

# The Potential Utility for Massage Therapy During Pregnancy to Decrease Stress and Tobacco Use

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**Background:** A significant number of women continue to smoke tobacco during pregnancy despite the increased risk of complications to fetal and infant development. Therefore, effective interventions are needed to assist pregnant women with the process of tobacco cessation. Traditional counseling programs have demonstrated some success; however, novel approaches that target stress as a mechanism in the maintenance of addiction would be valuable.

**Objective:** To examine the role of stress in addiction and the utility of massage therapy to decrease stress during pregnancy.

**Conclusion:** Preliminary evidence suggests massage therapy may be beneficial to decreasing tobacco use, and research in pregnant populations is needed.

**KEY WORDS:** massage therapy; addiction; tobacco; nicotine

## INTRODUCTION

Tobacco smoking is a leading and preventable cause of illness. For women, smoking is associated with increased risk for cancer, heart disease, emphysema, as well as a reduction in fertility and multiple complications during pregnancy.<sup>(1)</sup> Tobacco use prohibits nutrients from proper absorption in the womb, and the mother is at greater risk for having a still or premature birth.<sup>(2-4)</sup> Additional risks of tobacco smoking during pregnancy include Sudden Infant Death Syndrome, infants being born with weak lungs resulting in asthma and increased susceptibility to infections, as well as birth defects, including cleft lip.<sup>(2,3,5,6)</sup> A recent study employing national birth cohort data from Sweden has shown for the first time an association between prenatal nicotine exposure and later schizophrenia diagnosis.<sup>(7)</sup> These prenatal consequences precede the adverse consequences of postpartum smoking on the child, which may include both acute (e.g., ear and respiratory tract infections) and chronic (e.g., asthma) illness.<sup>(8)</sup> Therefore, prenatal tobacco smoking promotes detrimental health consequences

across two generations and remains a significant public health concern.

Despite the well-documented health risks of tobacco smoking during pregnancy, a significant number of women continue to smoke during this critical period of development. In 2014, it was reported that nearly 16% of pregnant women smoked tobacco in the month prior to the survey.<sup>(9)</sup> Recent work suggests that rates of abstinence for alcohol, marijuana, and cocaine are higher than rates of tobacco during pregnancy.<sup>(10)</sup> Indeed, while approximately 50% of women quit smoking upon learning of their pregnancy, many struggle to maintain abstinence, with 40% of women relapsing within 6 months of delivery.<sup>(2,11)</sup> These findings converge with an independent sample of birth mothers placing their child for adoption, where only 22% discontinued smoking during pregnancy, in contrast to other illicit substances where discontinuation rates were significantly higher (e.g., cocaine, 96.0%; marijuana 86.8%).<sup>(12)</sup> Why would women be more likely to continue tobacco use during their pregnancy? One hypothesis suggests that there are greater physician-focused efforts to decrease illicit substance use during pregnancy.<sup>(10)</sup> However, women may also perceive tobacco consumption as being less harmful for their fetus and more socially acceptable; therefore, tobacco consumption may reflect a substitution for other substance use during pregnancy.<sup>(12)</sup> Consequently, it is important to identify and target the mechanisms underlying addiction to bolster tobacco cessation efforts during pregnancy.

Smoking cessation is a challenging process for non-parents as well as parents. Symptoms of tobacco withdrawal include increases in appetite, irritability, anxiety, cravings, restlessness, and bradycardia.<sup>(13)</sup> Research has found that to assist expectant mothers in quitting tobacco use, the standard self-help manuals are not as effective as measures tailored specifically for pregnant women. Specifically, women are about twice as likely to quit smoking using a health education program with content that focuses on assisting pregnant women to quit smoking than the generic *Freedom from Smoking Program Manual* by the American Lung Association—which does not explicitly reference pregnancy and motherhood.<sup>(14)</sup> This research suggests a unique motivation of pregnancy,

and that smoking cessation programs are needed that are tailored specifically for pregnant women in order to be most effective.

