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### Authors

Stucky, Brian D  
Edelen, Maria Orlando  
Tucker, Joan S  
et al.

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## ORIGINAL INVESTIGATION

# Development of the PROMIS<sup>®</sup> Negative Psychosocial Expectancies of Smoking Item Banks

Brian D. Stucky PhD<sup>1</sup>, Maria Orlando Edelen PhD<sup>2</sup>, Joan S. Tucker PhD<sup>1</sup>, William G. Shadel PhD<sup>3</sup>, Jennifer Cerully PhD<sup>1</sup>, Megan Kuhfeld MS<sup>4</sup>, Mark Hansen MPH<sup>4</sup>, Li Cai PhD<sup>4</sup>

<sup>1</sup>RAND Health, RAND Corporation, Santa Monica, CA; <sup>2</sup>RAND Health, RAND Corporation, Boston, MA; <sup>3</sup>RAND Health, RAND Corporation, Pittsburgh, PA; <sup>4</sup>CSE/CRESST, Graduate School of Education and Information Studies, University of California, Los Angeles, CA

Corresponding Author: Brian D. Stucky, PhD, RAND Health, RAND Corporation, 1776 Main Street, Santa Monica, CA 90407-2138, USA. Telephone: 310-393-0411, ext. 6336; Fax: 310-393-4818; E-mail: [bstucky@rand.org](mailto:bstucky@rand.org)

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## ABSTRACT

**Introduction:** Negative psychosocial expectancies of smoking include aspects of social disapproval and disappointment in oneself. This paper describes analyses conducted to develop and evaluate item banks for assessing psychosocial expectancies among daily and nondaily smokers.

**Methods:** Using data from a sample of daily ( $N = 4,201$ ) and nondaily ( $N = 1,183$ ) smokers, we conducted a series of item factor analyses, item response theory analyses, and differential item functioning analyses (according to gender, age, and race/ethnicity) to arrive at a unidimensional set of psychosocial expectancies items for daily and nondaily smokers. We also evaluated performance of short forms (SFs) and computer adaptive tests (CATs) to efficiently assess psychosocial expectancies.

**Results:** A total of 21 items were included in the Psychosocial Expectancies item banks: 14 items are common across daily and nondaily smokers, 6 are unique to daily, and 1 is unique to nondaily. For both daily and nondaily smokers, the Psychosocial Expectancies item banks are strongly unidimensional, highly reliable (reliability = 0.95 and 0.93, respectively), and perform similarly across gender, age, and race/ethnicity groups. A SF common to daily and nondaily smokers consists of 6 items (reliability = 0.85). Results from simulated CATs showed that, on average, fewer than 8 items are needed to assess psychosocial expectancies with adequate precision when using the item banks.

**Conclusions:** Psychosocial expectancies of smoking can be assessed on the basis of these item banks via the SF, by using CAT, or through a tailored set of items selected for a specific research purpose.

## INTRODUCTION

Item banks designed to assess the negative psychosocial expectancies of smoking among daily and nondaily smokers were developed as part of the PROMIS<sup>®</sup> Smoking Initiative. Items contained in the Psychosocial Expectancies item banks emerged following an extensive qualitative item pool development process (including literature reviews, focus groups, and cognitive interviews; Edelen, Tucker, Shadel, Stucky, & Cai, 2012) and initial analytic review using exploratory factor analysis of more than 3,000 daily smokers. This process revealed a collection of items that measure: (a) social disapproval of smoking, (b) normative values associated with smoking, and (c) negative beliefs about one's appearance when smoking. We broadly classify these attitudes as the negative psychosocial expectancies of smoking.

Perceptions of smoking expectancies are an important part of theoretical conceptualizations of health behavior change (Rosenstock, Strecher, & Becker, 1988) and these concepts have been applied in smoking cessation research (Strecher

et al., 2008). DiClemente et al. (1991) found subjects preparing to quit or contemplating quitting were more aware of the negative evaluations of others compared with smokers not contemplating quitting. Indeed, being able to accurately assess perceptions of psychosocial expectancies of smoking is critical to understanding success with quitting smoking. Research suggests that perceptions of social approval/disapproval and self-evaluations are linked with intentions to quit and quit attempts (Kim & Shanahan, 2003; MacPherson & Myers, 2009; Rohsenow et al., 2003), highlighting the importance of others' reactions in motivating attempts to change one's smoking behavior. The social process associated with smoking underscores the necessity of evaluating psychosocial constructs when trying to change smoking-related behaviors.

Previous research has assessed perceived psychosocial expectancies of smoking using various measures. Some measures of social norms around smoking cessation require respondents to rate their agreement with statements capturing both subjective norms (e.g., "Most people who are important to me think that

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I should quit smoking.” “Most people who are important to me want me to quit smoking”) and descriptive norms (e.g., “Most people who are important to me have quit smoking themselves”) (Dohnke, Weiss-Gerlach, & Spies, 2011). These measures of subjective norms predict a variety of smoking-related outcomes, including current smoking and susceptibility to smoke in the future (Primack, Switzer, & Dalton, 2007) and quitting intentions (Dohnke et al., 2011; Hanson, 1999).

