Attitudes and knowledge about nicotine and nicotine replacement therapy

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Nicotine replacement therapies (NRTs) represent an effective means of promoting smoking cessation, but they remain underutilized. Negative attitudes and false beliefs about nicotine and nicotine replacement may cause NRT underutilization. In a randomized, controlled, single-blind study of nicotine gum, 97 smokers were assessed on their attitudes and knowledge about nicotine, nicotine replacement, and smoking cessation therapy. Information from these self-report measures was used in an intervention that provided tailored, brief feedback to promote positive attitudes and accurate knowledge about NRT. Considerable variability in pretreatment attitudes and knowledge was observed across individuals. Moreover, attitudes and knowledge showed a consistent pattern of intercorrelation and were systematically related to smoking characteristics (e.g., prior use of NRT, nicotine dependence, treatment completion). The brief feedback intervention led to a significant global elevation in attitudes about nicotine, NRT, and assisted cessation but not knowledge about nicotine. Changes in attitudes and knowledge were not significantly related to gum use or smoking cessation. Recommendations for the appropriate application of brief feedback are offered.

Introduction

Nicotine replacement therapies (NRTs) have been shown to increase smoking cessation rates compared with placebo (Silagy, Lancaster, Stead, Mant, & Fowler, 2004). However, many smokers do not take advantage of NRT when quitting smoking (Cokkinides, Ward, Jemal, & Thun, 2005; Cummings & Hyland, 2005). Moreover, among those who initiate NRT, few complete the full course of treatment (Hughes, Pillitteri, Callas, Callahan, & Kenny, 2004; Johnson, Hollis, Stevens, & Woodson, 1991; Johnson, Stevens, Hollis, & Woodson, 1992; Lam, Abdullah, Chan, & Hedley, 2005; Shiffman, Hughes, Di Marino, & Sweeney, 2003; Shiffman, Hughes, Pillitteri, & Burton, 2003). Multiple factors likely influence the low initiation rates and subsequent noncompliance with NRTs, including cost (Hughes, Wadland, Fenwick, Lewis, & Bickel, 1991), ease of acquisition (i.e., prescription vs. over the counter; Shiffman et al., 1997), and issues surrounding the use of NRTs, such as social or practical prohibitions and side-effects (Hajek et al., 1999; Johnson et al., 1991; Millard, Waranch, & McEntee, 1992).

Underutilization of NRTs also may be attributed to beliefs and attitudes toward these medications. In the general medication literature, attitudes and beliefs about medications have been shown to predict treatment adherence (Horne & Weinman, 1999; Horne, Weinman, & Hankins, 1999). Recently, researchers have begun to evaluate smokers’ knowledge, attitudes, and expectations about nicotine and NRTs (Bansal, Cummings, Hyland, & Giovino, 2004; Cummings et al., 2004; de Zwart & Sellman, 2002; Etter & Perneger, 2001; Hammond, McDonald, Fong, & Borland, 2004; Hines, 1996; Juliano & Brandon, 2004; Parrott & Craig, 1995; Stanton, Lowe, Fisher, Gillespie, & Rose, 1999). Several countertherapeutic attitudes and beliefs are apparent.

First, smokers have questions about the efficacy of nicotine replacement, believing that quitting on their
own (i.e., “cold turkey,” without counseling or medication) is equally or more effective compared with assisted cessation (Bansal et al., 2004; Cummings et al., 2004; de Zwart & Sellman, 2002; Hammond et al., 2004; Stanton et al., 1999). These inaccurate beliefs may be generated because smokers compare or hear about the absolute number of success cases in assisted and unassisted methods, instead of comparing their success rates (Alonso & Fernandez-Berrocal, 2003; Pelham, Sumarta, & Myaskovsky, 1994). Because cold turkey is the most common approach (Fiore et al., 1990; Stephens & Siroonian, 1998), smokers may overlook data demonstrating that unassisted smoking cessation yields lower success rates than NRT. Second, smokers are concerned about the potential side-effects of nicotine (Etter & Perneger, 2001; Hajek et al., 1999; Millard et al., 1992). Smokers may erroneously attribute nicotine withdrawal symptoms to NRT, believing them to be medication side-effects (Barefoot & Girodo, 1972; Tate, Stanton, Green, Schmitz, & Marshall, 1994). A third area of concern focuses on the risk of addiction to nicotine as a possible detriment of NRT (Bansal et al., 2004; Cummings et al., 2004; Etter & Perneger, 2001). Although this concern is not unreasonable, empirical evidence for dependence on NRT is rare (Hughes et al., 2004; Shiffman, Hughes, Di Marino et al., 2003; Shiffman, Hughes, Pillitteri et al., 2003). Finally, smokers have false beliefs that nicotine is a major cause of tobacco-related health problems (Bansal et al., 2004; Cohen, 1996; Cummings et al., 2004; Etter, Kozlowski, & Perneger, 2003; Kozlowski et al., 1998; Kozlowski & Pillitteri, 2001; Shiffman, Pillitteri, Burton, Rohay, & Gitchell, 2001a, 2001b). Although nicotine is the chemical chiefly responsible for chronic tobacco use (U.S. Department of Health and Human Services [USDHHS], 1988), its health dangers relative to the other compounds in tobacco smoke are small (Benowitz, 1988). The short-term use of nicotine in the form of NRT presents minuscule risks compared with the potential dangers of continued smoking, even in those with heart disease (Joseph et al., 1996).

