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Acceptance-Based Treatment for Smoking Cessation

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This pilot study applied a theoretically derived model of acceptance-based treatment process to smoking cessation, and compared it to a pharmacological treatment based on a medical dependence model. Seventy-six nicotine-dependent smokers were randomly assigned to one of two treatments: Nicotine Replacement Treatment (NRT), or a smoking-focused version of Acceptance and Commitment Therapy (ACT). There were no differences between conditions at posttreatment; however, participants

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in the ACT condition had better long-term smoking outcomes at 1-year follow-up. As predicted by the acceptance process model, ACT outcomes at 1 year were mediated by improvements in acceptance-related skills. Withdrawal symptoms and negative affect neither differed between conditions nor predicted outcomes. Results were consistent with the functional acceptance-based treatment model.

The 1960s and 1970s were the golden age of behavior therapy development for smoking cessation. Multiple new technologies based on behavioral models resulted in notable improvements in outcomes (Shiffman, 1993a). Since that time, however, the development of new behavioral therapies has slowed (Niaura & Abrams, 2002; Shiffman, 1993a). According to Shiffman (1993a), this reduction may be attributed to a shift in focus from behavioral smoking cessation treatments that are based on unitary specified mechanisms of change to multicomponent, atheoretical grab-bag approaches incorporating any technologies believed to offer help.

While applying combinations of helpful treatments seems justifiable given the severe consequences of smoking, atheoretical treatment packages can obscure clarity about critical mechanisms of change (Shiffman, 1993a). Clarity about the processes responsible for treatment effects leads to better understanding of disorders and existing treatments, and leads to the development of new, more powerful therapies (Follette, 1995; Kazdin, 2001). Recently, a number of investigators have called for a return to theory-driven treatment development based on behavioral mechanisms of action (Niaura & Abrams, 2002; Rounsaville, Carroll, & Onken, 2001).

The present study is an investigation of a new treatment for smoking based on a specific behavioral theory of change. The treatment was designed for smokers whose smoking is maintained by efforts to avoid or modify aversive internal experiences such as negative affect and other withdrawal symptoms. It is a basic behavioral principle that avoiding aversive stimuli can provide negative reinforcement for maladaptive behavior. For example, the alcoholic who drinks to avoid or regulate negative affect reaps immediate benefits from drinking (Conger, 1956; Marlatt & Gordon, 1985).

Evidence suggests that the negative reinforcement available through avoidance is an important component of nicotine dependence (Shiffman, 1993b). Negative affect and the negative reinforcement produced by reductions in negative affect are potent predictors of smoking and smoking relapse (Brandon, 1994; Brandon, Tiffany, Obremski, & Baker, 1990). Negative affect is strongly associated with smoking in epidemiological studies (Anda et al., 1990; Cinciripini, Hecht, Henningfield, Manley, & Kramer, 1997), appears to predict treatment failure (Hall, Munoz, Reus, & Sees, 1993; Hall et al., 1996), and has powerful psychophysiological interactions with nicotine and nicotine withdrawal (Newhouse & Piasecki, 2000; Pomerleau & Pomerleau, 1984). In a recent study of 632 smokers (Kenford et al., 2002), postquit negative affect was the strongest predictor of relapse, above physiological dependence symptoms and history of drug exposure. Smoking may be maintained

by avoiding negative affect, and relapse may be triggered by the desire to reduce negative internal states.

The current project developed and applied a behavioral treatment based on a functional process model targeting negatively reinforced avoidance (Gifford, 1994, 2002a; Kohlenberg & Gifford, 1999). This model specifies that the critical component of the behavior change process is the ability to respond differently in the presence of negative affect and other internal states; in addition, the goal of treatment is to shape acceptance-related skills in order to reduce avoidance and increase cognitive and behavioral flexibility (Gifford, 2002b). There are four components to the process model:

1. An interpersonal context (e.g., the therapy relationship) that models, supports, and reinforces the development of acceptance-related skills.
2. Cognitive, affective, and physiological self-discrimination skills that help clients identify the aspects of their experience that have previously occasioned unhealthy behavior.
3. Guided exposure to previously avoided internal experiences, with response prevention.
4. Constructive behavioral activation in the presence of previously avoided thoughts and feelings.