A few measures in particular contain concepts of psychosocial expectancies, among them perhaps the most widely used is the Smoking Consequences Questionnaire (SCQ; Brandon & Baker, 1991) designed among college-aged smokers to assess outcome expectancies associated with smoking. A number of these expectancies are psychosocial in nature, including a set of items addressing concerns about negative social impressions (e.g., “I look ridiculous while smoking” and “Smoking make me seem less attractive”). In an efficacy study for the nicotine patch, the negative consequences factor from the SCQ was related to cessation success (Wetter et al., 1994). Subsequently, Copeland, Brandon, and Quinn (1995) developed the SCQ-Adult (SCQ-A) targeted toward adult smokers who had smoked for longer, smoked more cigarettes, and were generally more nicotine dependent than smokers participating in the development of the SCQ. Multiple brief versions of the SCQ and SCQ-A have been developed for specific populations including heavy smoking adults (Brief SCQ-A; Rash & Copeland, 2008), children (Copeland et al., 2007), and adolescents/young adult smokers (Lewis-Esquerre, Rodrigue, & Kaler, 2005; Myers, McCarthy, MacPherson, & Brown, 2003). The Decisional Balance measure of smoking attitudes (Velicer, DiClemente, Prochaska, & Brandenburg, 1985) includes a *Con* subscale that assesses negative aspects of smoking such as disapproving of one’s own smoking and perceiving the disapproval of others. The measure has been validated in both adult (Velicer et al., 1985) and adolescent populations (Pallonen, Prochaska, Velicer, Prokhorov, & Smith, 1998). Finally, the Smoking Process of Change scale (Prochaska, Velicer, DiClemente, & Fava, 1988) includes a Self-Reevaluation scale that includes items related to feelings of cognitive dissonance for still smoking given knowledge of its harmful effects (e.g., “I consciously struggle with the issue that smoking contradicts my view of myself as a caring and responsible person”).

The studies reviewed above illustrate the many instruments used to assess perceived psychosocial expectancies. While each of these existing instruments includes items pertaining to a few aspects of the psychosocial expectancies of smoking, none fully captures the diverse nature of this construct as it was uncovered in our extensive analyses. We address that gap here by representing all the critical facets of this construct in our development of state-of-the-art item banks measuring the negative psychosocial expectancies of smoking among daily and nondaily smokers. In the following section, we provide the psychometric analyses, which closely follow the procedures outlined by Reeve et al. (2007) that led to the calibrated banks of psychosocial expectancies items. To summarize the steps taken, we first describe the item factor analyses, item response theory (IRT) analyses, and the differential item functioning (DIF) analyses (according to gender, age, and race/ethnicity) that we conducted to arrive at unidimensional item banks assessing the psychosocial expectancies of smoking among daily and nondaily smokers. Following the development of the item banks, we then describe how we developed and evaluated the performance of short forms (SFs) and computer adaptive

tests (CATs) to efficiently, yet reliably assess this domain. More details of the analytic process used to develop the daily and nondaily smoker Psychosocial Expectancies item banks can be found in Hansen et al. in this supplement.

## METHODS

### Sample and Procedure

A national sample of smokers ( $N_{\text{total}} = 5,384$ ;  $N_{\text{daily}} = 4,201$ ;  $N_{\text{nondaily}} = 1,183$ ) was recruited by Harris Interactive through their online panel membership, and all assessments were completed via the Internet. All procedures were IRB approved. Individuals were eligible if they were 18 years or older, had been smoking for at least a year, had smoked in the past 30 days, and did not have plans to quit in the next 30 days. Based on their response to number of days smoked in past 30 days, those participants indicating smoking 28–30 of the past 30 days were classified as daily smokers; respondents smoking less than 28 of the past 30 days were classified as nondaily smokers. Sample recruitment was targeted to reflect the demographic composition of U.S. adult smokers in terms of gender, race/ethnicity, and age. The survey was fielded between July and September 2011 via a randomized block design (Reeve et al., 2007). The block design was constructed to minimize respondent burden while maximizing the inter-item covariance coverage. To cross-validate the dimensionality of the Psychosocial Expectancies item bank, the daily smoker sample was randomly split into exploratory ( $N_{\text{exploratory}} = 3,021$ ) and confirmatory ( $N_{\text{confirmatory}} = 1,180$ ) subsamples.

Mean age was 46.4 years for daily (D) smokers and 44.1 years for nondaily (ND) smokers. Females comprised about half the sample (D: 54.8%, ND: 47.0%). Most participants were employed full-time (D: 52.9%, ND: 60.6%) or part-time (D: 12.2%, ND: 14.4%). The racial/ethnic composition was primarily non-Hispanic White (D: 72.2%, ND: 55.2%), Black (D: 12.1%, ND: 15.5%), and Hispanic (D: 11.3%, ND: 24.4%). Most participants had attended at least some college (D: 80.5%, ND: 84%), and many had earned a bachelors or graduate degree (D: 29.8%, ND: 42.1%). More than half were currently married or cohabitating (D: 57.7%, ND: 55.1%), with fewer being divorced/separated/widowed (D: 21.8%, ND: 18.7%) or never married (D: 20.5%, ND: 26.1%). Although most differences are not large, chi-square tests (and *t*-test for age) indicated that daily and nondaily smokers significantly differed on each of these characteristics ( $p < .001$ ). Most notably, relative to daily smokers, nondaily smokers were less likely to be non-Hispanic White, and more likely to be employed and further educated. Table 1 compares these groups on smoking patterns. As expected, daily smokers had a longer smoking history, smoked more cigarettes on average per day, and reported fewer quit attempts compared with nondaily smokers ( $p < .0001$ ).

### Measures

#### Smoking Items

A total of 277 unique smoking items were administered. These items were developed according to PROMIS procedures from extant items in the literature as well as direct feedback from smokers. This process, described in more detail in Edelen et al. (2012), employed a rigorous qualitative approach that

**Table 1. Smoking Characteristics of Daily and Nondaily Smokers**

Smoking variable	Daily smokers ( <i>N</i> = 4,201)	Nondaily smokers ( <i>N</i> = 1,183)
Years smoked, %		
1–10 years	11.7	29.2
More than 10 years	88.3	70.8
Number of days smoked in past 30 days, %		
1 or 2 days	0.0	15.8
3–5 days	0.0	9.6
6–9 days	0.0	9.6
10–19 days	0.0	23.2
20–27 days	0.0	41.9
28–30 days	100.0	0.0
Average number of cigarettes per day in past 30 days, %		
<1 per day	0.2	13.0
1–5	8.0	48.3
6–10	22.0	22.3
11–20	47.3	13.5
20+	22.6	3.9
Number of times quit for at least 24 hr, %		
Never	18.0	14.7
1 time	12.3	6.2
2–3 times	30.7	19.1
4–5 times	19.7	12.7
6–9 times	7.4	7.8
10 or more times	12.0	40.1
Quitting contemplation, %		
Not thinking about quitting	40.1	42.3
Thinking about quitting, but no plans to quit	37.1	29.0
Plans to quit in next 6 months	22.7	28.7

included systematic literature review, binning and winnowing of items, item standardization, solicitation of feedback from smokers via focus groups and cognitive interviews, and final item revisions. All respondents completed 13 of the 277 smoking items that assessed their smoking behavior and quitting history. The remaining 264 items were candidate items that were being considered for inclusion in one of the smoking item banks. These items were distributed across 26 overlapping forms containing an average of 147 items (range = 134–158); each respondent was randomly assigned one of the 26 forms.