In a study of compliance with nicotine gum (Mooney, Babb, Jensen, & Hatsuksami, 2005), we evaluated treatment attitudes and knowledge about nicotine, NRT, and assisted cessation using several self-report measures. We employed a randomized, controlled design to test the effects of tailored, brief feedback on attitudes and beliefs about nicotine and NRT, compared with a usual-care condition. In addition, we implemented a second experimental condition that combined brief feedback about NRT attitudes and beliefs with a contingency management procedure for compliance. Contingency management has been useful in improving compliance with other substance abuse pharmacotherapies (Carroll, Sinha, Nich, Babuscio, & Rounsaville, 2002; Preston et al., 1999). Results showed that adding contingency management treatment to brief feedback significantly increased amounts of nicotine gum consumption and rates of compliance compared with brief feedback without contingency management or a usual-care condition. Brief feedback alone did not elevate compliance rates above those in the usual-care group.

This paper has several additional goals beyond our original report (Mooney et al., 2005). First, we further describe the methods used to assess treatment attitudes and knowledge about nicotine, NRT, and assisted cessation. Second, we evaluate the relationship of these measures to each other and to cessation-related subject characteristics. Third, we extend univariate analyses of attitudes and knowledge through the use of profile analysis to better characterize the global effects of the brief feedback intervention. Of particular interest are the potential effects of contingency management on attitudes and beliefs, since the effects of external reinforcement on beliefs are variable (Festinger & Carlsmith, 1959; Newman & Layton, 1984; Rossomando & Weiss, 1970). Last, we evaluate the relationship of changes in attitudes and knowledge about nicotine, nicotine replacement, and smoking cessation therapy to gum use, smoking cessation, and treatment completion.

**Method**

**Participants and procedures**

A complete description of study methods is provided elsewhere (Mooney et al., 2005). This study was reviewed and approved by the institutional review board at the University of Minnesota. Male and female cigarette smokers interested in quitting were recruited through newspaper advertisements, and they attended an initial screening visit at the Transdisciplinary Tobacco Use Research Center. Subjects provided informed consent and were screened for eligibility, including a review of health history. Eligible subjects: (a) were aged 18–65 years, (b) smoked 15–50 cigarettes/day for at least 1 year, (c) experienced past nicotine withdrawal syndrome according to the Diagnostic and Statistical Manual of Mental Disorders (4th edition) criteria (American Psychiatric Association, 1994), and (d) were willing and able to safely use nicotine gum. A total of 97 subjects were randomized to treatment; 53 subjects provided data at end of treatment.

The study occurred over the course of 9 weeks and involved three consecutive phases: (a) Baseline (weeks 1–2), (b) treatment (weeks 3–5), and (c) follow-up (weeks 6–9). For the purposes of the
current report, only the baseline and treatment phases are considered. During the study, participants were provided 216 pieces of 2-mg mint nicotine gum supplied by GlaxoSmithKline. A 2-mg dose of nicotine gum was chosen because the majority of smokers require this dose (i.e., they smoke fewer than 25 cigarettes/day). Smokers attended weekly visits during the study except for week 2, when they attended twice.

**Interventions**

Subjects were randomized to one of three interventions: (a) standard treatment \((n=31)\), (b) standard treatment plus brief feedback \((n=32)\), or (c) standard treatment and brief feedback plus contingency management \((n=34)\). Each intervention was administered according to a scripted outline and checklist by trained smoking cessation counselors. All participants were generally instructed to chew 12 or more pieces per day, but only the brief feedback and contingency management groups received additional emphasis on compliance.

**Standard treatment.** Standard treatment represented a control condition in which participants received a structured presentation on the benefits of quitting, a review of coping skills to deal with craving and withdrawal, and support and encouragement (Fiore et al., 2000).