Smoking cessation programs for pregnant women do exist. These programs primarily consist of a brief counseling session by a clinically trained professional, in addition to educational materials and advice.<sup>(15)</sup> A meta-analysis of these two-pronged programs showed an average risk ratio of 1.7 (1.3–2.2), suggesting a modest effect on increasing pregnant women's cessation rates using these programs.<sup>(16)</sup> However, brief counseling and educational interventions have been found to be less effective with highly addicted tobacco-smoking mothers.<sup>(16)</sup> These counseling and educational programs are also intended to be administered in a clinical setting, but a significant proportion of women do not disclose smoking behaviors to their health care provider.<sup>(17)</sup> Furthermore, while the primary goal of these programs is smoking cessation, there is no consideration of the underlying factors that may be motivating continued tobacco smoking during the prenatal period. Therefore, interventions for pregnant women are strongly needed that go beyond this traditional counseling method to reduce the urge to smoke, that encourage transparency in reporting smoking behaviors, are adaptable to be administered both within and outside of the clinic setting, and target mechanisms underlying addiction.

Taken together, a significant number of women continue to smoke tobacco during their pregnancy despite the existence of numerous cessation programs. Therefore, further investigation is needed into the mechanisms that maintain tobacco consumption during pregnancy, and the identification of novel approaches that may target these mechanisms to facilitate tobacco cessation. Here we will consider how one such mechanism, stress, plays a pivotal role in the maintenance of addiction, and explore the potential utility of massage therapy to decrease stress and support tobacco cessation during pregnancy. Critically, the application of massage therapy to tobacco (or any substance) addiction is novel, with only a handful of studies in this area, to date. Nevertheless, we outline the theoretical rationale for the potential benefit of massage therapy to tobacco cessation, drawing on literature from addiction and massage therapy studies.

### Stress and Negative Affect

Research shows that stress and negative affect are primary motivators underscoring cigarette usage in the general population.<sup>(18,19)</sup> This notion resonates with negative reinforcement models of addiction, which posit substance-using behaviors continue given the relief the drug affords to the negative affective states of craving and withdrawal.<sup>(20,21)</sup> Overtime, tobacco smoking, like other substance use, becomes a more general means of stress regulation, albeit a maladaptive, self-perpetuating one.<sup>(22,23)</sup> Indeed,

higher levels of stress lead to an increase in the number of cigarettes smoked per day, especially if the individual experiencing high levels of stress does not have a strong social support system.<sup>(24)</sup> Stress may also exacerbate drug-seeking behavior, and thus lead to relapse for those individuals able to abstain or increased use in non-abstaining individuals.<sup>(22)</sup> Notably, smoking behaviors also fluctuate with levels of stress. For instance, individuals who smoked consistently for six months, without any periods of abstinence, experienced high levels of maintained self-reported levels of stress.<sup>(25)</sup> These findings may reflect both the justification of stress to continue tobacco use, as well as the stress of remaining abstinent given the impact of craving. Noticeably this latter study reported that, once abstinence was achieved, stress levels appeared to decrease drastically, presumably as a result of feelings of increased efficacy and self-esteem attributable to achieving the goal of cessation.<sup>(25)</sup>

Further evidence for the role of stress has been provided by hormonal profiles. Levels of cortisol, the primary stress hormone produced by the Hypothalamus-Pituitary-Adrenal Axis, are positively correlated with cigarette craving in smokers.<sup>(18)</sup> Furthermore, after administering a psychosocial stress test, individuals displayed heightened levels of cortisol, as well as increased cravings of cigarettes, independent of their nicotine dependence level.<sup>(18)</sup> Increased levels of stress are particularly concerning during pregnancy given that elevated cortisol levels in the mother have been found to be linearly related to fetal cortisol levels, with maternal cortisol levels predicting approximately 40% of the variance in fetal concentrations.<sup>(26)</sup> Increased levels of cortisol during the prenatal period are also associated with detrimental outcomes for the child, including spontaneous abortion, preeclampsia, low birth weight, and pre-term delivery.<sup>(27)</sup> Furthermore, in the postpartum infant affective signals (e.g., cries) may be perceived as more stressful, increasing craving and relapse (if abstaining) or maintenance of substance use (if not abstaining).<sup>(28,29)</sup> Consistent with this notion, tobacco-smoking mothers who relapsed postpartum reported higher levels of stress, depression, and anxiety, with episodes of infant crying and irritability being reported as triggers of tobacco-using cognitions and behaviors.<sup>(30,31)</sup>

