# Development and Validation of the Wisconsin Smoking Withdrawal Scale

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The accurate assessment of nicotine withdrawal is important theoretically and clinically. A 28-item scale, the Wisconsin Smoking Withdrawal Scale, was developed that contains 7 reliable subscales tapping the major symptom elements of the nicotine withdrawal syndrome. Coefficients alpha for the subscales range from .75 to .93. This scale is sensitive to smoking withdrawal, is predictive of smoking cessation outcomes, and yields data that conform to a 7-factor structure. The 7 scales predicted intratreatment smoking, $\chi^2(7, N = 163) = 15.19$, $p = .034$. Moreover, the questionnaire is sufficiently brief so that it can be used in both clinical and research contexts.

The 1988 Surgeon General's report on nicotine addiction concluded that nicotine has the capacity to produce a dependence syndrome resembling those produced by other addictive drugs (U.S. Department of Health and Human Services, 1988). The sine qua non of physical dependence is the emergence of a characteristic withdrawal syndrome in response to declining levels of drug in the body after a period of drug exposure. The accurate measurement of nicotine withdrawal has clear theoretical and clinical importance: Research suggests that withdrawal is an important impediment to quit attempts (Jarvis, 1994), withdrawal is implicated in smoking relapse after a cessation attempt (Baker, Morse, & Sherman, 1986), exacerbation of withdrawal symptoms can be highly predictive of smoking relapse (Piasecki, Kenford, Smith, Fiore, & Baker, 1997), and withdrawal is one indicator for the diagnosis of nicotine dependence as described in the American Psychiatric Asso-

ciation's (1994) *Diagnostic and Statistical Manual of Mental Disorders (DSM–IV)*.

At present, the most frequently used measure of nicotine withdrawal is a self-report questionnaire, the Minnesota Smoking Withdrawal Scale (MNWS; Hughes & Hatsukami, 1986), which consists of individual items that show increases during nicotine abstinence in chronic users. Nine items are usually listed: viz., craving for cigarettes; irritability, frustration, or anger; anxiety; difficulty concentrating; restlessness; increased appetite; disrupted sleep; depressed mood; and impatience (Hughes, 1992; Hughes & Hatsukami, 1986). Except for craving for cigarettes and impatience, these items parallel the symptoms listed as part of the nicotine withdrawal syndrome in the *DSM–IV* (American Psychiatric Association, 1994).

The MNWS has generally been satisfactory in that the set of items, when used as a scale, has reliably reflected cessation of nicotine intake and replacement of nicotine through pharmacotherapy (e.g., Jorenby et al., 1996). However, this assessment approach may be inadequate for some clinical as well as research purposes that require the assessment of individual withdrawal symptoms. In a clinical context, the diagnosis of nicotine withdrawal requires that clinicians reliably assess the presence of individual withdrawal symptoms (American Psychiatric Association, 1994). In the research context, it is now clear that individual withdrawal symptoms have different time courses (Hughes, Higgins, & Hatsukami, 1990; Jorenby et al., 1996) and dissimilar relations with other manifestations of nicotine dependence, including relapse (Piasecki et al., 1997). The MNWS, by using single items to index symptom domains, is susceptible to weaknesses that plague single-item measures (Nunnally & Bernstein, 1994; Paunonen & Jackson, 1985). Not only do single items accentuate item-specific error, but also by their very nature they preclude assessment of internal consistency. Attempts to establish reliability of

withdrawal assessments through repeated measures (test–retest) strategies may be inappropriate because of the fluctuating nature of withdrawal symptoms and the possibility of proactive distortion or interference (repeated ratings may be affected by familiarity with the questionnaire).