**Brief feedback.** In the brief feedback condition, personalized feedback was based on responses to three questionnaires completed at the first clinic visit: (a) The Beliefs about Medicines Questionnaire (BMQ; Horne et al., 1999), (b) the Attitudes about Nicotine Replacement Therapy—12 scale (ANRT-12; Etter & Perneger, 2001), (c) and the Perceived Risks of Nicotine Replacement scale (PRNR; S. Shiffman, M. E. Mooney, & D. K. Hatsukami, unpublished scale). As inferred from clinical experience and the published literature (e.g., Etter & Perneger, 2001), the brief feedback intervention was organized to address three domains that relate to the use of nicotine replacement, with subdomain themes within each domain: (a) **effectiveness** (i.e., [i] NRT relieves withdrawal; [ii] NRT relieves craving; [iii] NRT increases chances of successful cessation), (b) **safety** (i.e., [i] NRT does not cause smoking-related ailments; [ii] side-effects are minor if used correctly; [iii] NRT is minimally dependence forming), and (c) **necessity** (i.e., [i] long-term health relies on quitting; [ii] all available treatment should be used; [iii] nicotine replacement is appropriate). Items from each of the three scales were categorized by the authors as falling exclusively into one of the nine subdomains. Responses were collated and scored using a specialized SAS program, with each item classified as being in favor of or against nicotine and nicotine replacement therapy (neutral responses were classified as against). A detailed intervention manual was developed that, within each subdomain, contained a limited number of tailored scripts corresponding to different patterns of item endorsement (M. Mooney & D. Hatsukami, 2002, unpublished manual).

For each subdomain, all subjects received a standardized didactic segment that first presented facts about nicotine replacement therapy. Depending on the pattern of responses, subjects then received specific tailored feedback. Specifically, accurate knowledge and pro-medications beliefs were reinforced while incorrect, negative, or ambivalent positions were raised using nonconfrontational language that allowed for engagement, reflection, and clarification. Each intervention was intended to meet each patient’s individual needs, that is, to be idiopathic; thus, few feedback sessions were identical (although group averages on the parent scales were not different; Table 1).

**Contingency management.** In the contingency management condition, participants were contingently reinforced for nicotine gum use. To receive a US$70 bonus payment, participants had to use 12 or more pieces of gum per day for 10 of 15 treatment days, as well as fulfill study procedures (attendance, completion of forms, refraining from smoking after quit date). In contrast, subjects in the standard treatment and brief feedback conditions received the $70 payment based only on fulfillment of the study procedures.

**Measures**

**Smoking history and demographics.** Demographic variables and smoking history were captured via questionnaires, including the Fagerström Test for Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerström, 1991).

**Nicotine and treatment attitudes.** At baseline and end of treatment (15 days postcessation and 30 days post-baseline assessment), two measures of attitudes and beliefs about nicotine, NRT, and assisted cessation were administered. The BMQ (Horne et al., 1999) measures medication beliefs in general, yielding two subscales, overuse and harm. Overuse describes beliefs that medications are overprescribed by doctors, and harm describes beliefs that medications are addictive or toxic. In addition, the BMQ can be customized to measure beliefs about a specific medication or treatment, in this study “quit smoking treatment,” providing two subscales, necessity and
To assess knowledge about the Nicotine knowledge. NRT dependence, side-effects, and efficacy. cessation, and concerns indexes underlying beliefs that quit smoking treatments are addictive, are disruptive, or cause side-effects. The Attitudes about Nicotine Replacement Therapy—12 scale (ANRT-12; Etter & Perneger, 2001) measures two factors: Advantages and drawbacks of nicotine replacement therapy. Advantages taps beliefs that NRT will provide relief from withdrawal and craving during cessation, and drawbacks describes concerns about NRT dependence, side-effects, and efficacy.