*Other Measures*

All respondents supplied basic demographic information and completed one of eight PROMIS psychosocial-related quality of life SF measures (alcohol consumption, anger, anxiety, depression, fatigue, physical functioning, sleep disturbance, and global psychosocial; Cella et al., 2007). These PROMIS measures were collected to provide preliminary validity evidence and results are reported elsewhere in this supplement (Edelen, Stucky, et al.).

**Item Factor Analyses**

Previous analyses of the daily smoker exploratory subsample identified a set of 37 items to be considered for inclusion in the Psychosocial Expectancies item bank for daily smokers

(Edelen et al., 2012). The same 37 items were also considered for nondaily smokers.

Using the exploratory subsample of daily smokers (*N* = 3,021) and the full sample of nondaily smokers (*N* = 1,183), we examined the underlying factor structures of the 37-item sets with the software IRTPRO (Cai, du Toit, & Thissen, 2011). Local dependence (LD) diagnostic indices (Chen & Thissen, 1997) and high-dimensional exploratory item factor analyses (Cai, 2010) were used to identify clusters of related items or LD departures from unidimensionality. Item bifactor models (e.g., Cai, Yang, & Hansen, 2011; Gibbons & Hedeker, 1992) were then specified to account for these LD clusters.

Examining model results for each smoker type, study team members evaluated items within each specific factor in order to select subsets of items that would collectively be more unidimensional than the initial sets of 37 items. We considered each item’s loading on the psychosocial expectancies factor, the percentage of common variance accounted for by the psychosocial expectancies factor (i.e., item explained common variance; Stucky, Thissen, & Edelen, 2013), and substantive content. Small numbers of items were selected from each item cluster (or specific factor). The two resulting item subsets for daily and nondaily smokers were selected to more closely conform to the unidimensional structure assumed in the final IRT models.

After selecting items for inclusion and removal in this way, the dimensionality of the two resultant item sets was re-evaluated by testing the fit of a one-factor model using the Mplus software (Muthén & Muthén, 1998–2010) with weighted least squares mean- and variance-adjusted (WLSMV) estimation for categorical response items and standard model fit indices and criteria (root mean squared error of approximation [RMSEA] ≤ 0.08, Tucker-Lewis index [TLI] ≥ 0.95, comparative fit index [CFI] ≥ 0.95; Browne & Cudeck, 1993; Hu & Bentler, 1999). For daily smokers, model fit was assessed first in the exploratory subsample (*N* = 3,021) and then confirmed using the validation subsample (*N* = 1,180); the analysis for nondaily smokers used the full nondaily sample (*N* = 1,183).

**Differential Item Functioning**

After identifying and confirming two sufficiently unidimensional item sets to represent nicotine dependence, the item sets were further evaluated for DIF. These evaluations were conducted using the full daily (*N* = 4,201) and nondaily (*N* = 1,183) smoker samples with IRTPRO (Cai et al., 2011). DIF was evaluated for significance according to gender, race/ethnicity (White, Black, Hispanic), and age (18–30, 31–50, 51+) using established procedures (Edelen, Thissen, Teresi, Kleinman, & O’cepek-Welickson, 2006; Orlando & Marshall, 2002). Items with significant DIF were further evaluated for “impact” by considering the weighted area between the expected score curves (“wABC”) and the expected difference in expected *a posteriori* score (“dEAP”), indices described in more detail in Hansen et al. Items with wABC values greater than 0.30 were screened for potential removal by evaluating graphical illustrations of the subgroups’ expected scores curves, along with the values of the wABC and dEAP indices. Items judged to have nonignorable DIF were removed from further consideration in their respective item banks (i.e., daily or nondaily).

**Calibration of Item Banks**

The Psychosocial Expectancies item banks for daily and nondaily smokers were concurrently calibrated using data from the full combined sample ( $N = 5,384$ ,  $N_{(daily)} = 4,201$ ,  $N_{(nondaily)} = 1,183$ ). We estimated a two-group IRT model with groups distinguishing daily and nondaily smokers. This calibration, which specified the daily smokers as the reference group, fixed the daily psychosocial expectancies mean to 0 and the *SD* to 1 and estimated unique nondaily mean and *SD*. Following PROMIS standards, IRT scores were subsequently rescaled using the *T*-score metric to have a mean of 50 and a *SD* of 10 for daily smokers. The scale for the daily–nondaily group difference was set based on pre-identified anchor items whose parameter estimates were constrained to be equal across the groups. Item parameters for nonanchor items were estimated separately for the two groups (see Hansen et al. for more details). The utility of the item banks was determined using IRT-based test information, score precision, and marginal reliability (MR).