In a 1996 review, Patten and Martin questioned the psychometric properties of existing withdrawal questionnaires. They also noted other problems that may limit the utility of the instruments for assessing withdrawal. The Smoker Complaint Scale (Schneider & Jarvik, 1984) is a collection of individual items that does not allow assessment of withdrawal subdomains because items are not aggregated according to symptom type. In addition, only a small portion of the items appears sensitive to smoking abstinence or nicotine repletion (Patten & Martin, 1996). The Smoking Withdrawal Questionnaire (Shiffman & Jarvik, 1976) does have subscales identified through factor analysis. However, these subscales do not map onto withdrawal criteria contained in the *DSM–IV* in a straightforward manner. In addition to the lack of adequate information on internal consistency, data are mixed on sensitivities of the subscales to smoking abstinence or nicotine repletion.

Some investigators use mood scales to assess withdrawal. Limitations of mood scales are that they do not measure the full range of withdrawal symptoms, and they tend to be lengthy. For example, the Multiple Affect Adjective Check List–Revised (Lubin, Zuckerman, Hanson, & Armstrong, 1986) consists of 132 items and has only two scales that relate to specific withdrawal symptoms. The Profile of Mood States (McNair, Lorr, & Droppleman, 1971) consists of 65 items and has only three scales that relate to specific withdrawal symptoms. Neither assesses other withdrawal symptoms such as sleep disturbance, hunger, or craving. A brief questionnaire that comprehensively assesses withdrawal symptoms is needed to address the deficiencies of the current measures.

The goal of this research is to produce a nicotine withdrawal questionnaire that permits reliable assessment of the different elements of the smoking withdrawal domain. The questionnaire must be brief so as not to be burdensome in a clinical or research context. A 37-item scale, the Wisconsin Smoking Withdrawal Scale (WSWS), was developed to contain reliable subscales tapping the major symptom elements of the nicotine withdrawal syndrome. Items were based on previous research and drew on those used in other withdrawal questionnaires (Hughes & Hatsukami, 1986; Schneider & Jarvik, 1984; Shiffman & Jarvik, 1976). The final scales of the WSWS reflect the pioneering work done by Hughes and Hatsukami in this area (Hughes & Hatsukami, 1986; Hughes et al., 1990). Eight scales were developed on theoretical grounds (Paunonen & Jackson, 1985) to include *DSM* symptoms and other signs of withdrawal. These scales were anger, anxiety, sadness, concentration, hunger, somatic symptoms, sleep, and craving. The items are scored on a 5-point scale, with 0 indicating *strongly disagree* and 4 indicating *strongly agree*. This response scale permitted reverse-scored items to use the same response scale. The WSWS has been administered to participants in several smoking cessation studies (e.g.,

Jorenby et al., 1995, 1996). However, those studies did not report data gathered using the WSWS because its reliability and validity have not yet been established. In this article, we report efforts to refine the scale and establish its reliability and validity.

## Method

Data from two studies were used to analyze the internal consistency of each theoretically derived subscale as well as to assess the psychometric properties of the whole scale (Jorenby et al., 1995, 1996). Item dispersion and item-total correlations were examined to identify items for possible deletion from the questionnaire. These properties were examined with respect to two assessment occasions in each study: pretreatment and posttreatment. Items that failed to increase coefficient alpha in at least three of the four analyses were removed from the questionnaire. However, no subscale was reduced to fewer than three items to preserve adequate psychometric properties (Nunnally & Bernstein, 1994).

Study 1 (Jorenby et al., 1996) was a randomized, double-blind, placebo-controlled clinical trial that recruited 211 participants (114 women and 97 men). The average age of participants was 41 years ($SD = 9.9$ years; range = 19–70 years). The ethnic background was 98% White. Participants were assigned randomly to receive either an active or placebo nicotine patch ($ns = 105$ and 106, respectively). Participants were recruited at two sites (98 at Madison, WI, and 113 at Minneapolis, MN). The purpose of the study was to characterize nicotine withdrawal symptoms. The study lasted 5 weeks, and participants completed daily diaries that included the WSWS. The first week was a prequit baseline. Pharmacological treatment consisted of 21-mg transdermal nicotine patches or placebo patches containing approximately 13% of the nicotine found in the active patches. A new patch was worn daily for 4 weeks.

