Published in final edited form as:

Womens Health Issues. 2019 ; 29(3): 259–266. doi:10.1016/j.whi.2019.03.006.

The Role of Self-Efficacy and Motivation in Postpartum Sustained Smoking Abstinence

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Abstract

Background: Postpartum relapse to cigarette smoking is common and relapse prevention interventions have indicated limited efficacy. Abstinence motivations and self-efficacy are two factors that might fluctuate during the postpartum period and predict smoking abstinence. The present study was a secondary analysis that examined statistical trends in motivations and self-efficacy to sustain postpartum abstinence and evaluated their association with sustained abstinence from pregnancy through 52 weeks postpartum.

Methods: Former smokers ($N=300$) were recruited for a parent study evaluating two postpartum behavioral relapse prevention interventions. Participants completed assessments prenatally (baseline) and at 12, 24, and 52 weeks postpartum. Motivations to sustain abstinence for internal (intrinsic motivation) and external (extrinsic motivation) reasons, for the health of the baby (baby's health motivation), to maintain a healthy pregnancy (pregnancy motivation), and to avoid children becoming smokers (parenting motivation) were measured at each assessment. Confidence in maintaining abstinence, despite negative affective experiences (internal self-efficacy) and outside circumstances (external self-efficacy), was also assessed. Smoking was biochemically-verified at each assessment.

Results: Linear mixed models indicated decreasing intrinsic, baby's health, and parenting motivations from baseline to 12 and 24 weeks postpartum and increasing motivations from 24 to 52 weeks postpartum ($ps<.03$). Higher baseline internal self-efficacy was associated with lower probability of relapse at 24 weeks postpartum (OR=0.92, 95% CI [0.87, 0.98]), though this effect

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Declaration of Interest:
None declared.

became nonsignificant after adjustment for multiple statistical tests. Abstinence motivations and external self-efficacy were not significantly associated with relapse ($p>.10$).

Conclusions: Levels of abstinence motivations fluctuated from pregnancy through postpartum. Future work should investigate more potent predictors of postpartum abstinence.

Keywords

motivation; self-efficacy; smoking abstinence; relapse; postpartum

Introduction

Maternal cigarette smoking during pregnancy and postpartum is associated with deleterious effects for both the mother (e.g., cancer) and her infant (e.g., sudden infant death syndrome; US Department of Health and Human Services, 2006). Moreover, although many women quit smoking during pregnancy, more than 40% relapse by 6 months postpartum (Jones, Lewis, Parrott, Wormall, & Coleman, 2016) and 85% relapse by 12 months postpartum (Fang et al., 2004). These high postpartum relapse rates, coupled with limited efficacious postpartum relapse prevention interventions (Su & Bутtenheim, 2014), suggest a need to identify factors that might be addressed in interventions designed to improve postpartum sustained abstinence. Social Learning Theory (Bandura, 1977) and the Transtheoretical Model (Prochaska & DiClemente, 1983) posit two such factors influencing behavior change: (1) confidence in achieving change (i.e., self-efficacy); and (2) reasons to change (i.e., motivation). Indeed, extant research indicates that motivation and self-efficacy for smoking abstinence predict cessation during pregnancy and postpartum (e.g., Curry, McBride, Grothaus, Lando, & Pirie, 2001; Heppner et al., 2011; Mullen, Pollak, & Kok, 1999; Simmons, Sutton, Quinn, Meade, & Brandon, 2014). However, most of this research has evaluated global measures of abstinence motivation and self-efficacy. Understanding how *specific types* of abstinence motivations and self-efficacy change as women transition through the postpartum period and which abstinence motivations and self-efficacy predict sustained abstinence could help optimize future postpartum relapse prevention interventions.

Prior research has indicated that motivations to quit smoking during pregnancy are largely associated with the pregnancy itself (Curry et al., 2001; Mullen et al., 1999). These motivations include not wanting to smoke due to concerns about (a) being healthy during pregnancy (i.e., pregnancy-related motivation) and (b) the baby's health (i.e., baby's health motivation). Wanting to be healthy during pregnancy, or pregnancy-related motivation, predicts greater probability of smoking cessation *during* pregnancy (Curry et al., 2001) but may predict lower odds of cessation postpartum when women are no longer pregnant. In contrast, abstinence motivations related to the baby's health and also parenting, such as not wanting children to grow-up to be smokers or not wanting children to identify the mother as a smoker, may be more salient *after* the baby is born, and thus increase the probability of postpartum sustained abstinence (Heppner et al., 2011). Intrinsic and extrinsic motivations for smoking abstinence may also differentially predict postpartum sustained abstinence. Intrinsic motivations are driven by internal rewards (e.g., wanting self-control over smoking) and are associated with higher likelihood of abstinence during pregnancy (Curry et al., 2001; Mullen et al., 1999). In contrast, extrinsic motivations are driven by external rewards (e.g.,

saving money) and are linked to postpartum relapse (Notley, Blyth, Craig, Edwards, & Holland, 2015). Research has indicated that these extrinsic motivations, as well as pregnancy-related motivation, decrease from early to later pregnancy (Curry et al., 2001). Altogether, findings underscore the need to account for the multidimensionality of abstinence motivations and investigate their dynamic nature as women transition out of pregnancy.

