Title

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Journal

Nicotine & Tobacco Research, 16(9)

ISSN

1462-2203

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Publication Date

2014-09-01

DOI

10.1093/ntr/ntu050

Peer reviewed

Nicotine & Tobacco Research, Volume 16, Number 9 (September 2014) *1207–1215*

ORIGINAL INVESTIGATION

Smoking Cessation Outcomes Among Sexual and Gender Minority and Nonminority Smokers in Extended Smoking Treatments

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Received July 2, 2013; accepted March 6, 2014

ABSTRACT

Introduction: Sexual and gender minority individuals (i.e., lesbian, gay, bisexual, and transgender [LGBT]) have a higher smoking prevalence than nonminority individuals. There is limited evidence of smoking abstinence success in nontailored smoking treatments among LGBT smokers.

Methods: This study is a secondary data analysis comparing the efficacy of extended, nontailored treatments among sexual and gender minority and nonminority smokers. Data from two clinical trials were combined to increase power and generalizability of the findings. Trials began with 12 weeks of counseling, nicotine replacement, and bupropion, after which participants were randomized to an extended treatment.

Results: Follow-up occurred at weeks 12, 24, 52, 64, and 104. Of the sample (n = 777), 17% identified as sexual and gender minority and 83% as nonminority. The sample was 75% non-Hispanic White, with 86% completing at least some college, and 68% were employed. Sexual and gender minorities were younger and indicated a greater desire to quit smoking than nonminority smokers. No other differences emerged on demographic, smoking, or mood variables. The average Fagerström Test for Nicotine Dependence score was 4.8, and mean daily cigarettes was 19.8. The generalized estimating equations model revealed no significant differences in abstinence between sexual and gender minority smokers and nonminority smokers at all follow-up assessments.

Conclusions: Sexual and gender minority smokers appear as likely to quit or abstain as nonminority smokers in extended, nontailored interventions. However, these findings may not generalize to other geographic areas, where access to treatment is limited or a higher stigma of sexual orientation exists.

INTRODUCTION

In spite of many advances in treating nicotine dependence, smoking is the number one preventable cause of early mortality in the United States (Centers for Disease Control and Prevention, 2013). Despite persistent decline in the smoking prevalence of the general population over the past several decades, to approximately 21% (Centers for Disease Control and Prevention, 2007), smoking prevalence remains higher in specific groups of smokers, such as sexual minority (i.e., lesbian, gay, and bisexual) and gender minority individuals (i.e., transgender; Lee, Griffin, & Melvin, 2009). For example, lesbian, gay, bisexual, and transgender (LGBT) individuals are reported to have a smoking prevalence of 24%–45% (Clarke & Coughlin, 2012). Compared to heterosexual men, smoking prevalence among gay and bisexual men are estimated to be 27%–71% higher (Burkhalter, Warren, Shuk, Primavera, & Ostroff, 2009; Gruskin, Greenwood, Matevia, Pollack, & Bye, 2007), and compared to heterosexual women, smoking prevalence among lesbian and bisexual women are estimated to be 70%–350% higher (Burgard, Cochran, & Mays, 2005; Burkhalter et al., 2009; Gruskin et al., 2007). Research on smoking prevalence among transgender individuals is limited, though many believe estimates are higher than the general population (Burkhalter et al., 2009; Eliason, Dibble, Gordon, & Soliz, 2012; National Cancer Institute, 2000). Using a population-based sample, Tang and colleagues (2004) confirmed that sexual minority individuals were twice as likely to smoke as nonsexual minorities when comparing individuals of the same sex (i.e., lesbian women compared to heterosexual women and gay men compared to heterosexual men).

doi:10.1093/ntr/ntu050
Advance Access publication April 11, 2014

Along with higher smoking prevalence, sexual and gender minorities experience a greater prevalence of many other medical, social, mental health, and substance abuse problems that may increase the likelihood of smoking and are barriers to cessation (Burkhalter et al., 2009). The minority stress model (Meyer, 2003) serves as a conceptual model to understand the relations among many of these stressors in the LGBT community and how they contribute to smoking. According to this model, LGBT individuals are more likely to experience societal stressors related their minority group status such as discrimination, stigma, and victimization (Hendricks & Testa, 2012; Meyer, 2003). Though initially developed as a means of describing stress in sexual minorities, Hendricks and Testa (2012) note that many of the unique stressors experienced by sexual minority individuals are also experienced by transgender individuals. Specifically, for transgender individuals, the most documented source of stress comes from exceedingly high rates of physical and sexual violence. Blosnich, Lee, and Horn (2013) also note that smoking risk factors for sexual minorities are particularly important when they are either unique to the minority group, such as discrimination, or commonly occur in the general population, but are disproportionately greater among members of the minority group (e.g., depression).