This model was used to generate a version of Acceptance and Commitment Therapy (ACT) targeted toward smokers. ACT (Hayes, Strosahl, & Wilson, 1999) is based on a contextual theory of cognition and behavior (Hayes, Barnes-Holmes, & Roche, 2001) and aims at increasing behavioral self-control by facilitating skills in accepting internal experiences and recontextualizing problematic cognitions (see Hayes, 2004; this issue). Clients are taught to make overt behavioral choices on the basis of goals linked to life values, and not on the basis of seeking to modify certain thoughts or feelings.

Nicotine Replacement Treatment (NRT) was chosen as the comparison condition for this treatment development study. NRT is a widely used empirically supported treatment based on a physical dependence model (Cinciripini et al., 1997). The physical dependence model identifies that the basis for smoking is nicotine exposure, tolerance development, and resulting withdrawal symptoms in the absence of nicotine (Kenford et al., 2002). Nicotine-replacement therapy provides an alternative form of nicotine intended to relieve withdrawal symptoms in smokers abstaining from tobacco (Rigotti, 2002; Westmaas, Nath, & Brandon, 2000).

The model underlying NRT provides a clear contrast to a functional acceptance–based treatment model. The former treatment is based on altering the frequency or intensity of withdrawal symptoms, while the latter treatment is based on altering the function of such experiences. This direct difference permitted preliminary testing of both process and outcome. The physiological dependence model predicts that participants' withdrawal symptoms relate to outcome, and that the NRT treatment will produce better outcomes by reducing withdrawal symptoms. The functional acceptance–based

model predicts that participants' efforts to avoid relate to outcome, and that ACT treatment will produce better outcomes by reducing experiential avoidance and thereby increasing cognitive and behavioral flexibility.

Method

Participants

One hundred twenty-four participants completed screening. Forty-eight participants either were not accepted or dropped out before randomization; 25 out of this 48 were excluded for smoking and nicotine dependence criteria, 8 were excluded for nonsmoking study criteria (e.g., currently using alternative treatments, active psychiatric conditions), and 15 declined treatment prior to assignment. Seventy-six participants were provided informed consent, randomized, and began treatment.

Subject characteristics. Fifty-nine percent of participants were female, and 41% male. Almost a quarter of the sample (23%) was ethnic minority, and the remainder of the sample was Caucasian. The largest participant minority groups were Hispanic (7%) and Native American (7%). Participant ages ranged from 19 to 71, with an average age of 43 ($SD = 11.68$). Thirty-two percent of participants reported an income above $29,999. Fifty-seven percent of participants reported having attended at least some college, 17% reported completing high school, and 4% reported some high school or less.

Subject smoking histories. Participants reported smoking an average of 21.40 cigarettes per day ($SD = 7.05$). Participants reported an average of four quit attempts lasting more than 1 day over the past 2 years ($M = 4.0$, $SD = 6.86$). The length of quit periods varied widely, with the 25th percentile quitting for 4.13 days, the 50th percentile for 30 days, and the 75th percentile for 180 days or more. Forty percent of participants reported no previous treatment for smoking.

Procedures

Participants were recruited from the community through newspaper and radio advertisements, referrals from physicians and agencies, and flyers. After an initial phone screen with clinic personnel, participants underwent a semistructured interview with study psychiatrists to screen for smoking criteria and current medical or psychiatric diagnoses, including active or recent substance use dependence or abuse disorders, a history of psychosis, and mental retardation (see Table 1 for inclusion and exclusion criteria). The Fagerstrom Test for Nicotine Dependence (FTND), CAGE (a brief screening questionnaire for problem drinking; Buchsbaum, Buchanan, Centor, Scholl, & Lawton, 1991), Beck Depression Inventory (BDI), and the BAI (Beck Anxiety Inventory) were used to cross-validate certain criteria in the interview screening process (e.g., even if participants did not choose to disclose a problem with alcohol, CAGE scores of greater than 2 were cause for exclusion). After screening, participants were randomly assigned to: ACT or NRT. Both