**Short Form Development**

Item parameters from the final calibration were used in the development of a psychosocial expectancies fixed-item SF. In order to simplify the administration and scoring of this form, only those items with equal parameters for daily and nondaily smokers (i.e., anchor items in the two-group calibration) were considered for SF inclusion. Among all the possible combinations of eligible items, candidate SFs were identified using selection criteria related to overall content balance, inclusion of items favored by the study team, and the reliability of score estimates across a broad range of psychosocial expectancies (see Hansen et al. for more detail). Following PROMIS procedures, SF scoring was based on a transformation of the sum of responses to SF items. The use of summed scores has the particular advantage of allowing for the creation of translation tables by which researchers may convert an observed sum into an IRT-scaled score (Thissen, Nelson, Rosa, & McLeod, 2001). The performance of the SFs was evaluated using simulated data. For both the daily and nondaily item banks, we examined the reliability of each SF and obtained correlations of SF scores with scores based on the patterns of responses to the full sets of items.

**CAT Simulation**

CAT utilizes item selection algorithms to administer items that are tailored to the respondent’s estimated standing on the measured construct, often resulting in reductions in test length and respondent burden. We conducted CAT simulations using Firestar (Choi, 2009) to evaluate the utility of computer adaptive administration of the daily and nondaily smoker Psychosocial Expectancies item banks. These simulations: (a) provide an indication of the average number of items from the Psychosocial Expectancies item banks that would be administered under typical CAT conditions, (b) indicate which items would be most routinely selected for CAT administration, and (c) characterize the expected CAT-based score reliability.

**RESULTS**

**Item Factor Analyses**

Bifactor models, each with six specific factors, were selected to characterize the structure of both the 37 daily smoker items (using the exploratory daily smoker sample) and the 37 nondaily smoker items. In both cases, these models were selected based on their interpretability, comparisons of fit indices, and LD chi-squares. The specific factors identified in the bifactor model represent the content “clusters” in the psychosocial expectancies item sets (e.g., perceived social discrimination, self disapproval, disapproval from others, etc.).

The study team reviewed the bifactor model results for all 37 daily smoker and 37 nondaily smoker items and selected at least one item per specific factor to retain for further consideration in the item banks. Item selection was based primarily on item content and the strength of the general factor loading.

This process led to the selection of 23 daily smoker items, and 17 nondaily smoker items that balanced item content closely represented the psychosocial expectancies dimension. Next, one-factor models were fit to the selected item sets to confirm that they were sufficiently unidimensional. Relative to the original 37 daily smoker items (CFI = 0.91, TLI = 0.91, RMSEA = 0.06), the reduced set of 23 daily smoker items showed improved fit in both the exploratory and confirmatory subsamples

**Table 2. Negative Psychosocial Expectancies of Smoking Items Removed Because of DIF**

Item stem	No. comparisons with wABC > 0.3	DIF variable	wABC	dEAP
<b>Daily smokers</b>				
If I quit smoking I will set a good example for others.	1	White vs. Black	0.51	0.20
If I quit smoking I will be able to save more money.	1	White vs. Black	0.30	0.09
Others close to me would suffer if I became ill from smoking.	1	Age 18–30 vs. age 51+	0.41	–0.04
<b>Nondaily smokers</b>				
I smoke too much.	3	Hispanic vs. Black	0.44	0.17
		Age 31–50 vs. age 51+	0.35	0.17
		Age 18–30 vs. age 51+	0.34	0.16
I’m foolish to ignore the warnings about cigarettes.	2	Hispanic vs. Black	0.40	0.16
		White vs. Black	0.40	0.14

*Note.* dEAP = difference in expected a posteriori; DIF = differential item functioning; wABC = weighted area between the expected score curves.



(exploratory: CFI = 0.96, TLI = 0.96, RMSEA = 0.06; confirmatory: CFI = 0.96, TLI = 0.95, RMSEA = 0.06) with only a trivial reduction in reliability (MR went from 0.97 to 0.95). Furthermore, in the exploratory subsample, the test-level explained common variance (ECV; Reise, 2012) associated with the psychosocial expectancies (general) factor increased substantially from 0.68 to 0.79 indicating a more strongly unidimensional model. Fit indices for the nondaily smokers also suggest a strongly unidimensional item set (CFI = 0.97, TLI = 0.96, RMSEA = 0.07), with marginally improved fit compared with the 37-item set (CFI = 0.90, TLI = 0.89, RMSEA = 0.06) and a minimal loss in precision (MR went from 0.96 to 0.95). Similar to daily smoker results, the ECV associated with the psychosocial expectancies (general) factor in the nondaily sample solution increased from 0.65 to 0.85.

**Differential Item Functioning**

Next, the 23 daily and 17 nondaily smoker items underwent DIF testing according to gender, race/ethnicity (White, Black, Hispanic), and age (18–30, 31–50, 51+). For the daily smokers, across all comparisons, seven items met the wABC criterion for consideration of removal (i.e., wABC > 0.30), and three items were ultimately removed because of DIF. For the nondaily smokers, four items were considered for removal, and two items were removed. Details on the removed items are summarized in Table 2. Figure 1 shows the expected score curves for one of these items (“Others close to me would suffer if I became ill from smoking”) that displayed DIF according to age in comparing the youngest to oldest age groups. As can be seen from the curves in Figure 1, the item is much more strongly related to the underlying psychosocial expectancies construct for older respondents. Accordingly, older respondents are more discerning in their endorsement of the statement. Relative to the younger aged respondents, they endorse this statement at lower rates at the lower end of the continuum and at higher rates as the psychosocial expectancies score increases.

**Calibration of Item Banks**

Using the two-group IRT model with daily smokers as the reference group, 21 total items were calibrated. Within this set, 14 were anchor items (identical item parameters for daily and nondaily smokers) and no items had unique item parameters for daily and nondaily smokers. In addition, there were seven items per bank that were nonoverlapping (i.e., items that only

occur for that particular smoker group). This process resulted in two Psychosocial Expectancies item banks (one for daily and one for nondaily smokers) with 20 and 15 items, respectively. As can be seen in Table 3, the final items tended to be strongly related to the underlying psychosocial expectancies construct (*a* parameters for items in both banks ranged from 1.62 to 3.24) and covered a wide range of the psychosocial expectancies continuum (*b* parameters ranged from –1.68 to 2.50) that is fairly symmetric around the psychosocial expectancies mean.

