Published in final edited form as:

J Subst Abuse Treat. 2011 September ; 41(2): 137–147. doi:10.1016/j.jsat.2011.02.010.

Brief Assessment of Readiness to Change Tobacco Use in Treated Youth

Tammy Chung, PhD¹, Stephen A. Maisto, PhD², Anthony Mihalo, BS¹, Christopher S. Martin, PhD¹, Jack R. Cornelius, MD¹, and Duncan B. Clark, MD, PhD¹

¹ Western Psychiatric Institute and Clinic, University of Pittsburgh Medical Center, 3811 O'Hara Street, Pittsburgh, Pennsylvania 15213

² Syracuse University, 430 Huntington Hall, Syracuse, New York 13244

Abstract

This study examined the concurrent and predictive validity of four brief measures of readiness to change tobacco use for use with adolescents in clinical practice: Readiness Ruler, Thoughts About Abstinence (TAA), motivation to abstain, and confidence to abstain; and a single-item measure of difficulty to abstain. Participants were 154 adolescent smokers recruited from outpatient addictions treatment, who completed assessments shortly after admission, and at 6- and 12-month follow-up. Concurrent validity analyses indicated that the four readiness measures were moderately correlated at each time point. Predictive validity analyses indicated that Ruler and motivation to abstain ratings predicted number of cigarettes smoked at 6- and 12-months. Perceived difficulty to abstain predicted cigarette use over and above the readiness to change measures. Results support the clinical utility of the Ruler and motivation to abstain as brief measures of readiness to change, and perceived difficulty to abstain, as tools to aid adolescent tobacco cessation.

Keywords

readiness to change; tobacco; adolescent; substance abuse treatment

1. Introduction

The majority (>80%) of adolescents in substance abuse treatment smoke cigarettes (Myers & Kelly, 2006), and cigarette use tends to persist into young adulthood for the majority of these youth (Myers & Brown, 1997). Although smoking persistence tends to be high, many treated adolescents report attempts to quit smoking, which are often unsuccessful (Myers & MacPherson, 2004). Heavier cigarette users tend to be less ready to change smoking behavior (Ramo, Prochaska, & Myers, 2010; McDonald, Roberts, & Descheemaeker, 2000), and generally have worse substance use outcomes compared to lighter smokers and abstainers (Myers & Kelly, 2006; de Dios, Vaughan, Stanton, & Niaura, 2009). In light of these findings, there is a growing consensus regarding the importance of directly addressing

© 2011 Elsevier Inc. All rights reserved.

Correspondence concerning this article should be addressed to: Tammy Chung, Ph.D., WPIC/Pittsburgh Adolescent Alcohol Research Center, 3811 O'Hara Street, Pittsburgh, Pennsylvania 15213, FAX (412) 246-6550, chungta@upmc.edu.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

tobacco use during substance abuse treatment (e.g., Prochaska, 2010), and the potential utility of motivational enhancement interventions to increase readiness to change smoking behavior among adolescents in treatment (Myers & Kelly, 2006). Little is known, however, regarding optimal methods of assessing readiness to change tobacco use in adolescent substance users, although brief measures of this key construct can inform the structure and content of motivational interventions provided to youth.

Research on readiness to change has been guided by the transtheoretical model of behavior change (Prochaska, 1979; Prochaska & DiClemente, 1982), which proposes that individuals move through distinct stages of change, ranging from precontemplation (i.e., not yet thinking about change) to taking action to maintenance of behavior change. The stage of change model has provided a useful heuristic for understanding behavior change processes, but also has been criticized for complexities regarding determination of stage assignment (e.g., West, 2005). Simpler, single item measures that query desire to change and ability to change have performed as well as more complex stage of change measures in predicting smoking behavior (e.g., Abrams, Herzog, Emmons, & Linnan, 2000; Pisinger, Vestbo, Borch-Johnsen, & Jørgensen, 2005). For clinical purposes, single item measures of readiness to change are optimal, given time constraints and the importance of repeated administration of readiness measures to track changes in “readiness” as a function of treatment. This study focused on four brief measures that assess related aspects of readiness to change tobacco use: Readiness Ruler (Miller, 1985; 1999), Thoughts About Abstinence (Hall, Havassy, & Wasserman, 1990), an item on motivation to abstain, and an item on confidence to abstain.

The Readiness Ruler (Miller, 1985; 1999) has been recommended as a tool for use during motivational enhancement interventions that can help individuals to visualize their current status on a continuum of behavior change, ranging from 1–10. Ruler anchor points include phrases such as “not ready to change,” “unsure” and “trying to change.” A similar measure, the Contemplation Ladder (Biener & Abrams, 1991), depicts a ladder with 10 rungs, which correspond to increasing levels of readiness to change. Ladder scores have demonstrated reliability and validity in studies of smoking cessation in adults (review: Carey, Purnine, Maisto, & Carey, 1999), and in research with adolescent smokers (e.g., Stephens, Cellucci, & Gregory, 2004). In a sample of adjudicated youth in residential substance abuse treatment, marijuana ladder scores demonstrated predictive validity over 3-month follow-up (Slavet et al., 2006). Less is known regarding the use of the Ruler as a measure of readiness to change tobacco use in adolescents, despite its common use as a tool in motivational enhancement interventions.

In contrast to the Ruler, which explicitly assesses “readiness to change,” the Thoughts About Abstinence (TAA) measure asks the adolescent to identify his/her current goal regarding abstinence from tobacco use. TAA measures the degree to which the adolescent’s goal is total, and permanent, abstinence from tobacco use, versus less restrictive goals, such as “use when urges are strongly felt” (Hall et al., 1990). In an adult addictions treatment sample, endorsement of a total abstinence goal for tobacco was associated with lower risk for relapse (Hall et al., 1990), and with the number of cigarettes smoked over 3-month follow-up in a study of adult psychiatric patients (Shmueli, Fletcher, Hall, Hall, & Prochaska, 2008). Because TAA evaluates an individual’s commitment to abstinence, TAA scores may have a stronger association with abstinence-oriented outcomes (e.g., number of abstinent days) compared to a measure like the Ruler, which does not specify abstinence as a specific behavioral goal.

A single item measure of motivation to abstain from tobacco, rated on a 10-point scale, was examined because enhancing motivation to change tobacco use is thought to underlie effective smoking cessation interventions with youth (Myers & Kelly, 2006). Little is

known, however, regarding the utility of a single item measure of motivation to abstain in predicting subsequent tobacco use. One study of treated youth found that a single item measure of motivation to abstain from marijuana concurrently and prospectively predicted frequency of marijuana use over 6-month follow-up (King, Chung, & Maisto, 2009). The utility of a single item querying “motivation to abstain” suggests its promise as a marker of readiness to change tobacco use.