High self-efficacy also predicts sustained abstinence through 12 months postpartum (Correa, Simmons, Sutton, Meltzer, & Brandon, 2015; Mullen et al., 1999; Orton, Coleman, Coleman-Haynes, & Ussher, 2018; Severson, Andrews, Lichtenstein, Wall, & Akers, 1997; Simmons et al., 2014). Conversely, decreases in self-efficacy during pregnancy and postpartum are associated with greater odds of 6-month postpartum relapse (McBride, Pirie, & Curry, 1992). Investigations, however, have not examined the potential differential influence of internal (i.e., confidence in smoking restraint despite negative affective experiences) relative to external (i.e., confidence in smoking restraint despite outside circumstances) self-efficacy on postpartum sustained abstinence. Higher internal, but not external, self-efficacy in former smokers is associated with greater confidence in avoiding relapse (Etter, Bergman, Humair, & Perneger, 2000), which may translate to higher rates of sustained abstinence.

To improve the understanding of the potentially dynamic nature and predictive utility of motivations and self-efficacy for smoking abstinence, the present study aimed to investigate the following in a parent randomized clinical trial (RCT) evaluating two postpartum behavioral relapse prevention interventions: (1) changes in intrinsic, extrinsic, baby's health, parenting- and pregnancy-related abstinence motivations, as well as internal and external self-efficacy, from the end of pregnancy through 52 weeks postpartum; and (2) associations among abstinence motivations, self-efficacy, and postpartum smoking abstinence. These findings could inform interventions aimed at optimizing postpartum sustained abstinence, including identifying the utility of directly targeting different types of abstinence motivations and self-efficacy, and the optimal timing for implementing such self-efficacy- and motivation-enhancing techniques.

Methods

Participants

Participants were 300 women who had quit smoking prior to 34 weeks gestation. Thirty-four weeks was chosen as the cessation cut-off to balance the length of time women had quit before delivery with the potential of earlier delivery for women who smoked during pregnancy. Participants were recruited from 2008–2012 for a parent RCT evaluating two postpartum behavioral relapse prevention interventions. Participants were recruited through local programs in the Pittsburgh area that supported smoking cessation during pregnancy, as well as obstetric and pediatric offices. Eligibility was initially determined over the phone and later confirmed through an in-person screening at a prenatal baseline assessment scheduled after 34 weeks of gestation. Inclusion criteria included smoking ≥ 5 cigarettes per day prior to quitting, smoking ≥ 1 month during the 3 months before becoming pregnant, no smoking during the 2 weeks before screening (assessed using timeline follow-back methodology and

verified using expired-air carbon monoxide level (8 parts per million), and motivation to maintain abstinence postpartum (score 2 on a 0–3 Likert scale). Women were excluded for reporting current, acute psychiatric symptoms warranting immediate treatment, including non-nicotine substance use problems, assessed using either the Primary Care Evaluation of Mental Disorders (Prime-MD; Spitzer et al., 1994) or Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition Axis I Disorders (SCID-I; First, Spitzer, Gibbon, & Williams, 2002). Written informed consent was obtained from all participants. The research protocol was approved by the University of Pittsburgh Institutional Review Board. Additional methodological details are reported elsewhere (Levine, Cheng, Marcus, Kalarchian, & Emery, 2016; Levine, Marcus, Kalarchian, & Cheng, 2013).

Assessments

Participants reported demographic and smoking history information at the prenatal baseline assessment. The primary outcome was smoking abstinence at each postpartum assessment (12, 24, and 52 weeks). Assessment timepoints were fixed according to the parent trial (Levine et al., 2013) and involved balancing intervention timing and the feasibility of working with women in the postpartum period.