Nicotine knowledge. To assess knowledge about the disease-causing role of nicotine, we developed a new instrument based on questions written by Saul Shiffman for a survey commissioned by GlaxoSmithKline (S. Shiffman, personal communication, January 6, 2004). We titled this measure the PRNR (S. Shiffman, M. E. Mooney, & D. K. Hatsukami, unpublished scale). Respondents were asked, “Below are several medical conditions or diseases. Please indicate whether you think nicotine alone, not the other chemicals in tobacco, causes these conditions or diseases.” The PRNR items are: (1) high blood pressure, (2) stroke, (3) lung cancer, (4) asthma, (5) respiratory allergies, (6) coronary heart disease, (7) gum disease, (8) oral cancers, (9) increased wrinkling of the skin, (10) colon cancer, (11) diabetes, (12) cataracts, (13) heart attack, (14) emphysema, and (15) liver disease. Item 1 was considered to be caused by nicotine whereas the others were not. Responses (yes, no, or don’t know) were coded as correct or incorrect (e.g., cancers [incorrect], hypertension [correct]), yielding a knowledge score (total items correct). “Don’t know” answers were coded as incorrect (e.g., Cummings et al., 2004). We arrived at our scoring system based on our reading of the literature (Benowitz, 1988; Benowitz, 2001; Benowitz & Gourlay, 1997) and consultation with experts (N. Benowitz, personal communication, December 31, 2001; A. Joseph, personal communication, December 31, 2001). Nicotine could contribute to the pathogenesis of several of the conditions that we did not attribute to nicotine (i.e., stroke, coronary heart disease, diabetes, and heart attack). The PRNR does not address the complex, multifactorial etiology and course of the medical conditions it includes. Further, increasing knowledge since its drafting may lead to some revisions on this scale (e.g., possible carcinogenicity of nicotine; Hecht, Hochalter, Villalta, & Murphy, 2000; Heeschen et al., 2001; Song et al., 2003; West et al., 2003), although the relative risk for disease associated with nicotine use per se is magnitudes lower than with tobacco use.

Gum use and adherence. Used nicotine gum was collected for each day of the treatment phase (day 1 [quit day] to day 15) and subsequently counted. From directly measured gum use, three outcome variables were defined: (a) number of days (0–15) of nicotine gum adherence for 9 and 12 pieces/day, respectively (i.e., 0=chewed <9 or 12 pieces in a day, respectively; 1=chewed ≥9 or 12 pieces in a day, respectively) and (b) total pieces of nicotine gum chewed (0–216 pieces).

Smoking abstinence. Point-prevalence abstinence was defined as no self-reported smoking in the preceding 7 days and a carbon monoxide level of less than 8 ppm at the clinic visit (Benowitz et al., 2002; Hughes et al., 2003). Assessments were made on a weekly basis. In the present report, continuous abstinence during the treatment phase was evaluated, as indicated by point-prevalence abstinence at each timepoint.

Urinary cotinine. Total urinary cotinine (ng/ml) was assessed prior to cessation.
Data analyses

Assumptions. All analyses were conducted using SAS version 9.1. Unless otherwise stated, p values of less than .05 were considered statistically significant, based on two-tailed tests. To control for family-wise error rate in post-hoc comparisons, we used Tukey’s HSD procedure or Bonferroni adjustments (i.e., \( x = .05/n \) number of comparisons computed for a given measure). Because of occasional missing data on other variables, available samples sizes were sometimes smaller. All effect sizes are reported in terms of Cohen’s d (Cohen, 1988), which can be interpreted as follows: \( d = .20 \), “small”; \( d = .50 \), “medium”; \( d = .80 \), “large”.

General analyses. Analysis of variance (ANOVA) was used to test for group differences on continuous outcomes, and chi-square tests were used with categorical variables. Relationships were assessed using Pearson product-moment correlations, including point-biserial correlations.

Profile analysis. We used profile analysis (Tabachnick & Fidell, 1996) as the primary analytic technique to evaluate differences between intervention groups across the attitude domains (knowledge was assessed separately, using analysis of covariance [ANCOVA]). Profile analysis is a special case of the familiar multivariate analysis of variance (MANOVA), in which the multiple dependent variables are expressed on the same scale of measurement. Profile analysis allows examination of group differences over a set of dependent variables, identifying differences in the shape, level, and other characteristics of profiles. Prior investigations have demonstrated that profile analysis is a useful tool for investigating group differences in substance-abusing populations (e.g., Carbonari & DiClemente, 2000). In profile analysis, several hypotheses can be tested, but we focus on two for the current investigation.

The levels hypothesis (magnitude) states that regardless of whether individuals score differently across profile variables, the group averages over the six profile variables are the same. Rejection of this hypothesis implies that the profile of at least one group, although parallel to the others, is elevated or depressed and supports the position that group differences in amount are present. The parallelism hypothesis (shape) states that the patterns of values over the variables are the same for each group, although some groups may be elevated or depressed in comparison with others. Rejection of this hypothesis indicates that the shape of the profile for at least one group differs from the others and supports the position that group differences in kind are present.