Related to the constructs of motivation to abstain and readiness to change, perceived self-efficacy, which refers to a person’s belief in his/her ability to perform a certain behavior or to achieve a specific outcome, is considered a key component of successful behavior change (Prochaska, DiClemente, & Norcross, 1992). Although not a direct indicator of readiness to change, self-reported “confidence to abstain from tobacco use” can influence efforts to initiate and maintain behavior change. For example, greater perceived self-efficacy to quit smoking predicted intention and attempts to quit smoking, and was associated with better smoking cessation outcomes in adolescents (Myers, Brown, & Kelly, 2000; Woodruff, Conway, & Edwards, 2008; Ramo et al., 2010). Increases in adolescents’ smoking behavior over time predicted lower self-efficacy to abstain, and lower intention to quit, among youth with psychiatric disorders (Strong et al., 2007).

Another construct thought to play a role in behavior change is “perceived difficulty,” in this case, to abstain from tobacco use. Among the substances that treated adolescents report using, tobacco is most often identified as the substance from which it would be most difficult to abstain (Chung & Martin, 2005). “Perceived difficulty” is not conceptualized here as an indicator of readiness to change, but is hypothesized to play an important role in initiation and maintenance of behavior change that could be considered to be relatively independent of indicators of “readiness to change.” Perceived difficulty to abstain might index the severity of an adolescent’s substance involvement, and be associated with perceived confidence to abstain, such that greater perceived difficulty is associated with lower self-confidence to abstain. However, we hypothesize that self-reported, perceived difficulty to abstain might independently (i.e., uniquely) predict subsequent tobacco use, over and above measures of tobacco severity, readiness to change, and confidence to abstain, which would indicate the importance of specifically addressing an adolescent’s perception of the difficulty to abstain in a tobacco intervention.

The purpose of this study was to examine the concurrent and predictive validity of four tobacco readiness measures (i.e., Ruler, TAA, motivation to abstain, confidence to abstain), and a measure of difficulty to abstain, in a clinical sample of adolescents over 1-year follow-up. Because the primary reason for substance use treatment was not tobacco cessation, we predicted that readiness to change tobacco use would be low and stable over follow-up, although readiness to change tobacco use varies over time among adults in tobacco cessation treatment (e.g., Hughes, Keeley, Fagerstrom, & Callas, 2005). We predicted that difficulty to abstain from tobacco would be higher, compared to alcohol and marijuana, due, in part, to greater addiction liability for nicotine (Nutt, King, Saulsbury, & Blakemore, 2007).

For the concurrent validity analyses, we expected that each of the four readiness measures would be moderately correlated with one another at each time point, and with severity of tobacco use. For tests of predictive validity, we examined two cigarette use outcomes (i.e., total number of cigarettes in the past 30 days, number of abstinent days in the past 30 days), at both 6-months and 12-months, because readiness to change is not a static variable (e.g., Hughes et al., 2005; Breda & Helfinger, 2004). We hypothesized that the abstinence-oriented measures (e.g., TAA) would more consistently predict abstinence outcomes relative to a more general measure of readiness to change (e.g., Ruler), which does not specify a goal of abstinence. For the difficulty to abstain item, we expected that this measure would

account for unique variance in the two cigarette use outcomes over and above tobacco severity, and each of the four readiness to change measures, at 6- and 12-month follow-up.

2. Materials and methods

2.1 Sample Characteristics

Adolescents (age 14–18) were recruited from seven community-based treatment sites, which offer group-based intensive outpatient (IOP) treatment to adolescent substance users. Each site was located within the greater Pittsburgh, Pennsylvania area. Six of the sites were run by a large, non-profit rehabilitation center. The seventh site was an adolescent dual diagnosis clinic (i.e., substance use disorder and co-occurring psychopathology), which is part of a university-based medical center. Among the 184 adolescents who completed a baseline assessment and were eligible to complete the 1-year follow-up, analyses reported here included only adolescents who reported tobacco use in the past 6-months at baseline ($N=154$; 84% of 184 who were eligible).

The majority ($n=100$) of the 154 adolescents were male (64.9%); 89.0% were Caucasian, 5.8% were African-American, and 5.2% represented other ethnicities (e.g., multi-racial). The sample had a mean age of 16.7 ($SD=1.2$) and represented a range in socioeconomic status (SES) (range 1–5, $M=2.5$, $SD=1.1$) (Hollingshead, 1975). Most (58.4%) were recruited from the rehabilitation center; 41.6% were recruited from the dual diagnosis clinic.

At baseline, participants smoked cigarettes an average of 25.1 days in the past month ($SD=9.3$), and, on average, 293.2 cigarettes in the past month ($SD=222.5$). Roughly half (49.4%) met criteria for a current (past 6 months) DSM-IV nicotine dependence diagnosis at baseline. Alcohol and marijuana were the most common substances for which the adolescents reported they were attending treatment. At baseline, 55.8% reported marijuana as their primary drug, 11.7% reported alcohol, and among the remaining youth, the largest proportion reported opiates as their primary drug (9.1%). At baseline, 53.2% had a current DSM-IV alcohol use disorder (43.5% alcohol abuse, 9.7% alcohol dependence); 94.1% had a current marijuana use disorder (54.5% marijuana abuse, 39.6% marijuana dependence). The demographic (i.e., gender and mean age) and substance use characteristics of the sample are similar to those of adolescents admitted to publicly funded treatment (SAMHSA, 2007).

2.2 Treatment Program Characteristics

Each treatment site from which adolescents were recruited to the study adhered to a goal of abstinence from alcohol, marijuana, and other illicit substances. Similar to many community-based substance use treatment programs (Prochaska, 2010), none of the treatment sites addressed tobacco cessation as a standard component of treatment (although reduction in cigarette use might occur as a secondary benefit of IOP treatment). The recommended course of treatment was 6–8 weeks of IOP treatment. Each site ran one rolling admissions adolescent IOP treatment group, which met three times per week, for 3-hours per session. Preliminary analyses indicated no significant correlations between number of outpatient days attended from the start of the index treatment episode to 6-month follow-up and either of the 6-month cigarette outcomes ($r=-.06$ for abstinent days and $.09$ for total number of cigarettes, $p>.2$), which may be expected, because the index treatment episode did not specifically address tobacco cessation.

2.3 Study Recruitment and Assessment Procedures

After admission to IOP treatment, all adolescents were informed by clinic staff about an ongoing longitudinal research project. For youth who expressed initial interest in research participation, research staff provided a description of the study procedures. Among youth

referred by clinical staff to research personnel (n=367), 67% provided informed assent (minor youth) and/or consent (for youth age 18, and parental consent for participation by minor adolescents) for study participation. Among adolescents who provided informed consent, 74% (n= 184) completed the baseline assessment. There were no differences on demographic characteristics (gender, age) among those who provided consent, and did versus did not complete baseline.

Adolescents completed the baseline assessment typically within two weeks of treatment entry. The baseline assessment collected lifetime history of substance use and substance use disorders, psychiatric conditions, and readiness to change substance use behavior. Follow-ups at 6- and 12-months covered the same domains for the interval since the last assessment. Participants were compensated for their time. The University's Institutional Review Board approved the study protocol.

Retention at 6-months (85.1%; n= 131) and 12-months (87.7%; n= 135) was good. There were no significant differences between those who did versus did not complete the 6- or 12-month assessments on demographic characteristics (i.e., sex, age, ethnicity, SES) and baseline substance use (i.e., frequency of alcohol, marijuana, or tobacco use).