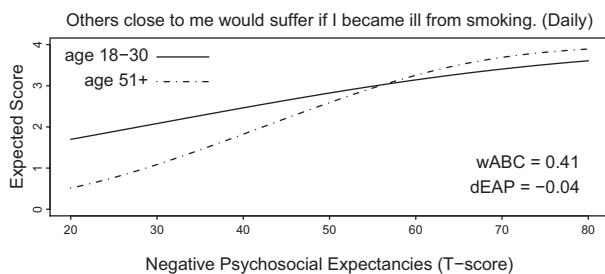
Figure 2 illustrates the score reliability for the daily and nondaily smoker Psychosocial Expectancies item banks (and SF) on a standard *T*-score scale. Full bank scores have reliability values greater than 0.80 from approximately 2½ *SD*s below the mean to greater than 3 *SD*s above the mean (i.e., from about 25 to 80, in the *T*-score scale). Nondaily smokers had a mean value of 48.5, 0.15 *SD*s below the daily smoker mean of 50. In addition, the nondaily smoker sample had essentially the same variability (*SD* = 10.03) compared with daily smokers (*SD* = 10).

**Psychosocial Expectancies Short Form**

Examination of candidate item sets indicated that six items were sufficient to reliably capture the content of the psychosocial expectancies construct. After considering several six-item sets, we selected those items indicated in Table 3 to comprise the six-item SF; the summed score to IRT score translation table for the SF is contained in Table 4. Figure 2 shows the reduction in score reliability when going from the complete item banks (of 20 and 15 items) to the SF. Despite this reduction, the MR of the SF scores remains quite good (0.85). In addition, these scores correlate strongly (0.95) with those obtained from the complete banks. The results suggest that the six-item SF provides efficient and reliable measures of psychosocial expectancies.

**CAT Simulations**

CAT simulations were conducted on the daily and nondaily smoker Psychosocial Expectancies item banks. Table 5 provides the results of simulations that used a *SE* of 3.0 (in the *T*-score metric) as the CAT stopping criterion, which corresponds to a reliability of slightly greater than 0.90, and a range of limits on the maximum number of items allowed to be administered (4, 6, 8, 10, 12). To summarize these results, the correlation between CAT and full bank scores is greater than 0.95, and the average CAT, with the minimum number of items allowed to be administered set to no fewer than eight items, will terminate with a *SE* of 3 when about six or seven items have been administered. The CAT administration rates for each item under the 10-item maximum condition are displayed in Table 3. Most CATs administered to daily and nondaily smokers will select very similar items. Four items were included in the majority (at least 85%) of simulated CATs and two of these items are included in the SF. Because the SF was developed in an effort to sample content from each of the specific factors, two other items frequently selected by the CAT algorithm were not included in the six-item SF.



**Figure 1.** Item removed due to differential item functioning from the daily Negative Psychosocial Expectancies of Smoking item bank.

**DISCUSSION**

A core set of 21 items were calibrated for the PROMIS Psychosocial Expectancies item bank: 14 items were common

**Table 3.** Negative Psychosocial Expectancies of Smoking Item Banks for Daily and Nondaily Smokers

Item	D/ND	CAT		Item parameters				
		D	ND	<i>a</i>	<i>b</i> <sub>1</sub>	<i>b</i> <sub>2</sub>	<i>b</i> <sub>3</sub>	<i>b</i> <sub>4</sub>
My smoking makes me feel less attractive. (SF)	Both	0.87	0.83	3.03	-0.26	0.40	0.97	1.50
My need for cigarettes makes me feel disappointed in myself. (SF)	Both	0.98	0.98	2.94	-0.43	0.22	0.80	1.33
If I quit smoking, my friends will respect me more. (SF)	Both	0.09	0.22	1.89	-0.59	0.07	1.01	1.67
People think less of me if they see me smoking. (SF)	Both	0.06	0.23	1.86	-0.64	0.28	1.31	2.04
If I quit smoking I will be more in control of my life. (SF)	Both	0.25	0.30	1.77	-1.02	-0.39	0.54	1.16
My cigarette smoking bothers others. (SF)	Both	0.14	0.20	1.65	-1.68	-0.32	1.01	1.88
My smoking makes me respect myself less.	Both	1.00	1.00	3.24	-0.03	0.58	1.16	1.73
I feel embarrassed when I smoke. <sup>a</sup>	Both	0.85	0.84	2.65	-0.38	0.40	1.49	2.39
I get upset when I think about my smoking.	Both	0.53	0.50	2.39	-0.23	0.59	1.33	1.99
I look ridiculous while smoking.	Both	0.14	0.12	2.29	0.05	0.72	1.48	2.05
My smoking makes me less attractive to other people.	Both	0.47	0.53	2.19	-0.90	-0.05	0.99	1.71
If I quit smoking, I will be more attractive to others.	Both	0.30	0.39	1.90	-0.83	-0.18	0.84	1.47
People I care about respect me less because I smoke.	Both	0.02	0.01	1.76	0.06	0.95	1.84	2.50
People think I'm foolish for ignoring the warnings about cigarette smoking.	Both	0.16	0.22	1.62	-1.67	-0.61	0.42	1.30
Most of the people I care about want me to quit smoking.	D	0.24		1.72	-1.82	-0.73	0.07	0.77
I'm foolish to ignore the warnings about cigarettes.	D	0.21		1.67	-1.71	-0.93	-0.09	0.58
I smoke too much.	D	0.09		1.50	-1.83	-0.74	0.17	0.86
Smoking leaves an unpleasant odor on my clothes.	D	0.04		1.35	-2.48	-0.91	0.12	0.99
I hide my smoking from other people.	D	0.00		1.05	0.66	1.62	2.57	3.48
I feel uncomfortable smoking around kids.	D	0.01		0.97	-2.53	-1.37	-0.39	0.63
People close to me disapprove of my smoking.	ND		0.33	1.79	-1.47	-0.42	0.38	1.02

*Note.* CAT = computer adaptive test, SF = short form. D/ND column indicates if the item parameters were identical in daily and nondaily groups (both), unique to only the daily group (D), or unique to only the nondaily group (ND). CAT column indicates the rate of item administration for the 10-item maximum condition. Item slope and threshold parameters were obtained through calibrations of the full item banks.