TABLE 1
INCLUSION AND EXCLUSION CRITERIA

Inclusion Criteria	Exclusion Criteria
Self-identified nicotine-dependent smokers smoking 10 cigarettes or more per day for at least 12 months with FTND scores of 5 or more.	Previous or present diagnosis of a psychotic disorder.
Willing to be randomly assigned to treatment.	Borderline mental retardation.
Agree to continue with the project for the full 7-week treatment period.	Diagnosis of alcohol or drug dependence within the last year (excluding nicotine).
Agree to participate in follow-up assessment for 1 year posttreatment.	Under 18 years of age.
Agree not to seek other treatment for smoking during the 7-week active treatment period.	Non-English speaking.
Previous quit attempt lasting at least 24 hours.	History of serious cardiac disease.
	Active peptic ulcer.
	Currently using tobacco products other than cigarettes.
	Currently using nicotine replacement products, including gum, patch, or medication such as fluoxetine, clonidine, bupsirone, doxepin.
	Skin allergies and/or active dermatological conditions involving large areas of the skin surface.
	Currently receiving psychotherapy.
	Living with anyone who has been or is being treated by the UNR Smoking Cessation Clinic.
	Active affective disorders, including major depressive disorder, bipolar disorder, or anxiety disorders.

treatments lasted 7 weeks with participants visiting the clinic at least once per week.

NRT

NRT providers. Participants in the NRT condition were treated by a board-certified psychiatrist with extensive training in the medical management of smoking cessation, including nicotine replacement therapies, and a psychiatry resident under her supervision. These two providers had strong allegiance to the medical management of smoking cessation. The primary psychiatrist was on 24-hour call throughout treatment.

NRT protocol. Nicotine replacement was delivered via nicotine patches provided free of charge to participants. Participants attended an initial 1.5-hour group education meeting conducted by the psychiatrist, during which an empirically supported treatment rationale was presented to participants (see below), along with basic advice on quitting smoking. Participants were provided with a 30-minute question-and-answer period and received instructions on how to reach the doctor in the event of any concerns. Participants were instructed not to smoke when using the patch.

During the patch education meeting conducted by the study psychiatrist, participants were given the following rationale (from Tsoh et al., 1997):

> One reason people smoke is to obtain nicotine. Nicotine is the ingredient in tobacco smoke believed to be responsible for addiction or tobacco dependence. Many smokers feel bad when they stop smoking. They may experience cravings for cigarettes, tension, irritability, sadness, problems with sleep, and difficulty concentrating. These symptoms are partly the result of nicotine withdrawal—the reaction of our bodies to the removal of nicotine when we are accustomed to getting it.
>
> Sometimes, people want a cigarette in specific situations where they are used to smoking, such as after a meal or while driving. Problems with withdrawal and a desire to smoke in particular settings may lead to relapse. The patch can help by maintaining a constant (but lower than smoking) level of nicotine throughout the day. Using the patch results in a reduced desire to smoke and provides an opportunity for a new nonsmoker to practice all of the new nonsmoking skills without being burdened by cravings. (p. 16)

Patch schedule was determined by guideline recommendations (Fiore, Jorenby, Baker, & Kenford, 1992), with 22 mg patches used for 4 weeks followed by 11 mg patches for 3 weeks. Participants received the following instructions: (1) No smoking allowed while on the patch; (2) Apply a patch immediately upon waking on the quit day; (3) Wear each patch for 24 hours unless you are instructed to do otherwise by the study physician; (4) Use a new patch every morning (do not apply a new patch before bedtime) and place the used patch in the box for collection at the weekly check-in; and (5) Each day, apply the new patch to an area of hairless skin below the neck and above the waist, rotating patch sites each day. Participants were told to discontinue patch use and contact the study physician if they experienced skin irritation at the patch site, chest pain, stomach pain, nausea, or light-headedness.

Adherence. Participants returned to the clinic weekly in order to return used patches and to receive new patches for the following week. The number of used patches was recorded and participants were interviewed to determine adherence. Nonadherence was defined as failing to use a patch for 2 days in a row or for more than 3 nonconsecutive days for the week. If patients were nonadherent, they consulted with the study physician on dosage and smoking status before resuming treatment in order to ensure appropriate dosage. If resuming treatment, participants were once again provided with the NRT rationale and patch instructions.

ACT

ACT providers. Participants in this condition were seen by one of four therapists experienced in ACT. One of these therapists was a psychologist in the department of psychiatry, the other three therapists were advanced doctoral students in the department of psychology.

ACT protocol. Treatment was delivered in seven 50-minute individual sessions and seven 90-minute group sessions. Participants attended one group and one individual session per week for 7 weeks. Therapists conducted treatment according to individual and group treatment manuals. Therapists were encouraged to apply the manual interventions idiographically, in line with the functional model and resulting case conceptualizations.

