



Longitudinal analysis of peer social support and quitting Smoking: Moderation by sex and implications for cessation interventions

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ABSTRACT

Social support predicts better health and lower mortality, but the benefits of peer social support for helping cigarette smokers quit are unclear. Moreover, sex as a moderating factor has not been investigated despite sex differences in social support processes. This study of smokers' perceived availability of peer social support in quitting cigarette smoking is a secondary analysis of 1,010 individuals enrolled in an RCT that provided quitting assistance using tailored emails scheduled around a quit date. Participants completed measures of peer support for quitting cigarettes at enrollment (baseline), and at 1-, 3-, and 6-month follow-ups. Peer support at follow-ups was categorized as never-present, always-present, or mixed. A Generalized Estimating Equation (GEE) examined the association between peer support and 7-day point prevalence abstinence at follow-ups, controlling for baseline peer support, experimental condition, stress, depression, and sociodemographic and smoking behavior-related variables. Interactions of peer support \times time, and peer support \times sex, were tested. Results indicated that among women, always-present or mixed peer support was associated with, respectively, odds of abstinence that were 4.36 (95 % CI, 2.54–7.49, $p = 0.0001$), and 2.21 (OR = 2.21, 95 % CI, 1.27–3.85, $p = 0.005$) greater than among women reporting never-present peer support. Among men, peer support did not predict abstinence. Women who smoke may be especially receptive to the benefits of peer support when attempting to quit. Investigation of the basis of their perceptions, how they might be increased, and whether interventions to change them would be effective, is warranted.

1. Introduction

The majority of people who smoke cigarettes say they would like to quit (U.S. Department of Health and Human Services, 2020), but quitting smoking can be difficult and stressful due to withdrawal symptoms experienced during the early days of quitting (e.g., anxiety, depression, etc.) (Etter, 2005). In exploring strategies to increase success in quitting cigarette smoking, investigators have turned to the potential benefits of social support from peers in the quitting process (Westmaas et al., 2010; May and West, 2000; May et al., 2006; Park et al., 2004; Park et al., 2004; Faseru et al., 2018; Cobb et al., 2005; Soulakova et al., 2018). The majority of interventions that have enlisted peers to provide social support to people attempting quitting, however, have generally not

demonstrated efficacy (May and West, 2000; Faseru et al., 2018; Pia-secki and Baker, 2001). Yet, because professionally-provided social support for quitting (e.g., telephone counseling) is established as effective (Meites and Thom, 2007), theoretically, peer social support for quitting smoking should be beneficial.

1.1. Research on social support for quitting smoking

One limitation of previous studies of peer social support on smoking cessation is the absence of manipulation checks to verify that study conditions truly differed in levels of support provided by peers (Westmaas et al., 2010). Additionally, peer support in trials was often added to what were already highly socially supportive treatments, for example

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group treatment programs, or telephone counseling. Quitline counseling in particular (such as that provided by 1–800-Quit-NOW) provides all three functions of social support. Specifically, emotional support through counselors' expressions of empathy, and allowing callers to express thoughts and feelings related to their quit attempt, instrumental or tangible support if NRT is provided, and informational support through the provision of advice on how to quit (Cohen, 2004). Any effects of peer support may thus be masked when added to interventions that already included other elements of social support (Westmaas et al., 2010).

We propose that in the context of less intense or less socially interactive cessation treatments, for example texting or internet cessation programs, the benefits of peer support on quitting may be more observable. Consistent with this idea is pilot data from a recently published randomized controlled trial (RCT). It found that an automated texting program to which peer social support for quitting was added significantly increased quit rates compared to the intervention without the peer support component (White et al., 2020).

In the current longitudinal study, which delivered tailored email messages for quitting, we hypothesized that individuals who consistently perceive they have peer social support during a quit attempt will be significantly more likely to achieve abstinence compared to individuals who do not believe peer support is available. We focused on individuals' perceptions of the *availability of peer social support* (which hereon we also refer to as “peer support”) because in prior research health outcomes were more strongly associated with perceived support availability than with reports of received support (Wethington and Kessler, 1986; Rui and Guo, 2022). We were also interested in identifying sociodemographic or smoking-behavior-related factors that might predict levels of perceived available peer support for quitting. This knowledge could provide insight into who might be most vulnerable to low peer support.