2.4 Measures

DSM-IV substance use disorder (SUD) diagnoses and symptoms—An adapted version of the Structured Clinical Interview for DSM-IV SUDs (SCID; First, Spitzer, Gibbon, & Williams, 2002; Martin, Kaczynski, Maisto, Bukstein, & Moss, 1995; Martin, Pollock, Bukstein, & Lynch, 1999) was used to determine the presence of SUD diagnoses and symptom counts. SCID adaptations accommodated developmental considerations in symptom assessment with adolescents. The adapted SCID has fair to high retest reliability for DSM-IV alcohol abuse (k= 0.64) and dependence (k= 0.69), marijuana abuse (k= 0.45) and dependence (k= 0.87), and nicotine dependence (k= 0.66) (Chung, Martin, San Pedro, Shriberg & Cornelius, 2004). Two-week retest intraclass correlations (ICCs) for total symptom count were high (alcohol= 0.91, marijuana= 0.95, nicotine= 0.89) (Chung et al., 2004).

Timeline Follow-Back (TLFB; Sobell & Sobell, 1995)—The TLFB calendar method was used to collect data on the number of days of cigarette use (the most common form of tobacco use in the sample) and the number of cigarettes used per day in the 30-days prior to baseline, 6- and 12-month assessments. To facilitate reliable and valid report, information was obtained about events that occurred since the last assessment (e.g., holidays, birthdays, start and end of treatment). TLFB data collected from adolescents has good reliability and validity (Donohue et al., 2004; Donohue, Hill, Azrin, Cross, & Strada, 2007; Lewis-Esquerre et al., 2005; Waldron, Slesnick, Brody, Turner, & Peterson, 2001). TLFB data provided the two cigarette use outcomes that were examined: total number of cigarettes, and number of cigarette abstinence days, in the 30 days prior to each follow-up assessment. These outcomes are related, but because the TAA specifically addresses tobacco abstinence goals (not just reduction in use), we included a measure of abstinent days as an outcome. The distribution for the total number of cigarettes used was positively skewed. A square root transformation provided the best approximation of a normal distribution, and was used for the analyses.

Readiness Ruler (Miller, 1985, 1999; CASAA, 1995)—The tobacco ruler uses a 10-point scale to indicate how ready a participant is to reduce tobacco use. The question stem is: "Using the ruler below, indicate how ready you are to make a change (quit or cut down) in your [drug] use. If you are not at all ready to make a change, you would circle "1". If you

are already trying hard to make a change, you would circle “10”. If you don’t use a drug listed, please circle “don’t use” (e.g., 1= “not ready to change”, 4= “unsure”, 6= “ready to change”, 10= “trying hard to change”).

Thoughts About Abstinence (TAA; Hall et al., 1990; Shmueli et al., 2008)—TAA describes six possible tobacco abstinence goals, ranging from 1= “total abstinence” to 6= “no goal” to limit tobacco use (see Table 1 for all six category descriptors). Adolescents selected the tobacco abstinence goal that best represented the goal for use “right now”. Because some TAA categories represented few respondents, categories were collapsed to represent 3 tobacco abstinence goals (cf. Shmueli et al., 2008): Total abstinence (combined “Total abstinence, never use again” and “Total abstinence, slip possible”), Occasional use (combined “Occasional use, when urges are strong”, “Temporary abstinence”, “Controlled use”), and No goal to limit tobacco use (i.e., recoded as 1=Total abstinence, 2=Occasional use, 3=No goal; higher TAA score indicates less readiness to change tobacco use).

Motivation, Confidence, and Difficulty to Abstain from Tobacco—These single item measures, each rated on a 10-point scale specifically in relation to tobacco, were prefaced with the stem, “Thinking about the next 30 days...” The motivation item asked, “How motivated are you to abstain (not use at all) from tobacco,” with anchors ranging from 1= “not at all” to 10= “very motivated”. The confidence item asked, “How confident are you that you will be able to abstain (not use at all) from tobacco,” with anchors ranging from 1= “not at all” to 10= “very confident”. The difficulty item asked, “How difficult would or will it be to abstain (not use at all) from tobacco,” with anchors ranging from 1= “not at all” to 10= “very difficult”.

2.5 Approach to Data Analysis

Analyses proceeded in several steps. We first examined change from baseline through 12-month follow-up for the two cigarette outcomes (i.e., total number of cigarettes in the past 30 days, number of days of abstinence from cigarettes in the past 30 days), each of the four readiness measures, and difficulty to abstain. Next, evidence for the concurrent validity of each of the four readiness measures at each time point was examined using Pearson correlations (i.e., associations among the readiness measures, and associations between readiness measures and measures of tobacco use severity).

To examine predictive validity, four hierarchical regression models (i.e., each of the four baseline readiness measures were examined in separate models) were used to predict each of two 6-month tobacco outcomes, and four regression models (i.e., each of the four 6-month readiness measures) were used to predict each of two 12-month tobacco outcomes. Thus, a total of 16 regression models were run. Exploratory factor analyses of the measures at baseline indicated that the four readiness measures represented a main factor (Eigenvalue= 2.8, 56.2% of the variance), with difficulty to abstain representing a separate secondary factor (Eigenvalue= 1.1, 21.7% of the variance). Thus, we examined each of the four readiness measures in separate models, but included difficulty to abstain in each model to examine perceived difficulty as a unique predictor of outcome.

For each regression model, the critical test of predictive validity was the additional percentage of variance in outcome accounted for by the readiness measure, after controlling for demographic variables (i.e., sex, age, ethnicity, SES), treatment site (i.e., rehabilitation center versus dual diagnosis clinic), number of days in a controlled environment in the 30 days prior to the follow-up assessment, and baseline number of current (past 6 months) DSM-IV nicotine dependence symptoms as an indicator of use severity. The difficulty to abstain measure was entered last in each model in order to examine the extent to which this

measure would predict the outcome over and above the readiness measure. The 12-month predictive validity models controlled for demographic characteristics, nicotine dependence severity at 6-months, and residential treatment at 6-months, and examined 6-month difficulty to abstain as a predictor of 12-month outcomes over and above 6-month readiness.

3. Results

Table 1 presents descriptive statistics for tobacco use, readiness to change, and difficulty to abstain measures. Average number of cigarette abstinence days increased slightly from baseline to 12-months ($F[2, 265] = 5.32, p < .01$). However, the proportion of youth who reported abstinence from cigarettes in the past 30 days at 6-months (9%, $n=13$) and 12-months (13%, $n=18$) did not differ ($p > .22$). There also were no significant differences over follow-up in the proportion with a current nicotine diagnosis (42–49% over 1-year), or in nicotine dependence symptom count from baseline to 12-months ($ps > .05$). With regard to treatment participation over follow-up, a minority reported any treatment (i.e., inpatient, residential, or outpatient) in the 30 days prior to the 6-month (41%) and 12-month (25%) follow-ups, which is consistent with discharge from the index treatment episode after 6–8 weeks.