It is a difficult task to respond without smoking when confronted with physical sensations or emotional states that previously triggered smoking. The overarching goal of treatment was to provide an intensive experiential training program based on the functional model. Thus the protocol focused on helping people notice their internal triggers as they occurred, change what they could and accept what they could not change, make public commitments to behaving in alignment with their values, and practice a variety of constructive actions in response to these triggers. The protocol had several emphases and components aimed at shaping these repertoires:

1. *Internal versus external triggers.* Therapists helped clients identify their internal triggers, i.e., thoughts, feelings, and physiological sensations associated with smoking. Therapists described the role internal triggers play in smoking and their relevance to the quitting process.
2. *Problems with control efforts.* Therapists helped clients identify that efforts to control or avoid internal experience are linked to smoking and to problems with quitting. Experiences from participants' smoking histories and history of smoking attempts were considered (e.g., drawing out the success or failure of previous cessation strategies). This section of the ACT protocol was designed to help clients identify control-based strategies and enhance motivation to try acceptance-based strategies instead.
3. *Values, goals, and barriers.* Therapists helped clients clarify their values, define goals related to their values, and identify barriers to achieving their goals. Goals were defined as specific behavioral tasks related to quitting smoking. Barriers were defined as thoughts/feelings/sensations that derail efforts to perform these tasks. Clients were asked to identify the internal experiences most likely to function as barriers (i.e., the thoughts, feelings and sensations most likely to trigger smoking or attrition from treatment).
4. *Acceptance and willingness.* Therapists provided the rationale for approaching/accepting previously avoided internal stimuli, and for the skills training format. Through exercises and metaphors, clients identified that there is not an intrinsic link between feelings and actions, and

that the presence of aversive internal experiences in and of themselves does not constitute a threat. (Clients had multiple programmed opportunities to experience feelings and thoughts fully without acting on them.) The purpose of this component was to reduce motivation for avoidant behavior and to increase tolerance for discomfort.

5. *Mindfulness skills.* Clients participated in experiential exercises designed to develop a safe and consistent perspective from which to observe and accept all changing inner experiences. Mindfulness techniques were incorporated during this phase in order to enhance awareness of problematic stimuli and also to expand awareness of alternative features of their experience and environment in order to promote cognitive and behavioral flexibility.
6. *Graduated exposure.* Therapists helped clients establish individualized exposure hierarchies. During these exposure sessions clients experienced increasing levels of withdrawal symptoms and aversive internal states. Therapists provided support and reinforced participants' contact with their previously avoided inner experiences. The goal of this treatment component was to alter the avoidant and smoking-related stimulus functions of internal stimuli through extinction and to add stimulus functions linked to alternative responses.
7. *Scheduled smoking.* If requested by participants as part of their graduated exposure hierarchies, therapists provided smoking schedules according to algorithms based on current client smoking and hours of wakefulness. Scheduled smoking increases the latency between the stimuli associated with smoking and the occurrence of smoking responses. These structured periods of delayed responding provided windows in which to practice identifying and responding differently to withdrawal symptoms/internal triggers outside of the treatment session.
8. *Cognitive defusion skills.* Clients participated in a series of exercises designed to identify and defuse cognitive triggers, with particular emphasis on rationalizations for smoking. For example, clients were taught to see thoughts as what they are (more or less helpful descriptors, depending on the specific cognition), and not as what they say they are (infallibly accurate reflections of reality). The goal of this component was to help clients alter the functions of cognitions that limit achievement of their behavioral goals.
9. *Behavioral activation and commitment.* Clients practiced a range of adaptive responses in the presence of negative affect and other internal triggers. The goal was to shape flexibility by developing repertoires that provide realistic behavioral alternatives to smoking.

Therapist supervision and adherence. S. Hayes, B. Kohlenberg, E. Gifford, and D. Antonuccio supervised the study therapists in weekly group supervision sessions. Therapists also received individual supervision as requested.

Special attention was paid to therapist adherence in order to ensure that therapists identified the appropriate functional classes and delivered the ACT interventions as intended by the treatment development team. Treatment attendance was recorded at the time of treatment sessions, and confirmed with clinic records.

Measures

Participants completed assessments at intake, weekly during the active treatment phase, and at posttreatment, 6-month follow-up, and 1-year follow-up. The current study evaluated the data from intake, posttreatment, 6-month, and 1-year follow-up time points. Descriptions of the study measures are provided below.