Due in large part to the unique stressors that LGBT individuals face relative to the general population, many have called for researchers to design and evaluate tailored smoking interventions for the LGBT community. Recently, the American Lung Association (2010) published a report in a special series focused on disparities in lung health encouraging specific interventions and antismoking messages for sexual and gender minority individuals. One recently published report by Eliason and colleagues (2012) describe the results of a seven-session LGBT-tailored smoking intervention, delivered more than six weeks, which provided education and support and followed up participants at one, three, and six months later. They reported point prevalence abstinence of 60% and 36% at the end of treatment and six-month follow up, respectively, and noted that these results are similar to nontailored interventions. The generality of these findings is limited, however, as the study did not include a comparison group, relied solely on self-report for smoking status, and had a considerable amount of missing data. A second study, by Matthews Li, Kuhns, Tasker, and Cesario (2013), reported the results of community-based smoking programs, based on the American Lung Association's Freedom from Smoking Program, which was adapted to the LGBT community and provided more than seven sessions. The sample consisted of 198 LGBT smokers who completed at least one session. Posttreatment self-reported abstinence was 32% (Matthews et al., 2013). Though promising, these results are limited by a lack of a control group, biologic confirmation of smoking status, and long-term follow-up assessment.

Many have called for tailored smoking cessation programs for sexual and gender minorities. However, given that few such programs exist, it is also important to examine smoking cessation for this population using nontailored interventions. The most recent Clinical Practice Guidelines (Fiore et al., 2008) note that future research is needed on intervention effectiveness for treatments offering medication and counseling for LGBT individuals. One study by Covey, Weissman, LoDuca, and Duan (2009) reported results from a standard, nontailored smoking treatment that compared heterosexual men to gay and bisexual men over an eight-week period. Their end-of-treatment results revealed no significant differences between groups and they reported no follow-up data (Covey et al., 2009). The study by Covey et al. (2009) is the only study we are aware of to examine quit rate differences based on sexual orientation. Given the paucity of research in this area, the degree to which nontailored interventions can be used to achieve smoking abstinence in sexual and gender minorities is in question. This study expands on previous work in this area in several ways. First, Covey and colleagues (2009) report smoking outcomes at eight weeks, but offer no follow-up data. Conceptualizing smoking as a chronic, relapsing disorder (Steinberg, Schmelzer, Lin, & Garcia, 2010), relapse is more likely to occur following a short-term treatment. This study reports data from studies that provided treatment for up to one year, with an additional year of follow up. Second, Covey et al. (2009) examined differences between heterosexual men and gay/bisexual men, but they did not include heterosexual women, lesbian/bisexual women, or transgender individuals. This study expands on this work by including gay, lesbian, bisexual, and transgender smokers. Finally, the sample size of this study is larger, providing increased power to detect differences that may exist. Therefore, the purpose of this study was to compare smoking cessation abstinence outcomes between sexual and gender minority and nonminority smokers in extended-duration smoking interventions.

METHODS

This study is a secondary data analysis using data from two randomized clinical trials of extended smoking cessation interventions. Data from two clinical trials were combined to increase statistical power and generality of the findings. More detailed information on each study is available elsewhere (Hall et al., 2009, 2010). We will summarize aspects of each study relevant to the goals of this paper in the Participants and Procedure section.

Participants and Procedures

Participants (N = 808) were recruited by public service announcements, advertisements, and flyers placed on local bulletin boards, in general and local LGBT newspapers, at health clinics, laundromats, corner stores, and throughout the general community and LGBT-identified neighborhoods within the city and county of San Francisco. Interested participants called the research clinic to complete a phone screening. Those who met the screening criteria were invited to an orientation meeting where detailed information about the study was provided and consent was obtained. In Study 1 (N = 402; Hall et al., 2009), participants had to be 50 years of age or older and smoke at least 10 cigarettes/day. In Study 2 (N = 406; Hall et al., 2010), participants had to be at least 18 years old, smoke at least 10 cigarettes/day, and smoke within 30 min of waking. Exclusionary criteria were the same for both studies. Medical exclusionary criteria included evidence of cardiovascular disease, severe allergies, and seizures. Psychiatric exclusionary criteria included evidence of a history of bipolar disorder, current major depressive disorder or use of any psychiatric medication, current suicidal or psychotic symptoms, and psychiatric hospitalization within one year. Participants were also excluded if they received treatment for drug or alcohol use

within the prior six months. See Figure 1 for the Consolidated Standards of Reporting Trials chart, which displays recruitment and retention information for this sample.