For internal consistency analyses in Study 1, scores from the 7th day before quit date and 1 day after quit date were used. The prequit date was chosen to avoid possible increases in anxiety as the quit date approached. All 200 participants with data for that day were still smoking. The first postquit day was chosen as the time when withdrawal symptoms would be severe and not yet contaminated by numerous postcessation lapses. We did not collect carbon monoxide (CO) samples on that particular day, but 163 of the 198 participants providing data for that day claimed abstinence and had a confirmatory CO test 1 week later (on Day 7).

Study 2 (Jorenby et al., 1995) was a randomized, double-blind clinical trial that recruited 504 participants (269 women and 235 men) at two sites (252 each from Madison, WI, and Rochester, MN). The average age of participants was 44 years. The ethnic background was 98% White. Participants received either regular-dose (22 mg) or high-dose (44 mg) transdermal nicotine therapy with one of three levels of counseling. Each participant wore two patches daily for 4 weeks, either two 22-mg patches or one 22-mg patch and one placebo patch. The placebo patches in this study contained no nicotine. During Weeks 5 and 6, all participants wore one 22-mg patch. During Weeks 7 and 8, participants wore one 11-mg patch. Participants completed one questionnaire per week and were assessed for their smoking status. Participants completed five weekly diaries that included the WSWS. The first week was a prequit baseline.

Because only weekly diaries were collected in Study 2, internal consistency analyses used scores from the week before the quit date (500 participants with data) and the first week after the quit day (of 469 participants with data, 414 had a CO of no more than 10 ppm).

The directions for the questionnaire (see Appendix) were

Table 1
*Post-quit Coefficients Alpha for Studies 1 and 2*

| Subscale | Study 1 | Study 2 |
|---|---|---|
| Anger | .89 | .88 |
| Anxiety | .75 | .75 |
| Concentration | .90 | .86 |
| Sadness | .86 | .79 |
| Hunger | .89 | .85 |
| Sleep | .93 | .90 |
| Craving | .90 | .88 |
| Whole scale | .91 | .90 |

customized to match the interval between completion of the questionnaire for each study: "over the last 24 hours" for Study 1 and "over the last week" for Study 2.

## Results

Coefficient alpha was used to assess the internal consistency of the scales of the WSWS. In each study, coefficient alpha was calculated before quitting (before withdrawal) and after quitting (during the first week of cessation). The three items constituting the general Somatic Symptoms subscale were eliminated because of the low coefficients alpha (.61 and .35, respectively, for the pre- and postquit measures in Study 1), resulting in the elimination of the Somatic Symptoms subscale from the questionnaire. Six items that failed to increase coefficient alpha in at least three of the four analyses were then removed from the questionnaire. Three items related to dreams were eliminated from the Sleep subscale, and one item each was eliminated from the Anger, Craving, and Hunger subscales. This resulted in a 28-item questionnaire with seven subscales with three to five items per scale (see Appendix).

Postquit coefficients alpha are listed in Table 1 for both Studies 1 and 2. In Study 1, prequit coefficients alpha ranged from .81 to .89. In Study 2, prequit coefficients alpha ranged from .70 to .88. The correlation matrix of subscale scores for both studies is presented in Table 2.

A coefficient alpha cannot be calculated for the MNWS because only single items are used to measure withdrawal symptoms. A test–retest zero-order correlation between repeated measures can provide an estimate of reliability. Zero-order correlations for the MNWS items decline rapidly when there is more than 24 hr between assessments. For

example, analyses of the MNWS used in Study 1 revealed that the zero-order correlation between Postquit Day 1 and Day 2 of the "Irritability, Frustration, Anger" item was .62 and between Postquit Day 1 and Day 3 the correlation, .52. Having to infer reliability on the basis of separate administrations of these single items may suggest a lack of reliability, which, in fact, actually reflects the lability of withdrawal symptoms.