For each measure of readiness to change tobacco use (i.e., Ruler, TAA, motivation and confidence to abstain), mean scores were not significantly different from baseline through 12-month follow-up ($ps > .05$). For each readiness measure, correlations between adjacent time points (i.e., baseline and 6-months, 6- and 12-months) were small to moderate ($rs = .20-.53, ps < .05$) (Table 2). Among the four measures, the smallest correlations between adjacent time points were obtained for TAA at baseline and 6-months ($r = .20, p < .05$), and motivation to abstain at baseline and 6-months ($r = .21, p < .05$).

Mean scores on the difficulty to abstain item did not significantly differ over 12-month follow-up ($p > .05$). Correlations for ratings of difficulty to abstain between adjacent time points were moderate ($rs = .48-.53, ps < .01$; Table 2). Comparison of difficulty ratings for alcohol, marijuana, and tobacco indicated cross-drug differences at baseline ($F[2, 284] = 88.97, p < .01$), 6-months ($F[2, 250] = 92.37, p < .01$), and 12-months ($F[2, 254] = 118.22, p < .01$). As predicted, at each time point, post-hoc comparisons indicated greater difficulty to abstain from tobacco, compared to alcohol and marijuana ($ps < .01$).

Table 3 presents the concurrent correlations among the four baseline readiness measures, difficulty to abstain, and tobacco use severity (i.e., total number of cigarettes in the past month, abstinent days in the past month, and current nicotine dependence symptoms). At baseline, the four readiness measures were moderately to highly correlated with one another. However, only confidence to abstain was significantly associated (negative correlation) with difficulty to abstain. At 6- and 12-months, concurrent correlations indicated that all 4 readiness measures and difficulty to abstain were moderately to highly correlated (Tables 4–5).

At baseline (Table 3), the Ruler, motivation to abstain, and confidence to abstain were negatively correlated with total number of cigarettes in the past month ($ps < .01$), and positively correlated with abstinent days in the past month ($ps < .01$), suggesting that heavier users were less likely to report being ready to change tobacco use. Difficulty to abstain and TAA were positively associated with total number of cigarettes in the past month and current nicotine dependence symptoms ($ps < .01$), and negatively associated with abstinent days in the past month ($ps < .01$), suggesting that heavier tobacco users were more likely to report greater difficulty to abstain and no goal to limit tobacco use. Concurrent 6- and 12-month correlations (Tables 4–5) between readiness and tobacco use measures were generally

similar to the pattern observed at baseline, with some notable exceptions. Specifically, at baseline, difficulty to abstain was not associated with scores on the Ruler, TAA, and motivation to abstain, but was associated with scores on these measures at 6- and 12-months, follow-up time points at which many youth were no longer in active treatment.

Tables 6A and 6B summarize results of hierarchical multiple regression models testing the predictive validity of four baseline readiness measures (i.e., motivation to abstain, confidence to abstain, the Ruler, TAA) in relation to the two 6-month tobacco use outcomes: total number of cigarettes and number of abstinent days in the 30 days prior to the 6-month follow-up. Based on the criterion of increment in variance accounted for in the first 6-month outcome, total number of cigarettes in the past 30 days, scores on three baseline measures (the Ruler, motivation to abstain, confidence to abstain) showed evidence for predictive validity (Table 6A). For the second 6-month outcome, abstinent days in the past 30 days, only baseline confidence to abstain showed evidence for predictive validity (Table 6B). Baseline rating of difficulty to abstain predicted total number of cigarettes in the past month at 6-months over and above each of the four readiness measures and severity of tobacco use at the prior assessment, but did not account for additional variance in abstinent days at 6-months.

Tables 7A and 7B present results for 6-month readiness measures as predictors of the two tobacco use outcomes at 12-months. Compared to predictive validity at 6-months, where only three of the four readiness measures predicted total number of cigarettes in the past month, all four of the 6-month readiness measures accounted for additional variance in total number of cigarettes in the past month at 12-months (Table 7A). For the abstinent days outcome, in contrast to the 6-month predictive validity analyses, confidence to abstain was the only 6-month readiness measure that was *not* associated with abstinent days—motivation to abstain, the Ruler, and TAA at 6-months all accounted for additional variance in abstinent days at 12-months (Table 7B). Similar to 6-month predictive validity results, difficulty to abstain predicted total number of cigarettes in the past month at 12-months over and above each of the four readiness measures, and severity of tobacco use. However, in contrast to the 6-month predictive validity analyses, 6-month difficulty to abstain only predicted variance in abstinent days at 12-months over and above the 6-month confidence to abstain measure, when 6-month confidence to abstain did not predict abstinent days at 12-months.

4. Discussion

Scores on the four measures of readiness to change tobacco use were low and stable over 1-year follow-up, in contrast to findings for alcohol and marijuana use outcomes, which showed declines in readiness over 1-year follow-up in this adolescent treatment sample (Maisto et al., under review-a, b). As predicted, the four readiness measures were correlated with one another in expected directions at each time point (e.g., positive correlation between motivation and confidence to abstain, negative correlation between motivation to abstain and TAA). Also as expected, difficulty to abstain was higher for tobacco, compared to alcohol and marijuana. Predictive validity analyses provided support for scores on the Ruler, motivation and confidence to abstain as predictors of total number of cigarettes smoked at 6- and 12-month follow-up. The perceived difficulty to abstain item predicted cigarette use at 6- and 12-months over and above each measure of readiness to change and prior severity of tobacco use, as hypothesized, but did not predict abstinent days at 6-months. Difficulty to abstain only predicted abstinent days at 12-months, the time point at which confidence to abstain did not account for incremental variance in the 12-month tobacco abstinence outcome.

Concurrent correlations at each time point suggest that the four measures of readiness to change (i.e., the Ruler, TAA, motivation and confidence to abstain) were moderately associated with one another. However, predictive validity analyses suggest that the measures are not necessarily interchangeable, in that most measures showed a distinct pattern of associations with the two tobacco use outcomes at the two time points that were examined. Among the four measures studied, the Ruler and motivation to abstain showed a similar pattern of results in predicting 6- and 12-month outcomes, and had relatively high concurrent correlations (.65–.78). These two single item measures, however, differ in whether “abstinence” or a more general goal of reducing use is specified, a difference that resulted in a somewhat stronger prediction of 12-month abstinent days by motivation to abstain ($\beta=.16, p<.01$), compared to the Ruler ($\beta=.07, p<.01$). In addition, the measures differ in assessing “current” readiness to change (i.e., Ruler), abstinence goals “right now” (i.e., TAA), and motivation or confidence to abstain in “the next 30 days”. Differences across measures in the time frames to be considered (i.e., “now”, “next 30 days”) can reflect differences in short versus longer-term goals that are relevant to examining the predictive validity of a given measure over shorter (e.g., 1 month) and longer (e.g., 6 months) follow-up intervals, and warrant attention during the selection of measures.