In both studies, all participants received a standard 12-week treatment including group counseling, nicotine replacement therapy (NRT), and bupropion sustained release (SR), after which they were randomized to one extended treatment group. Following the 12-week treatment period, the two studies differed in the type of extended treatment provided. In Study 1 (Hall et al., 2009), the extended treatment options were as follows: a no-extended treatment control, extended counseling, extended NRT, and extended combined counseling + NRT. In Study 2 (Hall et al., 2010), the five options included the following: a no-extended treatment control, extended active bupropion SR alone, extended placebo bupropion SR alone, extended active bupropion SR with counseling, or extended placebo bupropion with counseling. In both studies, treatment lasted until Week 52.

Assessments

Data were collected at baseline and follow-up assessments at Weeks 12, 24, 52, 64, and 104. Study staff contacted all participants to schedule follow-up visits regardless of whether the participants continued in the treatment groups. Participants were compensated $25 for each follow-up assessment.

Measures

All measures included in this analysis, except for smoking status, were collected only at baseline.

Demographics

Participants responded to questions assessing age, gender, gender identity, sexual orientation, education, living situation, employment, race/ethnicity, and income. Sexual orientation was assessed by asking the participant to indicate whether

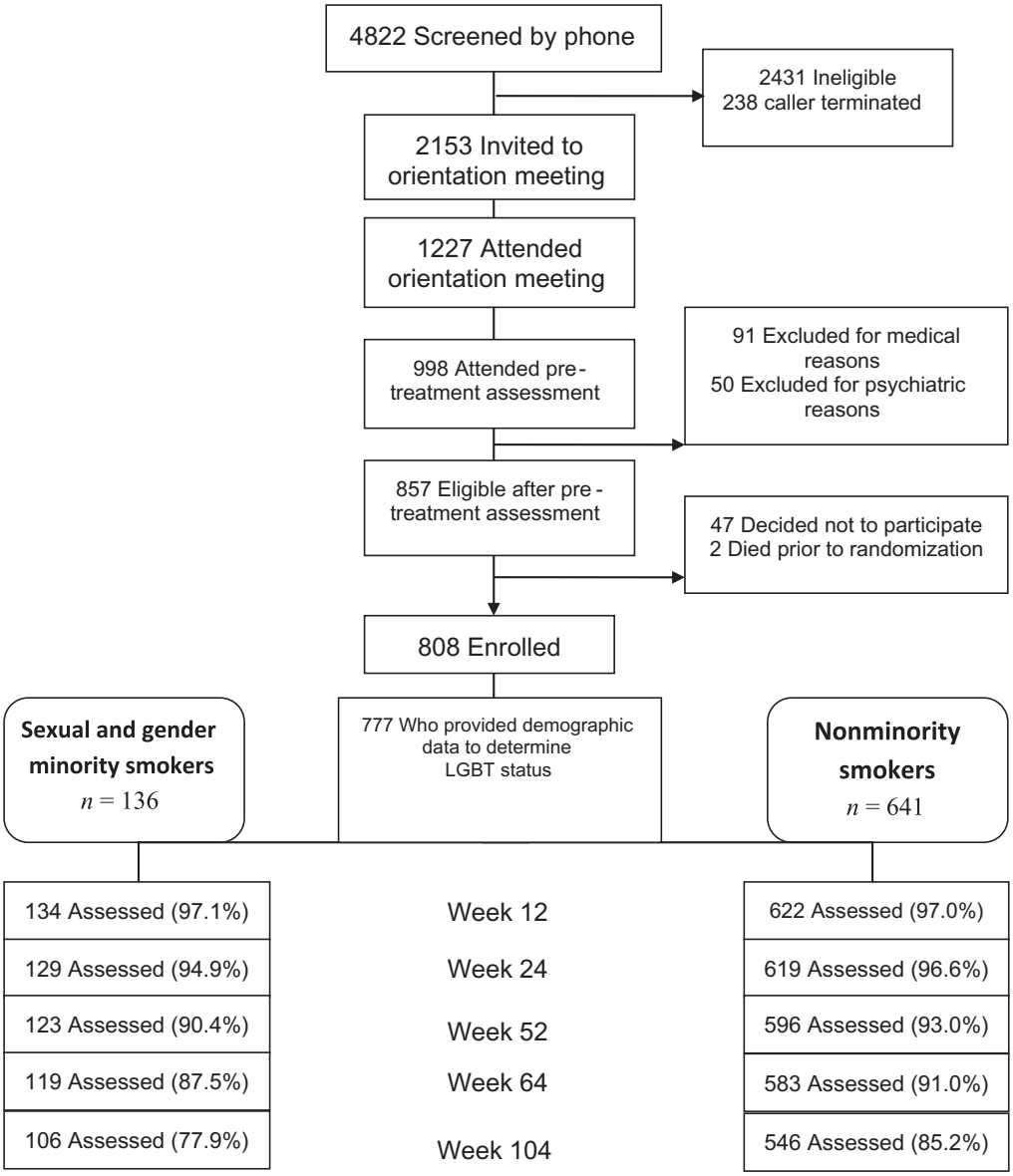

Figure 1. Consolidated Standards of Reporting Trails diagram displaying recruitment and retention data for the two studies combined.
Note. LGBT = lesbian, gay, bisexual, and transgender.