<sup>a</sup>Indicates items that used the following response options: 0 = never, 1 = rarely, 2 = sometimes, 3 = often, 4 = always. All other items used the following response options: 0 = not at all, 1 = a little bit, 2 = somewhat, 3 = quite a bit, 4 = very much.

across daily and nondaily smokers, 6 items were unique to daily smokers, and 1 item was unique to nondaily smokers. The item banks have been found to be unidimensional and highly reliable, with little evidence of item bias across gender, race/ethnicity, and age. The content of the banks brings together facets of psychosocial expectancies of smoking that are not captured by any single existing instrument including self-disapproval (e.g., "My need for cigarettes makes me feel disappointed in myself"), disapproval from others (e.g., "My cigarette smoking bothers others"), and embarrassment (e.g., "I feel embarrassed when I smoke").

An item banking approach provides researchers and practitioners with a flexible approach toward assessing the negative psychosocial expectancies of daily and nondaily smokers. While the six-item SF has demonstrated excellent properties, interested users may wish to administer the items using a CAT approach. Evidence provided here indicates that in a CAT framework as few as 6–7 items are needed to obtain at least a 0.90 level of reliability. Other users may benefit from selecting a tailored subset of items focused on their research or clinical needs (e.g., selecting only the items having to do with self-disapproval or feelings of unattractiveness

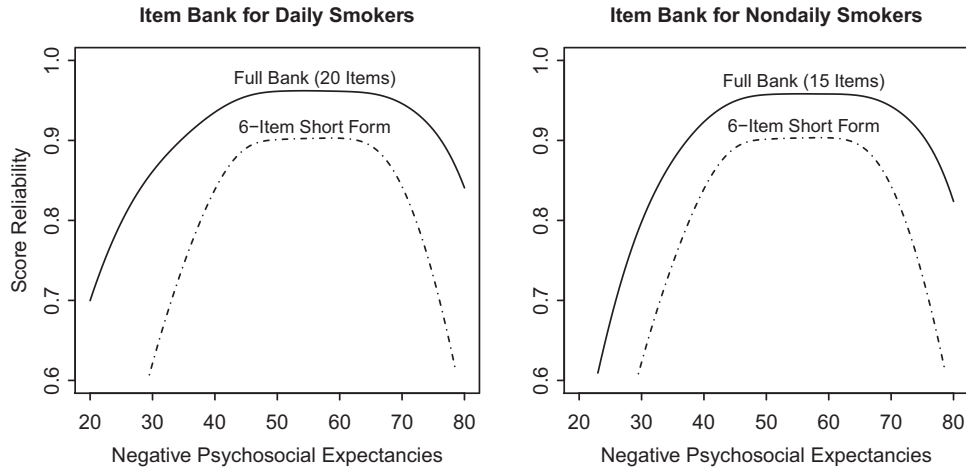


Figure 2. Score reliability for the daily and nondaily Negative Psychosocial Expectancies of Smoking item banks.

Table 4. Negative Psychosocial Expectancies of Smoking Summed Score to Scaled Score Translation Table for the 6-Item Short Form

Six-item short form		
Summed score	Scaled score ( <i>T</i> )	<i>SE</i>
0	31.5	5.8
1	35.9	4.8
2	38.7	4.5
3	41.0	4.2
4	42.9	4.0
5	44.7	3.8
6	46.3	3.7
7	47.8	3.6
8	49.2	3.5
9	50.5	3.4
10	51.8	3.4
11	53.1	3.4
12	54.3	3.3
13	55.5	3.3
14	56.8	3.3
15	58.0	3.3
16	59.3	3.3
17	60.6	3.4
18	61.9	3.4
19	63.3	3.5
20	64.9	3.6
21	66.5	3.8
22	68.5	4.0
23	70.5	4.2
24	74.1	5.0

when smoking). Because the items were calibrated on the same underlying continuum, tailored subsets of items will provide comparable scores to one another, as well as to the full bank score, SF score, and any CAT. The Negative Psychosocial Expectancies of Smoking item banks and SF will be available for public use through PROMIS library, and a free online tool for administering adaptive tests is available through the PROMIS Assessment Center Web site ([www.assessmentcenter.net](http://www.assessmentcenter.net)).

The smoking assessment toolkit products are also available for download from the project Web site (<http://www.rand.org/health/projects/promis-smoking-initiative.html>).

The PROMIS Smoking Initiative is currently conducting preliminary analyses that examine how responses to the Psychosocial Expectancies item banks are associated with history of quitting and current motivation to quit in both a national Internet sample and a sample of smokers recruited from a community setting. Based on previous studies, we expect that smokers who have a greater perception of the psychosocial expectancies of smoking may be more likely to make quit attempts (Kim & Shanahan, 2003; MacPherson & Myers, 2009; Rohsenow et al., 2003). Future research in smoking cessation interventions may wish to consider the benefit of incorporating strategies that directly address the current smoker’s understanding of the psychosocial expectancies of smoking. Currently, motivational interviewing, which has been linked to improving motivation to quit (Schlam & Baker, 2013), is one such intervention that includes awareness of psychosocial expectancies of smoking during the intervention. Evidence suggests that when juxtaposed against the individual’s normative beliefs (e.g., that quitting smoking is better for one’s health), focusing on psychosocial expectancies may be an effective way of motivating smoking cessation (Hettema & Hendricks, 2010; Miller & Rollnick, 2002) and future quit attempts (Stecher et al., 2008). It is also possible that the item bank scores can serve as a precursor to an intervention by identifying those individuals that are more likely to engage and respond to the intervention. While these areas provide exciting avenues for further research, more generally the PROMIS Negative Psychosocial Expectancies of Smoking item banks are intended to enable efficient and flexible assessment of the perceived psychosocial expectancies of smoking among daily and nondaily smokers.