Smoking behavior.—Smoking was confirmed using a timeline follow-back (TLFB) interview (Brown et al., 1998) and biochemical verification. Expired-air carbon monoxide (parts per million) was assessed using a Vitalograph carbon monoxide monitor (Vitalograph Inc., Lenexa, KS). Salivary cotinine ($\mu\text{g/L}$) was collected and analyzed only for women self-reporting *not* smoking during any of the three postpartum assessments. Per recommended guidelines (Hughes et al., 2003; SRNT Subcommittee on Biochemical Verification, 2002), relapse was defined as self-reported 7 consecutive smoking days, carbon monoxide level >8 parts per million, or salivary cotinine level $>15 \mu\text{g/L}$. Participants lost to follow-up were considered to have relapsed as of the day after the last assessment on which abstinence was verified. As reported in the parent study, there were no significant differences between the two postpartum behavioral relapse prevention intervention groups in smoking abstinence or time to relapse.

Motivation for smoking abstinence.—The Reasons for Quitting (RFQ) questionnaire (Curry, Wagner, & Grothaus, 1990; Curry et al., 2001) was used to assess five types of motivations for staying quit: intrinsic reasons (10 items assessing health concerns and self-control; e.g., “So that I can feel in control of my life”), extrinsic reasons (10 items assessing immediate reinforcement and social influence; e.g., “Because people I am close to will be upset with me if I don’t quit”), pregnancy-related reasons (1 item: “Because I want to be as healthy as possible during pregnancy”), baby’s health reasons (1 item: “Because I am concerned about my baby’s health”), and parenting-related reasons (2 items: “Because I don’t want my children to grow up to be smokers;” “Because I don’t want my children to know me as a smoker”). Participants responded to items on a 0 (*not at all true*) to 4 (*extremely true*) rating scale. Mean scores were computed for each subscale.

The RFQ subscales in the present study were above threshold for acceptable reliability (Tavakol & Dennick, 2011) at each assessment (intrinsic subscale: α s=0.83–0.86; extrinsic subscale: α s=0.77–0.79; parenting subscale: α s=0.84–0.88). Alpha values were comparable to those reported previously (Curry et al., 1990; Curry et al., 2001). The original pregnancy subscale in the expanded RFQ questionnaire is typically comprised of the items “because I want to be as healthy as possible during pregnancy” and “because I am concerned about my baby’s health.” However, due to the relevance of the former item to only the prenatal baseline assessment and the below-threshold reliability of this subscale at the postpartum assessments (all α s<0.62), these items were separated to reflect pregnancy-related motivation at the prenatal baseline assessment only and baby’s health motivation that was relevant to all assessment timepoints. Principal components analysis during RFQ questionnaire development confirmed the distinction between the intrinsic-extrinsic dimensions (Curry et al., 1990) and the RFQ has demonstrated moderate to high levels of internal consistency, as well as convergent and discriminant validity (Curry et al., 1990; Curry, Grothaus, & McBride, 1997). Additional psychometric analyses have indicated that the pregnancy- and parenting-related motivation scales in the expanded version of the RFQ emerged as subdimensions distinct from the intrinsic-extrinsic dimensions (Curry et al., 2001).

Self-efficacy for smoking abstinence.—The Self-Efficacy Questionnaire (SEQ-12; Etter et al., 2000) was used to evaluate internal self-efficacy (6 items assessing confidence in smoking restraint when facing internal stimuli; e.g., “When I feel very anxious”) and external self-efficacy (6 items assessing confidence in smoking restraint when facing external stimuli; e.g., “When I am with smokers”). Participants responded to whether they were “sure” they could “refrain from smoking in each situation” on a 1 (*not at all sure*) to 5 (*absolutely sure*) Likert rating scale. Sum scores were computed for each subscale. Consistent with prior research (Etter et al., 2000), the SEQ-12 indicated adequate reliability in the present study at each assessment (internal subscale: α s=0.91–0.94; external subscale: α s=0.86–0.89). The two-dimensional nature of the SEQ-12 has been supported in extant research and has demonstrated high internal consistency and test-retest correlation coefficients, as well as significant predictive utility (Etter et al., 2000).

Procedure

Following completion of the prenatal baseline assessment between 34 and 38 weeks gestation, participants were randomly assigned to either the Strategies to Avoid Returning to Smoking (STARTS) intervention group, a cognitive behavioral relapse prevention intervention targeting postpartum mood, stress, and weight, or a supportive, time and attention-controlled comparison (SUPPORT) group. Participants completed up to 13 intervention sessions (M sessions completed=10.93 [SD =3.77]) following delivery through 24 weeks postpartum. Women completed measures of motivation and self-efficacy for smoking abstinence, a TLFB interview, and provided carbon monoxide and salivary cotinine samples at the prenatal baseline assessment and at 12, 24, and 52 weeks postpartum. Participants were compensated upon completion of each assessment, with compensation increasing over time (total compensation \$170).