### Confirmatory Factor Analysis

Confirmatory factor analyses (CFA) were performed on the first weekly sample from the second study using the final 28 items listed in the Appendix. We compared the seven-factor a priori model that guided our scale development with alternative models, including a four-factor model, a one-factor model, and a model with a second-order factor representing "Affect-Urge." The one-factor model would represent withdrawal, at least as measured at a single point in time, as a unitary construct. This is consistent with the manner in which current assessments of nicotine withdrawal are often used by researchers (i.e., collapsing across different withdrawal items of the MNWS; Fiore, Jorenby, Baker, & Kenford, 1992) and also consistent with theoretical discussions that treat withdrawal as a unitary construct. The four-factor model groups negative affect, Craving, Hunger, and Sleep disturbance into separate factors. The negative affect factor comprised items that otherwise constituted the Anger, Anxiety, Sadness, and Concentration subscales. The rationale for this factor is the fact that negative emotions tend to be highly intercorrelated and often yield a common factor (Watson & Clark, 1992). Moreover, some drug motivational models emphasize the role of negative affectivity and do not distinguish among the specific negative emotions (Baker et al., 1986). Finally, inability to concentrate was included in this factor because of previous findings that it loaded highly on a negative affectivity factor (Hughes, 1992; Piasecki et al., 1997; also cf. Table 2). The Craving subscale was analyzed as a separate factor because it is not an element of the *DSM–IV* nicotine withdrawal syndrome. It typically shows a unique time course relative to other withdrawal symptoms (Hughes et al., 1990) and may have unique origins (Tiffany & Drobes, 1991). Hunger and Sleep constitute the remaining two factors because they represent independent constructs. A three-factor model that combined

Table 2
*Correlation Matrix of Subscale Scores*

| Subscale | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| 1. Anger | — | .76** | .57** | .47** | .51** | .28** | .11 |
| 2. Anxiety | .76** | — | .60** | .54** | .58** | .38** | .16* |
| 3. Sadness | .67** | .65** | — | .45** | .42** | .29** | .06 |
| 4. Concentration | .52** | .60** | .62** | — | .36** | .17* | .02 |
| 5. Craving | .49** | .48** | .42** | .38** | — | .09 | .14** |
| 6. Sleep | .14** | .23** | .24** | .24** | .25** | — | −.01 |
| 7. Hunger | .08 | .10* | .04 | .08 | .20** | .07 | — |

*Note.* Values from Study 1 are above the diagonal. Values from Study 2 are below the diagonal.
*p < .05, two-tailed. **p < .01, two-tailed.

Hunger and Sleep into a physical symptoms factor achieved a poorer fit when compared with the four-factor model and is, therefore, not reported.

Thus, the four-factor model grouped Anger, Anxiety, Sadness, and Concentration subscales from the seven-factor model into a negative affect factor with Sleep, Hunger, and Craving as the remaining three factors. The seven-factor model allows all seven latent variables to covary. Two second-order factor models were examined. One model had each of the seven factors loading onto a single higher order withdrawal factor, whereas the second model eliminated the Hunger and Sleep factor loadings, creating a higher order affect-urge factor. Because these two second-order models had nearly identical fit indexes, only the more parsimonious affect-urge model is reported. Standardized regression weights from the affect-urge factor to the Anger, Anxiety, Sadness, Concentration, and Craving factors were .91, .99, .87, .72, and .60, respectively. A small number of participants (21 of 490, or 4%) were missing data for one or more items on the first weekly postquit assessment in Study 2 and were excluded from the analyses. The small number of participants in Study 1 resulted in unstable solutions for some models, so the CFA analyses from Study 2 only are reported.