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**Table 5.** Simulated Adaptive Tests for the Negative Psychosocial Expectancies of Smoking Item Banks

	Maximum no. of items					All items
	4	6	8	10	12	
<b>Daily smokers</b>						
Average items administered	3.94	5.20	5.91	6.42	6.81	20
Proportion receiving maximum items	0.94	0.53	0.32	0.24	0.18	1
Marginal reliability	0.83	0.87	0.89	0.90	0.90	0.95
$r(T_{CAT}, T_{full})$	0.95	0.97	0.98	0.98	0.98	1.00
<b>Nondaily smokers</b>						
Average items administered	3.95	5.28	6.10	6.71	7.19	15
Proportion receiving maximum items	0.95	0.58	0.37	0.28	0.22	1
Marginal reliability	0.82	0.87	0.88	0.89	0.90	0.93
$r(T_{CAT}, T_{full})$	0.95	0.97	0.98	0.98	0.98	1.00

Note. CAT = computer adaptive test.

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## DECLARATION OF INTERESTS

None declared.

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## REFERENCES

- Brandon, T. H., & Baker, T. B. (1991). The Smoking Consequences Questionnaire: The subjective expected utility of smoking in college students. *Psychological Assessment: A Journal of Consulting and Clinical Psychology*, 3, 484–491. doi:10.1037/1040-3590.3.3.484
- Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. Bollen and J. Long (Eds.), *Testing structural equation models* (pp. 136–162). Newbury Park, CA: Sage.
- Cai, L. (2010). High-dimensional exploratory item factor analysis by a Metropolis-Hastings Robbins-Monro algorithm. *Psychometrika*, 75, 33–57. doi:10.1007/s11336-009-9136-x
- Cai, L., du Toit, S. H. C., & Thissen, D. (2011). *IRTPRO: Flexible, multidimensional, multiple categorical IRT modeling [Computer software]*. Chicago, IL: Scientific Software International.
- Cai, L., Yang, J. S., & Hansen, M. (2011). Generalized full-information item bifactor analysis. *Psychological Methods*, 16, 221–248. doi:10.1037/a0023350
- Cella, D., Yount, S., Rothrock, N., Gershon, R., Cook, K., Reeve, B., ... Rose, M. (2007). The patient-reported outcomes measurement information system (PROMIS): Progress of an NIH roadmap cooperative group during its first two years. *Medical Care*, 45, S3–S11. doi:10.1097/01.mlr.0000258615.42478.55
- Chen, W.-H., & Thissen, D. (1997). Local dependence indices for item pairs using item response theory. *Journal of Educational and Behavioral Statistics*, 22, 265–289. doi:10.3102/10769986022003265
- Choi, S. W. (2009). Firestar: Computerized adaptive testing simulation program for polytomous item response theory models. *Applied Psychological Measurement*, 33, 644–645. doi:10.1177/0146621608329892
- Copeland, A. L., Brandon, T. H., & Quinn, E. P. (1995). The Smoking Consequences Questionnaire-Adult: Measurement of smoking outcome expectancies of experienced smokers. *Psychological Assessment*, 7, 484–494. doi:10.1037/1040-3590.7.4.484
- Copeland, A. L., Diefendorff, J. M., Kendzor, D. E., Rash, C. J., Businelle, M. S., Patterson, S. M., & Williamson, D. A. (2007). Measurement of smoking outcome expectancies in children: The Smoking Consequences Questionnaire-Child. *Psychology of Addictive Behaviors*, 21, 469–477. doi:10.1037/0893-164X.21.4.469
- DiClemente, C. C., Prochaska, J. O., Fairhurst, S. K., Velicer, W. F., Velasquez, M. M., & Rossi, J. S. (1991). The process of smoking cessation: An analysis of precontemplation, contemplation, and preparation stages of change. *Journal of Consulting and Clinical Psychology*, 59, 295–304. doi:10.1037/0022-006X.59.2.295
- Dohnke, B., Weiss-Gerlach, E., & Spies, C. D. (2011). Social influences on the motivation to quit smoking: Main and moderating effects of social norms. *Addictive Behaviors*, 36, 286–293. doi:10.1016/j.addbeh.2010.11.001
- Edelen, M. O., Stucky, B. D., Hansen, M., Tucker, J. S., Shadel, W. G., & Cai, L. (2014). The PROMIS® smoking initiative: initial validity evidence for six new smoking item banks. *Nicotine & Tobacco Research*, 16, S249–S259.
- Edelen, M. O., Thissen, D., Teresi, J., Kleinman, M., & Ocepek-Welikson, K. (2006). Identification of differential item functioning using Item Response Theory and the likelihood-based model comparison approach: Application to the Mini-Mental Status Examination. *Medical Care*, 44(Suppl. 3), S134–S142. doi:10.1097/01.mlr.0000245251.83359.8c
- Edelen, M. O., Tucker, J. S., Shadel, W. G., Stucky, B. D., & Cai, L. (2012). Toward a more systematic assessment of smoking: Development of a smoking module for PROMIS®. *Addictive Behaviors*, 37, 1278–1284. doi:10.1016/j.addbeh.2012.06.016
- Gibbons, R. D., & Hedeker, D. (1992). Full-information item bifactor analysis. *Psychometrika*, 57, 423–436. doi:10.1007/BF02295430
- Hansen, M., Cai, L., Stucky, B. D., Tucker, J. S., Shadel, W. G., & Edelen, M. O. (2014). Methodology for developing and