Overview of interventions

Sessions for the STARTS intervention group involved psychoeducation about mood and weight concerns and skills to enhance motivation for continued abstinence. Cognitive behavioral strategies were used to address maladaptive cognitions and behaviors related to mood, stress, and weight concerns. Strategies used included self-monitoring to track situations, thoughts, and moods related to smoking urges; modifying maladaptive cognitions; using social support; engaging in pleasurable activities; using relaxation techniques to regulate mood; modifying maladaptive cognitions and beliefs pertaining to shape and weight; engaging in physical activity and healthy eating; and balancing mothers' and babies' needs. The SUPPORT group addressed general topics pertaining to postpartum relapse prevention and focused on psychoeducation of the consequences of smoking, motivations to sustain abstinence, utilizing social support, preventing the occurrence of urges, and problem-solving challenges women encountered week-to-week to avoid return to smoking. Unlike the STARTS intervention, the SUPPORT intervention did not focus on mood, stress, and weight concerns. Both interventions targeted motivations to sustain abstinence but did not target self-efficacy.

Statistical analysis

Linear mixed models (LMMs) were used to evaluate change in motivation and self-efficacy subscales across the three postpartum assessments (12, 24, and 52 weeks) by randomization group. Demographic variables were evaluated to determine their statistical contribution to abstinence. Prenatal baseline covariates were retained when associated with abstinence rates over time (Levine et al., 2016). Fixed terms included group, the overall effect of time as a factor (baseline and 12, 24, and 52 weeks postpartum), age, education, weeks quit at baseline, and race as a stratified factor. The group x time interaction was also included to account for potential differential intervention group effects on motivation that may have occurred as intervention progressed. Participant was included as a random term to account for dependence among repeated measures from the same subject.

Generalized linear mixed models (GLMMs) with logit links were performed to examine the effects of motivation and self-efficacy subscales on relapse. Again, GLMMs included fixed terms of group, time, the group x time interaction, age, education, weeks quit at baseline, and race as a stratified factor. Interactions between time and both motivation and self-efficacy were also included to evaluate whether the effects of motivations and self-efficacy on relapse emerged differentially depending on the time of postpartum follow-up. Participant was included as a random term to account for dependence among repeated abstinence measures from the same individual. Repeated assessments were used as time-varying covariates to predict relapse during the subsequent assessment interval for nearly all motivation variables. Given the relevance of pregnancy motivation to only the prenatal baseline assessment and lack of internal ($p=.90$) and external ($p=.77$) self-efficacy change across time, GLMMs were performed to examine associations of baseline self-efficacy and pregnancy motivation on relapse at follow-up. The Benjamini-Hochberg method (Benjamini & Yekutieli, 2001) was used to adjust for multiple comparisons. Sample size was based on the evaluation of treatment effects expected in the parent study (Levine et al., 2013).

The effects of self-efficacy as a predictor of cessation tend to be overestimated when failing to adjust for current smoking status (Gwaltney, Metrik, Kahler, & Shiffman, 2009). Thus, models assessing relapse were also adjusted for current smoking status. Participants were deemed to be currently smoking if meeting 1 of the following criteria: (a) any smoking on the day prior to the assessment, (b) carbon monoxide level >8 parts per million, or (c) salivary cotinine level >15 µg/L.

Results

Participant characteristics

Data were analyzed from 300 women ($n=150$ in STARTS; $n=150$ in SUPPORT). Participant baseline characteristics and comparisons of characteristics between groups are reported in Table 1. There were no significant prenatal baseline differences in age, race, education, income, number of cigarettes smoked per day prior to quitting, number of weeks quit, or number of weeks pregnant between intervention groups (ps between .21-.96), and no significant differences in baseline motivation or self-efficacy scores between intervention groups (ps between .09-.94).

Abstinence motivation and self-efficacy trends from pregnancy through postpartum

LMMs indicated a significant overall effect of time (i.e., results from the Type I [sequential] ANOVA) on intrinsic motivation ($F(3,719)=3.30$, $p=.02$), parenting-related motivation ($F(3,718)=4.02$, $p=.01$), and baby's health motivation ($F(3,725)=23.83$, $p<.0001$), such that intrinsic, parenting-related, and baby's health motivations decreased from the prenatal baseline assessment to 12 and 24 weeks postpartum and increased between 24 and 52 weeks postpartum (Table 2; Figure 1).

There was a significant group x time interaction on baby's health motivation ($F(3,725)=2.78$, $p=.04$), such that women in STARTS (vs. SUPPORT) endorsed significantly higher baby's health motivation at 12 weeks postpartum ($t(734)=2.43$, $p=.02$, odds ratio [OR]=1.43, 95% confidence interval [CI] [1.07, 1.91]). There was also a group x time interaction on extrinsic motivation ($F(3,721)=2.81$, $p=.04$), such that women in SUPPORT (vs. STARTS) endorsed significantly higher extrinsic motivation at 12 weeks postpartum ($t(482)=2.22$, $p=.03$, OR=1.23, 95% CI [1.02, 1.49]). There was no main effect of time or effect of group x time on self-efficacy measures (ps between .23-.90). There were no significant group x time interactions on intrinsic ($p=.68$) or parenting-related ($p=.75$) motivation. Motivation and self-efficacy subscales were low to moderately correlated (Table 3).