1.2. Assessing social support for quitting smoking

Although some longitudinal or prospective studies have suggested benefits of peer social support for quitting smoking, methodological limitations include the use of social support measures assessed at a baseline or single timepoint only (e.g., before or after smokers' quit date) (Creswell et al., 2015; van den Brand et al., 2019; Bandiera et al., 2016; Waring et al., 2020), short duration of study (e.g., two-weeks (Waring et al., 2020), assessment of *general* social support rather than support more specific to quitting or support during quitting (Derrick et al., 2013), or an exclusive focus on spousal/partner support (Laudet et al., 2004; Burns et al., 2014). Moreover, the majority of studies assessed social support using the Partner Interaction Questionnaire (PIQ) or adaptations thereof (Mermelstein et al., 1983; Mermelstein et al., 1986; Lawhon et al., 2009), which appears to confound “positive” and “negative” support for quitting with smoking status (May and West, 2000). Specifically, some negative support items of the PIQ are applicable only if a person is still smoking (e.g., “criticized your smoking,” “refused to clean up your cigarette butts”), and some positive support items apply only if the smoker has quit (e.g., “complimented my not smoking,” “celebrated my quitting with me”). As May and West pointed out, it would thus not be surprising to find that “positive” support is associated with quitting and “negative” support with continued smoking (May and West, 2000).

Assessing social support at only baseline or at a single timepoint also ignores the possibility that peer support for quitting smoking may change over time. For example, some smokers may perceive high levels of peer support when preparing to quit, but this perception may diminish over time if others' ability or inclination to be supportive decreases.

1.3. Sex and social support

Sex is likely to be an important characteristic for understanding relationships between peer support and quitting (Donato et al., 2018; Neff and Karney, 2005; Shumaker and Hill, 1991; Shumaker and Hill, 1991). Men are more likely to name their spouse as their main confidante, in contrast to women who, with their more expansive social networks, appear to rely on a wider network of individuals for emotional and other support (Belle, 1991; Powers and Bultena, 1976). Social influences as a motivational factor in quitting may also influence men's abstinence more than women's (Westmaas et al., 2002). Research also suggests that perceived support from others predicts women's mortality more than men's (Lyyra and Heikkinen, 2006). Based on this body of research we were interested in examining whether men and women differed in how much peer support they perceived was available during their quit, and the extent to which this support was associated with abstinence.

1.4. Overview

This study used data from an RCT testing the efficacy of a tailored email intervention for cessation for adults who wanted to quit smoking (Westmaas et al., 2018). In an earlier report we observed a significant difference in abstinence between intervention and control groups (Westmaas et al., 2018), but in the current study we were interested in whether, after controlling for experimental condition, peer support would be associated with abstinence. We also wanted to include as control variables other predictors of abstinence or smoking identified in previous research.

2. Methods

In an RCT 1,010 individuals who smoked were randomized to one of three conditions: (i) receiving 27 tailored cessation emails over a two-month period (deluxe email group; DEG), (ii) receiving 3 to 4 tailored emails with links to downloadable booklets (basic email group; BEG), or (iii) receiving a single non-tailored email (single email group; SEG) (Westmaas et al., 2018). The tailored emails in the DEG provided motivation, support, and information for quitting, and were delivered on a schedule determined by the chosen quit date. All emails in all conditions included links to quitting resources. Participants completed measures of peer support for quitting at enrollment (baseline), and at 1-, 3-, and 6-month follow-ups. Self-reported abstinence was assessed at the three follow-ups. The study received Human Subjects approval from George Washington University. A more detailed description of study procedures (including enrollment flow and exclusions, etc.) is reported elsewhere (Westmaas et al., 2018). This analysis is restricted to 848 participants who provided peer support data at all 3 timepoints and smoking status at two or more follow-ups.

