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Beliefs and Attitudes about Bupropion: Implications for Medication Adherence and Smoking Cessation Treatment

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Abstract

Beliefs about medication are associated with treatment adherence and outcome. This is a secondary analysis of the role of beliefs and attitudes about bupropion in treatment adherence and smoking cessation outcomes using data from a smoking cessation trial of open-label sustained-release (SR) bupropion therapy reported previously (Toll et al., 2007). Positive beliefs and attitudes were positively correlated with intentions, desire, confidence, and motivation to quit smoking, expectation of quitting success, perceived benefits of quitting, and perceived disadvantages of smoking. Positive beliefs were also associated with greater medication adherence, an increased likelihood of completing treatment and being continuously abstinent, and a delayed latency to smoking lapse. These findings provide preliminary support that positive beliefs and attitudes about bupropion are associated with positive attitudes toward quitting, better treatment adherence, and potentially better treatment response.

Keywords

Beliefs; attitudes; bupropion; adherence; smoking

Introduction

Sustained-release (SR) bupropion, an antidepressant approved for smoking cessation, has been shown to double quit rates relative to placebo (e.g., Gonzales et al., 2002; Hall et al., 2002; Hurt et al., 1997; Jorenby et al., 1999; Simon, Duncan, Carmody, & Hudes, 2004; Tønnesen et al., 2003). Bupropion may promote abstinence by blocking nicotine effects (Warner & Shoaib, 2005), alleviating withdrawal (Cryan, Bruijnzeel, Skjei, & Markou, 2003), or reducing negative affect (Lerman et al., 2002; Shiffman et al., 2000). There is also evidence that bupropion is efficacious for smokers with co-morbid medical and psychiatric conditions (e.g., Cox et al., 2004; Evins et al., 2005; Hertzberg, Moore, Feldman, & Beckham, 2001; Tashkin et al., 2001; Tonstad et al., 2003; Wagena, Knipschild, Huibers, Wouters, & van Schayck, 2005). Nevertheless, only 15–30% of smokers achieve long-term

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abstinence with bupropion or other effective smoking cessation treatments that include bupropion (reviewed in Fiore et al., 2000; Hughes, Stead, & Lancaster, 2007).

Limited long-term smoking cessation outcomes may be due to poor adherence to bupropion treatment. Higher rates of bupropion adherence are associated with an increased likelihood of smoking abstinence (Killen et al., 2004; Mooney, Sayre, Hokanson, Stotts, & Schmitz, 2007; Schmitz, Stotts, Mooney, DeLaune, & Moeller, 2007; Swan, Javitz, Jack, Curry & McAfee, 2004). Many smokers, however, demonstrate poor adherence by taking inadequate doses or stopping use prematurely (Hurt et al., 1997; Lam, Abdullah, Chan, & Hedley, 2005; reviewed in Waldroup, Gifford, & Kalra, 2006). Moreover, adherence appears to decrease progressively over time (Waldroup et al., 2006). Gifford and colleagues (2002) showed that bupropion adherence rates were 75% within the first few weeks of treatment but declined to 20% by week 10.

These findings may be partially attributable to smokers' beliefs and attitudes about bupropion. According to social cognitive models, behavior is guided by an individual's knowledge and attitudes about the behavior, beliefs in one's ability to perform the behavior, and perceived social norms about the behavior (Ajzen, 1991; Bandura, 1977; Kirsch, 1999). Thus, individuals are more likely to perform behaviors that they feel skilled in, expect will result in positive outcomes, and perceive to be acceptable to others (Ajzen, 1991; Bandura, 1977). These cognitive factors are purported to play a role in medication adherence (Horne & Weinman, 1999). Among patients with chronic illnesses, perceiving medication to be necessary for health maintenance is associated with greater adherence whereas maintaining strong beliefs about the adverse effects of medication is linked to poor adherence (Horne & Weinman, 1999).