Abstinence motivation and self-efficacy as predictors of postpartum relapse

As reported elsewhere (Levine et al., 2016), there were no significant differences between groups in relapse at follow-up (12 weeks: 58.7% vs. 65.3% relapsed; 24 weeks: 62.0% vs. 70.7% relapsed; 52 weeks: 73.3% vs. 78.7% relapsed in SUPPORT vs. STARTS, respectively; ps between .11 and .28). GLMMs indicated a significant twoway interaction of prenatal baseline internal self-efficacy x time on relapse ($p=.03$), such that higher baseline internal self-efficacy predicted lower probability of relapse at 24 weeks postpartum ($p=.01$; Table 4). This association became nonsignificant after the Benjamini-Hochberg method was

applied. There were no main effects or interactions with time for external self-efficacy or the motivation subscales when predicting postpartum relapse (ps between .08-.99).

Discussion

The prenatal and postpartum periods are unique times during which motivation and self-efficacy to maintain abstinence likely fluctuate as roles and demands change. The present study was the first to examine trends in abstinence motivations and self-efficacy from the end of pregnancy through 52 weeks postpartum as well as the time-varying associations between abstinence motivations, self-efficacy, and postpartum sustained smoking abstinence. Identifying factors associated with postpartum abstinence, such as motivations and self-efficacy to remain quit, is critical given the adverse health effects of smoking on both the mother and baby as well as the need to optimize behavioral relapse prevention interventions.

In the current study, motivations for smoking abstinence, but neither internal nor external self-efficacy for smoking abstinence, changed from the end of pregnancy through 52 weeks postpartum. Specifically, abstinence motivations related to intrinsic reasons (e.g., living healthier), the health of the baby, and parenting-related factors decreased from pregnancy through 12 and 24 weeks postpartum and increased from 24 to 52 weeks postpartum. Quitting smoking during pregnancy may reflect a “suspension” of smoking that is not always “intentional, permanent, or made for personal benefit” (pp. 331; Stotts, DiClemente, Carbonari, & Mullen, 2000). Thus, motivations to sustain abstinence during pregnancy may largely reflect pressure from society and oneself to quit smoking for the health of the baby and mother, resulting in natural decreases in these types of abstinence motivations following artificially high motivation during pregnancy. Extant research also indicates that stress, depression, and cognitive performance deficits (e.g., in memory, information processing) are elevated in the first several months postpartum (Buckwalter, Buckwalter, Bluestein, & Stanczyk, 2001; de Groot, Vuurman, Hornstra, & Jolles, 2006; Don, Chong, Biehle, Gordon, & Mickelson, 2014; Wu, Selig, Roberts, & Steele, 2011). Thus, heightened negative affect and depleted cognitive resources postpartum could initially play a role in reduced motivation to maintain cessation. However, improvement in some of these constructs by 12 months postpartum (e.g., decreased depressive symptoms; Wu et al., 2011), as well as mothers feeling better-equipped to balance their own needs with those of their newborns (Stotts et al., 2000), could make available the cognitive resources and energy to refocus on abstinence and heighten motivation.

The effect of time on motivations related to the baby’s health and extrinsic reasons for sustaining abstinence (e.g., saving money) should be interpreted in the context of intervention. Women in the STARTS (vs. SUPPORT) group reported significantly higher baby’s health motivation at 12 weeks postpartum. This group difference may reflect the focus on balancing baby’s needs with one’s own needs, a topic of intervention in the STARTS, but not SUPPORT, group. Surprisingly, extrinsic motivation was significantly higher in the SUPPORT group at 12 weeks postpartum, which may reflect the SUPPORT group’s focus on reviewing motivations to stay quit, many of which were extrinsic, at 12 weeks postpartum. It also is notable that, despite efforts to increase abstinence motivations in both interventions and the heightened abstinence motivations observed depending on

intervention group at 12 weeks postpartum (i.e., abstinence motivation x intervention group interactions), there was still an overall decrease in abstinence motivation from pregnancy through 24 weeks postpartum. This result underscores the potentially robust decline in motivations for smoking abstinence across the postpartum period.

