Research Article

Smoking Cessation in Pregnancy

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Abstract

Background: Approximately 15% of women in Tennessee continue to smoke during pregnancy despite known health risks to themselves and their unborn babies. The use of evidence based interventions is essential to assist pregnant women who smoke in their cessation attempts and in the reduction of adverse effects of smoking during pregnancy.

Objective: This scholarly project aims to determine if the use of motivational text messages and a reactive smoking cessation quit line influence smoking behaviors (motivation to quit, dependence on nicotine and number of cigarettes smoked per day) in a group of pregnant women who smoke in Tennessee.

Methods: The study sample consisted of pregnant women in Tennessee who self-reported smoking. Participants were enrolled to receive motivational text messages from Smoke-Free Mom, and were given the contact information for the Tennessee Tobacco Quit line. Baseline motivation to quit was obtained with the Motivation to Stop Scale, dependence on nicotine was measured with the Autonomy over Smoking Scale, and self-reported cigarettes smoked per day was obtained. Utilization of the interventions was assessed during the study, and post-intervention motivation to quit score, dependence on nicotine score, and self-reported cigarettes smoked per day were obtained.

Results: 43 participants (87%) completed post-test questionnaires. Wilcoxan Signed Ranks test demonstrated an overall increase in self-reported motivation to quit, decrease in dependence, and cigarettes smoked per day. Linear regression demonstrated a correlation between utilization of the text messages and decrease in dependence and an increase in motivation to quit, however, the effect was small. No significant relationship was found between utilization of text messages and cigarettes smoked per day. This study provided inconclusive results supporting the benefit of motivational text messages and a reactive quit line in pregnant women who smoke.

Conclusion: High levels of intrinsic motivation present in pregnancy can influence changes in health behaviors irrespective of intervention. Health care providers are encouraged to assess smoking status in all pregnant patients, and to provide smoking cessation counseling to all patients who self-report as a smoker. Further studies are warranted to determine efficacy of motivational text messages and smoking cessation quit lines in pregnant women.

Approximately 8.4% of pregnant women in the United States continue to smoke during pregnancy despite warnings about health risks to themselves and their unborn babies [1]. The use of evidence-based interventions is essential to assist pregnant women who smoke in their cessation attempts, while reducing the adverse effects of smoking during pregnancy to mother and baby [2]. Healthcare providers have a unique opportunity to deliver interventions to assist pregnant women in smoking cessation efforts.

Background

Risks of smoking in pregnancy

When a pregnant woman smoke, the oxygen carrying capacity of maternal blood is decreased, which results in fetal hypoxia [3]. Placental development and function are compromised, and placental calcification and necrosis can occur [3]. These changes can lead to intrauterine growth restriction, low birth weight, premature rupture of membranes, and premature delivery [3]. Smoking is also known to affect children later in life with cognitive development, behavioral health problems such as ADHD, [4] and chronic health problems including impaired lung function, middle ear disease, and respiratory illness [5]. Medical costs for a baby born to a mother who smoked during pregnancy is approximately 66% higher than for a baby born to a non-smoker (Smoking During Pregnancy, 2016) [6]. A reduction in smoking prevalence of 1% would result in a $21 million medical cost savings due to decreased incidence of low birth weight and preterm birth [6]. The issues related to smoking are especially relevant in the South, where the low birth weight and preterm birth rates are well above the national average, as is the smoking rate during pregnancy [7].

Smoking in Tennessee

The State of Tennessee currently offers pregnancy specific smoking cessation programs, including free smoking cessation counseling via county health departments, a free tobacco quitline, and Baby and Me, a program in which $25 diaper vouchers are given to those women who have validated smoking cessation [8]. Despite these interventions, approximately 15% of pregnant women in Tennessee smoke, as compared to the national prevalence of smoking during pregnancy of 8.9% [1]. Additionally, some areas in Tennessee report a smoking rate of up to 25-40% during pregnancy [7]. Smoking prevalence is highest in those women who have a low income (less than $25,000/year), are between the ages of 20-24, have a high school education or less, and for those who have Medicaid insurance [1]. A birth certificate analysis of maternal smoking prevalence and cessation 3 months before and during pregnancy in the United States revealed that approximately 20% of women who smoke during pregnancy are successful in their quit attempt [1]. In comparison, a 2015 study of 1,486 pregnant women in Tennessee who smoke demonstrated a 28% success rate in smoking after a brief intervention [7].

Behavior Interventions in pregnancy

Pregnancy and regular prenatal care are ripe opportunities for consistent health promotion in which providers have the opportunity to offer women non-judgmental, evidence based interventions in their cessation efforts. Integration of smoking cessation education into prenatal visits has been demonstrated to improve quit rates [9,10], however, many providers fail to provide appropriate counseling and resources to assist patients with cessation [11,12]. Support from health care providers during pregnancy is essential to increase confidence and self-efficacy in smoking cessation efforts [13]. The US Preventive Task Force currently recommends the use of behavioral interventions for smoking cessation in pregnant women [14]. Providers are encouraged to ask all pregnant women about tobacco use, and to advise them to stop using tobacco. The use of nicotine replacement therapy has not been sufficiently assessed for harms or benefit in pregnancy [14]. With recent polls revealing that approximately 4.55 billion people worldwide use cellular phones, the opportunity for delivery of healthcare information via mobile technology is growing [15]. Behavioral interventions via mobile delivery is increasingly appealing to providers as an adjunct to face-to-face patient care [16]. Mobile technology, such as web-based applications [16], tablet and electronic medical record use in offices, video conferencing, and mobile phones have been demonstrated to be cost effective and convenient portals to increase access to health communication [17]. Digital interventions are especially useful in pregnancy because they are easily tailored to deliver pregnancy specific information, and may reduce barriers that pregnant women may encounter when attempting to receive support for smoking cessation, such as lack of access and fear of judgement from their provider[18].

Smoke Free Mom

Smoke Free Mom is a text message service specifically tailored for pregnant women who smoke. After completing a questionnaire that includes due date and demographic information such as age and zip code, the mother is asked about desire and motivation to quit smoking. The mother then begins to receive 1-5 daily text messages that are concentrated around the quit date that the woman chooses at enrollment, as well as the due date. The length of participation is based on the participant's due date, but the messages will be sent for no less than 6 weeks [19]. The messages are standardized, and include information about quitting smoking and preventing relapse, such as "Have you Smoked Today?" and "Every cigarette smoked means less oxygen for your growing baby. Quitting, or even cutting back, will increase baby's oxygen supply" [19]. The service is free, and is funded by the National Cancer Institute [19]. The messages also encourage interaction from the participant by giving key words such as DATE to reset the planned quit date, and SMOKED to receive extra support because the participant smoked a cigarette and feels like they need help.