The role of beliefs about smoking pharmacotherapies in adherence and smoking cessation outcomes has also been explored. Beliefs that NRT will facilitate quitting are associated with greater use and intended use of NRT as well as stronger motivation to quit smoking (Etter & Perneger, 2001; Juliano & Brandon, 2004). There is also preliminary evidence that smokers' knowledge and attitudes about NRT can be modified and that these changes may contribute to smoking cessation outcomes (Fucito & Juliano, 2007; Mooney et al., 2006; Tate, Stanton, Green, & Schmitz, 1994).

In light of these findings, smokers' beliefs and attitudes about bupropion may influence adherence and the overall effectiveness of bupropion for smoking cessation. Poor attitudes about bupropion may be associated with decreased bupropion utilization and adherence and may be self-fulfilling (Juliano & Brandon, 2004). It has been proposed that a significant portion of all antidepressant responses is due to placebo effects (Kirsch & Sapirstein, 1999). Thus, maintaining negative beliefs about bupropion may contribute to poorer outcomes. Relatively little is known, however, about the role of smokers' beliefs and attitudes about bupropion in treatment adherence and smoking cessation outcomes.

This report investigated smokers' beliefs and attitudes about bupropion and their association with: (a) beliefs about smoking and quitting; (b) treatment adherence; and (c) smoking cessation outcomes. Positive beliefs about bupropion were anticipated to be associated with positive beliefs about quitting and abstinence, greater treatment adherence, a greater likelihood of smoking abstinence, and a longer latency to smoking lapse.

Method

Participants

This is a secondary analysis of data from a randomized controlled trial of message framing for smoking cessation with open-label bupropion SR therapy (300 mg/day) reported previously (Toll et al., 2007). Eligibility requirements included being at least 18 years of age, smoking at least 10 cigarettes per day for at least 1 year, and having a baseline expired air carbon monoxide (CO) level of at least 10 parts per million (ppm). Participants were excluded for current serious neurologic, psychiatric, or medical illness and current alcohol dependence. Two hundred forty-nine participants in the treatment seeking sample (129 women, 120 men) were primarily Caucasian (81.9%), had a mean age of 42.65 (SD = 11.54) years, smoked an average of 22.61 (SD = 9.32) cigarettes per day for a mean of 25.00 (SD = 2.06) years, and had a mean Fagerström Test for Nicotine Dependence (FTND) score of 5.37 (SD = 2.06). Fifty-two participants (20.9%) had prior experience using bupropion to quit smoking.

Procedure

All participants received bupropion SR therapy (300mg/day) for a 7-week period (1 week pre-quit and 6 weeks post-week) and were randomly assigned to receive messages emphasizing either the benefits of quitting (gain-framed) or the costs of continued smoking (loss-framed). After their quit date, participants attended bi-weekly research appointments for 6 weeks. Beliefs were assessed the day before participants quit smoking, which was 1 week after bupropion pretreatment.

Measures

Beliefs and attitudes about bupropion—This 6-item measure assessed smokers' confidence in bupropion as a smoking cessation aid (2 items), general expectancy that bupropion helps people stop smoking (1 item), perceived utility/importance of bupropion for smoking cessation (2 items), and confidence that they would adhere to bupropion as indicated (1 item) on a 5-point Likert scale (*1 = not at all, 5 = extremely*). Two-item subscale scores were derived by summing individual items. A principal components analysis with varimax rotation performed on the 6 items confirmed this 4-factor solution and revealed 4 components with eigenvalues greater than 1, accounting for 93.31% of the total variance. Only items that loaded .40 on 1 factor and less than .40 on all other factors were assigned to factors (Hatcher, 1994). Factor 1 contained 2 items [$r(244) = .74, p < .01$], Factor 2 contained 1 item, Factor 3 had 2 items [$r(244) = .85, p < .01$], and Factor 4 contained 1 item. The items and factor loadings are shown in Table 1.