This technique allows discrimination of nonspecific treatment effects that influence all domains (rejection of the levels hypothesis) from specific treatment effects that influence some of the domains (rejection of the parallelism hypothesis). For the present study, profile analyses were performed for baseline and posttreatment assessments. To aid interpretation, the concerns, overdose, and harm scales from the BMQ and the drawbacks scale from the ANRT-12 were reflected so that increasing scores on all scales indicated pro-therapeutic attitudes. Because profile analysis assumes that all variables are measured using the same metric (Tabachnick & Fidell, 2001), we used standardized means of 50 and deviations of 10 following Carbonari and DiClemente (2000). To follow up on profile analysis hypothesis testing, we performed additional analyses on the scores in their original metric to identify differences. Between-subjects ANCOVA was used to assess for pairwise group differences on each variable. The SAS GLM procedure was used for these analyses, and the multivariate repeated-measures option was used to test profile differences. This technique also was used to evaluate the knowledge score from the PRNR. Baseline scores for respective measures were included as covariates.

Results

Sample description

We observed no differences across groups for any of the baseline characteristics. The sample was predominantly female (59.8%) and White (88.7%) with a mean age of 34.1 years (SD = 10.5). The majority of subjects were not married (73.2%) and had postsecondary education (73%). The sample was comprised of moderately dependent smokers (cigarettes/day: \( M = 20.7, SD = 5.1 \); FTND score, \( M = 4.7, SD = 1.5 \)). The sample had made multiple quit attempts of at least 24 hr (\( Mdn = 3 \) attempts) with an average quit time of a few months (\( Mdn = 60 \) days). On a scale from 1 to 10, with 10 being the most motivated to quit smoking, smokers generally showed high motivation (\( M = 8.6, SD = 1.2 \)). In rank order of frequency of use, the following cessation methods were used (many participants used more than one technique): “Cold turkey” (73.2%), nicotine patch (39.5%), bupropion (24.7%), nicotine gum (16.5%), nicotine nasal spray (1%), and nicotine inhaler (0%).

Baseline attitudes and knowledge about nicotine and NRT

To provide a sense of raw scores of scales used in the battery, we present mean baseline values, standard deviations, and ranges in Table 1. No differences by
treatment group were observed in any of the scales in the battery. Mean scale scores tended to fall one-quarter to one-half of the way from either end of the respective scales, showing room for clinical improvement prior to intervention.

Baseline knowledge from the PRNR about the safety of NRT was low, with an overall inaccuracy rate of 69.4%. Item-level inaccuracy rates were as follows: high blood pressure (57.3%), stroke (77.9%), lung cancer (65.7%), asthma (61.4%), respiratory allergies (27.0%), coronary heart disease (77.0%), gum disease (78.2%), oral cancers (71.2%), increased wrinkling of the skin (69.7%), colon cancer (69.7%), diabetes (63.5%), cataracts (64.6%), heart attack (77.1%), emphysema (67.7%), and liver disease (63.5%).

Correlation of attitudes and knowledge about nicotine and NRT

Attitudes and knowledge about nicotine and NRT were examined at baseline (Table 2). Perceived harm of medicines in general was positively associated with both concerns about “quit smoking treatment” and overuse of medicines in general. At the same time, concerns about medicines in general was positively correlated with drawbacks for NRT. Thus we observed some evidence for convergent validity of some of the scales. Knowledge about nicotine showed no association with attitudes and beliefs.

Associations between baseline attitudes and knowledge with smoking characteristics

Using correlation analyses, we examined the relationship of five smoking and cessation characteristics to baseline attitudes and knowledge about nicotine and NRT (Table 3). Only one effect reached significance under the Bonferroni adjustment: Those who had quit longer prior to entering the study saw more perceived advantages of NRT. Nevertheless, we observed a number of other interpretable, though nonsignificant, relationships. Perceived advantages of NRT was higher in those who had used NRT before. Those with more severe nicotine dependence (i.e., based on FTND score) perceived greater need for smoking cessation treatment yet had less accurate knowledge about the disease-causing role of nicotine. To some extent, participants who had quit previously for a longer period of time had a more favorable view of NRT and smoking cessation treatment. Higher motivation to quit smoking was associated with higher perceived necessity of smoking cessation treatment, and lower concerns about smoking cessation treatment. Higher total urinary cotinine appeared to bear little relationship to the measured attitudes and knowledge.

Effects of intervention

At baseline, the parallelism hypothesis was not rejected, $\chi^2=0.95, F(10, 148)=0.39, ns$, partial $\eta^2=.03$, indicating that there were no reliable differences in profile shape among groups. The levels hypothesis also was not rejected, $F(2, 78)=0.69, ns$, standard $\eta^2=.02$, indicating that reliable differences in amount were not found among groups when overall scores were averaged. Thus randomization produced groups with equivalent attitudes about NRT and nicotine.