Surprisingly, external self-efficacy, as well as all types of motivations to sustain smoking abstinence, were *not* significantly associated with postpartum relapse. Greater internal self-efficacy was associated with lower probability of relapse at 24 weeks postpartum, though this effect was nonsignificant after applying a correction for multiple statistical tests. These null findings are in conflict with Social Learning Theory (Bandura, 1977) and the Transtheoretical Model (Prochaska & DiClemente, 1983), which emphasize the roles of motivation and self-efficacy in eliciting health behavior change. Moreover, prior research has reported on the predictive roles of motivation and self-efficacy in smoking abstinence. Thus, although prior findings have underscored the potential utility of assessing abstinence motivations and self-efficacy given their ties to abstinence, results from the present study suggest that other factors may be worth evaluating as more potent targets of relapse (e.g., social support, affect, nicotine dependence; Notley et al., 2015; Orton et al., 2018).

The present study had a number of strengths, including a sample of diverse women and a longitudinal design spanning the end of pregnancy through the first postpartum year. However, there were limitations. First, the changes observed in motivations for smoking abstinence occurred in the context of an RCT and may not represent naturally-occurring changes in motivations. Second, abstinence motivations and self-efficacy in the present study did not predict postpartum sustained abstinence, which may have resulted from restricted variability in reporting. Third, the present study evaluated relationships between smoking relapse and abstinence motivations and self-efficacy that were distant in time. Meta-analytic findings indicate that the relationship between abstinence self-efficacy and smoking cessation decreases in strength with the continuation of time (Gwaltney et al., 2009). Thus, assessments of motivations and self-efficacy for smoking abstinence closer in time to smoking events could be optimally informative. Finally, data from the parent RCT were collected beginning in 2008 when electronic cigarettes and other novel nicotine substitution products were not readily available as cessation aids. It is unclear how access to these devices during the postpartum period may have altered abstinence motivation and self-efficacy trends, as well as the utility of these constructs in predicting sustained abstinence.

Implications for Practice and/or Policy

Findings from the current study indicated changes in degree of motivation levels, but not self-efficacy levels, for smoking abstinence from pregnancy through postpartum. Specifically, motivations for staying quit that related to intrinsic reasons, the health of the baby, and parenting-related reasons decreased from pregnancy through 12 and 24 weeks postpartum and increased from 24 to 52 weeks postpartum. Thus, it seems that intervening to enhance motivations for smoking abstinence during pregnancy, with continued intervention in early postpartum when we observe declines in abstinence motivation, may optimize postpartum relapse prevention. However, extant meta-analyses have indicated that interventions specifically targeting abstinence motivations, such as motivational

interviewing, do not perform better than comparison conditions in sustaining postpartum abstinence (Heckman, Eggleston, & Hofmann, 2010; Hettema & Hendricks, 2010). Moreover, though interventions aimed specifically at enhancing abstinence self-efficacy can successfully heighten self-efficacy levels, there is little evidence that such increases in self-efficacy influence abstinence (Hyde, Hankins, Deale, & Marteau, 2008). Thus, even if we observed increased levels of self-efficacy in the present study—due to the intervention or some other means—these increases may not have had any direct impact on sustained abstinence during the postpartum period. Altogether, results of the present study and prior meta-analyses/systematic reviews on motivation- and self-efficacy-enhancing interventions suggest that motivation and self-efficacy may not be the most critical targets of postpartum relapse prevention.

Conclusions

The present study was the first to investigate trends in motivations and self-efficacy for smoking abstinence as women transitioned from pregnancy through postpartum. Although several types of abstinence motivations (intrinsic, parenting, and baby's health-related) changed from the end of pregnancy through 52 weeks postpartum, neither levels of motivation nor self-efficacy were associated with postpartum smoking relapse after adjustment for multiple statistical comparisons. Future studies should consider examining other factors beyond motivations and self-efficacy for staying quit that are more potent in predicting postpartum abstinence.

Acknowledgements:

Authors Lisa Germeroth, Zheng Wang, Yu Cheng, and Michele Levine had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Funding statement:

This work was supported by the National Institutes of Health (grant numbers R01DA021608, 2007–2012; T32HL007560–34; 2016–2018).

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Figure 1.

Motivation (a.) and self-efficacy (b.) subscale scores and corresponding standard error bars at the prenatal baseline assessment and three postpartum follow-up assessments (12, 24, and 52 weeks, respectively). Pregnancy-related abstinence motivation score was only reported at baseline when participants were pregnant.

* $p < .05$.