2.1. Measures

Peer support availability. At baseline and at each follow-up, participants were asked “Getting support from your friends or family is important when you're trying to quit smoking. By support we mean (i) getting reassurance or encouragement from another person or being given the opportunity to tell someone what you're going through, (ii) getting helpful advice or information, and/or (iii) getting help with everyday tasks or other responsibilities during your quit attempt. Is there someone in your life who you can turn to for social support when you try to quit smoking?” (yes/no). Participants' responses at the 1-, 3-, and 6-month follow-ups were used to create a categorical variable indicating overall level of peer support following the quit attempt: (i) never-present (i.e., no supporter available at all 3 follow-ups), (ii) always-present (i.e., a peer supporter available at all 3 follow-ups), and (iii) mixed (i.e., a peer supporter available at 1 or 2 but not all 3 follow-ups).

Relationship to peer supporter. If participants acknowledged that a

peer supporter was available, they were asked “What is his/her relationship to you?” and asked to choose one of the following (i) spouse or partner, (ii) family member or relative, (iii) work or school associate, (iv) neighbor, (v) friend, or (vi) other. Due to low frequencies for the latter 4 categories these were collapsed to form a single “friend” category.

Depressed symptoms. At baseline participants completed the 2-item depression screener from the 4-item Personal Health Questionnaire (PHQ4), a validated, reliable screener for depression and anxiety (Kroenke et al., 2009; Kroenke et al., 2003). The questions were “During the past 2 weeks, how often have you been bothered by any of the following problems? (i) feeling down, depressed, or hopeless? and (ii) little interest or pleasure in doing things?” Items were averaged to create a single index of depressive symptoms (Cronbach’s $\alpha = 0.79$).

Perceived stress. At baseline two items from the Perceived Stress Scale (PSS (Cohen et al., 1983), a widely used, reliable, and validated measure of perceived stress for use in community samples asked “In the last week, how often have you felt nervous and ‘stressed’?” and “In the last week, how often have you found that you could not cope with all the things that you had to do?” Items were rated on a 5-point scale from 0 (“never”) to 4 (“very often”). The two items were averaged to create a composite measure of perceived stress (Cronbach’s $\alpha = 0.62$).

Smoking-related behavior. Measures of smoking and quitting at baseline and/or follow-ups used standard items from national and international surveys of smoking behavior (Etter et al., 2009; Heatherton et al., 1991; International Tobacco Control Policy Evaluation Project; Centers for Disease Control and Prevention). At baseline, nicotine dependence was assessed using two items from the Fagerstrom Test for Nicotine Dependence as suggested by Heatherton et al (Heatherton et al., 1991; Heatherton et al., 1989). Items were “How soon after you wake up do you smoke your first cigarette? (Within 5 min; 6–30 min, 31–60 min, after 60 min),” scored from 3 to 0, respectively, and “How many cigarettes per day do you smoke? (10 or less, 11–20, 21–30, 31 or more),” scored from 0 to 3, respectively. Items were summed to create a single measure indicating heaviness of smoking.

We also included an item from the Cigarette Dependence Scale (Etter et al., 2009) to potentially capture individuals whose dependence may be less accurately reflected by the number of cigarettes smoked each day (U.S. Department of Health and Human Services, 1998). Participants were asked to respond on a Likert scale from 1 to 5 to the statement “Before going out, I always make sure I have cigarettes with me.” Response options ranged from “totally disagree” to “fully agree.”

Additional baseline measures assessed were number of cigarettes smoked per day, number of previous quit attempts, interest in quitting smoking (“Overall, on a scale from 1 to 10 where 1 is not at all interested and 10 is extremely interested, how interested are you in quitting smoking?”), and self-efficacy for quitting (“How sure are you that you will succeed in quitting smoking for good at this attempt?”) assessed on a Likert scale from 1 (“not at all sure”) to 4 (“extremely sure”).

At all follow-ups, use of cessation medications, non-medication cessation aids, presence of a smoker in the household, and 7-day point prevalence abstinence were assessed. Abstinence was assessed by the question “Have you smoked a cigarette, even a puff, in the last 7 days?” with response options of “no” or “yes” (coded 1 and 0 respectively). Because we sampled from a general population of people who smoked and who were not required to visit a clinic or to interact with clinical staff (which might increase social desirability to report abstinence), we expected low rates of misreporting (SRNT Subcommittee on Biochemical Verification, 2002; Caraballo et al., 2001; West et al., 2007; Yeager and Krosnick, 2010).