Table 3 presents the CFA results for Study 2. Multiple criteria have been recommended for evaluation of model fit from different perspectives (Crowley & Fan, 1997). A comparative fit index (CFI) above .90 is considered to indicate good fit (Crowley & Fan, 1997). Examination of the fit of the four models using data from the first postquit week of Study 2 shows a CFI of .91 for the seven-factor model, .72 for the four-factor model, .47 for the one-factor model, and .90 for the second-order factor model. It is clear from the fit indexes that the seven-factor model provides a superior fit compared with the one- and the three-factor models. However, the second-order factor model also yielded excellent fit indexes. No modifications to the seven-factor model or the second-order factor model were necessary to obtain a satisfactory result.

### Predictive Validity

Withdrawal symptoms are expected to follow several specific performance characteristics (Hughes et al., 1990). For example, withdrawal symptoms should increase with initial abstinence, decline with continued abstinence, and

Table 3

*Fit Indexes for One-, Four-, and Seven-Factor Models and a Second-Order Factor Model for Study 2*

| Model | $df$ | $\chi^2$ | CFI | PCFI | NFI | RMR | RMSEA |
|---|---|---|---|---|---|---|---|
| One factor | 350 | 4,418.51 | .47 | .44 | .45 | .21 | .16 |
| Four factor | 344 | 1,560.68 | .84 | .77 | .81 | .09 | .09 |
| Seven factor | 329 | 1,002.62 | .91 | .79 | .88 | .08 | .07 |
| Second order | 345 | 1,090.53 | .90 | .82 | .87 | .13 | .07 |

*Note.* CFI = comparative fit index; PCFI = parsimonious comparative fit index; RMR = root mean square residual; RMSEA = root mean square error of approximation; NFI = normed fit index.

decrease with nicotine replacement treatment. The following analyses address these three characteristics by testing the change between prequit and postquit ratings, testing the linear trend of the ratings over 4 weeks of postquit ratings, and testing the main effect of nicotine replacement compared with placebo during treatment.

Using data from Study 1, a multivariate, repeated measures general linear model showed significant multivariate tests for the change in mean ratings from the prequit week to the first postquit week ($p < .001$) and for the interactions between the change in ratings and treatment group ($p = .002$). Univariate tests showed significant increases in mean ratings for all seven WSWS subscales and for the total WSWS rating (all $ps < .001$). Univariate tests for the interaction between the changes in mean ratings and treatment group were significant for the total WSWS rating and six of the seven subscales ($p = .003-.023$). Only the Sleep Subscale × Treatment Group interaction was not significant ($p = .366$). In contrast, only five of the nine item ratings of the MNWS demonstrated a significant interaction with treatment group: Anger, Anxiety, Concentration, Craving, and Impatience. Ratings of Depression, Hunger, Sleep, and Restlessness were not significant ($ps = .054, .080, .362$, and .142, respectively).

Using the four postquit weekly mean ratings from Study 1, a multivariate, repeated measures general linear model showed a significant within-subjects effect ($p < .001$) and a significant treatment group effect ($p = .029$). Univariate tests indicated a significant linear decrease for all subscales' mean ratings from Week 1 through Week 4 (all $p < .001$, except sleep, $p = .002$, and hunger, $p = .032$). The MNWS showed similar results.

When examining treatment group differences for each weekly mean rating from Study 1, a multivariate general linear model showed a significant group effect for the WSWS at Weeks 1 and 2 but only at Week 1 for the MNWS. Univariate tests at Week 1 showed a significant difference for all WSWS subscales except Hunger and Sleep and for all MNWS items except Hunger, Sleep, and Restlessness. Univariate tests at Week 2 showed a significant difference for the Anger subscale of the WSWS.