The Avoidance and Inflexibility Scale (AIS; $\alpha = .93$; Gifford et al., 2002). The AIS is a 13-item measure designed to evaluate smoker's endorsement of avoidance strategies related to smoking and smoking cessation. High scores on this Likert-type scale describe an avoidant strategy toward internal experiences and an inflexible link between these experiences and smoking (e.g., negative affect necessarily leads to smoking, and efforts to quit are directed toward avoiding negative affect). The measure's reliability was established in a recent study of 306 participants (Gifford et al., 2002).

The Client Satisfaction Questionnaire–3 (CSQ-3; $\alpha = .92$, Nguyen, Attkisson, & Stegner, 1983). The CSQ-3 measures client satisfaction with services. Items include, "To what extent has our program met your needs?" Items are rated on a 4-point Likert scale, with higher scores indicating greater client satisfaction.

Expired carbon monoxide. Air samples to measure carbon monoxide (CO) were obtained by the breath-holding procedure described in Irving, Clark, Crombie, and Smith (1988). Concentrations of CO were used to corroborate 24-hour point prevalence reports of smoking status during treatment and follow-up. Readings of 11 parts per million or less were defined as the nonsmoking range (Irving et al., 1988).

Fagerstrom Test for Nicotine Dependence (FTND; $\alpha = .56$; Payne, Smith, McCracken, McSherry, & Antony, 1994). The FTND is a 5-item self-report measure of nicotine dependence. Items include, "Do you smoke if you are so ill that you are in bed most of the day?" This measure evaluates symptoms of nicotine dependence.

Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 1971). The POMS is a 65-item self-report measure yielding six subscale scores (depression-dejection, tension-anxiety, anger-irritability, confusion, fatigue, and vigor) and a Total Mood Disturbance Score. McNair et al. (1971) reported excellent internal consistency reliability, with values ranging from .89 to .95 within scales. Patten and Martin (1996) state that the POMS "should be included in any comparison of the self-report measures of tobacco withdrawal" (p. 105).

Shiffman Tobacco Withdrawal Scale (STWS; Shiffman & Jarvik, 1976). This 25-item scale assesses current symptoms frequently associated with cig-

arette withdrawal. The scale has good internal consistency, has been validated in the study of withdrawal, and allows for examination of relatively small changes in withdrawal symptomatology (Patten & Martin, 1996).

Treatment Confidence Questionnaire (TCQ; Condiotte & Lichtenstein, 1981). The TCQ is a 47-item self-report measure assessing self-efficacy (i.e., ability to resist smoking) in a variety of specific situations. Participants rate their perceived probability of resisting smoking in each situation on a 10-point scale.

Working Alliance Inventory (WAI; $\alpha = .93$; Horvath & Greenberg, 1989). This 12-item inventory is based on Bordin's concept of the alliance as a bond between treatment provider and patient based on shared tasks and goals. Items include "my treatment provider and I agree about the things I will need to do in treatment to help improve my situation." Higher scores indicate stronger endorsement of the treatment relationship.

Data Analysis Plan

The primary outcome was 24-hour point prevalence smoking self-report confirmed by CO. If CO contradicted self-report, the participants were categorized as smokers. In the present sample two participants who denied smoking but had CO readings of 37 ppm and 28 ppm were categorized as smokers.

Because this study is a small initial evaluation of a novel treatment for smokers, efficacy analyses were conducted for the primary outcomes. Efficacy analyses reflect the results of treatment for those who participated and whose data was collected. To correct for possible bias due to missing data, analyses on final outcomes were also performed using generalized estimating equations (GEE) to replace missing data. According to Hall et al. (2001), there are caveats for the use of GEE for small samples with nonnormally distributed outcomes, as "there is limited information about the effects on the data analysis when the assumptions are violated or if the sample size is small" (p. 196). Therefore, both sets of results are presented.

The remaining variables were secondary outcomes hypothesized to impact primary outcomes: (a) withdrawal symptoms, (b) negative affect, and (c) experiential avoidance and inflexibility. If these variables were significantly related to outcome, then mediational analyses were conducted according to the analytic strategy proposed by Baron and Kenny (1986). Finally, a MANOVA was conducted on AIS items to further evaluate differences between conditions. Follow-up ANOVA comparisons were subjected to Bonferonni corrections. Eta was estimated to evaluate effect sizes for the follow-up comparisons.