Other baseline self-report measures included the *Perceived Risks and Benefits Questionnaire* (McKee, O'Malley, Salovey, Krishnan-Sarin, & Mazure, 2005), a 40-item measure of the perceived risks and benefits associated with smoking cessation; the *Thoughts about Abstinence Scale* (Hall, Havassy, & Wasserman, 1991), a 6-item measure of commitment to abstinence, motivation, desire, and confidence to quit smoking, and expected outcomes of quitting; *Decisional Balance for Smoking-Short Form* (Velicer, DiClemente, Prochaska, & Bradenburg, 1985), a 6-item measure of perceived costs and benefits of smoking; and a 2-item measure, designed for this study, to assess intentions to quit smoking within the next 6 weeks and 6 months (5-point Likert scale).

Treatment adherence—Bupropion SR adherence was evaluated using electronic drug exposure monitor caps (APREX, Union City, CA) that recorded the time and day that the pill bottle was opened. Percent adherence was defined as the number of cap openings divided by 95 (the total number of times bupropion should have been taken over the

treatment period) (Kastrissios & Blaschke, 1997). The number of treatment sessions attended and whether participants completed treatment was also recorded.

Smoking behavior—Timeline Followback (TLFB; Brown et al., 1998; Sobell & Sobell, 1992; 2003) methodology was used to assess the number of cigarettes smoked per day. Abstinence was defined by self-reports of no smoking (not even a puff) and an expired air CO level ≤ 10 ppm (SRNT Subcommittee on Biochemical Verification, 2002). Participants who dropped out or missed multiple appointments were coded as smoking. Data for a single missed appointment were coded abstinent if participants reported not smoking and had expired air CO levels ≤ 10 ppm at the sessions before and after the missed appointment. The following smoking outcomes were examined: (a) continuous 6-week abstinence from the quit date, (b) point prevalence abstinence over the last 7 days of treatment, (c) latency to first smoking lapse during treatment, and (d) 7-day point prevalence smoking abstinence at 3- and 6-month follow-up appointments.

Statistical Analysis

T-tests were conducted to examine if beliefs and attitudes about bupropion significantly differed by prior experience using bupropion for a quit attempt. Pearson correlations were calculated to examine associations between beliefs and attitudes about bupropion and beliefs about smoking (i.e., DBS-SF) and quitting (i.e., TAAS, PRBQ, intentions to quit smoking). Linear and logistic regression analyses were used to test the relationships among bupropion beliefs, treatment adherence, and abstinence outcomes, controlling for message framing condition (gain- vs. loss-framed). Cox regression analysis was also conducted to evaluate if beliefs were associated with latency to smoking lapse (range 1–42 days), controlling for condition. Regression models were fitted in steps. Message framing condition was entered in Step 1. Beliefs and attitudes about bupropion or treatment adherence variables were then entered in Step 2. Similar models were also tested without controlling for the effect of framing condition. Linear and logistic regression analyses were also conducted to evaluate treatment adherence variables as potential mediators of the relationship between bupropion beliefs and smoking outcomes. The relationship between beliefs and smoking outcomes was evaluated for the full sample ($N = 249$) and the subsample of treatment completers ($N = 170$) in line with recent theoretical and statistical advances that suggest supplementary analyses accounting for treatment adherence may be of value and should be reported (Armitage, 1998; Pocock & Abdalla, 1998). Armitage (1998) contends that intention to treat analysis often underestimates the “true” treatment effect, as non-adherent participants will attenuate whatever effect may have been shown in adherent participants.

Results

Experience with Bupropion

Beliefs about the importance/utility of bupropion as a smoking cessation aid, confidence that bupropion would facilitate quitting, expectancies that bupropion helps people quit smoking, and perceived confidence that one would use bupropion as indicated did not statistically differ by prior experience using bupropion for a quit attempt.

Beliefs about Smoking and Quitting

As shown in Table 2, beliefs and attitudes about bupropion were positively associated with desire to quit smoking, expectation of quitting success, quitting confidence, motivation to quit, perceived benefits of quitting, perceived costs of smoking, and intentions to quit smoking and were negatively associated with expected difficulty remaining abstinent and perceived risks of quitting.