In contrast to the predictive utility of the Ruler and motivation to abstain measures in relation to 6-month tobacco outcomes, the baseline TAA measure, with its focus on abstinence-related goals, was not predictive of either 6-month outcome, suggesting that this measure may be less useful to administer during active treatment, if the goal is to predict level of tobacco use at follow-up. It may be the case that, among treated adolescents, outcomes reflecting cigarette abstinence take longer to achieve than reductions in quantity and frequency of cigarette use.

Baseline rating of confidence to abstain from tobacco appears to be a good predictor of both tobacco use and abstinence from tobacco at 6-months, suggesting the utility of this single-item measure in a clinical setting. Predictive validity analyses at 12-months, however, indicated that difficulty to abstain, but not confidence to abstain, predicted number of abstinent days. These results suggest that confidence to abstain and perceived difficulty to abstain are not direct counterparts (i.e., one can report high difficulty and high confidence to abstain), that the association between these two measures can change over time, and that the two measures differentially predict outcomes.

The absence of a concurrent association at baseline between perceived difficulty and measures of readiness to change (i.e., Ruler, TAA, motivation to abstain), suggests a possible effect of the index episode of substance use treatment on reducing the association between perceived difficulty and readiness to change tobacco use (e.g., perceived difficulty may be less associated with readiness to change in an environment that provides support for change), given that greater perceived difficulty was associated with lower readiness to change at 6- and 12-months (when most youth were no longer in active treatment). These findings suggest a potential window of opportunity for a tobacco-related intervention near the start of treatment in which the association between perceived difficulty to abstain and readiness is not very strong (e.g., some youth might perceive high difficulty to abstain, but nevertheless express readiness to change tobacco use). In addition, study results suggest that, in the absence of active treatment involvement (e.g., at 6-month follow-up), perceived difficulty to abstain may be a better predictor of subsequent number of abstinent days, relative to perceived confidence to abstain. Differences across time points in the relative utility of various measures as predictors of tobacco use highlight the need for further investigation of treatment-specific effects, as well as dynamic, and possibly reciprocal relations among the constructs of confidence to abstain, difficulty to abstain, and tobacco abstinence to better understand their relationships over time.

The finding that perceived difficulty to abstain from tobacco was higher, compared to alcohol and marijuana, may, in part, explain the persistence of tobacco use over time among many treated adolescents. Perceived difficulty was moderately and positively correlated with severity of tobacco use, suggesting that perceived difficulty might index severity of tobacco involvement. However, perceived difficulty prospectively predicted the number of cigarettes smoked, over and above nicotine dependence severity, suggesting the independent contribution of perceived difficulty as a predictor of subsequent cigarette use in adolescents. Given that perceived difficulty emerges as an independent predictor of cigarette outcomes, determining what adolescents think about when reporting “perceived difficulty” in abstaining from tobacco (e.g., craving, compulsion to use), particularly in relation to readiness to change, warrants study.

Treated adolescents’ greater perceived difficulty to abstain from tobacco, compared to other substances, is in accord with prior research indicating that intention to quit and interest in quitting tobacco use was lower, compared to alcohol and other drugs among youth in substance use treatment (McDonald et al., 2000; Ramo et al., 2010). Other analyses conducted in this adolescent treatment sample suggest lower readiness to change tobacco use, compared to Ruler scores for alcohol over 1-year (5.8–6.6, with no evidence of change over time), and for marijuana (7.4–6.4, with evidence of a decline over time) (Maisto et al., under review-a, b). Treated adolescents’ apparent lower readiness to change tobacco use, relative to alcohol and marijuana, may reflect the fact that substance abuse treatment did not directly address tobacco cessation, may reflect greater perceived difficulty to abstain from tobacco use, or may reflect the influence of other factors not directly addressed in this study. The finding that some treated youth, albeit a minority, are interested in reducing tobacco use suggests the importance of specifically addressing tobacco cessation during adolescent substance abuse treatment.

There is growing interest in addressing tobacco cessation as part of substance abuse treatment (Prochaska, 2010). Concerns that addressing smoking cessation during substance abuse treatment will adversely affect efforts to reduce the use of “primary” substances of abuse (e.g., alcohol, marijuana) appear to be unfounded, given findings that tobacco cessation is associated with better substance use outcomes (Baca & Yahne, 2009; Myers & Brown, 1997; Prochaska, 2010). Due to the greater perceived difficulty and lower readiness to change tobacco use compared to other substances among youth in substance use treatment, multicomponent and relatively intensive interventions appear to be needed to initiate reductions in tobacco use (Myers & Kelly, 2006). Motivational enhancement and other interventions that address tobacco use, in addition to “primary” substances of abuse, may enhance substance use outcomes in youth more generally, because similar processes of change can be used across substances.

Study limitations warrant comment. Self-reports of cigarette use were used, without biochemical verification, resulting in possible underestimate of tobacco severity. Only two cigarette use outcomes were examined. Analyses focused on cigarette use outcomes, rather than tobacco use more generally (e.g., chewing tobacco). Quit attempts also represent an important outcome that was not examined in this study. Further research is needed to examine the validity of readiness to change scores in relation to a broader array of validating variables, and in other adolescent samples. Although this study provided some information on predictive validity of some brief measures of readiness to change, further study is needed to characterize dynamic, and reciprocal influences among readiness to change, confidence and difficulty to abstain, and tobacco use over time (cf. King et al., 2009; Strong et al., 2007). Another direction for future research would involve incremental validity analyses (i.e., the extent to which a measure adds unique predictive information), which could inform

the prioritization of readiness to change measures that would be administered as predictors of specific outcomes over shorter and longer follow-up intervals.

Study results suggest that brief measures of readiness to change tobacco use and related constructs, such as perceived difficulty to abstain from tobacco use, demonstrate some clinical utility as predictors of subsequent tobacco use in treated adolescents. In particular, study findings support the use of single-item Ruler and motivation to abstain measures as predictors of cigarette use at 6- and 12-months. A single-item assessing difficulty to abstain from tobacco also provided additional prediction of variance in treated adolescents' tobacco use over 1-year follow-up. These brief, easily administered measures could be used during motivational enhancement interventions as tools to determine an adolescent's readiness to change tobacco use, to structure tobacco cessation treatment content, to monitor treatment progress, and to identify points at which booster tobacco-related interventions may be indicated.

Acknowledgments

Support for the conduct of the research and preparation of the manuscript was provided by funding from the National Institute on Alcohol Abuse and Alcoholism (R01 AA014357, K02 AA018195, R21 AA017128).