Posttreatment profiles did not differ in shape, $\chi^2=0.83, F(10, 88)=0.39, ns$, partial $\eta^2=.09$. However, rejection of the levels hypothesis indicated that profiles differed in amount, $F(2, 48)=3.39, p=.04$, standard $\eta^2=.12$. Thus group profiles were parallel with at least one group being reliably elevated or depressed in comparison with the others. This finding suggests a nonspecific treatment effect on all attitude and knowledge variables. Pairwise comparisons taken at posttreatment indicated that individuals receiving brief feedback and contingency management had more pro-therapeutic profiles than those receiving standard treatment ($p=.0057$ and $p=.0451$, respectively). Profile differences are best demonstrated by plotting group means across variables in the model (Carbonari & DiClemente, 2000). Figure 1 shows the mean profiles of each of the three diagnostic groups.

Table 2. Correlation of three measures of nicotine attitudes and knowledge at baseline.

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<td>6. Drawbacksb</td>
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Note. Correlations of observations taken at baseline. aItems from the Beliefs about Medication Questionnaire (Horne et al., 1999). bItems from the Attitudes about Nicotine Replacement Therapy—12 scale (Etter & Perneger, 2001). cItems from the Perceived Risks of Nicotine Replacement scale (S. Shiffman, M. E. Mooney, & D. K. Hatsukami, unpublished scale). *p<.05. †Bonferonni adjusted (s=20), p<.0025. N=97.
Table 3. Associations between baseline attitudes and knowledge with smoking characteristics.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Ever used NRT</th>
<th>FTND score</th>
<th>Longest time quit</th>
<th>Motivation to quit</th>
<th>Urinary cotinine</th>
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Note. FTND, Fagerström Test for Nicotine Dependence. All values are Pearson product-moment correlations. aItems from the Beliefs about Medication Questionnaire (Horne et al., 1999). bItems from the Attitudes about Nicotine Replacement Therapy—12 scale (Etter & Perneger, 2001). cItems from the Perceived Risks of Nicotine Replacement Therapy scale (S. Shiftman, M. E. Mooney, & D. K. Hatzukami, unpublished scale). dLongest attempt, motivation to quit, and baseline cotinine were skewed and were log transformed prior to analysis. *p<.05. †Bonferroni adjusted (α=.04), p<.0015. N=97.

Although profile analysis indicated a nonspecific treatment effect, between-subject ANCOVAs were performed on posttreatment scores to more closely examine the individual treatment effect on each attitude and belief domain. Results of these tests were as follows: Advantages, F(2, 42)=1.60, ns, d=0.55; drawbacks, F(2, 42)=5.74, p=.0063, d=1.03; necessity, F(2, 42)=3.56, p=.0376, d=0.81; concerns, F(2, 42)=1.11, ns, d=0.45; overuse, F(2, 42)=0.20, ns, d=0.19; and harm: F(2, 42)=0.47, d=0.30, p=ns. Although only two of the scales showed statistically significant differences, the range of effect sizes indicates that intervention effects may be present but not detectable on some of the scales because of power limitations. Scales with significant overall differences (drawbacks and necessity) were analyzed with Tukey’s HSD procedure (αFW=.05), which demonstrated significant differences between the brief feedback and standard treatment groups and the contingency management plus brief feedback and standard treatment groups.

The effects of the intervention on nicotine knowledge were examined separately from the profile analysis. Controlling for baseline knowledge on the PRNR (M=5.9, SD=.4), we found that knowledge about the risks of nicotine did not increase following the intervention in any of the groups, F(2, 9.9)=.10, ns. Averaging across groups, the total number of items answered correctly at end of treatment was 7.6 (SD=0.5).

Correlation of attitudes and knowledge with outcomes

We wished to evaluate the role of change in baseline attitudes and knowledge in connection with these outcomes (Table 4). In this reduced sample of 53 subjects who completed treatment, change in scores showed little obvious relationship to the gum-use outcomes. Reductions in two BMQ scales relating to medicines in general, overuse and harm, tended to be related to a greater likelihood of continuous abstinence, although neither relation achieved statistical significance after Bonferroni adjustment.

We further evaluated the role of the seven baseline attitudes and knowledge scores to treatment completion (i.e., attending six visits over a 1-month period). Under a Bonferroni-correction (α/7=.007), those who completed treatment had significantly more accurate baseline knowledge, r(96)=.32, p=.0016. Although not statistically significant under Bonferroni adjustment, those who completed treatment had lower perceived overuse of medicines in general, r(96)=−.21, p=.0379. Correlations for other scores were as follows: Advantage, r(88)=.10, ns; drawback, r(92)=−.12, ns; necessity, r(94)=−.16, ns; concerns, r(88)=−.19, ns; and harm, r(97)=−.17, ns.