Treatment Adherence

Beliefs and attitudes about bupropion were significantly associated with treatment adherence. Greater confidence that one would use bupropion as indicated was significantly associated with a greater mean percentage of cap openings [$\Delta R^2 = .04$; $\Delta F(1, 239) = 8.77$, $p = .003$; $\beta = .19$], a greater number of treatment sessions attended [$\Delta R^2 = .02$; $\Delta F(1, 241) = 5.71$, $p = .02$; $\beta = .15$], and an increased likelihood of completing treatment [Nagelkerke $R^2 = .03$; $\chi^2(1) = 4.22$, $p = .04$; Wald = 4.18, OR = 1.55, 95% CI = 1.02–2.36], after controlling for message framing condition. Other beliefs and attitudes about bupropion were unrelated to adherence, attendance, or the likelihood of completing treatment. Similar results were obtained without controlling for message framing condition.

Smoking Outcomes

Among all participants ($N = 249$), logistic regression analyses demonstrated that the mean percentage of cap openings, the number of sessions attended, and the likelihood of completing treatment were significantly related to an increased odds of smoking abstinence and a delayed latency to smoking lapse among all participants (see Table 3).

Beliefs and attitudes about bupropion were unrelated to smoking outcomes among all participants. Among treatment completers ($N = 170$), however, greater beliefs about the importance/utility of bupropion as a smoking cessation aid were significantly related to an increased likelihood of continuous smoking abstinence [Nagelkerke $R^2 = .06$; $\chi^2(1) = 4.73$, $p = .03$; OR = 1.28, 95% CI = 1.02–1.60] and a delayed latency to smoking lapse over the 6-week treatment period [$\chi^2(1) = 4.74$, $p = .03$; OR = 1.18, 95% CI = 1.01–1.37], after controlling for message framing condition. Greater confidence that one would use bupropion as indicated was also nonsignificantly related to an increased likelihood of continuous abstinence [Nagelkerke $R^2 = .05$; $\chi^2(1) = 2.91$, $p = .088$; OR = 1.59, 95% CI = .93–2.72] and 6-week point prevalence abstinence [Nagelkerke $R^2 = .03$; $\chi^2(1) = 2.88$, $p = .098$; OR = 1.68, 95% CI = .91–2.89], after controlling for treatment condition. Other bupropion beliefs were unrelated to smoking outcomes. Similar results were obtained for all analyses without controlling for condition.

The potential mediating effects of the mean percentage of cap openings, number of sessions attended, and likelihood of completing treatment on the relationship between bupropion beliefs and smoking outcomes were also examined among the full sample and subsample of treatment completers but yielded no significant results. Similarly, treatment adherence variables were also examined as mediators of the associations between other smoking and quitting cognitions (i.e., TAAS, PRBQ, DBS-SF) and smoking outcomes. None of these analyses were significant.

Discussion

Positive beliefs about bupropion were related to greater intentions, motivation, confidence, and desire to quit smoking, stronger perceived benefits of quitting and disadvantages of smoking, greater expectation of quitting success, and better treatment adherence. These results lend support to previous studies that showed positive NRT expectancies were associated with greater quit intentions, NRT utilization, and adherence (Etter & Perneger, 2001; Juliano & Brandon, 2004) and expand upon this research by demonstrating that positive bupropion beliefs were also related to better smoking cessation outcomes. Moreover, such results provide preliminary support for the convergent and predictive validity of the beliefs and attitudes about bupropion scale used in the present study. In addition, greater treatment adherence was associated with an increased likelihood of being abstinent and a longer latency to smoking lapse. This finding is consistent with prior

research that has shown positive associations between bupropion adherence and smoking cessation outcomes (Killen et al., 2004; Mooney et al., 2007; Schmitz et al., 2007; Swan et al., 2004). In accordance with social cognitive models of behavior, smokers who expect positive outcomes from using bupropion (i.e., that bupropion will facilitate quitting) and feel confident in their abilities to use bupropion as indicated may be more likely to take bupropion and adhere to adequate dosing schedules. Consequently, these positive beliefs may be self-fulfilling by enhancing the overall effectiveness of bupropion.