The Tennessee Tobacco Quit line is a free tobacco cessation counseling service available anyone over the age of 12 in Tennessee with active smoking behavior. Counseling sessions are available via phone and are designed to individualize interventions related to each participant's tobacco history, setting a quit date, relapse prevention, quit plan development, and discussion of withdrawal, weight gain, and stress management [20]. Additionally, the quit line targets populations with unique risks and/or known disparities in the burden of tobacco abuse including pregnant women, racial/ethnic minority groups, and populations with low literacy skills and chronic health conditions [20]. Currently there are no special-

ized materials to assist the LGBT community, older tobacco users (55 years+), those with multiple addictions or with mental health disorders [20]. The Quit line cost per smoker in Tennessee is estimated at $0.19 [20]. Individuals can be referred to services by their healthcare provider via fax referral, which will prompt a counselor to call the patient, or the client can initiate quit line contact independently by calling the quit line [20]. In 2016, 2,906 people who smoke in Tennessee received phone counseling from the Tennessee Tobacco Quit line, including 57 pregnant women who were referred via fax by a provider to the quit line, and 23 who were self-referred [21]. The majority of the callers (60%) were between the ages of 18-34, and were primarily Caucasian (63%) [21]. 49% of the pregnant callers reported a high school diploma/GED level of education or less [21].

Review of Literature

Behavior changes in pregnancy

Behavioral interventions must be tailored to the changes in motivation that occur in pregnancy. During pregnancy, the intrinsic and extrinsic motivators for smoking cessation are different than in non-pregnant women who smoke [22]. In pregnancy, the intrinsic motivation to quit is related to knowledge that smoking is harmful not only to the individual, but also to the baby. Extrinsic motivation may also come from shame based on the pregnant woman's perception of disapproval from others [22]. Because of this conflict, smoking during pregnancy can create a cognitive dissonance, in which the pregnant woman justifies her smoking behavior. Pregnant women tend to modify their perception of their behavior, and will alter smoking habits, then rationalize their behavior with myths and lay knowledge that is not grounded in science or evidence [23]. Knowledge of the ideas that develop in pregnant women who smoke can assist the provider to adjust their interventions for smoking cessation [23].

Brief, well executed interventions have been demonstrated to be both cost effective and to increase smoking cessation. In a 2013 meta-analysis of smoking interventions in pregnant women, there was no significant effect on smoking when frequency of contact to the intervention was increased [24]. Intensive, lengthy periods of smoking cessation intervention have not been shown to be more efficacious than brief targeted interventions in pregnant women [25]. As such, providers are urged to focus on the quality of the intervention, rather than overburdening the patient with the intervention [24].

Typically, smoking cessation is measured in point prevalence, that is, a measurement of how long since the last cigarette smoked by the person [26]. The use of point prevalence can lead to falsely pessimistic reporting of nonsmoking by exclusion of people who have reduced their number of cigarettes per day [26]. The negative characterization of a woman who has decreased the number of cigarettes per day, but has not quit completely, as not making progress is especially important due to the dose dependent relationship in pregnancy between overall tobacco exposure and birth weight [27]. The low self-confidence of pregnant women in their ability to quit smoking may be overcome by introducing interventions that encourage reduction of smoking, and then measuring success in cigarettes smoked per day rather than a binary measure of successful cessation [27]. Reduction in smoking during pregnancy, rather than stopping abruptly, has been demonstrated to contribute to higher 6-month smoking abstinence rates [27]. The use of number of cigarettes smoked per day in this scholarly project allowed the project leader to obtain an accurate report of smoking behavior, and encourage participants to continue to decrease smoking per day even if they could not quit completely.

Impact of text messages on behavior change

The use of mobile technology includes text messages to increase healthy behaviors. Health care information delivered by means of text message service has been demonstrated to improve physical activity, weight loss, glycemic control in diabetics [28], and increase medication adherence in HIV positive patients [29]. The use of motivational text messages specifically for smoking cessation support has not only improved cessation rates in the general population [15,30,31,32] but has also assisted pregnant women who smoke in their cessation attempts [33,34,35]. Although increased cessation attempts were seen with the use of text messages in all of the studies in pregnant women, it is important to note that the effect was small, especially when the text messages were studied as a stand-alone intervention.

Impact of quit lines on behavior change

Smoking cessations quit lines offer free, confidential, tailored counseling for people who request help with quitting smoking [36], and have been utilized to increase smoking cessation in multiple populations. The success of quit lines has been demonstrated in the general population [37,38], in different cultures, including Hispanic, Asian and American Indian individuals who smoke, [39], in patients with medical morbidities, such as diabetes [40], and in patients who seek counseling for alcohol and illicit drug abuse [41]. The use of quit line services has also been demonstrated to decrease smoking in pregnant women [36,42]. Quit lines as a modality of smoking cessation intervention have been studied based on proactive services, or counselor initiated calls, as well as reactive services, in which calls are initiated by the individual seeking support with smoking cessation, and have the capability to reach large numbers of people who smoke [43].

Problem Statement

Despite health risk warnings, some pregnant women continue to smoke during pregnancy. Documented rates of temporary smoking cessation during pregnancy and high rates of relapse post-partum suggest that women need additional support to be successful in sustained tobacco cessation. To determine what interventions are most efficacious for smoking cessation during preg-

nancy, different methods have been evaluated, including smoking cessation quit lines and motivational text messages [28,36]. The Tobacco quit line has been active since 2005, and limited research has evaluated the impact on smoking behaviors, motivation to quit, and dependence level on the 15% of Tennessee women who continue to smoke during and after pregnancy.

Objective/Aims

The objective of this study is to determine if the use of motivational text messages and the Tennessee Tobacco quit line influence motivation to quit, dependence level, and smoking behaviors in Tennessee women during their pregnancy.