they identified as gay or lesbian, bisexual, or heterosexual. Gender identity was assessed by having the participant indicate whether they currently identified as male, female, or transgender. We did not assess sex assigned at birth.

Smoking Behavior and History
We asked participants to report on their average number of cigarettes smoked per day, age of smoking initiation, total number of years as a smoker, and previous quit attempts.

Nicotine Dependence
We used the Fagerström Test for Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerström, 1991) to assess nicotine dependence. The FTND is a widely used instrument of nicotine dependence. Items correspond to physical dependence, with higher total scores indicating greater dependence. The FTND has demonstrated adequate psychometric properties.

Thoughts About Abstinence
The Thoughts About Abstinence questionnaire (Hall, Havassy, & Wasserman, 1990) assesses motivation to quit and abstinence self-efficacy. Participants reported on their (a) desire to quit, (b) expectation of success, (c) perceived difficulty, and (d) abstinence goal. Desire to quit, expectation of success, and perceived difficulty are all scored on a 10-point scale with higher scores indicating greater agreement with the item. Abstinence goal offers the participant seven categorical options and asks to choose one. Options include not having a clear goal in mind; using cigarettes in a "controlled" manner; being totally abstinent for a period of time, after which a new decision would be made; occasional use; complete abstinence forever; complete abstinence for good, but acknowledging the possibility of slips; and "other." For the purpose of this paper, we dichotomized this item to a goal of complete abstinence forever versus all other options.

Profile of Mood States
The Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 1992) is a self-report measure of mood fluctuations over the past week. We used items that comprise two of the six subscales, depression–dejection and anger–irritability. All items are scored from–0 (*not at all*) to 5 (*extremely*). The POMS has excellent internal consistency and test–retest reliability and the ability to differentiate between psychiatric and nonpsychiatric samples.

Perceived Stress Scale
The Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983) is a 14-item scale that measures one's perception of stressful life situations over the past 30 days. Items are scored on a 5-point Likert scale, half of which are reverse-scored. Higher total scores indicate higher levels of perceived stress.

State-Trait Anger Expression Inventory
The State-Trait Anger Expression Inventory (second edition, STAXI-2; Spielberger, 1999) is a 57-item scale that measures one's experiences of anger intensity and as a personality trait. Items are scored on 4-point Likert scale, with higher scores indicating a greater degree of anger.

Smoking Abstinence
We assessed seven-day point prevalence smoking abstinence at each follow-up assessment via self-report with biologic confirmation. Specifically, participants were asked "have you had any cigarettes, even a puff, in the last seven days?" All participants were also asked to provide an expired carbon monoxide reading, with levels less than 10 parts per million (ppm) indicating abstinence. Participants who reported abstaining from cigarettes and provided a carbon monoxide less than 10 ppm were asked to provide a urine sample. Study 1 analyzed urinary cotinine with levels less than 60 ng/ml indicating abstinence. Study 2 analyzed urinary anatabine/anabasine, two alkaloids present in tobacco, but not NRT (Benowitz et al., 2002). Anatabine/anabasine analysis provides a sensitive biologic confirmation, like cotinine, but is not confounded by the presence of cotinine metabolites in persons using NRT but not smoking. Anatabine/anabasine levels less than or equal to 2 ng/ml were considered indicative of abstinence.