Table 1

Demographic and Baseline Characteristics of Total Sample and Groups

	Total (N=300)	STARTS (n=150)	SUPPORT (n=150)	p-value
Age (years) [†]	24.99 (5.65)	24.97 (5.74)	25.01 (5.57)	.96
Race ^f				
Black	163 (54.3)	82 (54.7)	81 (54.0)	.91
Education level high school [†]	137 (45.7)	69 (46.0)	68 (45.3)	.21
Annual household income <\$30,000 ^f	234 (78.0)	119 (79.3)	115 (76.7)	.96
Weeks pregnant [†]	35.50 (1.68)	35.42 (1.58)	35.57 (1.78)	.46
CPD prior to quitting [†]	11 (9)	10 (7)	12 (11)	.27
Weeks quit [†]	17.33 (11.73)	16.42 (11.76)	18.21 (11.69)	.22
Motivation [†]				
Intrinsic	2.16 (1.03)	2.13 (1.06)	2.18 (0.99)	.94
Extrinsic	1.31 (0.76)	1.30 (0.79)	1.31 (0.73)	.80
Parenting	3.49 (1.02)	3.42 (1.12)	3.55 (0.91)	.53
Baby's health	3.78 (0.67)	3.83 (0.55)	3.74 (0.76)	.52
Pregnancy	3.84 (0.54)	3.89 (0.39)	3.80 (0.66)	.57
Self-efficacy [†]				
Internal	20.02 (6.64)	20.55 (6.45)	19.50 (6.81)	.09
External	19.94 (6.97)	20.35 (6.91)	19.53 (7.03)	.09

Note.

[†] indicates mean (standard deviation; *SD*);^f indicates number (%);CPD=cigarettes smoked per day. Group differences were assessed via *t*-tests (continuous) or χ^2 tests (categorical). All *p*-values are from two-tailed tests, with $\alpha < 0.05$.

Table 2

Abstinence Motivations and Self-Efficacy Means and Standard Deviations across Intervention Groups at Each Assessment

Subscale/item	Total, <i>M (SD)</i>				Sample STARTS Group, <i>M (SD)</i>				SUPPORT Group, <i>M (SD)</i>	
	Baseline	Week 12	Week 24	Week 52	Baseline	Week 12	Week 24	Week 52	Baseline	Week 52
Intrinsic motivation	2.16 (1.03)	2.04 (0.96)	2.04 (1.03)	2.18 (1.02)	2.13 (1.06)	1.99 (0.97)	2.04 (1.09)	2.17 (1.04)	2.18 (0.99)	2.09 (0.96)
Extrinsic motivation	1.31 (0.76)	1.33 (0.72)	1.29 (0.75)	1.38 (0.76)	1.30 (0.79)	1.22 (0.74)	1.26 (0.78)	1.34 (0.79)	1.31 (0.73)	1.44 (0.78)
Parenting motivation	3.49 (1.02)	3.44 (1.05)	3.29 (1.16)	3.36 (1.11)	3.42 (1.12)	3.34 (1.12)	3.29 (1.18)	3.30 (1.13)	3.55 (0.91)	3.53 (0.91)
Baby's health motivation	3.78 (0.67)	3.23 (1.31)	3.18 (1.34)	3.26 (1.23)	3.83 (0.55)	3.40 (1.08)	3.19 (1.32)	3.25 (1.22)	3.74 (0.76)	3.07 (0.67)
Pregnancy motivation	3.84 (0.54)	.	.	.	3.89 (0.39)	.	.	.	3.80 (0.66)	.
Internal self-efficacy	20.02 (6.64)	19.87 (7.13)	19.79 (7.60)	20.12 (7.81)	20.55 (6.45)	19.73 (7.11)	20.11 (7.42)	19.72 (7.88)	19.50 (6.81)	20.00 (6.81)
External self-efficacy	19.94 (6.97)	19.79 (7.32)	19.90 (7.52)	20.33 (7.49)	20.35 (6.91)	19.84 (7.04)	20.12 (7.30)	20.02 (7.37)	19.53 (7.03)	19.73 (7.03)

Note. *M*=mean; *SD*=standard deviation; STARTS=Strategies to Avoid Returning to Smoking; SUPPORT=a supportive, time and attention-controlled comparison. *N*=300, 268, 267, and 265 for the total sample at baseline (prenatal assessment), and 12-, 24-, and 52-week postpartum follow-up, respectively. *N*=150, 129, 130, and 127 for the STARTS group at baseline, and 12-, 24-, and 52-week postpartum follow-up, respectively. *N*=150, 139, 137, and 138 for the SUPPORT group at baseline, and 12-, 24-, and 52-week postpartum follow-up, respectively. Information regarding reasons for drop-outs at follow-up are reported elsewhere (Levine et al., 2016).