References

- Abrams DB, Herzog TA, Emmons KM, Linnan L. Stages of change versus addiction: A replication and extension. *Nicotine and Tobacco Research*. 2000; 2:223–229. [PubMed: 11082822]
- Baca CT, Yahne CE. Smoking cessation during substance abuse treatment: What you need to know. *Journal of Substance Abuse Treatment*. 2009; 36:205–219. [PubMed: 18715746]
- Biener L, Abrams D. The Contemplation Ladder: Validation of a measure of readiness to consider smoking cessation. *Health Psychology*. 1991; 10:360–365. [PubMed: 1935872]
- Breda C, Heflinger CA. Predicting incentives to change among adolescents with substance abuse disorder. *The American Journal of Drug and Alcohol Abuse*. 2004; 30(2):251–267. [PubMed: 15230075]
- Carey KB, Purnine DM, Maisto SA, Carey MP. Assessing readiness to change substance abuse: A critical review of instruments. *Clinical Psychology: Science and Practice*. 1999; 6(3):245–266.
- Center on Alcoholism, Substance Abuse, and Addictions (CASAA). Readiness Ruler. Albuquerque, NH: CASAA; 1995.
- Chung T, Martin CS. What were they thinking? Adolescents' interpretations of DSM-IV alcohol dependence symptom queries and implications for diagnostic validity. *Drug and Alcohol Dependence*. 2005; 80:191–200. [PubMed: 15894432]
- Chung T, Martin CS, San Pedro R, Shriberg RF, Cornelius JR. Retest reliability and discrepancy interview for DSM-IV alcohol, cannabis, and nicotine diagnoses in treated adolescents. *Alcoholism: Clinical and Experimental Research*. 2004; 28(5 Suppl) 27th Annual Meeting; abstract #111A.
- de Dios MA, Vaughan EL, Stanton CA, Niaura R. Adolescent tobacco and substance abuse treatment outcomes. *Journal of Substance Abuse Treatment*. 2009; 37:17–24. [PubMed: 19004603]
- Donohue B, Azrin NH, Strada MJ, Silver NC, Teichner G, Murphy H. Psychometric evaluation of self- and collateral timeline follow-back reports of drug and alcohol use in a sample of drug-abusing and conduct-disordered adolescents and their parents. *Psychology of Addictive Behaviors*. 2004; 18(2):184–189. [PubMed: 15238061]
- Donohue B, Hill HH, Azrin NH, Cross C, Strada MJ. Psychometric support for contemporaneous and retrospective youth and parent reports of adolescent marijuana use frequency in an adolescent outpatient treatment population. *Addictive Behaviors*. 2007; 32(9):1787–1797. [PubMed: 17261356]
- First, MB.; Spitzer, RL.; Gibbon, M.; Williams, JBW. Structured Clinical Interview for DSM-IV-TR Axis I Disorders. New York: Biometrics Research, New York State Psychiatric Institute; 2002.

- Hall SM, Havassy BE, Wasserman DA. Commitment to abstinence and acute stress in relapse to alcohol, opiates, and nicotine. *Journal of Counseling and Clinical Psychology*. 1990; 58:175–181.
- Hollingshead, AB. Unpublished manuscript. New Haven, CT: 1975. Four factor index of social status.
- Hughes J, Keeley J, Fagerstrom KO, Callas PW. Intentions to quit smoking change over short periods of time. *Addictive Behaviors*. 2005; 30:653–662. [PubMed: 15833571]
- King KM, Chung T, Maisto SA. Adolescents' thoughts about abstinence curb the return of marijuana use during and after treatment. *Journal of Consulting and Clinical Psychology*. 2009; 77:554–565. [PubMed: 19485595]
- Lewis-Esquerre JM, Colby SM, Tevyaw TOL, Eaton CA, Kahler CW, Monti PM. Validation of the timeline follow-back in the assessment of adolescent smoking. *Drug and Alcohol Dependence*. 2005; 79(1):33–43. [PubMed: 15943942]
- Maisto, SA.; Krennek, M.; Chung, T.; Martin, CS.; Cornelius, JR.; Clark, DB. A comparison of the concurrent and predictive validity of four measures of readiness to change alcohol use in a clinical sample of adolescents. (under review-a)
- Maisto, SA.; Krennek, M.; Chung, T.; Martin, CS.; Cornelius, JR.; Clark, DB. A comparison of the concurrent and predictive validity of four measures of readiness to change marijuana use in a clinical sample of adolescents. (under review-b)
- Martin CS, Kaczynski NA, Maisto SA, Bukstein O, Moss HB. Patterns of DSM-IV alcohol abuse and dependence symptoms in adolescent drinkers. *Journal of Studies on Alcohol*. 1995; 56:672–680. [PubMed: 8558899]
- Martin CS, Pollock NK, Bukstein O, Lynch KG. Inter-rater reliability of the SCID alcohol and substance use disorders section among adolescents. *Drug and Alcohol Dependence*. 1999; 59(2): 173–176. [PubMed: 10891630]
- McDonald CA, Roberts S, Descheemaeker N. Intentions to quit smoking in substance-abusing teens exposed to a tobacco program. *Journal of Substance Abuse Treatment*. 2000; 18:291–308. [PubMed: 10742645]
- Miller WR. Motivation for treatment: A review with special emphasis on alcoholism. *Psychological Bulletin*. 1985; 98(1):84–107. [PubMed: 3898175]
- Miller, WR. Treatment Improvement Protocol Series. Vol. 35. Rockville, MD: US Department of Health and Human Services; 1999. Enhancing motivation to change in substance abuse treatment.
- Myers MG, Brown SA. Cigarette smoking four years following treatment for adolescent substance abuse. *Journal of Child and Adolescent Substance Abuse*. 1997; 7:1–15.
- Myers MG, Brown SA, Kelly JF. A smoking intervention for substance abusing adolescents: Outcomes, predictors of cessation attempts, and post-treatment substance use. *Journal of Child and Adolescent Substance Abuse*. 2000; 9:77–91.
- Myers MG, Kelly JF. Cigarette smoking among adolescents with alcohol and other drug use problems. *Alcohol Research and Health*. 2006; 29:221–227. [PubMed: 17373413]
- Myers MG, MacPherson L. Smoking cessation efforts among substance abusing adolescents. *Drug and Alcohol Dependence*. 2004; 73:209–213. [PubMed: 14725961]
- Nutt D, King LA, Saulsbury W, Blakemore C. Development of a rational scale to assess the harm of drugs of potential misuse. *Lancet*. 2007; 369:1047–1053. [PubMed: 17382831]
- Pisinger C, Vestbo J, Borch-Johnsen K, Jørgensen T. It is possible to help smokers in early motivational stages to quit. The Inter99 study. *Preventive Medicine*. 2005; 40:278–284. [PubMed: 15533540]
- Prochaska JJ. Failure to treat tobacco use in mental health and addiction treatment settings: A form of harm reduction? *Drug and Alcohol Dependence*. 2010; 110:177–182. [PubMed: 20378281]
- Prochaska, JO. Systems of psychotherapy: A transtheoretical analysis. Oxford England; Dorsey: 1979.
- Prochaska JO, DiClemente CC. Transtheoretical therapy: Toward a more integrative model of change. *Psychotherapy: Theory, Research & Practice*. 1982; 19(3):276–288.
- Prochaska JO, DiClemente CC, Norcross JC. In search of how people change: Applications to addictive behaviors. *American Psychologist*. 1992; 47:1102–1114. [PubMed: 1329589]
- Ramo DE, Prochaska JJ, Myers MG. Intentions to quit smoking among youth in substance abuse treatment. *Drug and Alcohol Dependence*. 2010; 106:48–51. [PubMed: 19699041]

