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Literature Review of Tobacco Cessation Interventions among Prenatal Care Populations

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Technical Report 1

Prepared for

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EXECUTIVE SUMMARY

Smoking during pregnancy increases the risk of multiple negative birth outcomes. This report provides the Bureau of Tobacco Free Florida (BTFF) with an in-depth review of evidence-based tobacco cessation interventions for pregnant and postpartum women. The information in this report will inform BTFF’s approach to promoting tobacco cessation among pregnant and postpartum women.

RTI conducted a review of three types of literature: guidelines from public health agencies, peer reviewed literature, and “gray” literature available on state program websites pertaining to their activities and evaluations of those activities. We followed a systematic search strategy and abstraction process that allowed for coding and synthesis by intervention area. We summarize the strength of evidence for the following intervention categories:

- Feedback
- Incentives
- In-person Counseling with a Health Care Provider or Trained Counselor
- Nicotine Replacement Therapy (NRT) and Pharmacotherapy
- Self-Help Materials
- Social Support
- Systems Change and Provider Education
- Telephone Counseling
- Text Messaging or Short Message Service (SMS)
- Web-based

We found strong evidence supporting the use of in-person counseling, telephone counseling (e.g., pregnancy-specific quitline protocols), feedback, self-help materials, incentives, and health systems change/provider education. We found limited, weak, or inconclusive research support for NRT and pharmacotherapy, social support interventions, text messaging interventions, and web-based interventions. Our findings generally aligned with public health agency recommendations, except that the World Health Organization (WHO) is the only public health agency that currently recommends using incentive-based interventions even though our review of the literature revealed that incentives are effective and cost-effective. WHO also recommends social support interventions, whereas our review of the peer-reviewed literature did not find sufficient evidence to recommend them.

We also reviewed the literature for effects of policy on tobacco cessation among pregnant women, and found that tobacco control policies such as workplace bans and increases in
tobacco taxes, as well as policies that increase Medicaid coverage for cessation services, were associated with increased rates of cessation among pregnant women. Researchers suggest that outreach to providers and pregnant Medicaid-eligible women can be an effective way to increase use of these services and cessation rates.

Limited information is available regarding the cost-effectiveness of smoking cessation interventions for pregnant women, however our search revealed that psychosocial cessation programs targeted at pregnant women are generally cost-effective.

BTFF is interested in knowing how the provision of tobacco cessation services might affect equity in birth outcomes such as low birthweight. It is unclear to what extent tobacco use rates contribute to observed racial disparities in birth outcomes, however, studies indicate that disparities in rates of tobacco use by SES are marked. Therefore, efforts to reach low-income women may hold promise for improving equity in tobacco use. Low income women are more likely to be affected by interventions that increase access to or use of Medicaid cessation benefits, policies that increase excise taxes and incentive-based interventions. With regard to race or ethnicity, interventions are not likely to need tailoring, however interventions are not currently being used by ethnic minority groups at the same rate as whites; therefore, increased targeting of minority groups may improve reach and therefore outcomes.

Our review revealed that even though some interventions help women quit using tobacco during pregnancy, they often relapse after giving birth; hence, the postpartum period is a critical time in which to take advantage of a mother’s efforts to quit using tobacco for the sake of her baby. Maintaining coverage in the post-partum period is important, and programs offering counseling and other behavioral approaches, combined with incentives, appear to be the most promising with regard to preventing relapse in the postpartum period when many women return to smoking.

Based on our review, RTI makes the following recommendations to BTFF:

- Continue to work with health care organizations to support incorporation of the AAR protocol and counseling interventions as part of routine prenatal and postpartum care such that healthcare providers routinely assess smoking status and provide pre- and post-natal smoking cessation services to their patients and referrals to BTFF-provided services (i.e. quitline with pregnancy-tailored counseling). This includes systems change interventions and training currently offered by AHECs to increase use of the AAR protocol within health systems and BTFF’s plans to implement the AAR framework within WIC offices. Proceed with BTFF’s current plan to work with WIC on electronic referral systems to the Quitline. To prevent relapse, postpartum care providers, in particular, should address barriers and stresses experienced by women. Health care providers should be trained to recognize that women with low SES, low educational attainment, Medicaid insurance, and women who are heavier smokers and who, historically, have had less success with quitting (e.g., African American women) may need more intensive interventions. Meernick and Goldstein (2015) suggest that clinicians use a risk assessment tool to identify high-risk women
Executive Summary

(e.g., women intending to remain smoke-free only during pregnancy or living with another smoker) for more intensive support. Make systems-level interventions and training accessible to larger numbers of prenatal care providers and other providers who attend to women and infants during the postpartum period. When working with OB/GYN practices and other providers who cater to pregnant and postpartum women, offer pregnancy-specific cessation training, including training that specifically addresses how to work with socioeconomically disadvantaged women to minimize stigma and help them overcome barriers. Support the implementation of automated electronic referral systems to the state quitline.