The weekly means (from Study 1) of the withdrawal symptoms represented by the seven WSWS subscales are illustrated in Figure 1. The Anger, Anxiety, Concentration, and Sadness subscales exhibit a typical withdrawal symptom pattern with an increase in symptom ratings for the first week after quitting (compared with the prequit week) followed by a gradual return to prequit symptom ratings over the next 3 weeks. Hunger ratings remain elevated throughout the postquit weeks and were related to an increase in weight over this same time period. Craving ratings show a smaller increase in the first week followed by a rapid decline below prequit levels. The Sleep subscale is the only one to show higher symptom levels in the nicotine patch group than in the placebo group. There are at least two possible explanations for this. One is that the more vivid dreams reported with patch use are subjectively interpreted as sleep disturbance. The other is that nicotine levels from the patch peak during the day when other symptoms are
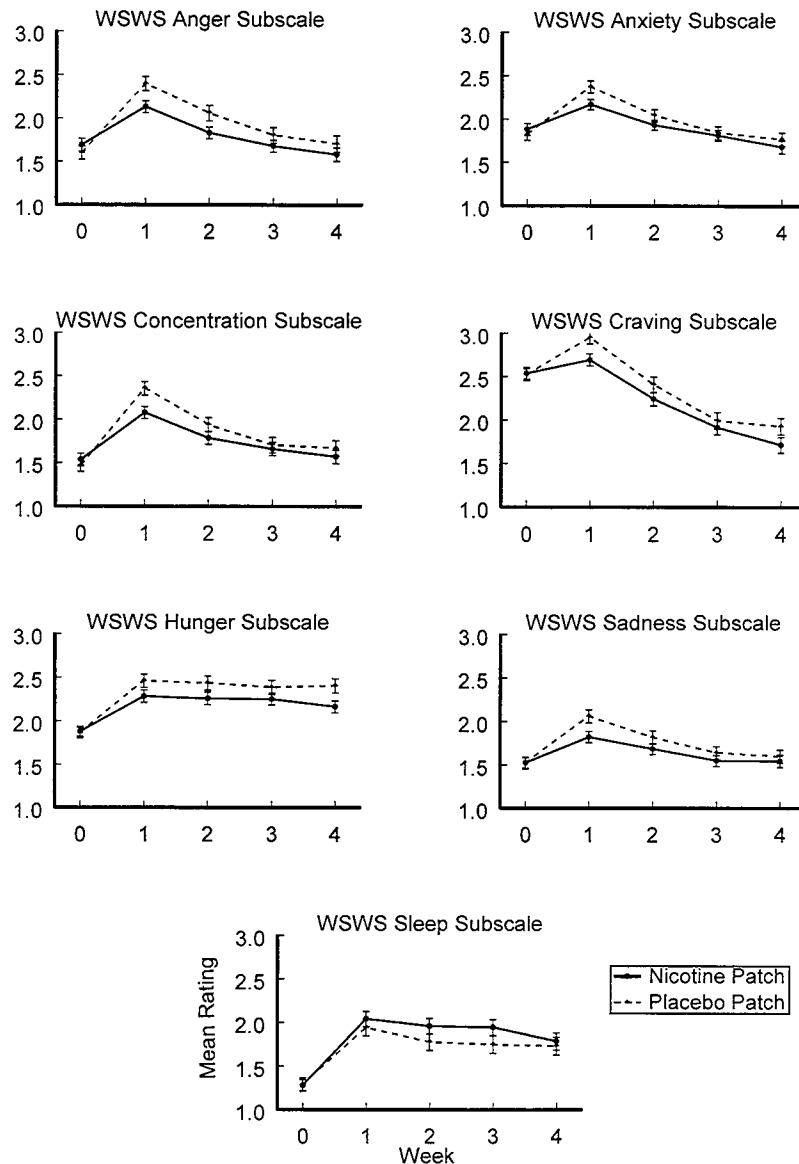
*Figure 1.* Weekly mean Wisconsin Smoking Withdrawal Scale (WSWS) subscale ratings (with *SE* bars) in participants receiving nicotine ($n = 105$) and placebo ($n = 106$) patch treatment in Study 1.

present, whereas blood levels at night are low. Thus, the higher levels of sleep disturbance reported by the nicotine patch users may reflect untreated withdrawal.