Sociodemographic variables. At baseline participants indicated their sex, age, educational attainment, marital status, sexual orientation, and race/ethnicity. Marital status was coded as a dichotomous variable to indicate single (never been married, separated, divorced, or widowed) or partnered (married, living with a partner) status.

2.2. Statistical analysis

Chi-squared tests examined associations between peer support (never-present, always-present, mixed) and categorical baseline variables. For continuous baseline measures, analyses of variance followed by pairwise comparisons (using least-significance-difference tests) compared means by level of peer support. Significant pairwise differences were reported, after adjustments to p -levels for multiple comparisons based on the Bonferroni correction to reduce Type 1 error. Chi-squared tests examined whether the type of relationship to the peer supporter at baseline and at each follow-up differed by participant sex (limited to those reporting a peer supporter at each wave). The significance level for all tests was 5 %.

We conducted a Generalized Estimating Equation (GEE) model in which the repeated-measures dependent variable was 7-day point prevalence abstinence at each of the 3 follow-ups, and peer support the independent variable; GEE accounts for the temporal correlation of repeated measures from the same individual (Liang and zeger, 1986). Included as covariates were baseline sociodemographic and smoking behavior-related variables, stress, depression, experimental condition, and baseline peer support. Using backward stepwise elimination, nonsignificant variables (>10 % significance level) were excluded. Baseline peer support and condition remained in the model because we were especially interested in any effects of peer support independently of these two factors. Interaction terms of peer support \times participant sex, and time \times peer support, were tested individually and retained in the final model if significant at the 5 % significance level. The reference category for GEEs was never-present peer support.

3. Results

3.1. Sample characteristics

Sample characteristics and results of bivariate analyses are provided in Table 1. Overall peer support was not associated with age, sex, or race/ethnicity (all $p > 0.19$); however, 42.4 % of participants with more than a high school education reported always-present peer support compared to 27.9 % of those with high school or less ($p = 0.002$). Participants with romantic partners were also more likely to report always-present peer support (43.6 %) compared to single participants (35 %, $p = 0.04$).

Compared to those reporting never-present peer support, individuals reporting always-present peer support smoked fewer cigarettes per day at baseline ($M = 16.5$ vs 18.4 , $p = 0.05$), were less dependent smokers ($M = 2.9$ vs 3.4 , $p = 0.01$), and had higher self-efficacy for quitting ($M = 2.9$ vs 2.6 , $p = 0.003$).

Use of any cessation medication by the 1-month follow-up was significantly associated with peer support; among those who had used cessation medication, always-present peer support was most commonly reported; in contrast among those who did not use cessation medication mixed peer support was most commonly reported (46.2 %) ($p = 0.004$).

Participants with always-present peer support had lower baseline depression symptoms ($M = 0.8$ vs 1.1 , $p = 0.003$) and lower stress ($M = 1.9$ vs 2.2 , $p = 0.02$) compared to those reporting never-present peer support.

Baseline peer support was significantly associated with overall (follow-up) peer support ($p = 0.0001$). Of the 699 individuals who at baseline perceived peer support was available, 89 % reported mixed or always-present overall support at follow-ups, with only 11.2 % reporting never-present peer support. In contrast, of the 149 individuals who reported no baseline peer support, more than a third (36.2 %) also reported never-present follow-up support.

There were no differences in peer support by experimental conditions ($p < 0.58$).

At baseline, a greater proportion of men reported a spouse or partner as their peer supporter (47 %) than did women (38.1 %, $p = .03$)

Table 1
Sample characteristics by overall perceived support availability (N = 848).