Discussion

Consistent with other surveys (Bansal et al., 2004; Cummings et al., 2004; de Zwart & Sellman, 2002; Hammond et al., 2004; Hines, 1996; Schnoll et al., 2002; Stanton et al., 1999), smokers in the present study showed considerable variability in their attitudes and knowledge about nicotine, nicotine replacement, and assisted cessation even though they volunteered for a treatment study using NRT (Table 1). Of particular interest, the majority of subjects asserted that nicotine alone was a cause of a number of smoking-related ailments, including lung cancer (c.f. Bansal et al., 2004; Cummings et al., 2004). Confusion about the pathogenic effects of nicotine relative to tobacco is not surprising, in light of public health campaigns broadly condemning tobacco products. Smokers have developed false beliefs about the benefits of reduced nicotine exposure and value these beliefs in their selection of cigarettes (Cohen, 1996; Etter et al., 2003; Kozlowski et al., 1998; Kozlowski & Pillitteri, 2001; Shiftman et al., 2001a, 2001b).

In the present study, smokers who had used NRT in the past were more likely to have favorable attitudes toward NRT than those who had never used it, consistent with a recent, large-scale survey of smokers (Bansal et al., 2004). Previous users of NRT
Figure 1. (A) Profile analysis of baseline scores on the Attitudes about Nicotine Replacement Therapy—12 scale (ANRT-12), Beliefs about Medication Questionnaire (BMQ), and Perceived Risks of Nicotine Replacement scale (PRNR). Scale scores on negative attitudes and beliefs were reflected to make increases indicative of more pro-therapeutic attitudes. All scales were standardized as T-scores ($M=50$, $SD=10$). (B) Profile analysis of posttreatment scores on the Attitudes about Nicotine Replacement Therapy—12 scale (ANRT-12), Beliefs about Medication Questionnaire (BMQ), and Perceived Risks of Nicotine Replacement scale (PRNR). Scale scores on negative attitudes and beliefs were reflected to make increases indicative of more pro-therapeutic attitudes. All scales were standardized as T-scores ($M=50$, $SD=10$). The brief feedback intervention increased the overall level of pro-therapeutic attitudes relative to a control condition.
believed that the treatment was less harmful, had fewer drawbacks, and had more advantages, compared with participants who were using NRT for the first time. Those who completed the full course of treatment had more favorable attitudes and more accurate knowledge about NRT than those who did not. Thus attitudes and knowledge may inform the decision to initiate or discontinue NRT, along with other psychological factors such as motivation or self-efficacy concerning smoking cessation (Garcia, Schmitz, & Doerfler, 1990; Gwaltney et al., 2002). In the present study, a tailored, brief feedback intervention produced a significant elevation in pro-therapeutic attitudes about nicotine. Results indicated that brief feedback, with and without contingency management, had a nonspecific effect.

In other words, treatment did not target only one or two attitudinal domains. Rather, the intervention changed all attitudinal domains, although some (e.g., drawbacks and necessity) were changed more than others (e.g., overuse and harm). In contrast to nomothetic interventions targeting a specific deficit area for all individuals, the current idiopathic approach, which was designed to reverse counter-therapeutic attitudes and strengthen preexisting pro-therapeutic attitudes for each participant, may have allowed for a multidimensional effect. Indeed, tailored feedback has shown efficacy in promoting smoking cessation (Velicer & Prochaska, 1999) and more generally seems an important approach to increasing motivation for health change and health maintenance behaviors (de Vries & Brug, 1999; DiClemente, Marinilli, Singh, & Bellino, 2001).

Although the brief feedback intervention significantly elevated NRT attitudes in comparison with standard treatment, brief feedback was shown to be no different than standard treatment in maintaining daily treatment compliance (Mooney et al., 2005). At the same time, the combination of contingency management and brief feedback was shown to increase daily gum utilization (Mooney et al., 2005). Other studies have demonstrated a reliable association between attitudes and medication compliance (Horne & Weinman, 1999; Horne et al., 1999; Ross, Walker, & MacLeod, 2004). In light of the dissociation of treatment effects, attitudinal factors may be less important in the maintenance of daily NRT treatment compliance. However, because attitudes are related to previous NRT use and current NRT completion, they may be crucial in motivating the decision to initiate and remain committed to NRT. Viewed in terms of the transtheoretical model and the stages of change (DiClemente & Scott, 1997), brief feedback about the pros and cons of medication treatment are most important in shifting a patient into the action stage, where the decision to instigate and remain in treatment occurs. However, in the action stage, environmental factors such as the complexity of the treatment, extrinsic rewards for compliance, and social support are key determinants of daily compliance (Willey, 1999). In fact, treatments that directly reinforce medication taking have shown consistent success in the substance abuse literature (Petry, 2000). Thus a sequential, two-stage treatment approach may be maximally beneficial. First, counter-therapeutic attitudes and beliefs are targeted to motivate the decision to quit with NRT. Then, reinforcement is provided contingent on daily compliance with NRT with sustained emphasis on maintaining positive attitudes about NRT to ensure treatment continuation.