- Shmueli D, Fletcher L, Hall SE, Hall SM, Prochaska JJ. Changes in psychiatric patients' thoughts about quitting smoking during a smoke-free hospitalization. *Nicotine & Tobacco Research*. 2008; 10(5):875–881. [PubMed: 18569762]
- Slavet JD, Stein L, Colby SM, Barnett NP, Monti PM, Golembeske CJ, et al. The Marijuana Ladder: Measuring motivation to change marijuana use in incarcerated adolescents. *Drug and Alcohol Dependence*. 2006; 83(1):42–48. [PubMed: 16289930]
- Sobell, LC.; Sobell, MB. *Alcohol Timeline Followback Users' Manual*. Toronto, Canada: Addiction Research Foundation; 1995.
- Stephens S, Cellucci T, Gregory J. Comparing stages of change measures in adolescent smokers. *Addictive Behaviors*. 2004; 29:759–764. [PubMed: 15135558]
- Strong DR, Kahler CW, Abrantes AM, MacPherson L, Myers MG, Ramsey SE, Brown RA. Nicotine dependence symptoms among adolescents with psychiatric disorders: Using a Rasch model to evaluate symptom expression across time. *Nicotine Tobacco Research*. 2007; 9:557–569. [PubMed: 17454712]
- Substance Abuse and Mental Health Services Administration, Office of Applied Studies. OAS Series #S-45, HHS Publication No. (SMA) 09–4360. Rockville, MD: 2009. Treatment Episode Data Set (TEDS) Highlights -- 2007 National Admissions to Substance Abuse Treatment Services.
- Waldron HB, Slesnick N, Brody JL, Turner CW, Peterson TR. Treatment outcomes for adolescent substance abuse at 4- and 7-month assessments. *Journal of Consulting and Clinical Psychology*. 2001; 69:802–813. [PubMed: 11680557]
- West R. Time for a change: Putting the transtheoretical (Stages of Change) model to rest. *Addiction*. 2005; 100:1036–1039. [PubMed: 16042624]
- Woodruff SI, Conway TL, Edwards CC. Sociodemographic and smoking-related psychosocial predictors of smoking behavioral change among high school smokers. *Addictive Behaviors*. 2008; 33:354–358. [PubMed: 17900818]

Table 1

Sample descriptive statistics

	Baseline (N=154)		6-month (N=131)		12-month (N=135)	
	n	%	n	%	n	%
Current Nicotine Dep Dx (%)	76	49.4	70	45.5	64	41.6
Current Nicotine Dep Sxs (M, SD)	153	2.1 (1.6)	130	2.3 (1.7)	134	1.9 (1.6)
# of cig days, past 30 (M, SD)	154	25.2 (9.1)	140	23.4 (11.0)	137	23.7 (11.1)
Total cig, past month (M, SD)	154	293.2 (222.5)	140	286.4 (246.7)	137	275.7 (230.5)
Cig abstinence days, past 30 (M, SD)	154	1.9 (6.3)	140	3.3 (8.9)	137	4.5 (10.5)
Motivation to abstain						
Tobacco (M, SD)	147	2.8 (2.9)	129	2.7 (2.6)	131	2.8 (2.9)
Difficulty to abstain						
Alcohol (M, SD)	150	3.7 (3.0)	130	3.6 (2.9)	133	3.7 (3.0)
Marijuana	150	4.9 (3.2)	131	4.5 (3.1)	133	4.0 (3.1)
Tobacco	147	7.9 (3.1)	129	7.6 (3.0)	130	7.9 (3.0)
Confidence to abstain						
Tobacco (M, SD)	145	2.7 (2.8)	102	3.1 (3.0)	129	2.8 (2.8)
Readiness Ruler						
Tobacco (M, SD)	148	2.9 (2.9)	122	3.7 (3.0)	124	3.7 (3.1)
Tobacco Thoughts About Abstinence	n	%	n	%	n	%
1-Total Abstin., Never Use Again	5	3.2	6	3.9	8	5.2
2-Total Abstin., Slip Possible	5	3.2	6	3.9	10	6.5
3-Occasional Use, Urges Strong	11	7.1	6	3.9	8	5.2
4-Temporary Abstinence	1	0.6	3	1.9	0	0.0
5-Controlled Use	21	13.6	32	20.8	32	20.8
6-No Goal	104	67.5	76	49.4	73	47.4

Notes: "Current" refers to past 6 months, M=Mean, SD=Standard Deviation, Dep Dx= Dependence Diagnosis, Dep Sxs=Dependence Symptom count, Cig=Cigarette, Abstin=Abstinence

Table 2

Correlations over time, within a scale, for readiness and difficulty to abstain measures

	<u>Baseline & 6-months</u>	<u>6-months & 12-months</u>	<u>Baseline & 12-months</u>
Motivation to Abstain	.21 [*]	.44 ^{**}	.14
Difficulty to Abstain	.48 ^{**}	.53 ^{**}	.42 ^{**}
Confidence to Abstain	.29 ^{**}	.30 ^{**}	.20 ^{**}
Readiness Ruler	.24 ^{**}	.28 ^{**}	.23 ^{**}
Thoughts About Abstinence	.20 [*]	.52 ^{**}	.25 ^{**}

Ns = 93 to 129,

^{**}
p<0.01^{*}
p<0.05 2-tailed tests

Table 3

Baseline: Concurrent correlations among readiness measures and tobacco use severity

	1	2	3	4	5	6	7	8
1. TLFB Total Cigarettes (transformed)	X	-.50**	.63**	-.33**	.50**	-.44**	-.30**	.34**
2. TLFB Abstinent Days		X	-.16	.30**	-.22**	.27**	.28**	-.29**
3. Current Nicotine Dependence Sx Count			X	-.08	.44**	-.23**	-.02	.12
4. Motivation to Abstain				X	-.06	.57**	.78**	-.63**
5. Difficulty to Abstain					X	-.30**	-.02	.12
6. Confidence to Abstain						X	.42**	-.47**
7. Readiness Ruler							X	-.68**
8. Thoughts About Abstinence ¹								X

Notes: Ns= 145 to 154.

**
p<0.01

*
p<0.05 2-tailed tests. TLFB = Time Line Follow-Back, Sx = symptom

¹ Responses were collapsed from 6 to 3 categories

Table 4
6-month follow-up: Concurrent correlations among readiness measures and tobacco use severity

	1	2	3	4	5	6	7	8
1. TLFB Total Cigarettes (transformed)	X	-.60**	.42**	-.58**	.59**	-.45**	-.47**	.49**
2. TLFB Abstinent Days		X	-.22*	.62**	-.50**	.43**	.43**	-.53**
3. Current Nicotine Dependence Sx Count			X	-.03	.41**	-.20*	-.03	.01
4. Motivation to Abstain				X	-.41**	.57**	.75**	-.76**
5. Difficulty to Abstain					X	-.60**	-.32**	.35**
6. Confidence to Abstain						X	.36**	-.42**
7. Readiness Ruler							X	-.73**
8. Thoughts About Abstinence ¹								X

Notes: Ns= 97 to 131.