Results

Preliminary Analyses

Equivalence of comparison groups. Two-tailed *t* tests for continuous variables and chi-square for categorical variables revealed no significant differ-

ences between conditions at baseline in demographic variables (age, gender, income, education, ethnicity, relationship status), smoking variables (number of cigarettes smoked, length of time smoked, FTND scores, previous treatment for smoking, number of previous 24-hour quit attempts), or partner support. Two-tailed *t* tests on intake levels of secondary process measures also showed no significant differences between conditions except for a significant difference between groups at intake on Treatment Confidence Questionnaire (TCQ) scores with the ACT condition showing slightly higher confidence levels than the NRT condition, ACT $M = 82.06$, $SD = 26.15$, NRT $M = 70.05$, $SD = 24.49$, $t(2, 71) = 2.02$, $p = .047$. However, there was no significant difference on intake TCQ for those who completed treatment.

Treatment attendance. Of the 76 participants who entered treatment, 62 (82%) received 3 or more weeks of treatment, and 43 participants (57%) received 5 or more weeks of treatment. Of the 33 who entered ACT treatment, 63.6% ($n = 21$) completed treatment. Of the 43 who began treatment in the NRT condition, 61.9% (28) completed treatment. There was no difference between conditions on number of weeks completed: ACT $M = 5.09$, $SD = 1.84$; NRT $M = 4.56$, $SD = 2.49$, $t(2, 74) = 1.03$, $p = .306$.

Treatment acceptability. There were no significant differences between conditions on treatment satisfaction (CSQ), ACT $M = 6.88$, $SD = 2.86$, NRT $M = 7.00$, $SD = 2.88$, $t(2, 62) = -.16$, $p = .88$. Posttreatment, ACT participants endorsed better relationships with their treatment providers as measured by the Working Alliance Inventory (WAI), ACT $M = 63.37$, $SD = 9.90$; NRT $M = 54.91$, $SD = 9.59$; $t(2, 59) = 3.37$, $p = .001$.

Attrition from assessment. Posttreatment data were collected from 62 participants (82%): 26 participants in the ACT condition (79%) and 36 participants in the NRT condition (84%) provided assessment information. Twelve-month data were collected from 55 participants: 20 participants in the ACT condition (61%) and 35 participants in the NRT condition (81%). Chi square (χ^2) analyses were used to evaluate the randomness of attrition from assessment. There was no relationship between assessment attrition and gender, income, participating in an intimate relationship, education, or ethnicity. Those who completed treatment in both conditions were significantly more likely to provide assessment data at post ($p = .01$) and at 1-year follow-up ($p = .04$). Assessment attrition was not related to condition at post. Although there was more attrition from the ACT condition, attrition at 1 year was not significantly related to condition, $\chi^2(76) = 4.04$, $p = .07$. In addition, there was no relationship between assessment attrition and primary or secondary outcome variables, indicating that smoking status and treatment process were not related to study attrition.

Intervention Effects on Smoking Status

Efficacy analysis smoking outcomes. Logistic regressions were performed on treatment condition and quit status at posttreatment, 6-month, and 1-year follow-up. The average number of cigarettes smoked at baseline was entered

into the equation as a covariate. Quit rates did not differ significantly at post, Wald $\chi^2(1, N = 62) = .05$, $p = .93$, with 35% quit versus 33% in the NRT condition, or at 6-month follow-up, Wald $\chi^2(1, N = 65) = .67$, $p = .36$ with 23% quit in the ACT condition versus 11% in the NRT condition. However, the ACT condition had significantly better outcomes at 1-year follow-up, Wald $\chi^2(1, N = 55) = 4.07$, $p = .04$, *OR* = 4.2 (*CI* 1.04–16.73), with 35% quit versus 15% in the NRT condition (see Figure 1).

Estimated smoking outcomes. Of the original 76 participants, 6 participants had missing data at all three time points (postmeasurement; 6 months; and 12 months). Because the GEE develops its estimates from previous data (implicit imputation), the missing data analyses were conducted on 70 participants. Of the 210 possible observations (70 participants at three time points), 28 observations were missing. Using SAS, the GENMOD procedure was utilized with both condition and time included in the model as class variables. Although the condition was not significant ($p = 0.26$), the odds ratio of 1.82 ($\beta = 0.60$) suggests that participants in the ACT condition were 82% more likely to quit smoking than those in the control condition.