Data Analysis Plan

First, we provide descriptive information for the sample. We compared sexual and gender minority and nonminority participants on demographic, smoking history/behavior, and mood and stress, using *t* tests for continuous variables and Pearson's chi-square tests for categorical variables. The final model examining smoking point prevalence abstinence at five follow-up assessments between sexual and gender minorities and nonminorities was analyzed using a generalized estimating equations (GEEs) model, using an intent-to-treat approach. We considered covariates for the final model that were theoretically relevant and statistically different between the sexual and gender minority and nonminority participants, or were correlated with abstinence outcome. Potential covariates differed between the two studies, which could result in biased and inaccurate estimates (Newgard, Hedges, Arthur, & Mullins, 2004). To account for this in a single index instead of adding all of these as covariates, we used the propensity score method (Austin, 2011). In this case, we calculated propensity scores for each participant by regressing all potential covariates onto a dichotomous dummy-coded variable representing the two treatment studies. This method, often used in observational studies, adjusts for variability between covariates and results in a single score for each participant that can be included in the final model. The variables that were included in the propensity score analysis were living situation (rent or own vs. do not rent or own), income, nicotine dependence, number of cigarettes smoked per day, total years as a smoker, and two questions from the Thoughts About Abstinence questionnaire, one pertaining to degree of expected success, and the other related to abstinence goal. Age was excluded from the propensity score analysis to be included as an individual covariate in the model, given the significant age difference between the two studies. Desire to quit was also included as a covariate given the significant difference between sexual and gender minority and nonminority smokers. Finally, we explored factors related to abstinence specifically in the LGBT sample using Pearson correlations. Variables we considered included demographics, smoking history, mood, stress, and anger expression in relation to abstinence outcome at all five follow-up periods. Analyses were conducted using SPSS version 18 and SAS version 9.3.

Missing Data
Missing data were primarily the result of attrition with 80% of participants having complete abstinence data, with an

additional 7% of participants missing data only at the Week 104 assessment. A series of Pearson's chi-square analyses revealed a significant difference in attrition magnitude between sexual and gender minority and nonminority smokers at Week 104 ($p = .037$), but no significant differences at all other timepoints. Thirty-one participants did not provide data indicating sexual orientation or gender identity and thus were not included in this analysis. These 31 individuals did not differ from the remaining sample in regard to age, income, employment, education, level of nicotine dependence, cigarettes smoked per day, number of years as a smoker, POMS total, depression, and anger, perceived stress, desire to quit, expectation of success in quitting, perceived difficulty, and abstinence goal ($p > .05$). They did differ from the remaining sample in terms of living situation, with a smaller proportion from the excluded group owning or renting a home ($p < .001$), and also differed in identifying as White, with a greater proportion in the missing sample identifying as White compared to the retained sample ($p = .002$).

Missing values were imputed using a multiple imputation procedure. This procedure imputes values using an iterative process based on the remaining available data (McKnight, McKnight, Sidani, & Figueredo, 2007). Missing values are replaced with imputed values to create a complete data set. Each iteration of the procedure creates a separate and unique complete data set, from which a parameter estimate is calculated. Parameter estimates from each iteration are then averaged to provide a single estimate (McKnight et al., 2007). For this study, our multiple imputation procedure utilized 20 iterations to impute data and reach the final estimate. We used multiple imputation to replace missing values as missing data can have a profound impact on the internal and external validity of the study and its findings (McKnight et al., 2007). Compared to single imputation (e.g., listwise deletion, last observation carried forward, return to baseline, and so forth) methods, multiple imputation is more robust and better able to replicate reality (McPherson, Barbosa-Leiker, Burns, Howell, & Roll, 2012), thus decreasing the potential threats to validity.

Treatment Group Reduction

To reduce the number of parameters in the model, we combined treatment groups between the two studies (Study 1: Hall et al., 2009; Study 2: Hall et al., 2010) that were similar in structure and content, and had similar point prevalence abstinence at follow-up assessments. We compared point prevalence abstinence at each follow-up point between treatment groups we considered combining, using Pearson's chi-square analysis. The "no further treatment" control conditions from both studies, along with the "placebo bupropion alone" condition from Study 2, were not statistically different at any follow-up timepoint and were combined into one group. The "extended counseling" group from Study 1 and the "placebo bupropion and extended counseling" group from Study 2 were statistically different from one another at Week 24 ($p = .04$), but not at all other timepoints and were combined into one group. Though these two groups were significantly different at one assessment, we chose to combine the groups given that they were not different at all other timepoints and between-treatment group differences were not the focus of this paper. The "extended, combined counseling, and NRT group" from Study 1 and the "extended, combined counseling, and active bupropion group" from Study 2 were not statistically different at any timepoint and were combined. Finally, the "extended NRT" group from Study 1 and "extended, active bupropion" group from Study 2 were not combined, as the Pearson's chi-square analysis revealed significant differences in abstinence at Weeks 24, 52, 64, and 104. This procedure resulted in a reduction of treatment groups from nine to five.

Variables in the Model

A GEE model using PROC GENMOD in SAS 9.3 was used to assess differences in smoking abstinence by sexual and gender minority status across time. Two models were estimated, one without missing values imputed and one with missing values imputed, as described previously, with the results combined using PROC MIANALYZE. The independent variable in the final model was sexual and gender minority and nonminority status, with smoking abstinence at Weeks 12, 24, 52, 64, and 104 as the dependent variables. We included treatment group with five levels, propensity score values, and desire to quit, and age as covariates in the final model.