**
p<0.01

*
p<0.05 2-tailed tests. TLFB = Time Line Follow-Back, Sx = symptom

¹ Responses were collapsed from 6 to 3 categories

Table 5
12-month follow-up: Concurrent correlations among readiness measures and tobacco use severity

	1	2	3	4	5	6	7	8
1. TLFB Total Cigarettes (transformed)	X	-.70**	.57**	-.63**	.59**	-.60**	-.42**	.67**
2. TLFB Abstinent Days		X	-.34**	.69**	-.60**	.72**	.41**	-.64**
3. Current Nicotine Dependence Sx Count			X	-.18*	.32**	-.17	-.07	.21*
4. Motivation to Abstain				X	-.69**	.76**	.65**	-.76**
5. Difficulty to Abstain					X	-.72**	-.45**	.59**
6. Confidence to Abstain						X	.51**	-.66**
7. Readiness Ruler							X	-.61**
8. Thoughts About Abstinence ¹								X

Notes: Ns= 122 to 135.

**
p<0.01

*
p<0.05 2-tailed tests. TLFB = Time Line Follow-Back, Sx = symptom

¹ Responses were collapsed from 6 to 3 categories

Predictive Validity: Baseline Readiness Predicting Number of Cigarettes in the Past Month at Six Months in Hierarchical Regression

Table 6A

	Motivation		Confidence		Ruler		TAA	
	N=132		N=130		N=132		N=132	
	beta	ΔR ²	beta	ΔR ²	beta	ΔR ²	beta	ΔR ²
Step 1								
Sex (1=female, 2=male)	.18*	.05	.17	.04	.18*	.05	.18*	.05
Age	.01		-.01		.01		.01	
Race (1=White, 2=Black, 3=Other)	-.12		-.12		-.12		-.12	
SES	.02		.02		.02		.02	
Step 2 (Clinic: Dual dx=1, Other=0)	.24**	.05**	.23*	.05*	.24**	.05**	.24**	.05**
Step 3 (residential days, last 30 days)	-.16	.03	-.18*	.03*	-.16	.03	-.16	.03
Step 4 (BL Nicotine dep sx count)	.36**	.12**	.37**	.13**	.36**	.12**	.36**	.12**
Step 5 (BL Readiness measure)	-.23**	.05**	-.26**	.06**	-.27**	.07**	.14	.02
Step 6 (BL Difficulty to abstain)	.29**	.06**	.25**	.04**	.30**	.07**	.29**	.06**

Table 6B
Predictive Validity: Baseline Readiness Predicting Abstinent Days at Six Months

	Motivation		Confidence		Ruler		TAA	
	N=132		N=130		N=132		N=132	
	beta	ΔR ²	beta	ΔR ²	beta	ΔR ²	beta	ΔR ²
Step 1								
Sex	-.20 *	.04	-.20 *	.04	-.20 *	.04	-.20 *	.04
Age	.04		.04		.04		.04	
Race	.03		.03		.03		.03	
SES	-.00		-.00		-.00		-.00	
Step 2	-.10	.01	-.09	.01	-.10	.01	-.10	.01
Step 3	.15	.02	.15	.02	.15	.02	.15	.02
Step 4	.02	.00	.02	.00	.02	.00	.02	.00
Step 5	.15	.02	.21 *	.04 *	.17	.03	-.17	.03
Step 6	-.17	.02	-.13	.01	-.17	.02	-.16	.02

Notes: Ns differ due to missing data. Total cigarettes in the past month was transformed. Dual dx=Dual Diagnosis Clinic. Other=Other clinic setting. SES=Socioeconomic Status. BL=Baseline. Nicotine dep sx count=Nicotine dependence symptom count in the past 6 months. Motiv=Motivation to abstain from nicotine in the next 30 days. Confid=Confidence to abstain from nicotine in the next 30 days. Ruler=Readiness Ruler. TAA=Thoughts About Abstinence. Residential days = days in a controlled environment in the 30 days prior to 6-month follow-up. All betas are standardized; beta is reported for the variable when entered at that step.

**
p≤.01

*
p≤.05 2-tailed tests

Table 7A
Predictive Validity: 6-month Readiness Predicting Number of Cigarettes in the Past Month at 12-Months in Hierarchical Regression

	Motivation N=121		Confidence N=96		Ruler N=115		TAA N=121	
	beta	ΔR ²	beta	ΔR ²	beta	ΔR ²	beta	ΔR ²
Step 1								
Sex (1=female, 2=male)	.22*	.06	.28**	.12*	.18	.05	.22*	.06
Age	.10		.16		.12		.10	
Race (1=White, 2=Black, 3=Other)	.03		.02		.01		.03	
SES	-.01		.05		.03		-.01	
Step 2 (Clinic: Dual dx=1, Other=0)	.17	.03	.21*	.04*	.20*	.04*	.17	.03
Step 3 (residential days, last 30 days)	-.24*	.05*	-.24*	.05*	-.25**	.06**	-.24*	.05*
Step 4 (6-mo Nicotine dep sx count)	.34**	.11**	.32**	.09**	.34**	.11**	.34**	.11**
Step 5 (6-mo Readiness measure)	-.36**	.12**	-.25**	.06**	-.37**	.13**	.37**	.12**
Step 6 (6-mo Difficulty to abstain)	.24*	.03*	.39**	.07**	.23*	.03*	.24**	.04**

Table 7B
Predictive Validity: 6-month Readiness Predicting Abstinence Days at 12-months

	Motivation		Confidence		Ruler		TAA	
	N=122		N=97		N=116		N=122	
	beta	ΔR ²	beta	ΔR ²	beta	ΔR ²	beta	ΔR ²
Step 1								
Sex	-.07	.03	-.03	.03	.01	.01	-.07	.03
Age	-.01		-.11		-.04		-.01	
Race	-.08		-.08		-.06		-.08	
SES	.13		.07		.08		.13	
Step 2	-.16	.02	-.18	.03	-.21*	.04*	-.16	.02
Step 3	.27**	.07**	.32**	.09**	.31**	.08**	.27**	.07**
Step 4	-.12	.01	-.14	.02	-.11	.01	-.12	.01
Step 5	.41**	.16**	.15	.02	.28**	.07**	-.38**	.13**
Step 6	-.05	.00	-.31*	.05*	-.08	.00	-.10	.01

Notes: Ns differ due to missing data. Total cigarettes in the past month was transformed. Dual dx=Dual Diagnosis Clinic. Other=Other clinic setting. SES=Socioeconomic Status. BL=Baseline. 6-mo=6-months. Nicotine dep sx count=Nicotine dependence symptom count in the past 6 months. Motiv=Motivation to abstain from nicotine in the next 30 days. Confid=Confidence to abstain from nicotine in the next 30 days. Ruler=Readiness Ruler. TAA=Thoughts About Abstinence. Residential days = days in a controlled environment in the 30 days prior to 12-month follow-up. All betas are standardized; beta is reported for the variable when entered at that step.

**
p≤.01

*
p≤.05 2-tailed tests