To further examine the impact of the missing values, a logistic regression was conducted under the assumption of a worst-case scenario in which all missing data was converted to smoking status. We found that 9.3% quit in the control condition and 21.2% quit in the ACT condition at 1 year, producing a rate ratio of 2.28 (.212/.093; odds ratio = 2.62). Therefore, the participants in the ACT condition were 2.3 times more likely to quit compared to the control condition when the worst-case scenario was assumed for both conditions. The quit rates did not differ significantly at the end of 12 months, Wald $\chi^2(1, N = 76) = 2.04$, $p = .15$, OR = 2.62 (CI = 0.70–9.88).

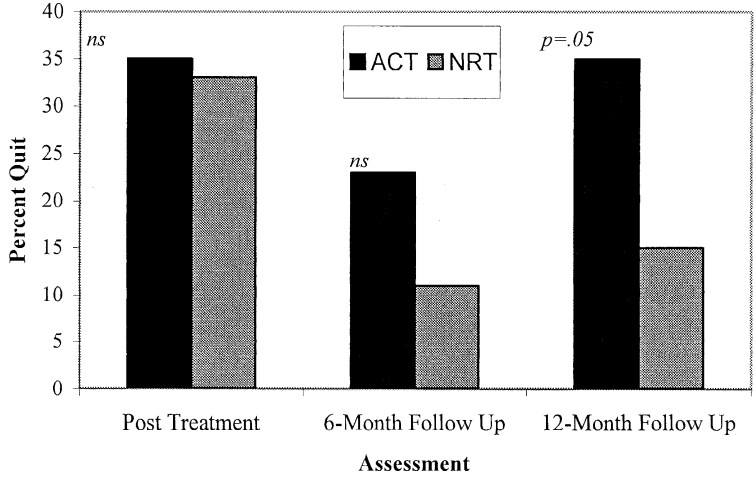

FIG. 1. Quit rates at posttreatment, 6-month, and 12-month follow-up assessment for the ACT and NRT treatment conditions.

The lack of significant finding may be due to the small sample size. Given the odds ratio of 2.62 (a medium effect size) and a sample size of 76, a two-sided test (alpha .05) has only 31% power to detect a significant difference. To achieve power at the .80 level with the current sample size would have required an odds ratio of 5.0 or larger, meaning that participants in one condition would have to have been five or more times as likely to quit than participants in the comparison condition. A difference of this size between active comparisons is highly unlikely. For example, the odds ratio for the difference between NRT and no treatment or placebo is 1.74 (1.64–1.86) (Silagy, Lancaster, Stead, Mant, & Fowler, 2004); the odds ratio for the difference between individualized behavior therapy and no treatment or minimal intervention is 1.62 (1.35–1.94) (Lancaster & Stead, 2004).

In sum, when examining the question from both a worst-case scenario and from the GENMOD's imputation of missing values, the ACT condition appears to produce better results than the control condition. While the results of this analysis suggest a positive outcome for the ACT approach, confirmatory studies should be undertaken.

Intervention Effects on Secondary Variables

Secondary analyses. The prospective relationships of three secondary variables to smoking outcomes were assessed. These variables were measured at their time of presumed greatest potency: withdrawal symptoms and negative affect were measured in the week following quit date for each of the conditions; avoidance and inflexibility were measured at posttreatment after the full course of skills training.[1]

After controlling for baseline level of cigarettes smoked, higher withdrawal symptoms were not significantly related to quit status, Wald χ^2 (1, $N = 50$) = .00, $p = .99$, nor were higher levels of negative affect related to quit status at 1 year, Wald χ^2 (1, $N = 46$) = .00, $p = .85$. However, lower levels of avoidance and inflexibility significantly increased likelihood of smoking abstinence, Wald χ^2 (1, $N = 53$) = .11, $p = .01$. Participants who were quit at 1 year had significantly lower post-AIS scores ($M = 31.45$, $SD = 13.01$) than those who were smoking ($M = 43.31$, $SD = 10.21$), $t(2, 74) = -2.90$, $p = .01$.

Mediational analyses. Because the relationship between avoidance and inflexibility and outcome was significant, we went on to test whether avoidance and inflexibility mediated the treatment-outcome relationship using the series of regression analyses suggested by Baron and Kenny (1986). In keeping with the above analyses we also controlled for intake number of cigarettes. The relationship between avoidance and inflexibility and condition was significant, Wald χ^2 (1, $N = 54$) = .42, $p = .04$, OR = 1.52 (CI 1.02–2.26), as was the relationship between condition and outcome, Wald χ^2 (1, $N = 54$) = 1.46, $p = .050$, OR = 4.31 (CI 1.00–18.55). However, when avoidance and

[1] Regressions on these variables were also conducted at posttreatment, with similar results.

inflexibility was added, condition became nonsignificant, Wald χ^2 (1, N = 54) = 1.34, p = .11, while the relationship between avoidance and inflexibility and outcome remained significant, Wald χ^2 (1, N = 54) = .43, p = .04, OR = 1.54 (CI 1.03–2.30). According to Baron and Kenny (1986), this pattern of results identifies a mediational effect, with avoidance and inflexibility mediating the effects of the acceptance-based smoking treatment on outcome.