RESULTS

Table 1 displays demographic, smoking history/behavior, and mood and stress information for the sexual and gender minorities and nonminorities. The final sample included 777 participants. Of the full sample, 17% identified as LGBT and 83% as nonminority. Nonminority smokers were significantly older than the sexual and gender minority smokers, $t = -3.33$, $p = .001$. The sample was predominantly non-Hispanic, White (75%), 86% completed at least some college, 68% reported being employed, and 59% reported earning at least $50,000 per year. The average number of cigarettes/day was 19.8, and the average nicotine dependence score was 4.8, indicating low-moderate dependence.

We observed no statistically significant differences between sexual and gender minorities and nonminorities on measures of mood, stress, cigarettes/day, and nicotine dependence. We did observe a statistically significant difference in desire to quit, with sexual and gender minorities indicating a slightly higher desire compared to nonminorities ($p = .03$). Groups did not differ on expectation of success, perceived degree of difficulty, or abstinence goal (see Table 1).

Figure 2 displays point prevalence abstinence for sexual and gender minority and nonminority smokers at all five follow-up assessments. Point prevalence abstinence for sexual and gender minority smokers compared to nonminorities were 55% versus 62% at Week 12, 50% versus 50% at Week 24, 37% versus 40% at Week 52, 35% versus 40% at Week 64, and 38% versus 40% at Week 104. The GEE model without imputed data revealed no significant differences between sexual and gender minorities compared to nonminorities, $\chi^2 = 0.27$, $p = .60$. There was an effect of treatment as expected, $\chi^2 = 93.57$, odds ratio (OR) = −0.008 (95% confidence interval [CI] = −0.0094, −0.0065), $p < .001$, indicating a significant treatment effect, regardless of sexual orientation or gender identity. The GEE model with imputed data yielded similar results, in that no differences emerged between sexual and gender minorities and nonminorities, $\chi^2 = 0.56$, $p = .57$. Again, a significant effect emerged for treatment, $\chi^2 = -8.16$, $OR = -0.008$ (95% CI = −0.0087, −0.0074), $p < .001$, indicating improvement regardless of minority status. Given the similar findings between the original, nonimputed data model, and the multiple imputation model, it is unlikely that differential attrition

Table 1. Demographic, Smoking, Mood, and Stress Comparisons Between Sexual and Gender Minority and Nonminority Smokers in a Combined Sample of Two Nontailored Smoking Cessation Studies

Variable	Sexual and gender minority (n = 136) (Count)	Nonminority (n = 641) (Count)	t or χ^2	p value
Demographics				
Gender identity				
Male	102	359		
Female	29	282		
Transgender	5			
Sexual orientation				
Gay	93			
Lesbian	14			
Bisexual	26			
	Mean (*SD*)	Mean (*SD*)		
Age	45.77 (11.32)	49.32 (11.27)	−3.33	**.001**
Income			12.24	.27
White			13.17	.07
Education			5.32	.50
Employment			3.07	.55
Living situation			4.57	.47
Mood and stress				
POMS – Total	14.65 (28.42)	18.07 (28.82)	−1.24	.22
POMS – Anger	6.68 (5.97)	6.85 (6.59)	−0.28	.78
POMS – Depression	6.95 (8.37)	7.90 (8.44)	−1.17	.24
Perceived Stress Scale	19.00 (7.69)	20.26 (7.48)	−1.80	.07
Smoking				
FTND total	5.15 (2.18)	4.81 (2.01)	1.72	.09
CPD	20.60 (8.82)	19.71 (8.03)	1.15	.25
Thoughts about abstinence				
1. Desire	8.65 (1.32)	8.34 (1.59)	2.12	**.03**
2. Expect success	8.07 (1.72)	7.89 (1.82)	1.11	.27
3. Difficulty	7.17 (2.36)	7.26 (2.25)	−0.43	.67
4. Goal (total abstinence vs. not)			0.45	.51

Note. POMS = Profile of Mood States; FTND = Fagerström Test for Nicotine Dependence; CPD = cigarettes/day. Means and *SD*s not provided for categorical demographic variables. Bold values indicates a statistically significant difference between sexual and gender minority and nonminority smokers.