The present study represents an initial effort to formally assess and modify nicotine attitudes and knowledge, and it has several limitations. First, the study was conducted in treatment-seeking smokers who were already motivated to use NRT. Thus more robust relationships between nicotine knowledge and attitudes and gum use might be seen in a more diversely motivated sample, including so-called hardcore smokers (Augustson & Marcus, 2004; Jarvis, Wardle, Waller, & Owen, 2003). Second, although the brief feedback intervention enhanced attitudes toward NRT, it had little effect on the accuracy of knowledge about nicotine. Perhaps a more didactic approach that presents scientific evidence supporting nicotine’s nonpathogenic properties may be more effective than the current attempt to address

### Table 4. Relation of changes in attitudes and beliefs to clinical outcomes.

<table>
<thead>
<tr>
<th>Gum compliance</th>
<th>≥9 pieces</th>
<th>≥12 pieces</th>
<th>Total gum usea</th>
<th>Smoking abstinenceb</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMQa</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔNecessity</td>
<td>.10</td>
<td>.15</td>
<td>.13</td>
<td>-.05</td>
</tr>
<tr>
<td>ΔConcerns</td>
<td>-.14</td>
<td>.01</td>
<td>-.12</td>
<td>.03</td>
</tr>
<tr>
<td>ΔOveruse</td>
<td>.10</td>
<td>.05</td>
<td>.16</td>
<td>-.32*</td>
</tr>
<tr>
<td>ΔHarm</td>
<td>.03</td>
<td>-.03</td>
<td>.05</td>
<td>-.26</td>
</tr>
<tr>
<td>ANRT-12c</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔAdvantages</td>
<td>.04</td>
<td>.09</td>
<td>.02</td>
<td>-.07</td>
</tr>
<tr>
<td>ΔDrawback</td>
<td>-.20</td>
<td>-.06</td>
<td>-.12</td>
<td>.03</td>
</tr>
<tr>
<td>PRNRd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔKnowledge</td>
<td>.13</td>
<td>.13</td>
<td>.12</td>
<td>-.17</td>
</tr>
</tbody>
</table>

Note. *p < .05, †Bonferonni adjusted (α/27), p < .0019. N = 53. All values are Pearson product-moment correlations. a indicates change scores (i.e., end of treatment score—baseline score). b Items from the Beliefs about Medication Questionnaire (Horne et al., 1999). c Items from the Attitudes about Nicotine Replacement Therapy—12 scale (Etter & Perneger, 2001). d Items from the Perceived Risks of Nicotine Replacement scale (S. Shiffman, M. E. Mooney, & D. K. Hatsukami, unpublished scale). e Number of days of compliant gum use, either ≥9 or ≥12 pieces/day. f Total pieces chewed (0–216). g Continuous abstinence based on repeated point-prevalence abstinence in the treatment phase.
knowledge in a therapeutic setting. Third, the intervention was relatively brief and occurred only on a single occasion; repeated assessment and intervention may be necessary to track and maintain maximal gains in NRT attitudes and knowledge. Finally, in this exploratory study, a relatively small sample was accumulated, and larger group sizes might have produced more stable and statistically reliable results.

The present report expanded on a previously published study (Mooney et al., 2005) to further describe the assessment of smokers’ knowledge and attitudes about nicotine, NRT, and assisted cessation. We evaluated the relationship of these phenomena to smoking characteristics and clinical outcomes, as well as more fully characterizing treatment effects using profile analysis. Findings from the present study outline the need to investigate the measurement and treatment of attitudes and knowledge about NRT. The outcome of such research may help to extend efforts toward assessing attitudes and knowledge about NRT in broader public health surveys of smokers (e.g., Bansal et al., 2004; Cummings et al., 2004). Although brief assessment and intervention with smokers can yield changes in treatment beliefs, as shown in the present study, interventions at a population level including information campaigns may yield the greatest benefits. In addition, programs that directly educate clinicians about patients’ attitudes and knowledge about nicotine as well as appropriate training in debiasing interventions may be important (e.g., opiate pain medication; Greer, Dalton, Carlson, & Youngblood, 2001). The present study is an initial step toward further research identifying the attitudes and beliefs that are most determinant of initiation of NRT and its full use.

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