Theoretical Framework

The Stages of Change Model (SOC) was developed by Di Clemente and Proschaska (1982) [44] as a framework for understanding and describing intentional behavior change. This theory was then developed to better understand nicotine cessation attempts, and has since been adapted to assist with changing other behaviors, including gambling and substance abuse [45]. This model is based on the hypothesis that change is a progressive process. Three main overarching constructs and five stages of change are the basis for the SOC model. These constructs refer to the overt and covert processes that guide people through the stages of behavior change, and interventions can be designed and targeted at moving individuals closer and closer to the desired behavior change. Experiential and behavioral processes, the first of the constructs, include the emotional reactions to warnings about smoking and finding sources of support [46]. This construct changes naturally during pregnancy, as someone in early pregnancy may not react to warnings about the risks of smoking, and may not seek support for cessation. As a woman progresses in her pregnancy, and gets closer to delivery, an increased awareness of the risk, influenced by an increased awareness of the growing baby, may motivate her progress through the stages of change. The next construct, self-efficacy, is one's belief in their own ability to accomplish a task, such as quitting smoking. Individuals who have higher self-efficacy have been found to be the most likely to progress to higher stages in the change cycle [46]. The third construct is decisional balance, a person's ability to weigh the pros and cons of their behavior [46]. To move along the stages of change, one must be able to effectively recognize the risks of smoking, identify the benefits of quitting, believe that they are capable of quitting and believe that the risks of not quitting are greater than the value or satisfaction they derive from smoking.

Each of the five stages of change has associated tasks that assist the person to move to the next [45]. The five stages of change include: precontemplation (when people are not ready for action), contemplation (the person is ready to take action to change the behavior), preparation (the person is ready to take action and begins taking steps to change), action (the behavior has been changed and the intent is to continue with that change), and maintenance (when

the person has sustained their change over time [47] (Figure 1). An individual's stage of change must be assessed to determine how to best support their smoking cessation attempt. Interventions that focus on an individual's current stage in the SOC cycle are twice as likely to result in a successful quit attempt [48]. To promote an individual's movement from precontemplation to contemplation, the provider should tailor the intervention towards developing both knowledge and awareness [49]. Increased knowledge is the simple recognition of the many health consequences of smoking, while developing awareness is the woman's perception of how taking these risks may relate to them personally. The individual must see herself as capable of reducing or quitting smoking in order to move from contemplation to preparation. Movement from preparation to action then requires the individual to identify and plan solutions to obstacles. Planning can include determining what to do if faced with a potential smoking trigger, such as stress or living in a home with a smoker. Finally, the individual moving from action to maintenance requires continued reinforcement, including long term positive consequences resulting from their behavior change. Positive consequences to smoking cessation could include health benefits and saving money. Provider influence can have a critical impact on the reinforcement, support and encouragement a patient needs to move between stages, including relapse. The provider must maintain awareness of specific needs corresponding to the individual's place in the stages of change for the best chances of success [49].
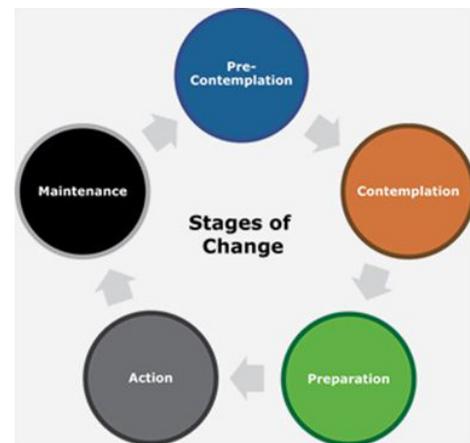

Figure 1: Stages of Change Model

Application of Theoretical Model

The use of message framing, or outlining the pros and cons of changing a behavior, in smoking cessation has influenced individual's processing of the message based on the stage of change, and has previously been applied to text messages for smoking cessation [49]. Individuals exposed to gain-framed messages (emphasizing positive effects) in the pre-contemplation and contemplation stages had high levels of central processing (high involvement and issue relevant thinking) of the messages [49]. Those individuals in later stages who were planning to quit in the next 30 days found the

loss-framed (emphasizing negative effects) more effective in their cessation efforts [49]. The knowledge of the effect of intervention based on the stage of change lends to the need to assess stage of change, and to tailor the messages based on the individual's current stage in the cycle. A message that emphasizes the negative effects of smoking on pregnancy would not be as effective on a person who is early in the stages of change as it would be on a person who is later in the stages of change. This is especially important in younger smokers because they are not as concerned about the long-term effects of smoking [50]. The use of message framing is noted in the Smoke Free Mom text message service since they provide motivational messages, along with advice and tips for healthy pregnancy (National Cancer Institute, 2016) [19].

Research has demonstrated that part of the self-evaluation that takes place in the contemplation and preparation stages contributes to long-term cessation success [51]. Often when pregnancy is confirmed, early parts of the cycle are omitted, or bypassed, internal motivation and self-efficacy are not developed, and return to smoking is more likely [25,51]. The risk of relapse due to omission of stages in the change cycle is especially relevant in the postpartum period when the external motivation, the pregnancy, is removed [51].

The Stages of Change Model was applied in this project through the measure of motivation to quit. Through the use of the Motivation to Stop Scale, the project leader effectively mapped the participant's stage of change to determine if the influence of the intervention was affected by the stage of change.

Design/ Procedure

In this purposive sample, all pregnant women presenting for care in the clinical setting were screened for smoking status. Those patients who self-reported smoking cigarettes were invited to participate if they were older than 18 years, pregnant, English speaking, with capability to receive text messages and make phone calls. The independent variables in this quasi-experimental study were self-report utilization of the smoking cessation quit line and the Smoke Free Mom text messaging program. The dependent variables were self-reported motivation to quit (assessed by the Motivation to Stop Scale), dependence on nicotine (assessed by the Autonomy over Smoking Scale), and self-reported number of cigarettes per day. Outcome measures included: differences in pre and post intervention motivation to quit, dependence summed scores, and number of cigarettes smoked per day, and effect of utilization of the text messages and tobacco quit line on these measures. This project was approved by the Belmont University Institutional Review Board, and after obtaining approvals to recruit participants at each of three clinic locations, recruitment flyers were posted in the waiting room, exam rooms, and patient restroom. Individuals

presenting to any of the three clinics between August 2016 and December 2016 who met the inclusion criteria were informed by clinic staff of the opportunity to participate, and those willing were included by convenience sampling. The project leader was present to consent all participants after which the intake questionnaire was completed (Figure 2). Upon obtaining consent, the questionnaires were coded with a number to correspond with their place in the enrollment process (the first patient being assigned the number one, the second, number two). Clinic location of enrollment was recorded to detect any differences in the sample that might be explained by site.