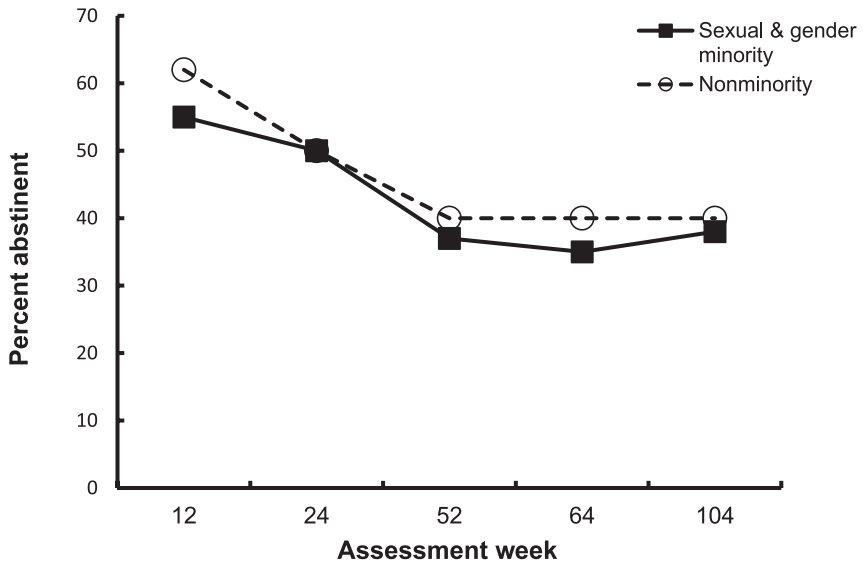

Figure 2. Smoking abstinence point prevalence for sexual and gender minority and nonminority smokers over time.

Table 2. Pearson Correlations of Factors Related to Smoking Abstinence in a Sample of Lesbian, Gay, Bisexual, and Transgender (LGBT) Smokers (n = 136)

	Week 12 abstinence	Week 24 abstinence	Week 52 abstinence	Week 64 abstinence	Week 104 abstinence
FTND	−.18*	−.21*	−.19*	−.22*	−.11
CPD at baseline	−.26**	−.15	−.16	−.17	.14
POMS total	−.17	−.09	.13	.08	.22*
POMS depression	−.23**	−.17	.01	−.02	.16
Angry at other's mistakes (STAXI-2)	.14	.22*	.24*	.25**	.29**

Note. FTND = Fagerström Test for Nicotine Dependence; CPD = cigarettes/day; POMS = Profile of Mood States; STAXI = State-Trait Anger Expression Inventory (second edition).
*$p < .05$. **$p < .01$.

impacted the outcome in smoking abstinence between sexual and gender minorities and nonminorities.

Pearson correlations for baseline variables correlated with smoking abstinence among the LGBT subsample are presented in Table 2. Factors revealed to be correlated with abstinence included nicotine dependence, cigarettes smoked per day, POMS total score and POMS depression, and being angry at others' mistakes. Among this sample of LGBT smokers, demographic variables and indicators of perceived stress were not correlated with smoking abstinence, whereas indicators of mood problems were only seldom correlated with abstinence.

DISCUSSION

The primary goal of this study was to determine if smoking abstinence between sexual and gender minorities and nonminorities differed in extended, nontailored smoking interventions. This was the first study to evaluate this question and can shed light on whether nontailored treatments can achieve similar outcomes in both populations.

Regarding the outcome of smoking abstinence, our results indicated that sexual and gender minority smokers do as well as nonminority smokers in nontailored extended studies. These results are promising given the wide availability of standard smoking treatment programs to the public. Further, these results confirm and expand upon an earlier report by Covey and colleagues (2009) showing no differences in smoking outcome based on sexual orientation and gender identity. However, the question still remains as to whether a tailored smoking intervention would be of greater benefit. Our study does not answer the question of whether LGBT smokers are less likely to attend a nontailored intervention. Some have reported that a tailored intervention would be well received by the LGBT community. Schwappach (2009) surveyed gay men about their perspective on a tailored smoking intervention and many reported they would likely use such an intervention as it would offer the opportunity to refrain from smoking without refraining from social activities. Indeed a tailored program may increase one's comfort level, thus increasing the likelihood of an LGBT smoker attending the treatment sessions and reducing dropout after treatment has begun.

One potential contributing factor to our findings pertains to the individualized nature of the behavioral treatments offered in the studies used for this analysis. Though the 12-week standard treatment was conducted in a group format, it offered all participants an "individualized quit plan." Using this treatment tool, study counselors work with each participant to apply the material to their unique circumstances. Though this may differ from a completely tailored treatment design, it functions in a similar manner to a tailored program by focusing on how the material fits with each person's smoking behaviors and routines.

