CLINICAL TRIAL REPORT

# Comparative Analysis of Alternate Measures of Readiness to Quit Smoking: Stages of Change and the Contemplation Ladder

Kelsey Miskimins, Amanda Kaufmann, David AF Haaga [ID]

Department of Psychology, American University, Washington, DC, USA

Correspondence: David AF Haaga, Department of Psychology, Asbury Building, American University, 4400 Massachusetts Ave. NW, Washington, DC, 20016-8062, USA, Tel +1-202-885-1718, Fax +1-202-885-1023, Email dhaaga@american.edu

**Purpose:** Two methods of operationalizing readiness to quit smoking have been used extensively in prior research. An algorithm derived from the transtheoretical model classifies current smokers in distinct stages of precontemplation (not intending to quit in next 6 months), contemplation (serious intent to quit within 6 months), and preparation (serious intent to quit within 30 days). The Contemplation Ladder (CL) is a single-item continuous (0–10) rating. The current study, a secondary analysis of a clinical trial testing a method of inducing quit attempts, examined the convergent validity, one-month retest reliability, and predictive validity (for quit attempts) of the CL and the stages of change algorithm.

**Patients and Methods:** Adult daily smokers (≥10 cigarettes/day; N = 278) completed the CL and stage of change algorithm measures and underwent an experimental manipulation intended to induce quit attempts. Four weeks later they completed the same measures and reported on whether they had attempted to quit smoking in the interim.

**Results:** The CL and the staging algorithm showed strong convergent validity, with intercorrelations of 0.50 and 0.51 at baseline and follow-up assessments. Retest reliability was similar for each measure (CL $r = 0.52$; stage of change $r = 0.57$). Each showed predictive validity in that smokers who went on to make a quit attempt had scored significantly higher at baseline in readiness to quit.

**Conclusion:** Researchers and clinicians can reasonably choose either measure of readiness to quit smoking with confidence that the results would parallel what would have been obtained with the other.

**Keywords:** smoking, assessment, contemplation, cessation

## Introduction

The transtheoretical model advanced by Prochaska, DiClemente et al greatly influenced thinking about addictive behavior change, particularly in the sense of characterizing readiness to change as being more complex than the dichotomy of ready vs not ready and perhaps in denial of the problem.[1] Research based on this framework typically operationalizes readiness to change a behavior such as cigarette smoking by means of a stage of change algorithm.[2] Someone in the precontemplation stage, characterized by a lack of motivation for change, does not seriously intend to quit smoking within the next six months. The contemplation stage, which is associated with greater awareness of the negative consequences of current behavior and the need for change, is operationally defined as having a serious intent to quit smoking within the next 6 months. The preparation stage entails intent to quit within the next 30 days and indeed the initiation of some changes. Finally, action (1 day to 6 months of abstinence from smoking) and maintenance (more than 6 months of abstinence) stages would go beyond readiness to change and require actually making the behavior change of quitting smoking. Stage classification has shown high short-term retest reliability[3,4] and has proven useful as a predictor of behavior change. For example, a secondary analysis of five smoking cessation trials found that 37% of those in the preparation stage at baseline were abstinent at 24-month follow-up, compared to 26% of contemplators and 16% of precontemplators.[5] Similarly, stage of change predicted making a quit attempt in the following year.[6]

Whereas the concept that readiness to change among current smokers is not a dichotomy has been widely accepted, the conceptual and practical utility of segmenting levels of readiness into stages, and the validity of the particular cutpoints for differentiating precontemplation, contemplation, and preparation, have been questioned.[7] The Contemplation Ladder[8] provides an alternative assessment of readiness to quit smoking without invoking stages. It consists of a visual depiction of a ten-rung ladder and calls for a 0–10 rating as to where one stands on the ladder, where 0 reflects "no thought of quitting", and 5 signifies "think I should quit but not quite ready", while 10 would mean "taking action to quit (ie cutting down, enrolling in a program)".[8]