1.	**What is your age?**
	Less than 18 years old
	18-25
	26-30
	31-35
	35 +
2.	**Are you pregnant?**
	Yes
	No
3.	**Do you smoke?**
	Yes
	No
4.	**What is your due date? _____/_____/_____**
5.	**How many cigarettes do you smoke a day?**
6.	**Have you tried quitting smoking before? _____ How many times? ____**
	Has your provider talked to you about smoking during your pregnancy? ____ If so, what have they given you? Brochures/literature Counselling Nicotine Patch

Figure 2: Participants Questionnaire

Baseline motivation to quit and dependence level were assessed at enrollment using the Autonomy over Smoking scale (AUTOS) (Figure 3) and Motivation to Stop Scale (MTSS) (Figure 4), and number of cigarettes smoked per day was recorded. The participants were provided the phone number for the quit line via text message, and the project leader registered all participants to receive daily text messages from Smoke Free Mom at the time of enrollment. The project leader was present for all interviews to determine eligibility and request participation. For protection of the patient's confidentiality, the questionnaires were completed privately.

This statement describes me:	Not at all	A little	Pretty well	Very well
When I go too long without a cigarette I get nervous or anxious	0	1	2	3
When I go too long without a cigarette I lose my temper more easily	0	1	2	3
When I go too long without a cigarette I get strong urges that are hard to get rid of	0	1	2	3
When I go too long without a cigarette I get impatient	0	1	2	3
I would go crazy if I could not smoke	0	1	2	3
I rely on smoking to deal with stress	0	1	2	3
I rely on smoking to take my mind off being bored	0	1	2	3
I rely on smoking to focus my attention	0	1	2	3
After eating I want a cigarette	0	1	2	3
When I smell cigarette smoke I want a cigarette	0	1	2	3
When I see other people smoking I want a cigarette	0	1	2	3
When I feel stressed I want a cigarette	0	1	2	3

Figure 3: Autonomy over Smoking scale

Which of the following describes you?	
1.	I don't want to stop smoking
2.	I think I should stop smoking but I don't really want to
3.	I want to stop smoking and but haven't thought about when
4.	I REALLY want to stop smoking but I don't know when I will
5.	I want to stop smoking and I hope to soon
6.	I REALLY want to stop smoking and intend to in the next 3 months
7.	I REALLY want to stop smoking and intend to in the next month

Figure 4: Motivation to Stop Scale

Utilization of the intervention was measured every two weeks with the utilization survey via phone call from the project leader (Figure 5). If the participant answered yes, the utilization questionnaire was completed. The participants were reminded of the availability of the quit line during follow up calls, and the project leader verified that the participant was still in possession of the contact number. If the project leader was unsuccessful in the follow up attempt at two weeks, a call was made weekly thereafter until the participant was reached, or until the conclusion of the study (Figure 6). Motivation to quit and dependence level were reassessed at the conclusion of the study using the MTSS and AUTOS scale (respectively), and number of cigarettes smoked per day was recorded via phone call to the participant from the project leader. At the conclusion of the study, participants were also asked if they received enough text messages, too many, or not enough, and what they thought of the text messages. If the participant did not call the quit line, they were asked about barriers to calling, as well as what would motivate them to call. If the participant did call the quit line, they were asked about their perception of the counseling they received.

1.	**Did you read the Smoke Free Mom text messages?**		
	Always Sometimes	Hardly Ever	Never
2.	**Did the text messages help you to reduce or stop smoking?**		
	I quit smoking because of this A lot A little Not at all		
3.	**Did you unsubscribe to the Smoke Free Mom text messages?**		
	Yes No		
4.	**Did you call the Tobacco Quitline?**		
	Yes	No	
5.	**How many times did you call the quitline?**		
	More than 10	6-10	1-5 0
6.	**Did you feel that the Quitline counselor helped you?**		
	I quit smoking because of this A lot A little Not at all		

Figure 5: Utilization Survey

Enrollment in program
Inclusion questionnaire
Informed consent
AUTOS and MTSS
Number of cigarettes/day

Two weeks follow up
Did project leader reach participant?

Yes   No

*Utilization   Attempt to reach
Survey   participant in one week

**Conclusion of study – Utilization survey
MTSS, AUTOS, number of
cigarettes/day

Figure 6: Conclusion of the Study

*At the time of the follow up call, the project leader introduced herself, and requested permission to follow up on the smoking cessation information that the participant was given at the enrollment visit. Once permission was obtained, the project leader asked the utilization questions, and read all possible responses to the participant before the question was answered.

**At the conclusion of the study, the AUTOS and MTSS scales were done for each participant. All questions and possible responses were read to the participant before each question was answered. The project leader provided encouragement in the participants smoking cessation attempt, and verified that the participant was still in possession of the quit line number prior to ending the call.

Clinical Setting

The clinical settings included three, privately owned, hospital-based OB/GYN clinics in the Nashville, Tennessee area. The population serviced by these clinics is primarily covered by TNCare /Medicaid insurance. All of the practices are managed by physicians, and offer both obstetrical and non-obstetrical services. The combined, active OB population of these clinics was 367, with 17% self-reporting current tobacco use. None of the clinics have a standardized smoking cessation protocol, and no specific tracking is in place for identification of smoking status in the pregnant population of these clinics.

Materials

The Autonomy over Smoking Scale (AUTOS) has been validated as a tool for measure of addiction, and this 12 item instrument was designed to measure withdrawal symptoms, psychological dependence, and cue-induced urges to use tobacco [52]. These measures of dependency, as obtained from study participants using the AUTOS scale, have been inversely correlated with latency to wanting a cigarette, i.e. the higher the dependence, the shorter the latency to wanting a cigarette [53]. The AUTOS scale has been validated across demographic groups (Wellman, 2015), as well as in different age groups [53]. For the AUTOS scale, Cronbach's Alpha was .94 [52].

If a smokers' motivation to quit is high prior to a smoking cessation attempt, it is likely to stay high, even if the person is not successful in quitting. High motivation does, however, increase the cessation success rates [54,55]. The motivation to quit has to be autonomous to result in an increase in cessation success [56], and intention to quit has also been correlated with smoking cessation success [34]. Based on these findings, the project leader determined that motivation was a key element of baseline assessment. The Motivation to Stop Scale (MTSS) is a one question tool for assessment of desire, intention, and belief that one should quit smoking [57]. The participant is asked "Which of the following describes you?". The answers include: "I don't want to stop smoking"; "I think I should stop smoking but don't really want to"; "I want to stop smoking but haven't thought about when"; "I REALLY want to stop smoking but I don't know when I will"; "I want to stop smoking and hope to soon"; "I REALLY want to stop smoking and intend to in the next 3 months"; "I REALLY want to stop smoking and intend to in the next month". These answers correlate with: 1, absence of any belief, desire or intention; 2, belief only; 3, moderate desire but no intention; 4, strong desire but no intention; 5, moderate desire and intention; 6, strong desire and medium-term intention; and 7, strong desire and short-term intention [57]. As an index of desire, the Motivation to Stop Scale has been shown to linearly predict the number of quit attempts [57]. For the purposes of this project, the project leader classified anyone who answers at level four or less as "Low Motivation" and at five or greater as "High Motivation." Motivation was mapped to the stages of change model after determining the presence of intent to quit in levels five and greater [57]. Participants who self-reported active tobacco use were classified as "Precontemplators" if they were in an early stage of readiness to quit (low motivation), and "contemplators" if they were in the later stages of readiness to quit (high motivation).