Taken altogether, these results have important implications for smoking cessation interventions and suggest that increasing positive beliefs and attitudes about bupropion may be an important target for promoting treatment adherence and possibly improving cessation outcomes. There is evidence that knowledge and beliefs about smoking pharmacotherapies (i.e., NRT) are modifiable. For example, providing individually tailored feedback to address smokers' negative beliefs and inaccurate knowledge about NRT led to significant increases in positive attitudes compared to standard smoking cessation treatment with no NRT feedback (Mooney, Leventhal, & Hatsukami, 2006). Such increases, however, did not impact medication adherence or cessation outcomes. Similarly, altering how information is presented about the effects of smoking pharmacotherapies may influence smokers' beliefs. Fucito and Juliano (2007) found that informing smokers about the benefits of the nicotine patch as a smoking aid resulted in a greater increase in positive expectancies compared to informing smokers about nicotine patch side effects, and these increases were related to improved subjective outcomes of patch use. No study to date, however, has investigated if bupropion beliefs can be altered and if such changes impact treatment adherence or smoking cessation outcomes.

This investigation has several limitations. Beliefs and attitudes were assessed by a short questionnaire designed for this study, which may not have adequately sampled the constructs that encompass smokers' beliefs about bupropion for smoking cessation. More research on assessing bupropion cognitions is warranted. Furthermore, beliefs were assessed before participants quit smoking but 1 week after pretreatment with bupropion. Ideally beliefs should be evaluated before smokers have experience with the medication since there is evidence that beliefs interact with pharmacological effects to produce medication responses (Kirsch, 1999). Thus, smokers' beliefs may have been influenced by the experience of side effects or a perceived lack of effect on smoking motivation, thereby reducing the association between positive beliefs and better smoking outcomes. In addition, bupropion beliefs only accounted for a small percentage of the variance in adherence and smoking outcomes. Bupropion beliefs appear to be important but other factors may have stronger associations with adherence and smoking outcomes. Future research should investigate factors related to bupropion adherence in order to identify additional targets for intervention. Beliefs were also not directly manipulated and therefore it is not possible to draw conclusions about their potential causal role in adherence or smoking outcomes.

This is the first study to provide preliminary support for the hypothesis that positive beliefs and attitudes about bupropion are associated with more positive attitudes about quitting and better treatment adherence and response. More research is needed to better understand the role that bupropion beliefs (and other smoking pharmacotherapies such as varenicline) play in perceived drug effects, medication adherence, and smoking cessation outcomes.

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Table 1

Rotated four-factor matrix for beliefs and attitudes about bupropion scale (N = 249)

Item	Importance/Utility Factor	Expectancy Factor	Quitting Confidence Factor	Adherence Confidence Factor
1. How important will it be for you to use Zyban to help you stop smoking?	.88	.14	.22	.19
2. How helpful will it be for you to use Zyban to help you stop smoking?	.88	.12	.28	.07
3. Zyban can help people stop smoking.	.18	.92	.34	.12
4. How confident are you that Zyban can help you quit smoking?	.24	.29	.86	.20
5. How confident are you that Zyban will be useful to you as you quit smoking.	.35	.22	.86	.15
6. How confident are you that you will use Zyban as indicated by your doctor?	.16	.11	.20	.96

Note. Varimax rotation method was used. Bold items were assigned to factors.

Table 2

Correlation matrix for beliefs and attitudes about bupropion scale and other smoking and quitting cognitions
(N = 249)

Item	Importance/Utility Factor	Expectancy Factor	Confidence Factor	Adherence Confidence Factor
<i>TAAS</i>				
1. Desire to quit smoking	.20 **	.05	.26 **	.20 **
2. Expectation of success in quitting	.10	.06	.20 **	.08
3. Perceived difficulty remaining abstinent	-.10	-.17 *	-.16 *	-.06
4. Confidence will be able to quit smoking	.09	.03	.20 **	.10
5. Motivation to quit smoking	.22 **	.14 *	.26 **	.18 **
<i>PRBQ</i>				
1. Perceived risks of quitting smoking	-.03	-.06	-.12	-.15 *
2. Perceived benefits of quitting smoking	.11	.15 *	.07	.07
<i>DBS-SF</i>				
1. Costs of smoking	.23 **	.03	.10	.04
<i>Intentions</i>				
1. Intentions to quit smoking within next 6 weeks	.21 **	.12	.32 **	.27 **
2. Intentions to quit smoking within next 6 months	.26 **	.19 **	.32 **	.33 **

Note. Bold items reflect significant correlation coefficients.