Few studies have included both the stages of change algorithm and the Contemplation Ladder and conducted a comparative empirical examination. One study of adolescent smokers[9] found stronger associations with theoretically related constructs for groups formed on the basis of score ranges on the Contemplation Ladder than for groupings formed via the stages of change algorithm. The authors' interpretation was that the precontemplation stage in particular is heterogeneous and contains some arguably misclassified participants who actually are somewhat motivated to change their behavior. A large worksite smoking cessation trial found the univariate predictive ability of the stages of change algorithm for 2-year follow-up smoking status to be the same (partial correlation of 0.11, controlling for other predictors) as that of the Contemplation Ladder.[10] Correlation of the two measures of readiness to quit was not a focus of this research.

Thus, both the stage algorithm derived from the transtheoretical model and the Contemplation Ladder have proven useful for predicting changes in smoking behavior, but there is not much evidence from samples of adult smokers of the extent to which they yield converging results. Interpretation of results from studies using only one or the other measure would be facilitated by knowing how highly they are correlated. The current study is a secondary analysis of research evaluating a method of inducing quit attempts.[11] The stages of change algorithm and Contemplation Ladder were measured at a baseline assessment and again at one-month follow-up. The convergent validity of the measures was evaluated, along with their retest reliability and their association with occurrence of a quit attempt in the subsequent month.

## Materials and Methods
### Participants

Participants were 278 adult smokers (133 women, 145 men) with a mean age of 49.79 years (SD = 11.42). A majority were African American (N = 215), whereas 47 were white/Caucasian, 8 Native American, 4 Asian, and 1 Pacific Islander/Native Hawaiian (3 declined to identify race). Participants reported an average baseline smoking rate of 16.62 cigarettes per day (SD = 8.13) and moderate nicotine dependence (Fagerstrom Test of Nicotine Dependence mean = 5.42, SD = 2.00). Inclusion criteria were (a) age 18 or older, (b) daily smoker (≥10 cigarettes/day), (c) total score <=5 on the Modified Mini Screen[12] and a score of 0 on the suicidality item, (d) fluent English speaker, and (e) intentions of remaining local for the duration of the study. Participants were excluded if they could not be contacted after expressing initial interest, could not travel to the lab, or were no longer interested in the study, as well as if they scored ≥6 on the MMS, suggesting high risk of anxiety, mood, or psychotic disorders.[11]

### Measures

Readiness to quit smoking was measured in two ways. The Contemplation Ladder[8] is a ladder with rungs numbered from 1 to 10, where the bottom rung (0) corresponds to "no thought of quitting" and the top rung (10) indicates "taking action to quit". The stages of change algorithm[1] assesses the self-reported timeline that an individual reports they will consider making a behavioral change and sorts them into one of five corresponding stages. The first three stages of change were the only salient stages in this study given that the aim was to investigate a possible intervention method to induce quit attempts, with the sample consisting of daily smokers.[11] Participants were sorted into one of the stages based on the timeline that they provided for motivation to make a meaningful behavioral change in relation to their smoking, such that intention to quit within the next 30 days is preparation (coded as 3), within the next 6 months but not 30 days is contemplation (coded as 2), and no intention in the next 6 months is precontemplation (coded as 1).

**168**

Substance Abuse and Rehabilitation 2023:14

## Procedure

Participants completed the measures of readiness to quit smoking as well as other measures not relevant to this report. After completing baseline measures, they were randomly assigned to receive either (a) neutral or (b) "looming vulnerability" (to the negative physical health consequences of smoking) guided imagery exercises. At a four-week follow-up, participants completed the same battery of measures and reported on any quit attempts between sessions. Full method details may be found in the report of the parent experiment.[11] There was 12% attrition from baseline to follow-up. Participants in the study provided informed consent and were treated in accordance with ethical standards of the American Psychological Association code. The study complied with the Declaration of Helsinki and was approved by the American University IRB and pre-registered on ClinicalTrials.gov (NCT02522156).