	Totaln(Col %)/M(SD)		Peer Support Availability			P			
			Never-present n(Row%)/M(SD)	Mixed n(Row%)/M(SD)	Always-present n(Row%)/M(SD)				
Sociodemographic Variables									
Age									
<40 yrs old	389	(45.9)	54	(13.9)	183	(47.0)	152	(39.1)	0.187
40 and older	404	(47.6)	63	(15.6)	164	(40.6)	177	(43.8)	
Sex									
Male	139	(16.4)	18	(12.9)	63	(45.3)	58	(41.7)	0.638
Female	709	(83.6)	114	(16.1)	315	(44.4)	280	(39.5)	
Race/ethnicity									
White	761	(89.7)	118	(15.5)	334	(43.9)	309	(40.6)	0.503
Nonwhite	77	(9.1)	13	(16.9)	38	(49.4)	26	(33.8)	
Education									
High school or less	147	(17.3)	23	(15.6)	83	(56.5)	41	(27.9)	0.002
More than high school	701	(82.7)	109	(15.5)	295	(42.1)	297	(42.4)	
Partner status									
Single	366	(43.2)	62	(16.9)	176	(48.1)	128	(35.0)	0.04
Partnered	482	(56.8)	70	(14.5)	202	(41.9)	210	(43.6)	
Sexual orientation									
Heterosexual or straight	771	(90.9)	121	(15.7)	349	(45.3)	301	(39.0)	0.064
Bisexual	32	(3.8)	6	(18.8)	16	(50.0)	10	(31.3)	
Gay or lesbian	45	(5.3)	5	(11.1)	13	(28.9)	27	(60.0)	
Smoking-related Behavior									
Cigarettes smoked per day	17.1	(7.8)	18.4 _a	(8.3)	17.1 _{a,b}	(7.7)	16.5 _b	(7.7)	0.049
Number of previous quit attempts	5.0	(3.3)	5.4	(3.5)	5.0	(3.2)	4.8	(3.3)	0.211
Heaviness of smoking	3.1	(1.5)	3.4 _a	(1.5)	3.1 _{a,b}	(1.5)	2.9 _b	(1.5)	0.01
Have cigarettes before going out	4.5	(1.1)	4.4	(1.2)	4.5	(1.1)	4.5	(1.2)	0.38
Self-efficacy for quitting	2.8	(0.8)	2.6 _a	(0.9)	2.9 _b	(0.8)	2.9 _b	(0.9)	0.003
Motivation to quit	9.5	(1.0)	9.4	(0.9)	9.5	(1.0)	9.6	(0.8)	0.033
Other smoker in household†									
No	489	(57.7)	59	(12.1)	209	(42.7)	221	(45.2)	0.087
Yes	295	(34.8)	51	(17.3)	127	(43.1)	117	(39.7)	
Any cessation medication†									
None used	593	(69.9)	103	(17.4)	274	(46.2)	216	(36.4)	0.004
Used NRT/varenicline/bupropion	255	(30.1)	29	(11.4)	104	(40.8)	122	(47.8)	
Non-medication cessation aids†									
Did not use	203	(23.9)	32	(15.8)	96	(47.3)	75	(36.9)	0.124
Used 1 or more	582	(68.6)	79	(13.6)	240	(41.2)	263	(45.2)	
Quit attempt in last 12 months									
No	323	(38.1)	55	(17.0)	128	(39.6)	140	(43.3)	0.075
Yes	525	(61.9)	77	(14.7)	250	(47.6)	198	(37.7)	
Psychological and Other Variables									
Depression	1.0	(0.9)	1.1 _a	(0.9)	0.9 _{a,b}	(0.9)	0.8 _b	(0.9)	0.003
Perceived stress	2.0	(1.0)	2.2 _a	(0.9)	2.0 _{a,b}	(1.0)	1.9 _b	(0.9)	0.018
Experimental condition									
Deluxe	299	(35.3)	50	(16.7)	125	(41.8)	124	(41.5)	0.581
Basic	283	(33.4)	47	(16.6)	126	(44.5)	110	(38.9)	
Web	266	(31.4)	35	(13.2)	127	(47.7)	104	(39.1)	
Peer support availability (baseline)									
Absent	149	(17.6)	54	(36.2)	70	(47.0)	25	(16.8)	0.000
Present	699	(82.4)	78	(11.2)	308	(44.1)	313	(44.8)	

Notes: Column percents may not total 100 % due to missing data for some characteristics; Mean values in a row not sharing the same subscript are statistically significantly different at $p < 0.05$ after Bonferroni correction.

†Based on response provided at the 1-month follow-up survey.