The utilization tool was developed to determine 1) if the participant used the interventions, 2) how frequently the intervention was used, and 3) if the participant perceived the intervention as helpful.

Results

Baseline Characteristics and Attrition

The project sample consisted of an eligible pool of 367 women. Of this pool of active obstetrical patients, 62 patients were recruited based on self-report of smoking, and 50 agreed to participate. Of the 50 pregnant women who completed the baseline survey, 1 withdrew from the project due to pregnancy loss. Follow up questionnaires (MTSS and AUTOS) were completed by 87% (n=43) of the participants. The characteristics of the remaining participant sample are shown in Table 1. Participants had a median age of 24 (mean 25.19 [SD5.034]), and a median gestational age of 17 weeks at enrollment (mean 19.19 [SD11.253]). 18 patients were in the first trimester at enrollment (41.9%), 9 were in the second trimester (20.9%), and 16 were in the third trimester at enrollment (37.2%). The distribution of patients recruited from each clinic was: Clinic 1 – 24 (55.8%), Clinic 2 – 17 (39.5%), and Clinic 3 - 2 (4.7%). 37 patients were Caucasian (86%), five were African American (11.6%), and one was mixed race (2.3%). The median number of weeks of exposure to the intervention from enrollment to post-test was 8 (mean 7.86 [SD4.853]). Follow up was attempted at two week intervals Figure 5, with 4 patients completing five follow up questionnaires, 6 completing four, 4 completing three, 9 completing two, and 20 completing one follow up questionnaire. A complete description of the patient distribution of weeks of exposure to the intervention is listed in (Table 1).

N = 43 Characteristic	Value
Age (years)	
Median	24
Mean (SD)	25.19, (5.034)
18-25 *n* (%)	24 (55.8)
26-30	13 (30.2)
31-35	5 (11.6)
36+	1 (2.3)
Gestation at enrolment (weeks)	
Median	179
Mean (SD)	19.19(11.253)
Trimester at enrolment	
1 *n*(%)	18 (41.9)
2	9 (20.9)
3	16 (37.2)
Clinic location	
1 n (%)	24 (55.8)
2	17 (93.5)
3	2 (4.7)
Race	

Caucasian *n* (%)	37 (86)
African American	5 (11.6)
Other	1 (2.3)
Weeks exposure to intervention	
Median	8
Mean (SD)	7.86(4.853)
2 *n* (%)	6 (14)
3	4 (9.3)
4	6 (14)
5	4 (9.3)
7	1 (2.3)
8	4 (9.3)
9	3 (7)
10	2 (4.7)
12	1 (2.3)
13	5 (11.6)
14	2 (4.7)
15	4 (9.3)
19	1 (2.3)
Number of completed follow up questionnaires	**Participants**
5	4
4	6
3	4
2	9
1	20

Table 1: Participant Demographics

At baseline, median self-reported number of cigarettes smoked per day at enrollment was 10 (mean 10.05 [SD7.868]), median motivation to quit score (as assessed by the Motivation to Stop Scale) was 5 (mean 4.63 [SD1.865]), and median baseline dependence (as assessed by the Autonomy over Smoking Scale summed score) was 17 (mean 19.05 [SD9.286]). Thirteen participants were determined to be in pre-contemplation stage of change (based on MTSS score of 4 or less), and 30 were in the contemplation stage of change (based on MTSS score of 5 or greater) (Table 2).

Measure (self-report)	Mean (SD)	$p < .05$	Mean Rank
Cigarettes smoked per day		<.001**	
Pre-intervention	10.05 (7.868)		19.6
Post-intervention	4.56 (5.039)		8.5
Motivation to Stop Smoking Scale		.020*	
Pre-intervention	4.63 (1.865)		13.06

Post-intervention	5.28 (1.750)		15.08
AUTOS Scale score		0.003*	
Pre-intervention	19.05 (9.286)		21.29
Post-intervention	15.14 (10.075)		20.1

*significant at p = .05 **significant at p = .01

Table 2: Pre-and Post-test scores

Stage of change at enrolment	0.596	0.984	.001*
Gestational weeks at enrolment	0.903	0.625	0.441
Clinic of enrolment	0.711	.033*	0.255

*significance at p=.05

Table 3: Linear regression correlation with predictors of change

Analysis

Analysis was completed using SPSS v. 23.0. A Wilcoxon Signed Ranks test was used to determine change in participant's self-reported number of cigarettes per day, motivation to quit smoking, and dependence on nicotine at enrollment and post intervention. Reported number of cigarettes smoked per day was lower at post-test administration (mean rank = 8.50) of the intervention that at enrollment (mean rank = 19.60) (p=.000). Motivation to quite increased from beginning (mean rank = 13.06) to post-test (mean rank = 15.08) (p = .020). Finally, dependence on cigarettes significantly decreased from enrollment to post-test (mean rank = 21.29 vs. mean rank = 20.10) (p= .003).

Linear regression analysis demonstrated that utilization of the text messages, measured by self-report with the follow up questionnaire, had an effect on change in dependence (p=.021) and motivation (p=.034), however, the effect was small. There was no significant change in number of cigarettes smoked per day correlated with utilization of text messages (.530). Changes in dependence, motivation, and number of cigarettes smoked were not found to be correlated with length of time of exposure to the intervention. Participants recruited from Clinic 1 had a more significant change in dependence than Clinic 2 (mean -6.07 and -1.47 from pre-test to post test, respectively). Motivation and number of cigarettes smoked per day were not influenced by clinic location at enrollment. No difference was demonstrated for change in dependence, motivation, or number of cigarettes smoked based on the participant's week of gestation at enrollment, or trimester of pregnancy at enrollment. Stage of change at enrollment was not found to have an effect on change in dependence or cigarettes smoked per day, however, those participants who were determined to be in the pre-contemplation stage (based on MTSS score of 4 or less) had a greater motivation mean change score (1.76) compared to the contemplation group (MTSS score of 5 or greater) (mean change score = .258) (p=.001) (Table 3).