# Results

## Convergent Validity

Spearman rank-order correlations were used to quantify the association between Contemplation Ladder scores and stage of change algorithm scores. As reflected in Table 1, at both the baseline assessment ($r = 0.51$) and one-month follow-up ($r = 0.50$), the two measures of readiness to quit smoking were positively correlated, supporting the convergent validity of each. To give another perspective on the convergence of these measures, there were significant differences at baseline on the Contemplation Ladder between participants in the preparation (n = 87, $M = 7.82$, $SD = 1.99$), contemplation (n = 80, $M = 6.10$, $SD = 2.24$), and precontemplation (n = 106, $M = 4.61$, $SD = 2.59$) stages, $F (2, 270) = 45.92$, $p < 0.001$, with all three pairwise comparisons significant ($p < 0.001$) by the Tukey–Kramer multiple comparison procedure.

## Retest Reliability

Scores on each measure were similar at baseline and follow-up (see Table 2). As such, and given that the experimental manipulation had no significant effect on quit attempts,[11] we considered it meaningful to frame the correlation of baseline with one-month follow-up data as a straightforward evaluation of retest reliability of the measures. In each case, as shown in Table 1, the results indicated fairly high retest reliability (CL: ($r = 0.52$, $p < 0.001$); Stage of change: ($r = 0.57$, $p < 0.001$)).

**Table 1** Intercorrelations of Contemplation Ladder and Stage of Change Status at Baseline and Follow-up

|  | **Baseline CL** | **Baseline SoC** | **Follow-up CL** | **Follow-up SoC** |
|---|---|---|---|---|
| Baseline CL |  |  |  |  |
| Baseline SoC | 0.51* |  |  |  |
| Follow-up CL | 0.52* |  |  |  |
| Follow-up SoC |  | 0.57* | 0.50* |  |

**Note**: *$p < 0.001$.
**Abbreviations**: CL, Contemplation Ladder; SoC, Stage of Change.

**Table 2** Descriptive Statistics for Contemplation Ladder and Stage of Change Status at Baseline and Follow Up

|  | **CBaseline** | **Follow-Up** |
|---|---|---|
| Contemplation Ladder | $M = 6.09$, $SD = 2.67$ | $M = 6.20$, $SD = 2.76$ |
| Stage of Change | $M = 1.93$, $SD = 0.84$ | $M = 2.00$, $SD = 0.84$ |

**Notes**: Stage of change scored as Precontemplation = 1, Contemplation = 2, Preparation = 3.

## Predictive Validity

To evaluate predictive validity, we compared baseline scores on each measure between groups defined by whether they did or did not subsequently make a quit attempt by the time of the one-month follow-up. For the Contemplation Ladder, a Levene's test revealed significantly unequal variances, so the "equal variances not assumed" result was used and revealed a significant difference ($t$ (70.223) = −4.44, $p < 0.001$). Participants who reported a quit attempt between assessments (n = 44, $M = 7.61$, $SD = 2.36$) had significantly higher baseline Contemplation Ladder scores than did those who did not report a subsequent quit attempt (n = 186, $M = 5.82$, $SD = 2.62$), corresponding to a medium-large effect size (Cohen's $d = 0.70$).

For the stage of change algorithm as well, variances were significantly unequal. Again, those who reported a quit attempt at follow-up (n = 45, $M = 2.49$, $SD = 0.79$) were significantly more ready for change than were those who did not make a quit attempt within the following month (n = 185, $M = 1.73$, $SD = 0.78$), ($t$ (66.75) = −5.81, $p < 0.001$). The group difference corresponded to a large effect size (Cohen's $d = 0.78$).

## Discussion

In a secondary analysis of an experiment testing an imagery-based method of intended to induce smoking cessation attempts, this study compared two alternate indicators of adult smokers' readiness to change their smoking behavior. Results showed the one-item continuous rating provided by the Contemplation Ladder[8] and the stage of change algorithm associated with the transtheoretical model[1] to yield similar information. Both at baseline and again at one-month follow-up, the measures were positively correlated with one another, supporting convergent validity. Both showed high retest reliability, and as in earlier research[10] each showed similar favorable evidence of predictive validity, meaning in the present study that participants who made a quit attempt in the month between assessments had scored higher at baseline on readiness measures than had those who made no quit attempt.