Taken together, this research indicates that decreasing stress, and therefore cortisol levels, during pregnancy may have beneficial effects for both mother and her developing child. It is also worthwhile noting that stressors exist that extend beyond, and interact with, negative affective states. For instance, there are several stressors that are associated with a woman being less likely to spontaneously quit smoking upon learning of her pregnancy, including lower levels of education and socio-economic status, as well as the documented higher levels of depressive traits.<sup>(32,33)</sup> Although some of these stressors are nonmodifiable, it is clear there would be value in employing tobacco

smoking cessation programs that specifically target stress reactivity and regulation more generally.

### Massage Therapy

The practice of utilizing massage therapy as a form of medicine can be traced back to 400 BC, yet it is not until the recent decades that the benefits have begun to be empirically validated.<sup>(34)</sup> Massage therapy has been found to reduce stress, depression, hostility, and anxiety, as well as potentially increase quality of sleep and psychosocial health.<sup>(34,35)</sup> Research has found the therapeutic practice of massage benefits a wide variety of populations across the lifespan, with both somatic and psychological illnesses.<sup>(34)</sup>

There is an extant literature documenting the benefits more generally of employing massage during pregnancy. Prenatal massage has a host of positive outcomes, including decreasing premature deliveries, rates of infants being born at low birth weight, and symptoms of postpartum depression.<sup>(36,37)</sup> Further, massage may positively impact neurotransmitter systems implicated in mood regulation.<sup>(34)</sup> Specifically, massage is associated with decreased levels of cortisol and increased levels of serotonin and dopamine.<sup>(36,38,39)</sup> Serotonin has activating properties that have been synthetically replicated in antidepressant drugs to improve negative mood states.<sup>(38)</sup> Increases in dopamine have also been associated with reduced levels of depression and stress.<sup>(38)</sup>

Pregnancy massage, as compared to relaxation therapy, has also led to improvements in mood, sleep, and back pain, as well as decreased anxiety.<sup>(37)</sup> Even in non-parents, very short massages have led to decreased heart rate and cortisol levels over time.<sup>(40)</sup> One physiological mechanism that may underscore these positive benefits of massage is vagal activity. This is most often measured by an individual's heart rate variability, acting as a measure of autonomic nervous system function and development.<sup>(41)</sup> Evidence suggests that vagal activity increases following the receipt of massage and in response to a course of massage treatments.<sup>(42)</sup> Vagal activity is also implicated in the massage-related changes in blood pressure, heart rate, and cortisol secretion, and may play a broader role in regulatory functioning.<sup>(43)</sup> Together this research suggests that massage therapy has a beneficial consequence through decreasing stress levels which may be mediated by vagal activity. Consequently, if massage therapy does decrease stress during pregnancy, women may experience less stress and less craving, and, therefore, may be able to decrease their tobacco use. Given the long-term benefits of massage, it may prove valuable as an intervention tool for maintaining abstinence from pregnancy to the postpartum period—perhaps exerting most benefit when integrated with other tobacco cessation efforts.