(Table 2). A similar pattern was evident at the 3-month follow-up, though marginally significant (50 % among men vs 38.9 % among women, $p = 0.06$); however, the effect was significant at the 6-month follow-up (50.7 % of men reported their spouse as their source of peer support vs 42.5 % of women, $p = 0.04$).

3.2. Generalized Estimating equations model

A significant peer support \times sex interaction [Wald $\chi^2(784) = 14.11$, $p = 0.001$], but not the time \times peer support interaction ($p = 0.30$), was included in the final model (QICC = 2350). Follow-up GEEs conducted separately for each sex parsed the interaction. In the GEE for women, those reporting always-present peer support had 4.36 greater odds of abstinence compared to those reporting never-present peer support (95 % CI, 2.54–7.49, $p = 0.0001$), and women reporting mixed peer support

had more than twice the odds of abstinence ($OR = 2.21$, 95 % CI, 1.27–3.85, $p = 0.005$). In the GEE for men, however, the model effect was not significant ($p = 0.93$). Follow-up GEEs indicated that ORs were largely unchanged when the model controlled for relationship partner status (single vs partnered), education, race/ethnicity, depression symptoms, or perceived stress.

A plot of adjusted abstinence rates based on GEE models for each sex (Figure 1) indicated that, among men, the overall abstinence rate across follow-ups was approximately 42 % at each level of peer support. Among women, however, abstinence rates ranged from approximately 11 % among those with never-present peer support to 38 % among women with always-present peer support.

In the final model, which controlled for the effect of experimental condition on abstinence ($OR = 1.44$, 95 % CI, 1.03–2.00, $p = 0.03$), and for baseline peer support ($OR = 0.88$, 95 % CI, 0.61–1.27, $p = 0.48$),

Table 2
Association between participant sex and relationship to peer supporter among people reporting peer support for quitting smoking.

Relationship to peer supporter	Participant Sex				p
	Male		Female		
	n	(%)	n	(%)	
Baseline†					
Spouse or partner	55	(47.0)	222	(38.1)	0.029
Family member or relative	24	(20.5)	191	(32.8)	
Friend	38	(32.5)	170	(29.2)	
At 1-month follow-up†					
Spouse or partner	50	(46.7)	203	(40.4)	0.475
Family member or relative	28	(26.2)	152	(30.3)	
Friend	29	(27.1)	147	(29.3)	
At 3-month follow-up†					
Spouse or partner	44	(50.0)	170	(38.9)	0.064
Family member or relative	17	(19.3)	134	(30.7)	
Friend	27	(30.7)	133	(30.4)	
At 6-month follow-up†					
Spouse or partner	37	(50.7)	162	(42.5)	0.042
Family member or relative	12	(16.4)	118	(31.0)	
Friend	24	(32.9)	101	(26.5)	

†Among participants reporting a peer supporter.

Note: Friend = ex-husband, sponsor, pastor, ACS staff, God, neighbor, work or school associate).

greater odds of abstinence were associated with male sex ($OR = 9.62$, 95 % CI , 1.42–2.89, $p = 0.001$), use of cessation medication at 1-month ($OR = 1.47$, 95 % CI , 1.11–1.96, $p = 0.007$), not having a household member who smoked ($OR = 1.33$, 95 % CI , 1.00–1.77, $p = 0.05$), greater self-efficacy for quitting ($OR = 1.35$, 95 % CI , 1.15–1.58, $p = 0.001$), smoking fewer cigarettes per day ($OR = 0.97$, 95 % CI , 0.95–0.99, $p = 0.004$), and greater levels of peer support [$\chi^2(784) = 5.30$, $p = 0.001$]. Univariate results indicated that, compared to participants with never-present peer support, those reporting always-present peer support had 4.56 greater odds of abstinence (95 % CI , 2.67–7.81, $p = 0.001$), and those reporting mixed support had 2.23 greater odds of abstinence (95 % CI , 1.28–3.86, $p = 0.004$).

4. Discussion

The current study avoided some of the methodological limitations of previous correlational and experimental studies of peer support for quitting by including measures of peer support at multiple timepoints, by assessing support from a peer that was not restricted to spousal or partner support, and by using a measure of peer support specifically for the quit attempt.