**
 $p < .01$.

*
 $p < .05$

Table 3

Logistic and Cox regression analyses of treatment adherence and message framing condition on smoking outcomes (N = 249)

Predictor Variables	Smoking Outcomes			
	Continuous abstinence over 6 weeks	7-day pp ^l abstinence at 6 weeks	Latency to smoking lapse over 6 weeks	7-day pp abstinence at 3 months
Mean % of cap openings	Wald = 28.77, $p < .001$ ^a OR = .96 95% CI = .95-.98	Wald = 45.18, $p < .001$ ^b OR = .96 95% CI = .95-.97	Wald = 51.44, $p < .001$ ^c OR = .98 95% CI = .98-.99	Wald = 12.42, $p < .001$ ^e OR = .97 95% CI = .95-.99
Number of sessions attended	Wald = 10.82, $p < .001$ ^f OR = .12 95% CI = .04-.43	Wald = 18.31, $p < .001$ ^g OR = .10 95% CI = .03-.28	Wald = 61.30, $p < .001$ ^h OR = .61 95% CI = .54-.69	Wald = 6.53, $p = .01$ ^j OR = .24 95% CI = .08-.72
Completed treatment or dropped out	Wald = .00, $p = .10$ ^k OR = .00 95% CI = .00	Wald = 22.42, $p < .001$ ^l OR = 124.80 95% CI = 16.92-920.47	Wald = 47.74, $p < .001$ ^m OR = 3.07 95% CI = 2.23-4.22	Wald = 9.29, $p < .01$ ^o OR = 9.61 95% CI = 2.24-41.15

^l pp = point prevalence

^a Step 1: χ^2 (1) = 1.93, $p = .17$; Step 2: χ^2 (1) = 48.48, $p < .001$;

^b Step 1: χ^2 (1) = .18, $p = .67$; Step 2: χ^2 (1) = 72.71, $p < .001$;

^c Step 1: χ^2 (1) = .57, $p = .45$; Step 2: χ^2 (1) = 49.24, $p < .001$

^d Step 1: χ^2 (1) = .50, $p = .46$; Step 2: χ^2 (1) = 22.72, $p < .001$;

^e Step 1: χ^2 (1) = .64, $p = .42$; Step 2: χ^2 (1) = 19.82, $p < .001$;

^f Step 1: χ^2 (1) = 1.70, $p = .19$; Step 2: χ^2 (1) = 58.85, $p < .001$

^g Step 1: χ^2 (1) = .10, $p = .76$; Step 2: χ^2 (1) = 99.64, $p < .001$,

^h Step 1: χ^2 (1) = .40, $p = .53$; Step 2: χ^2 (1) = 37.51, $p < .001$;

ⁱ Step 1: χ^2 (1) = .56, $p = .46$; Step 2: χ^2 (1) = 23.05, $p < .001$

^j Step 1: χ^2 (1) = .48, $p = .49$; Step 2: χ^2 (1) = 44.94, $p < .001$;

^k Step 1: χ^2 (1) = 1.17, $p = .19$; Step 2: χ^2 (1) = 66.82, $p < .001$;

^l Step 1: χ^2 (1) = .10, $p = .76$; Step 2: χ^2 (1) = 101.40, $p < .001$

^m Step 1: χ^2 (1) = .40, $p = .53$; Step 2: χ^2 (1) = 35.81, $p < .001$;

ⁿ Step 1: $\chi^2(1) = .56, p = .46$; Step 2: $\chi^2(1) = 16.85, p < .001$;
^o Step 1: $\chi^2(1) = .48, p = .49$; Step 2: $\chi^2(1) = 44.94, p < .001$