It is worth noting that we did not observe differences in mood, stress, and smoking variables between these groups. Measures of mood and stress tend to be elevated in sexual and gender minorities relative to the general population (Friedman, Marshall, Stall, Cheong, & Wright, 2008; Hatzenbuehler, Keyes, & Hasin, 2009; Meyer, 2003) and may contribute to higher smoking prevalence (Blosnich et al., 2013). Blosnich and colleagues (2013) noted that minority stress differs from general stressors in three important ways. Minority stress is experienced at a greater degree than everyday stress, it is chronic and is socially based on societal responses to cultural differences. The measures we used in this study assess common or everyday mood and stress problems. As such, it is possible that our measures did not capture the culturally specific stressors that would account for greater degrees of depression and stress reported in previous literature. Alternatively, it is possible that local LGBT-friendly community norms result in stress levels similar to those of nonminority smokers, or that LGBT participants in our studies were not representative of the LGBT community. It is also possible that stress levels do not differ between sexual and gender minority and nonminority smokers, and instead, differences in stress are being driven by nonsmokers.

We did observe a statistically significant difference in desire to quit with sexual and gender minority smokers indicating a slightly higher desire to quit smoking. We are unaware of other studies that have examined comparisons between sexual and gender minority and nonminority smokers with regard to desire to quit. However, others have noted that these groups of smokers have reported similar intentions to quit smoking (Blosnich et al., 2013). Furthermore, although the difference was statistically significant between groups, both groups reported very high levels of desire to quit (i.e., greater than 8 on a 10-point scale). Exploratory correlational analyses in the LGBT sample revealed that nicotine dependence, cigarettes/day, and mood were correlated with abstinence. These findings are consistent with the general smoking literature.

The study findings should be interpreted in light of the following limitations. The sample was primarily White, and thus the generality of findings may not be applicable to other racial and ethnic groups. The data were collected in San Francisco, and thus may differ from other geographic locations were higher stigma of sexual orientation and gender identity exist. The small number of sexual minority women and transgender individuals

in our sample limits our ability to generalize these findings to the larger respective groups. Given our sexual minority sample was primarily comprised of gay men, our findings may be most generalizable to this group. We did not assess sex assigned at birth, and thus some transgender individuals may have been misclassified. Further, it is possible that a smaller number of transgender individuals chose to participate in the study knowing that it was not tailored to the LGBT community. A potential selection bias may have influenced the findings due to the greater desire to quit among LGBT smokers enrolled in our study; that is, a greater desire to quit among LGBT smokers may be necessary to consider entering a program that is not tailored to those individuals. Though using the propensity scoring approach allowed us to combine the samples and thus increase statistical power, this approach is not able to completely control for differences between the study designs (i.e., age restrictions and medication types). Combining data from two studies with identical methodologies would have reduced potential confounds that may be present in the propensity scoring approach. Finally, given that the studies excluded people who used psychiatric medications and LGBT individuals experience disproportionately higher prevalence of mental health issues and subsequent medication use (Cochran & Cauce, 2006; Cochran & Mays, 2009), this sample may not generalize to the wider LGBT population. Strengths of this study include a large sample, biologic confirmation of smoking status, several follow-up assessments, and inclusion of LGBT smokers.

Future research would benefit from directly comparing tailored and nontailored smoking treatments for the LGBT community to determine if one results in greater outcomes. In such endeavors, study researchers should take care to recruit sufficient numbers of LGBT smokers to ensure adequate statistical power and generalizability. Investigators conducting general smoking cessation trials are also encouraged to include measures of sexual orientation and gender identity in the demographics. Questions assessing sexual orientation may be divided to include the individual elements of sexuality, such as attraction, sexual behavior, and affiliation (Sell, 2007). A more comprehensive assessment may also include measures of identity centrality and affirmation, as well as, resilience (Meyer, 2003; Mohr & Kendra, 2011; Riggle, Whitman, Olson, Rostosky, & Strong, 2008). It is also important to assess areas specific to minority-related stress, using such instruments as the Gay-Related Stressful Life Events Scale (Rosario, Schrimshaw, Hunter, & Gwadz, 2002), which assesses social-, familial-, and employment-related stress regarding one's sexual orientation.

The purpose of this study was to examine whether sexual and gender minority and nonminority smokers differed on smoking abstinence outcomes in extended, nontailored smoking interventions. This study adds to the literature by providing initial evidence that sexual and gender minority smokers appear to be as likely to quit smoking as nonminority smokers in nontailored, extended treatment programs. It also provides evidence that abstinence can be maintained to a similar degree following the end of treatment.

FUNDING

This work was supported by National Institute on Drug Abuse (grants P50DA09253, R01DA015732, R01DA02538, K05DA016752, and T32DA007250).

DECLARATION OF INTERESTS

SH is a principal investigator on a material grant from Pfizer Pharmaceuticals.

ACKNOWLEDGMENTS

The authors would like to thank Annesa Flentje, Nadra Lisha, and Cati Brown for their comments on earlier drafts of this manuscript. Ricardo F. Muñoz is now with the Department of Psychology, Palo Alto University, Palo Alto, CA.

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