Controlling for experimental condition, baseline peer support availability, and sociodemographic and smoking-related factors associated with abstinence, we observed among women a dose-response relationship between overall level of peer support and abstinence. Specifically, female participants who reported always-present peer support had more than 4 times the odds of abstinence, and those reporting mixed peer support availability had more than two times the odds of abstinence, compared to women reporting never-present peer support. Among men, however, there was no relationship between peer support at follow-ups and abstinence, despite men and women not differing in levels of peer support. Controlling for sociodemographic and smoking-related variables did not change the pattern of results.

Our results also pointed out environmental and psychological disadvantages among people who wanted to quit smoking but who did not believe peer support was available for their quit attempt: individuals reporting never-present peer support for quitting had lower income and education, greater depressive symptomatology and stress, lower self-efficacy for quitting, and lower motivation to quit, all factors associated with lower quitting success in prior research (Weinberger et al., 2017; Fluharty et al., 2017; Muench et al., 2020; Schuck et al., 2014).

One explanation is that feeling stressed and depressed engenders more negative perceptions of peer support availability when in fact peers may be willing to deliver support. Alternatively, potential peer supporters may feel ill-equipped to help and somehow convey this sentiment, or they may actually avoid someone who appears depressed and/or stressed (leading to lowered perceptions of peer support). Still, the strong benefit of peer support availability that we obtained could not be explained away by the disadvantages above because controlling for these factors did not reduce the apparent benefit of peer social support.

In addition, as noted above, the effect of peer support availability on abstinence was present for women but not men. Whether this reflects reality or perception could not be determined by this study but is worthy of future investigation. It is plausible that men who consistently reported the absence of peer support did in fact receive support but failed to recognize its occurrence or value while benefitting from it. In addition (or alternatively) men might have been more likely to attribute their quitting to their own willpower, or to other intrinsic reasons; in contrast, women may have been more attuned to instances of help from peer supporters, and these actions from others may have played a significant role in both influencing their perceptions of peer support and in facilitating their abstinence. Future research assessing real-time reports of peer support availability and actual support received would help in understanding the strong sex difference we obtained in the relationship between peer support and abstinence.

5. Limitations

Our results cannot establish that peer support is a cause of greater abstinence. They suggest, however, that asking people who plan to quit smoking about their availability of peer support before a quit attempt, particularly among women, is an important topic to address in future interventions. Understanding the roots of perceptions of peer support availability at baseline and during a quit attempt could provide insight into how perceptions might be changed to be more positive (e.g., asking individuals what actions from others they would recognize as showing support).

We do not believe that our results can be attributed to individuals who failed to quit simply blaming a lack of peer support for their failure. Subscribing to that explanation would require also explaining why this would be the case for women but not men. Moreover, while our baseline assessment of peer support was not associated with abstinence, baseline peer support was strongly associated with peer support at follow-ups, which in turn predicted increased odds of abstinence. This suggests that pre-quit perceptions of peer support availability are indirectly an important factor in quitting.

Our measure of abstinence did not include biochemical validation; however, according to the Society for Research on Nicotine and Tobacco (SRNT) Subcommittee on Biochemical Verification of Smoking and Cessation, for studies not involving face-to-face interactions but conducted through mail, telephone, or internet, self-reported abstinence from smoking is valid (SRNT Subcommittee on Biochemical Verification, 2002; Caraballo et al., 2001; West et al., 2007; Yeager and Krosnick, 2010).

6. Conclusions

Women who smoke may be especially receptive to the effects of peer support availability when attempting to quit. Investigation of the basis of their perceptions, how they might be changed, and whether interventions to change them would be effective, is warranted.

CRedit authorship contribution statement

J. Lee Westmaas: Conceptualization, Methodology, Investigation, Formal analysis, Writing – original draft. **Sicha Chantaprasopsuk:** Conceptualization, Validation, Writing – review & editing. **Jeuneviette**

Bontemps-Jones: Investigation, Project administration, Data curation, Supervision, Resources, Writing – review & editing. **Robert L. Stephens:** Formal analysis, Writing – review & editing. **Christopher Thorne:** Formal analysis. **Lorien C. Abrams:** Conceptualization, Methodology, Supervision, Investigation, Resources, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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