	Cigarettes/Day	AUTOS score	MTSS score
Utilization of text messages	0.53	.021*	.034*
Weeks exposure to intervention	0.155	0.388	0.125

Of the 43 participants included in the data analysis, three self-reported calling the quit line, and those patients each reported having called one time. The utilization of the quit line and its effect on smoking behaviors was not assessed due to low utilization of the intervention.

Discussion

Summary of Main Results

The findings of this scholarly project suggest that self-reported cigarettes per day, motivation to quit, and level of dependence on nicotine may change in pregnancy irrespective of utilization of a pregnancy tailored text message service and reactive quit line intervention. The intrinsic motivation present in pregnancy exists independent of other influences, including the gestation of pregnancy in which a patient is approached about smoking and how long a pregnant woman is exposed to an intervention. Thus, it is difficult to measure the added effect of motivational text messages during a time when motivation to quit smoking is already very high. In previous research, text messages have been shown to support cessation efforts in pregnant women who smoke [33,34,35]. However, the small effect of the text messages on dependence and motivation, suggests that with longer exposure the intervention could have impacted smoking behaviors.

Despite relative lack of influence on behaviors, the readership and patient perception of text messages for smoking cessation in this study is encouraging. Patients reported that the text messages were "helpful", "supportive", and "Encouraging". The rate of participants at the conclusion of the study who unsubscribed to the messages was low (1 participant), and only 4 participants stated that they received too many messages. All other participants stated that they had received just enough text messages.

The number of calls to the quit line corresponds with literature that describes low efficacy and low utilization of reactive quit lines that require initiation by the participant [43]. It also corresponds with current quitline utilization by pregnant women in the State of Tennessee. However, the use of proactive, or counselor initiated, quit line calls has previously been demonstrated to improve smoking behaviors in pregnant women, and should be considered as an intervention for smoking cessation [43].

Participants were asked at the conclusion of the study about barriers to calling the quit line, and many stated that they did not have time to call, they did not feel that they needed to call, or that they were not ready to quit smoking. The participants were also asked at post-test what would motivate them to call. Responses included "If I had more time", "If I felt the urge to smoke', and "if I did not have support". The participants who called the quit line stated that they felt supported and encouraged by the counselor, but they did not feel that they would call again. These responses reflect the participant's low level of motivation and lack of desire to quit smoking corresponding with pre-contemplation and contemplation stages of change. Pregnant women who are in the early stages of change lack the experiential process (emotional reaction to warnings) and behavioral processes (alternative coping strategies) necessary to initiate action [46]. Therefore, the intervention is based on the stages of change and motivation level, reactive calls may not be the most effective strategy for cessation services for pregnant women, especially those in early stages of change [58]. To effectively support a cessation attempt, all responses by the quit line counselors should be tailored to the caller's stage in readiness to quit. Customization of cessation interventions will likely enhance the impact of the intervention, and encourage people to continue to seek support from the quit line counselor.

Regardless of the intrinsic motivation of pregnancy, the level of stress in pregnancy is high, especially for low-income patients with poor health literacy [59]. Continuing to smoke, despite intervention, can be a coping mechanism for pregnant women and this is especially true in those who have not progressed, but have bypassed early stages of change in their quit attempt. Their self-efficacy and internal motivation have not been developed by the progression in the stages of change, and continued intervention and encouragement from the provider over the course of their pregnancy can assist in their cessation attempt. A short-term intervention might not adequately influence the patient to change behaviors. Based on the short length of time of some of the participants in this study, and the project leader's knowledge of differences in progression through the stages of change in pregnancy, the ability to draw a meaningful conclusion regarding text messages for smoking cessation in pregnancy is limited. The low uptake of a reactive smoking cessation quit line demonstrated that this is not appropriate for this population; however, the findings suggest that use of pregnancy tailored text messages is an acceptable method of intervention for smoking cessation in pregnancy, and may enhance readiness to quit in pregnant women who smoke.

Implications for Practice

The lack of correlation between duration of exposure to the intervention and change in smoking behaviors in this study reinforces the recommendations from the American College of Obstetricians and Gynecologists that every patient should be asked accomplished at every subsequent visit [60]. Although most patients stated at enrollment that their provider had talked to them about smoking during their pregnancy, it is important to note that none of the clinical settings for this study had a protocol to identify patients who smoke, or to provide intervention for those patients who self-reported smoking. The project leader recommends implementation of a protocol that would initiate smoking cessation counseling during the initial pregnancy office visit for anyone who self-reports smoking. The provider would then be prompted at subsequent prenatal visits to continue to counsel the patient about smoking cessation. The counseling should start at the initial prenatal visit since evidence demonstrates that if a pregnant woman quits smoking within the first three months, the baby has an equal risk of low birth weight as a baby born to a non-smoker [61]. Counseling should continue even if the patient self-reports quitting due to high rates of relapse during pregnancy and postpartum [60]. The use of motivational text messages and a proactive quit line will serve to support the patient in their cessation attempt, and can enhance the relationship between the provider and patient. The interventions will reinforce the counseling that the provider is offering in the cessation attempt, and may increase motivation to quit in pregnant women.

Strengths and Limitations

A strength of this study is the low attrition rate. The project leader received post-test follow up from 87% of the participant population. A second strength is the 17% self-report rate of smoking in this particular sample population is proportionate with the current smoking prevalence of pregnant women in Tennessee. However, the project leader recognizes the following limitations of the study. The pure effect of the intervention is difficult to determine due to small sample size, differences in exposure time in the participants, varying gestational age at enrollment, and differences in provider for prenatal care. The small sample size could be attributed to short recruitment time, relatively small patient population for recruitment, and false self-reporting of smoking status. Differences in exposure time, and varying gestational age is due variation in enrollment date in the study. This limitation could be addressed in future studies by allowing increased study duration with a specific enrollment and exposure time. A limitation on inclusion criteria could exclude participants who are not in the first trimester of pregnancy to facilitate evaluation of intervention at set points in the pregnancy. The project leader chose to utilize three clinics for recruitment, and this allowed for differences in the participant's prenatal care. Future studies could determine possible efficacy in a group of participants who receive prenatal care from the same provider at every visit to decrease risk of bias in the changes in smoking behaviors.

Conclusion

The adverse effects of smoking during pregnancy are well documented. With high rates of smoking during pregnancy in Tennessee, the need for appropriate interventions is critical, especially true in women who have a low education level and low income.