- evaluating the PROMIS® smoking item banks. *Nicotine & Tobacco Research*, 16, S174–S188.
- Hanson, M. S. (1999). Cross-cultural study of beliefs about smoking among teenaged females. *Western Journal of Nursing Research*, 21, 635–651. doi:10.1177/01939459922044090
- Hettema, J. E., & Hendricks, P. S. (2010). Motivational interviewing for smoking cessation: A meta-analytic review. *Journal of Consulting and Clinical Psychology*, 78, 868–884. doi:10.1037/a0021498
- Hu, L., & Bentler, P. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6, 1–55. doi:10.1080/10705519909540118
- Kim, S. H., & Shanahan, J. (2003). Stigmatizing smokers: Public sentiment toward cigarette smoking and its relationship to smoking behaviors. *Journal of Health Communication*, 8, 343–367. doi:10.1080/10810730305723
- Lewis-Esquerre, J. M., Rodrigue, J. R., & Kahler, C. W. (2005). Development and validation of an adolescent smoking consequences questionnaire. *Nicotine & Tobacco Research*, 7, 81–90. doi:10.1080/14622200412331328475
- Macpherson, L., & Myers, M. G. (2009). Examination of a process model of adolescent smoking self-change efforts in relation to gender. *Journal of Child & Adolescent Substance Abuse*, 19, 48–65. doi:10.1080/10678280903400644
- Miller, W. R., & Rollnick, S. (2002). *Motivational interviewing: Preparing people for change* (2nd ed.). New York, NY: Guilford Press.
- Muthén, L. K., & Muthén, B. O. (1998–2010). *Mplus user's guide*. Los Angeles, CA: Muthén & Muthén.
- Myers, M. G., McCarthy, D. M., MacPherson, L., & Brown, S. A. (2003). Constructing a short form of the Smoking Consequences Questionnaire with adolescents and young adults. *Psychological Assessment*, 15, 163–172. doi:10.1037/1040-3590.15.2.163
- Orlando, M., & Marshall, G. N. (2002). Differential item functioning in a Spanish translation of the PTSD checklist: Detection and evaluation of impact. *Psychological Assessment*, 14, 50–59. doi:10.1037/1040-3590.14.1.50
- Pallonen, U. E., Prochaska, J. O., Velicer, W. F., Prokhorov, A. V., & Smith, N. F. (1998). Stages of acquisition and cessation for adolescent smoking: An empirical integration. *Addictive Behaviors*, 23, 303–324. doi:10.1016/S0306-4603(97)00074-9
- Primack, B. A., Switzer, G. E., & Dalton, M. A. (2007). Improving measurement of normative beliefs involving smoking among adolescents. *Archives of Pediatrics & Adolescent Medicine*, 161, 434–439. doi:10.1001/archpedi.161.5.434
- Prochaska, J. O., Velicer, W. F., DiClemente, C. C., & Fava, J. (1988). Measuring processes of change: Applications to the cessation of smoking. *Journal of Consulting and Clinical Psychology*, 56, 520–528. doi:10.1037/0022-006X.56.4.520
- Rash, C., & Copeland, A. L. (2008). The Brief Smoking Consequences Questionnaire--Adult (BSCQ-A): Development of a short form of the SCQ-A. *Nicotine & Tobacco Research*, 10, 1633–1643. doi:10.1080/14622200802409990
- Reeve, B. B., Hays, R. D., Bjorner, J. B., Cook, K. F., Crane, P. K., Teresi, J. A., ... Cella, D. (2007). Psychometric evaluation and calibration of health-related quality of life items banks: plans for the patient-reported outcome measurement information system. (PROMIS). *Medical Care*, 45, S22–S31. doi:10.1097/01.mlr.0000250483.85507.04
- Reise, S. P. (2012). The rediscovery of bifactor measurement models. *Multivariate Behavioral Research*, 47, 667–696. doi:10.1080/00273171.2012.715555
- Rohsenow, D. J., Abrams, D. B., Monti, P. M., Colby, S. M., Martin, R., & Niaura, R. S. (2003). The Smoking Effects Questionnaire for adult populations. Development and psychometric properties. *Addictive Behaviors*, 28, 1257–1270. doi:10.1016/S0306-4603(02)00254-X
- Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social learning theory and the Health Belief Model. *Health Education Quarterly*, 15, 175–183. doi:10.1177/109019818801500203
- Schlam, T. R., & Baker, T. B. (2013). Interventions for tobacco smoking. *Annual Review of Clinical Psychology*, 9, 675–702. doi:10.1146/annurev-clinpsy-050212-185602
- Strecher, V., McClue, J., Alexander, G., Chakraborty, B., Nair, V., Konkel, J., ... Pomerleau, O. (2008). Web-based smoking-cessation program: Results of a randomized trial. *American Journal of Preventive Medicine*, 34, 373–381. doi:10.1016/j.amepre.2007.12.024
- Stucky, B. D., Thissen, D., & Edelen, M. O. (2013). Using logistic approximations of marginal trace lines to develop short assessments. *Applied Psychological Measurement*, 37, 41–57. doi:10.1177/0146621612462759
- Thissen, D., Nelson, L., Rosa, K., & McLeod, L. D. (2001). Item response theory for items scored in more than two categories. In D. Thissen & H. Wainer (Eds), *Test scoring* (pp. 141–186). Mahwah, NJ: Lawrence Erlbaum & Associates.
- Velicer, W. F., DiClemente, C. C., Prochaska, J. O., & Brandenburg, N. (1985). Decisional balance measure for assessing and predicting smoking status. *Journal of Personality and Social Psychology*, 48, 1279–1289. doi:10.1037/0022-3514.48.5.1279
- Wetter, D. W., Smith, S. S., Kenford, S. L., Jorenby, D. E., Fiore, M. C., Hurt, R. D., ... Baker, T. B. (1994). Smoking outcome expectancies: Factor structure, predictive validity, and discriminant validity. *Journal of Abnormal Psychology*, 103, 801–811. doi:10.1037/0021-843X.103.4.801