A logistic regression analysis was conducted to examine the predictive validity of the subscale scores. To ensure a prospective analysis, only the 163 participants abstinent during Week 1 (35 participants smoked during the first week) were included in the analysis. Self-reported abstinence was biochemically confirmed with a CO of less than 10 ppm. The dependent variable was continuous abstinence (abstinent vs. smoking) throughout the remainder of the 4-week duration of Study 1. The independent variables were mean withdrawal ratings in Week 1. Covariates entered as a block at Step 1 were treatment group, study site, sex, and age. The seven WSWS subscale ratings from Week 1 were

entered as a block at Step 2. This step was statistically significant, $\chi^2(7, N = 163) = 15.19, p = .034$. The Craving subscale was, by itself, significantly predictive of smoking ($B = 1.31, SE = .48$). Using the same procedure, substituting the nine items of the MNWS in the second step produced nonsignificant results, $\chi^2(9, N = 163) = 9.86, p = .362$.

## Discussion

The coefficients alpha listed in Table 1 suggest that the reliability of the WSWS is quite good when used with individuals experiencing nicotine withdrawal. The postquit values for the subscales range from .75 to .93, with the coefficients alpha for the total scale in Studies 1 and 2 at .91 and .90, respectively. CFA supports the a priori construction

of seven subscales with a CFI of .91 for Study 2. Fit indices for one- and four-factor models were considerably worse (see Table 3). A second-order factor model that loads five of the seven subscales onto an Affect-Urge factor has fit indexes similar to the model with seven correlated factors.

More research must be done, however, before the optimal structure for the WSWS is identified. For instance, it is clear that some of the subscales truly appear to reflect different constructs. Thus, in the second-order factor model, the Hunger and Sleep subscales do not load on the affect-urge factor because they were not highly intercorrelated; nor were they highly correlated with other withdrawal scales (see Table 2). Moreover, these subscales showed less sensitivity to nicotine replacement then did other scales. Yet ample evidence suggests the presence of a second-order factor, as suggested by the high correlations among the affect and Craving subscales and their similar sensitivity to tobacco abstinence and nicotine replacement. Despite these high correlations, it is important to preserve all of the subscales. The individual subscales have important clinical meaning and represent separable, although correlated, psychological constructs. In the final analysis, the appropriate theoretical-conceptual model of withdrawal will not emanate from factor analysis per se, which might reflect linguistic or semantic distinctions that are not reflected in withdrawal processes or mechanisms. Further research using psycho-metrically sound scales of specific withdrawal domains should yield important information on the most appropriate model of withdrawal symptomology.

The seven subscales of the WSWS relate directly to six of the eight nicotine withdrawal symptoms listed in the *DSM–IV*. The two symptoms not measured by the WSWS are restlessness and decreased heart rate. Although craving for cigarettes is no longer listed in the *DSM–IV* criteria for nicotine withdrawal, it is included as a WSWS subscale. It is included because considerable research suggests that craving is influenced by withdrawal (Jorenby et al., 1996; Zinser, Baker, Sherman, & Cannon, 1992; cf. Figure 1), because craving is viewed as an element of withdrawal by many motivational models of addiction (Baker et al., 1986; Siegel, 1983; Solomon, 1977) and because craving has considerable clinical importance (e.g., it predicts relapse likelihood; see Shiffman et al., 1997).

Validity assessments also show good support for the WSWS. Correlations of the WSWS negative affect scales (e.g., Anger, Anxiety) with the Negative Affect scale of the Positive and Negative Affect Schedule (Watson, Clark, & Tellegen, 1988) are fairly high, ranging from .46 to .59 with a correlation of .64 for the four subscales combined. Examination of the correlation matrix for the subscale scores (see Table 2) shows high correlations between negative affect subscales and the Craving subscale; the Hunger subscale is mostly uncorrelated with the other subscales, whereas the Sleep subscale is moderately correlated with the negative affect subscales. These correlations show that the subscales can discriminate appropriately between symptom types and also reveal the positive relationship between negative affect and craving (Baker et al., 1986). In addition, the WSWS significantly predicted smoking outcomes,

whereas the MNWS was less successful in this regard. Therefore, the use of multiple sets of reliable items may yield a clearer picture of the construct relations of withdrawal (Patten & Martin, 1996).