The high level of intrinsic motivation present in pregnancy makes that time a prime opportunity for smoking cessation, however, many pregnant women find it difficult to quit regardless of motivation due to increased amounts of stress during pregnancy. Counseling should be offered to every patient who self-reports as a smoker with subsequent counseling at every prenatal visit during the care of all pregnant patients who smoke. Assessment of the patient's current stage in the stages of change process can assist the provider in offering an appropriate level of intervention that is tailored to the patient's readiness to quit. Continued reinforcement of intentional behavior change can support the pregnant woman in her progress through the stages of change, and effectively influence health behaviors.

The trends noted in this scholarly project suggest the use of motivational text messages is an acceptable method of intervention for smoking cessation in pregnancy, however, the ability to draw a meaningful conclusion about the effect on smoking behaviors was limited. Despite inconclusive results from this scholarly project, the use of mobile technology is becoming increasingly popular and more relevant, and given this emerging trend, the application of mobile technology should continue to be evaluated in pregnant women who smoke. The low uptake of a reactive quit line is consistent with previous research, and should not dissuade providers from offering a proactive quit line to pregnant women who self-report as smoking. Future research should include a larger sample size, allow for a longer exposure time to the intervention, include a proactive quit line, and should limit sourcing of prenatal care to one provider.

References

1. Curtin SC and Mathews TJ (2016) Smoking prevalence and cessation before and during pregnancy: data from the birth certificate, 2014. National Vital Statistics Reports 65: 1-14.

2. Bryant J, Passey ME, Hall AE, Sanson-Fisher RW (2014) A systematic review of the quality of reporting in published smoking cessation trials for pregnant women: an explanation for the evidence-practice gap?. Implementation Science: IS, 994.

3. Cope G (2015) How smoking during pregnancy affects the mother and fetus. Nurse Prescribing 13: 282-286.

4. Knopik VS, Marceau K, Bidwell LC, Palmer RC, Smith TF et al. (2016) Smoking during pregnancy and ADHD risk: A genetically informed, multiple-rater approach. American Journal of Medical Genetics. Part B, Neuropsychiatric Genetics: The Official Publication of The International Society Of Psychiatric Genetics 171: 971-981.

5. Kegler MC, Bundy L, Haardörfer R, Escoffery C, Berg C Yembra D et al. (2015) A minimal intervention to promote smoke-free homes among 2-1-1 callers: A randomized controlled trial. American Journal Of Public Health, 105: 530-537.

6. Smoking During Pregnancy (2016).

7. Bailey BA (2015). Effectiveness of a pregnancy smoking intervention: the Tennessee intervention for pregnant smoker's program. Health Education & Behavior: The Official Publication Of The Society For Public Health Education 42: 824-831.

8. Tennessee Counties Help Pregnant Women Quit Smoking Through the Baby & Me Tobacco Free Program (2016).

9. Olaiya O, Sharma AJ, Tong VT, Dee D, Quinn C et al. (2015). Impact of the 5As brief counseling on smoking cessation among pregnant clients of special supplemental nutrition program for Women, Infants, and Children(WIC) clinics in Ohio. Preventive Medicine 81: 438-443.

10. Fendall L, Griffith W, Iliff A, Lee A, Radford J (2012). Integrating a clinical model of smoking cessation into antenatal care. British Journal of Midwifery20: 236-242.

11. Berrueta M, Morello P, Alemán A, Tong VT, Johnson C et al (2016). Smoking patterns and receipt of cessation services among pregnant women in Argentina and Uruguay. Nicotine & Tobacco Research, 18.

12. Chang J, Alexander S, Holland C, Arnold R, Landsittel D et al (2013). Smoking is bad for babies: obstetric care providers' use of best practice smoking cessation counseling techniques. American Journal Of Health Promotion 27: 170-176.

13. Petersen Z, Steyn K, Everett-Murphy K, Emmelin M (2010) Pregnant women's responses to a tailored smoking cessation intervention: turning hopelessness into competence. Global Health Action.

14. Tobacco smoking cessation in adults, including pregnant women: behavioral and pharmacotherapy interventions. (2016)

15. Spohr SA, Nandy R, Gandhiraj D, Vemulapalli, A, Anne S et al. (2015) Efficacy of SMS Text Message Interventions for Smoking Cessation: A Meta-Analysis. Journal of Substance Abuse Treatment 561-10.

16. Kar P, Saunders S, Buchanan P (2013). Diabetes healthcare and mobile technology: Panacea or a false dawn?. Diabetes Digest12: 38-40.

17. John ME, Samson-Akpan PE, Etowa JB, Akpabio II, EE John (2016) Enhancing self-care, adjustment and engagement through mobile phones in youth with HIV. International Nursing Review.

18. Griffiths SE, Brown KE, Fulton EA, Tombor I, Naughton F (2016) Are digital interventions for smoking cessation in pregnancy effective? A systematic review protocol. Systematic Reviews 5.

19. National Cancer Institute. Terms of Service. (2016).

20. Tennessee Quitline Profile. (2016).

21. Khalid A. (2017) Tennessee Tobacco Quitline Statistics. Personal communication

22. Curry S, McBride C, Grothaus L, Pirie P (2001) Motivation for smoking cessation among pregnant women. Psychology of Addictive Behavior 15: 126-132.

23. Goszczynska E, Knol-Michalowska K, Petrykowska A (2016) How to pregnant women justify smoking? A qualitative study with implications for nurses and midwives anti-tobacco interventions. Journal of Advanced Practice Nursing 72: 1567-78.

24. Coleman T, Chamberlain C, Cooper S, Leonardi-Bee J (2011) Efficacy and safety of nicotine replacement therapy for smoking cessation in pregnancy: systematic review and meta-analysis. Addiction 106: 52-61.

25. Samet J, Yoon, Soon-Young (2010) Gender, Women, and the Tobacco Epidemic. World Health Organization.

26. Oka R, Katapodi M, Lim J, Bacchetti P, Froelicher E (2006) Quantifying smoking cessation outcomes: the women's initiative for nonsmoking study (x). Nursing Research 55: 292-297.

27. Tombor I, Shahab L, Brown J, Crane D, Michie Set al. (2016) Development of Smoke Free Baby: a smoking cessation smartphone app for pregnant smokers. Translational Behavioral Medicine 6: 533–545.

28. Naughton F, Jamison J, Sutton S (2013) Attitudes towards SMS text message smoking cessation support: a qualitative study of pregnant smokers. Health Education Research 28: 911-922.

29. Dowshen N, Kuhns L, Johnson A, Holoyda B, Garofalo R (2012) Improving adherence to antiretroviral therapy for youth living with HIV/AIDS: a pilot study using personalized, interactive, daily text message reminders. Journal of Medical Internet Research 14: e51.