Table 3

Correlations between Prenatal Baseline Abstinence Motivations and Self-Efficacy Subscale Scores

Subscale/item	1	2	3	4	5	6	7
1- Intrinsic motivation	1.00	.	.	.	.	.	.
2- Extrinsic motivation	0.70 [†]	1.00	.	.	.	.	.
3- Parenting motivation	0.45 [†]	0.29 [†]	1.00	.	.	.	.
4- Baby's health motivation	0.18 ^{**}	0.22 ^{**}	0.29 [†]	1.00	.	.	.
5- Pregnancy motivation	0.24 [†]	0.19 ^{**}	0.33 [†]	0.57 [†]	1.00	.	.
6- Internal self-efficacy	0.11	0.02	0.07	0.03	0.14 [*]	1.00	.
7- External self-efficacy	0.12 [*]	0.03	0.03	-0.01	0.13 [*]	0.72 [†]	1.00

Note. N=300. Correlations (*r* values) are reported for prenatal baseline scores only. Significant effects ($p<.05$) are in boldface.

*
 $p<.05$.

**
 $p<.01$.

†
 $p<.0001$

Table 4

Main Effects of Abstinence Motivations and Self-Efficacy and Interactions with Time on Relapse

Subscale/item main effect and interaction with time on relapse	Statistics	
	<i>F</i> value (<i>df</i>)	<i>p</i> value
Intrinsic motivation ^a	0.01 (1,476)	.94
*time	0.01 (2,476)	.99
Extrinsic motivation ^a	0.05 (1,476)	.83
*time	0.23 (2,476)	.80
Parenting motivation ^a	0.30 (1,476)	.59
*time	1.44 (2,476)	.24
Baby's health motivation ^a	0.48 (1,476)	.49
*time	0.88 (2,476)	.42
Pregnancy motivation ^b	0.88 (1,248)	.35
*time	2.25 (2,490)	.11
Internal self-efficacy ^b	1.30 (1,248)	.25
time	3.44 (2,490)	.03
External self-efficacy ^b	0.12 (1,248)	.73
*time	2.58 (2,490)	.08
Contrasts of subscale/item on relapse at each timepoint	OR (95% CI)	<i>p</i> value
12 weeks postpartum		
Intrinsic motivation ^a	1.01 (0.75, 1.36)	.95
Extrinsic motivation ^a	0.95 (0.64, 1.41)	.80
Parenting motivation ^a	1.10 (0.79, 1.53)	.58
Baby's health motivation ^a	1.24 (0.79, 1.95)	.34
Pregnancy motivation ^b	0.50 (0.19, 1.29)	.15
Internal self-efficacy ^b	0.98 (0.94, 1.03)	.46
External self-efficacy ^b	1.00 (0.96, 1.04)	.99
24 weeks postpartum		
Intrinsic motivation ^a	0.98 (0.64, 1.52)	.94
Extrinsic motivation ^a	1.12 (0.65, 1.93)	.68
Parenting motivation ^a	1.11 (0.75, 1.64)	.61
Baby's health motivation ^a	0.87 (0.63, 1.20)	.39
Pregnancy motivation ^b	0.53 (0.15, 1.94)	.34
Internal self-efficacy ^b	0.92 (0.87, 0.98)	.01^{*c}
External self-efficacy ^b	0.95 (0.89, 1.00)	.06

Subscale/item main effect and interaction with time on relapse	Statistics	
	<i>F</i> value (<i>df</i>)	<i>p</i> value
52 weeks postpartum		
Intrinsic motivation ^a	0.98 (0.66, 1.45)	.93
Extrinsic motivation ^a	0.86 (0.50, 1.49)	.60
Parenting motivation ^a	0.73 (0.48, 1.10)	.13
Baby's health motivation ^a	0.91 (0.63, 1.31)	.59
Pregnancy motivation ^b	1.88 (0.74, 4.79)	.19
Internal self-efficacy ^b	1.04 (0.98, 1.11)	.20
External self-efficacy ^b	1.04 (0.98, 1.11)	.17

Note. *time=interaction of subscale with time; OR=odds ratio; CI=confidence interval. Models were adjusted for race, age, education, number of weeks quit at baseline (i.e., at the prenatal assessment), intervention group, and current smoking status. Sustained abstinence was coded 0=abstinent and 1=relapse, such that OR >1 indicated greater odds of relapse and OR <1 indicated greater odds of sustaining abstinence. Intervention group was coded as 0=SUPPORT (supportive, time and attention-controlled comparison) and 1=STARTS (Strategies to Avoid Returning to Smoking). Significant effects ($p<.05$) are in boldface.

^a Assessed as a time-varying predictor (e.g., 12-week value used to predict relapse at 24 weeks).

^b Assessed as prenatal baseline predictors (i.e., non-time-varying).

^c After the Benjamini-Hochberg method was applied, the association between internal self-efficacy and relapse at 24 weeks postpartum was nonsignificant.

*
 $p<.05$