The application of massage therapy to nicotine addiction and tobacco smoking is in its infancy, with

only one study, to date, that has examined the benefit of massage to tobacco cessation.<sup>(44)</sup> Twenty adult smokers were randomly assigned to a control group or a self-massage group. Both groups were asked to refrain from smoking one cigarette in the morning, one in the afternoon, and one in the evening. The control group was instructed to employ their typical techniques to abstain (e.g., nicotine gum), while the self-massage group was taught to administer a 5-minute self-massage to the ear or hand. After four weeks, the self-massage group reported fewer cravings, fewer cigarettes smoked, and lower anxiety scores than the control group. Despite this intervention being focused on self-massage rather than administration of massage by a therapist, the results are encouraging of the beneficial effects of massage to tobacco cessation. In considering the acceptability of engagement of massage therapy for nicotine addiction, it is interesting to note the following. When clients surveyed at an outpatient tobacco treatment clinic rated their interest in complementary and alternative medical practices to assist in the cessation of tobacco use, 67% said they were interested in alternative treatments, with 29% reporting specific interest in massage therapy.<sup>(45)</sup>

Critically, examining the utility and acceptability of massage therapy to prenatal tobacco smoking women is needed to ascertain whether these findings translate to pregnant women. Also needed are studies designed explicitly to address the role of massage in decreasing tobacco craving and consumption during pregnancy, including comparisons between self-delivered, other-delivered, and practitioner-led massage. Indeed, it is worth noting that studies have found that a 20-minute massage given by a significant other, partner or family member who had received training from a massage therapist, decreased cortisol and increased serotonin and dopamine in the postpartum period, in addition to decreasing reported levels anxiety and depression.<sup>(36,38)</sup> Reducing the need for repeated, time-intensive, in-clinic visits reduces the potential need to take time off work, and arrange childcare and transportation. These factors may make this intervention more accessible to mothers with lower levels of education and lower socio-economic status—stressors that have been found to put women at an increased risk for continuing tobacco use during pregnancy.<sup>(32,33)</sup>

### CONCLUSIONS AND FUTURE DIRECTIONS

Tobacco use while pregnant poses a severe health threat to both the expectant mother and her developing child. Despite the existence of numerous tobacco cessation programs, a significant number of women continue to smoke during their pregnancy. The purpose of this article was to begin exploring stress as a mechanism that may contribute to the maintenance of tobacco consumption during pregnancy, and

to consider how stress may be reduced by massage therapy delivered during pregnancy. Furthermore, this article may shed light on ways in which massage therapy may conceptually be integrated into current smoking cessation programs to increase rates of abstinence. Although no studies of massage therapy delivered to tobacco smoking women during pregnancy have been conducted to date, there is some preliminary evidence of the beneficial effect of self-massage to decreasing tobacco craving and smoking.<sup>(44)</sup> Therefore, there is significant scope for empirical, as well as intervention, research in women continuing to smoke tobacco during their pregnancy.

First, it will be necessary to document the acceptability of receiving prenatal massage and the feasibility of practitioner-led massage, as compared to self- or other-delivered massage, over an extended period of time. Second, it will be important to replicate the existing studies examining the administration of prenatal massage therapy to tobacco-smoking samples to ascertain whether similar benefits in mood, sleep, and back pain<sup>(37)</sup> are observed in tobacco-smoking pregnant women, as well as the previously noted changes in heart rate and cortisol levels.<sup>(40)</sup> Third, feasibility and effectiveness research is needed to establish the effects of massage therapy on the reduction of tobacco craving, stress, and negative affect in pregnant women. This research would benefit from the incorporation of behavioral and physiological outcome measures to more fully disentangle the complexities of potential massage therapy effects on tobacco cessation during the prenatal period. Fourth, if proven beneficial, it will be necessary to complete randomized clinical trials that directly compare the efficacy of massage therapy against other tobacco cessation programs during pregnancy, including short- and long-term follow-up, to determine the longevity, sustainability, and practical efficacy of massage therapy as a tobacco cessation tool.

Despite the body of work that is required in this area, the existing and well-documented benefits of massage therapy, alongside preliminary data from non-pregnant tobacco smoking adults, and the well-established role of stress in the maintenance of addiction, demonstrate that there is significant promise to further explore the utility of massage therapy during pregnancy to decrease tobacco use.

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## CONFLICT OF INTEREST NOTIFICATION

The authors declare there are no conflicts of interest.

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