>
<td>2</td>
</tr>
<tr>
<td>Agree</td>
<td>3</td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>4</td>
</tr>
</tbody>
</table>

Supplemental Materials

Table 3
Distribution of Individual PHBI Items

<table>
<thead>
<tr>
<th>PHBI Item</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0%</td>
<td>20%</td>
<td>36%</td>
<td>34%</td>
<td>10%</td>
</tr>
<tr>
<td>2</td>
<td>28%</td>
<td>25%</td>
<td>27%</td>
<td>17.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>3</td>
<td>47%</td>
<td>22%</td>
<td>21%</td>
<td>7.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>4</td>
<td>49%</td>
<td>15.5%</td>
<td>21.5%</td>
<td>12%</td>
<td>2%</td>
</tr>
<tr>
<td>5</td>
<td>37%</td>
<td>19.5%</td>
<td>21%</td>
<td>16.5%</td>
<td>6%</td>
</tr>
<tr>
<td>6</td>
<td>12.5%</td>
<td>27%</td>
<td>29.5%</td>
<td>26%</td>
<td>5%</td>
</tr>
<tr>
<td>7</td>
<td>26.5%</td>
<td>21%</td>
<td>32%</td>
<td>17.5%</td>
<td>3%</td>
</tr>
</tbody>
</table>
Personal Information Questionnaire (PIQ)

Instructions: Please place an ‘X’ in the appropriate space or write in the answer in the space provided.

1. Gender:
   - Female
   - Male

2. Age:
   _______ years old

3. Height:
   _______ feet  _______ inches

4. Weight:
   _______ pounds

5. Ethnicity:
   - Hispanic or Latino
   - Not Hispanic or Latino

6. Race (Check all that apply):
   - American Indian or Alaskan Native
   - Asian (including the Philippine Islands, South/Southeast Asia, and India)
   - Black or African American
   - Middle Eastern
   - Pacific Islander (Including Hawaii)
   - White

7. Education:
   - Less-than high school
   - High school diploma or GED
   - Some college completed or currently enrolled in college
   - College degree or higher

8. Marital Status:
   - Married
   - Currently living together with someone
   - Widowed
   - Separated
   - Divorced
   - Single and Never Married

9. Indicate your employment status as of TODAY (check appropriate box):
   - Full Time _______ Hours/Week
   - Part Time _______ Hours/Week
   - Retired or Disability
   - Unemployed
   - Summer Only _______ Hours/Week

10. Which category best describes your total PRE-TAX HOUSEHOLD income last year?
    - Less than $15,000
    - At least $15,000, but less than $30,000
    - At least $30,000, but less than $45,000
    - At least $45,000, but less than $60,000
    - At least $60,000, but less than $75,000
    - At least $75,000, but less than $90,000
    - At least $90,000, but less than $105,000
    - At least $105,000, but less than $120,000
    - Greater than $120,000