A methodological strength of the study was its fairly sizable and demographically diverse sample. By the same token, the short (one month) follow-up period is a limitation, and it would be important in future studies to evaluate predictive validity and retest reliability at longer intervals and to see if scores on the measures tend to change in tandem over such longer follow-up periods. Also, exclusion criteria for the parent trial restrict the generalizability of the findings. For instance, smokers at high risk for anxiety, mood, or psychotic disorders were ineligible. Future studies of these measures should include such participants in order to evaluate whether our results extend to these groups.

In conclusion, researchers and clinicians can reasonably choose either measure of readiness to quit smoking with confidence that the results would parallel what would have been obtained with the other, and reviewers can consider studies using one or the other indicator closely comparable.

## Conclusion

Researchers and clinicians can reasonably choose either measure of readiness to quit smoking with confidence that the results would parallel what would have been obtained with the other.

## Data Sharing Statement

The data that support the findings of this study are available from the corresponding author, [DAFH], upon reasonable request.

## Disclosure

The authors report no conflicts of interest in this work.

## References

1. DiClemente C, Prochaska J, Fairhurst S, Velicer W, Velasquez M, Rossi J. The process of smoking cessation: an analysis of precontemplation, contemplation, and preparation stages of change. *J Consult Clin Psychol*. 1991;59(2):295–304. doi:10.1037/0022-006X.59.2.295

2. Prochaska J, DiClemente C. Trans-theoretical therapy: toward a more integrative model of change. *Psychother*. 1982;19(3):276–288. doi:10.1037/h0088437

3. Etter JF, Sutton S. Assessing 'stage of change' in current and former smokers. *Addict*. 2002;97(9):1171–1182. doi:10.1046/j.1360-0443.2002.00198.x

4. Mainy N, Dibenedetto S, Hankins M, et al. Immediate test-retest reliabilities of intention to quit smoking measures in current adult smokers. *Qeios*. 2022. doi:10.32388/MZ3COF

5. Velicer WF, Redding CA, Sun X, Prochaska JO. Demographic variables, smoking variables, and outcome across five studies. *Health Psychol*. 2007;26(3):278–287. doi:10.1037/0278-6133.26.3.278

6. Hummel K, Candel MJJM, Nagelhout GE, et al. Construct and predictive validity of three measures of intention to quit smoking: findings from the International Tobacco Control (ITC) Netherlands Survey. *Nicotine Tob Res*. 2018;20(9):1101–1108. doi:10.1093/ntr/ntx092

7. Herzog TA, Blagg CO. Are most precontemplators contemplating smoking cessation? Assessing the validity of the stages of change. *Health Psychol*. 2007;26(2):222–231. doi:10.1037/0278-6133.26.2.222

8. Biener L, Abrams D. The contemplation ladder: validation of a measure of readiness to consider smoking cessation. *Health Psychol*. 1991;10(5):360–365. doi:10.1037/0278-6133.10.5.360

9. Herzog T, Komarla R. How distinct are the stages of change for smoking cessation? A comparison of the stages of change and the contemplation ladder using an adolescent sample. *J Drug Iss*. 2011;11(1):419–440. doi:10.1177/002204261104100306

10. Abrams D, Herzog T, Emmons K, Linnan L. Stages of change versus addiction: a replication and extension. *Nicotine Tob Res*. 2000;2:223–229. doi:10.1080/14622200050147484

11. Haaga DAF, Kaufmann A, Malloy EJ. Looming vulnerability and smoking cessation attempts. *Nicotine Tob Res*. 2020;22(9):1439–1445. doi:10.1093/ntr/ntaa034

12. Alexander MJ, Haugland G, Lin SP, Bertollo DN, McCorry FA. Mental health screening in addiction, corrections, and social service settings: validating the MMS. *Int J Mental Health Addict*. 2008;6(1):105–119. doi:10.1007/s11469-007-9100-x