Item analysis of the Avoidance and Inflexibility Scale. A one-way multivariate analysis of variance (MANOVA) was conducted to determine the effect of the two conditions on endorsement of the AIS items at posttreatment. Significant differences were found between the groups on the dependent items, Wilks' Lambda = .51, F(13, 49) = 3.64, $p < .01$. The multivariate η^2 based on Wilks' Lambda was .49, indicating that 49% of the multivariate variance of the AIS items was associated with the group factor. Analysis of variance (ANOVA) on each dependent variable was conducted as follow-up tests to the MANOVA. The ANOVA on the emotional avoidance item was significant after correcting for familywise error, F(1, 67) = 10.23, $p < .01$, η^2 = .14. This item from the AIS states that for some individuals smoking is related to certain feelings and asks, "How important is getting rid of these feelings?" The eta value of .14 signifies a large effect size for condition, with participants in the ACT condition significantly less likely to endorse the importance of reducing or eliminating emotions associated with smoking.

Discussion

This study performed an initial investigation of process and outcome in two treatments based on contrasting models: ACT, based on a functional model targeting acceptance skills; and NRT, based on a physiological dependence model targeting withdrawal symptoms. When examining outcomes from an efficacy analysis, the ACT condition produced better long-term results than the NRT condition. This finding was not significant in the imputed data set, although worst-case long-term outcomes indicate that ACT participants were more than twice as likely to quit compared to the NRT condition. A larger and more powerful replication study will be needed to test these preliminary results.

The acceptance theory-based model identifies negatively reinforced avoidance as a mechanism underlying smoking, and acceptance-related skills as the goal of treatment. According to this approach, it is the individual's response to his or her own difficult internal states that is at issue. The functional model did receive preliminary support: an inflexible, avoidant response to negative affect and withdrawal symptoms predicted quit rates, while absolute levels of withdrawal symptoms and negative affect did not. In other words, it was the individual's response to these symptoms, or the way in which these symptoms functioned for that individual person, which predicted smoking.

Results also indicate that avoidance of internal stimuli and concomitant inflexibility mediated the effects of ACT treatment on smoking outcomes. In particular, ACT participants were significantly less likely to endorse the

importance of reducing or eliminating emotions associated with smoking. It appears that the ACT technology may be a useful treatment for achieving the goals specified by the model. Clearly, further research on both treatment and process is warranted.

In the present study, withdrawal symptoms and negative affect were not meaningfully related to condition or outcome. Although reductions in withdrawal symptoms provide the conceptual rationale for NRT treatment, withdrawal symptoms were not meaningfully affected by the treatment. Others have noted that the relationship between withdrawal symptoms, smoking and NRT have received mixed support (e.g., see Antonuccio, 2002). Conclusions about the physical dependence model are beyond the purview of this small study. However, the lack of clarity about mechanisms of action may raise questions about psychosocial aspects of the NRT treatment process. The model underlying nicotine replacement delivers an implicit attributional message, i.e., the way to quit smoking is to reduce/avoid withdrawal symptoms or craving, and medication will help to accomplish this goal. If this interpretation is correct, the NRT rationale itself may create problems for smokers once the medication is removed, by heightening their concerns about symptoms. To the extent that removal of symptoms is reassuring, their return may be distressing. The same mechanism that works in the short term could sensitize some clients to their symptoms in the long term (Gifford, 2002b).

A central concern of most people entering smoking cessation treatment is ridding themselves of their urge to smoke. Cravings and withdrawal symptoms are painful, and can persist for years after cessation. It is understandable that people do not want to feel badly, and it is also understandable that an entire industry and field of study is aimed at helping smokers eliminate painful symptoms. However, treatment focused exclusively on eliminating or avoiding symptoms is not the only option. The results of the present study suggest that functional acceptance-based treatments may provide a useful addition to the smoking cessation armamentarium.

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