30. Free C, Phillips G, Galli L, Watson L, Felix Let al. (2013) The effectiveness of mobile-health technology-based health behavior change or disease management interventions for health care consumers: A systematic review.

31. Whittaker R, McRobbie H, Bullen C, Rodgers A, Gu Y (2016) Mobile phone-based interventions for smoking cessation. Cochrane Database of Systematic Reviews 4. Art. No. CD006611.

32. Ybarra ML, Jiang Y, Free C, Abroms LC, Whittaker R (2016) Participant-level meta-analysis of mobile phone-based interventions for smoking cessation across different countries. Preventive Medicine 89: 90-97.

33. Moniz MH, Meyn LA, Beigi RH (2015) Text messaging to improve preventive health attitudes and behaviors during pregnancy: A prospective cohort analysis. Journal of Reproductive Medicine 60: 378-382.

34. Pollak KI, Lyna P, Bilheimer A, Farrell D, Gao X et al. (2013) A pilot study testing SMS text delivered scheduled gradual reduction to pregnant smokers. Nicotine & Tobacco Research 15: 1773-1776.

35. Naughton F, Prevost A, Gilbert H, Sutton S. (2012). Randomized controlled trial evaluation of a tailored leaflet and SMS text message self-help intervention for pregnant smokers. Nicotine and Tobacco Research 14: 569-57

36. Bombard J, Farr S, Dietz P, Tong V, Zhang L et al. (2013) Telephone Smoking cessation quitline use among pregnant and non-pregnant women. Maternal & Child Health Journal 17: 989-995.

37. Barton MK (2011) Smoking cessation telephone quitlines effective regardless of recruitment method. CA: A Cancer Journal for Clinicians 61: 361-362.

38. Tzelepis F, Paul CL, Walsh RA, McElduff P, Knight J (2011) Proactive telephone counseling for smoking cessation: meta-analyses by recruitment channel and methodological quality. Journal of The National Cancer Institute 103: 922-941.

39. Cummins SE, Wong S, Bonnevie E, Lee H, Goto C J et al. (2015) A multistate Asian-language tobacco quitline: addressing a disparity in access to care. American Journal of Public Health 105: 2150-2155.

40. Schauer GL, Bush T, Cerutti B, Mahoney L, Thompson JR et al. (2013) Use and effectiveness of quitlines for smokers with diabetes: cessation and weight outcomes,Washington State Tobacco Quit Line, 2008. Preventing Chronic Disease 10E105.

41. Gates, P. (2015). The effectiveness of helplines for the treatment of alcohol and illicit substance use. Journal of Telemedicine & Telecare, 21(1), 18-28.

42. Cummins SE, Tedeschi GJ, Anderson CM, Zhu S (2016) Telephone intervention for pregnant smokers: A randomized controlled trial. American Journal of Preventive.

43. Skov-Ettrup LS, Dalum P, Bech M, Tolstrup JS (2016) The effectiveness of telephone counselling and internet- and text-message-based support for smoking cessation: results from a randomized controlled trial. Addiction 111: 1257-1266.

44. Prochaska JO and DiClemente CC (1982) Transtheoretical therapy: Toward a more integrative model of change. Psychotherapy: Theory, Research & Practice 19: 276-288.

45. Kennedy K and Gregoire TK (2009) Theories of motivation in addiction treatment: Testing the relationship of the transtheoretical model of change and self-determination theory. Journal of Social Work Practice in The Addictions 9.

46. Slade P, Laxton-Kane M, Spiby H (2006) Smoking in pregnancy: The role of the trans-theoretical model and the mother's attachment to the fetus. Addictive Behaviors 31: 743-757.

47. Zimmernan G, Olsen C, Bosworth M (2000) A 'Stages of Change' approach to helping patients change behavior. American Family Physician 61: 1409-1.

48. Lawrence T, Aveyard P, Evans O, Cheng KK (2003) A cluster randomised controlled trial of smoking cessation in pregnant women comparing interventions based on the transtheoretical (stages of change) model to standard care. Tobacco Control 12: 168-177.

49. Cornacchione J and Smith SW (2012) The effects of message framing within the stages of change on smoking cessation intentions and behaviors. Health Communication 27: 612-622.

50. DiClemente CC, Dolan-Mullen P, Windsor RA The process of pregnancy smoking cessation: implications for interventions Tobacco Control 2000

51. Stotts A, DiClemente C, Carbonari J, Mullen P (1996) Pregnancy smoking cessation: A case of mistaken identity. Addictive Behavior 21: 459-471.

52. DiFranza J, Savageau J, Wellman R (2012) A comparison of the autonomy over tobacco scale and the Fagerstrom test for nicotine dependence. Addictive Behaviors 37.

53. Ursprung WW, MorellaP, Gershenson B, DiFranza J (2010) Development of a measure of the latency to needing a cigarette. Journal of Adolescent Health 48:. 338-343.

54. Boardman T, Catley D, Mayo M, Ahluwalia J (2005) Self-efficacy and motivation to quit during participation in a smoking cessation program. International Journal Of Behavioral Medicine 12: 266-272.

55. Pineiro B, Lopez-Duran A, Fernandex del Rio E, Martinez U, Brandon T et al. (2016) Motivation to quit as a predictor of smoking cessation and abstinence maintenance among treated Spanish Smokers. Addictive Behaviors 53: 40-45.

56. Williams GC, Gagné M, Ryan RM, Deci EL (2002) Facilitating autonomous motivation for smoking cessation. Health Psychology: Official Journal of The Division of Health Psychology, American Psychological Association 21: 40-50

57. Kotz D, Brown J, West R (2013) Predictive validity of the motivation to stop (MTSS). Drug and Alcohol Dependence 128.

58. Slater JS, Nelson CL, Parks MJ, Ebbert JO (2016) Connecting low-income smokers to tobacco treatment services. Addictive Behaviors52: 108-114.

59. Lee M, Miller S, Wen K, Hui S, Roussi P et al. (2015) Cognitive-behavioral intervention to promote smoking cessation for pregnant and postpartum inner city women. Journal of Behavioral Medicine 38: 932-943.

60. Committee Opinion (2010) Smoking Cessation During Pregnancy. American College of Obstetricians and Gynecologists.

61. Yan J and Groothuis P (2015) Timing of prenatal smoking cessation or reduction and infant birth weight: Evidence from the United Kingdom millennium cohort study. Maternal & Child Health Journal 19: 447-458.