Patten and Martin (1996) reviewed three commonly used self-report withdrawal questionnaires: the Shiffman-Jarvik Smoking Withdrawal Questionnaire (Shiffman & Jarvik, 1976), the Smoker Complaint Scale (Schneider & Jarvik, 1984), and the Minnesota Nicotine Withdrawal Scale (Hughes & Hatsukami, 1986). They found psychometric properties inadequate for all three scales and noted that "it is apparent that the three general measures of tobacco withdrawal have been employed and subsequently recommended in the absence of appropriate or sufficient reliability and validity analyses" (p. 104). The WSWS subscales, presented in the Appendix, may be superior to existing instruments in some respects; for instance, the WSWS has good psychometric properties considering the number of items in the various subscales. However, numerous important questions remain regarding the WSWS. One question is the generalizability to non-White populations. Another question concerns whether additional subscales should be added. In addition, the WSWS may be improved by the use of a rating scale that is more sensitive at the lower end of the rating scale. Hughes and Hatsukami (1998) suggested three alternate rating scales for use with the MNWS, and it is unclear what sort of rating scale is optimal for withdrawal assessment. Further empirical testing of the WSWS may identify the optimal scale for discriminating differences and changes in withdrawal symptoms.

The present research demonstrates that the WSWS comprises seven internally consistent subscales that assess principal smoking withdrawal symptoms. This scale is sensitive to smoking withdrawal and is predictive of smoking cessation outcomes. The data conform to either a seven-factor data structure or a higher order factor structure. Moreover, the questionnaire is sufficiently brief so that it can be used in both the clinical and research contexts.

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# Appendix

## The 28-Item Wisconsin Smoking Withdrawal Scale Sorted by Subscale

Please answer the following questions based on how you have felt or what you have noticed [over the last 24 hours/*over the last week*]. Answer based on how you have felt in general during this time.

| 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Strongly disagree | Disagree | Feel neutral | Agree | Strongly agree |

| No. | Item | Subscale |
|---|---|---|
| 13 | I have been irritable, easily angered. | Anger |
| 15 | I have been bothered by negative moods such as anger, frustration, and irritability. | Anger |
| 18 | I have felt frustrated. | Anger |
| 3 | I have been tense or anxious. | Anxiety |
| 6 | I have felt impatient. | Anxiety |
| 8 | I have found myself worrying about my problems. | Anxiety |
| *10 | I have felt calm lately. | Anxiety |
| *4 | My level of concentration is excellent. | Concentration |
| 23 | It is hard to pay attention to things. | Concentration |
| 27 | It has been difficult to think clearly. | Concentration |
| 9 | I have had frequent urges to smoke. | Craving |
| 11 | I have been bothered by the desire to smoke a cigarette. | Craving |
| 20 | I have thought about smoking a lot. | Craving |
| 26 | I have trouble getting cigarettes off my mind. | Craving |
| *1 | Food is not particularly appealing to me. | Hunger |
| 14 | I want to nibble on snacks or sweets. | Hunger |
| 16 | I have been eating a lot. | Hunger |
| 21 | I have felt hungry. | Hunger |
| 28 | I think about food a lot. | Hunger |
| *7 | I have felt upbeat and optimistic. | Sadness |
| 12 | I have felt sad or depressed. | Sadness |
| 19 | I have felt hopeless or discouraged. | Sadness |
| *24 | I have felt happy and content. | Sadness |
| *2 | I am getting restful sleep. | Sleep |
| 5 | I awaken from sleep frequently during the night. | Sleep |
| *17 | I am satisfied with my sleep. | Sleep |
| *22 | I feel that I am getting enough sleep. | Sleep |
| 25 | My sleep has been troubled. | Sleep |

*These items are reverse scored.