▪ Consider additional outreach to promote the pregnancy-specific counseling available through Florida’s quitline (for example, updating the website to include information about services available for pregnant women and downloadable self-help guides tailored for pregnant women).

▪ Consider offering a combination of behavioral and incentive strategies for socioeconomically disadvantaged women, such as the Baby & Me—Tobacco Free cessation program currently operating in select sites within Florida, to reduce the high rate of relapse that occurs during the postpartum period. BTFF could partner with organizations that serve socioeconomically disadvantaged women (e.g., WIC) to promote Baby & Me—Tobacco Free, or a similar program, to women who are at highest risk. If such a program is offered, it would be important to conduct an evaluation. The evaluation could examine optimal types and amounts of incentives for the population being served. The evaluation should also include smoking and pregnancy outcomes of women who chose not to enroll or who were not successful in the program.

▪ Revisit text messaging interventions once more efficacy research is published. Although text messaging interventions may hold promise, particularly for reaching special populations, they can be very expensive to develop and test.

▪ Inform Medicaid subscribers about the ACA mandate requiring Medicaid to cover cessation services for pregnant women. Conduct a campaign to ensure that prenatal and postpartum care providers are aware of Medicaid reimbursement for tobacco cessation services and that pregnant Medicaid enrollees are aware of the coverage.

▪ Continue to support comprehensive tobacco-free policies and review secondary data (e.g., PRAMS) before and after implementation of new policies to determine their effects on prenatal smoking rates. Florida’s current cigarette tax of $1.34 per pack increased by $1.00 per pack in 2009, but is still less than the national average of $1.69 per pack (Campaign for Tobacco-Free Kids, 2017).
1. BACKGROUND

1.1 Purpose

Smoking during pregnancy increases the risk of miscarriage, premature birth, low birthweight, and certain birth defects, such as a cleft lip (CDC, 2016). Babies born to mothers who smoke are also at increased risk for Sudden Infant Death Syndrome (SIDS) (CDC, 2016). Effective cessation interventions for pregnant and postpartum women can improve birth outcomes (CDC, 2016) and provide a return on investment that often outweighs the costs (Ruger & Emmons, 2008). This report provides the Bureau of Tobacco Free Florida (BTFF) with an in-depth review of evidence-based tobacco cessation interventions for pregnant and postpartum women. The information in this report will inform BTFF’s approach to promoting tobacco cessation among pregnant and postpartum women. More specifically, this report summarizes

- current public health agency recommendations regarding tobacco cessation interventions for pregnant women (Section 3.1);
- evidence for interventions with strong research support based on peer-reviewed literature (Section 3.2.1);
- evidence for interventions with limited, weak, or inconclusive research support based on peer-reviewed literature (Section 3.2.2);
- Information on the effects of policy on tobacco cessation among pregnant women (Section 4);
- An assessment of cost effectiveness of smoking cessation interventions for pregnant women (section 5);
- equity concerns relating to smoking cessation and birth outcomes among pregnant and postpartum women (Section 6); and
- recommended actions for BTFF to consider taking to promote tobacco cessation among pregnant and postpartum women (Section 8).

1.2 Background

Surveillance data from Florida’s Pregnancy Risk Assessment Monitoring System (PRAMS) indicate the prevalence of new mothers using cigarettes in the 3 months before pregnancy increased by 24% from 2000 to 2011, and the prevalence of smoking during the last 3 months of pregnancy remained relatively constant from 2000 to 2011 at about 9% (Yu, Cohen, Adams-Thames, Lowry, Hylton, & Cui, n.d.). In 2013, approximately 7% of women in Florida smoked cigarettes during the last 3 months of their pregnancy. Women with less than a high school diploma and women with an annual household income of less than $15,000 per year had the highest smoking rates during pregnancy (15% and 12%, respectively) and after delivery (17% and 17%, respectively). Non-Hispanic white women had the highest rates of smoking during pregnancy (12%) and after delivery (16%) of all racial/ethnic groups. Non-Hispanic black and Hispanic women had lower rates of smoking
during pregnancy (7% and 0.5%, respectively) and after delivery (13% and 3%, respectively). Of all age groups, women aged 20 to 24 had the highest rates of smoking during pregnancy (10%) and after delivery (16%) (Cohen, Yu, & Cui, 2016).

Non-Hispanic black women have the highest incidence of having a low birthweight infant (12%) compared with non-Hispanic white (7%) and Hispanic (7%) women (Cohen et al., 2016). Although little is known about the cause of this disparity, we do know that smoking is one of many factors that can contribute to giving birth to an infant with a low birthweight (March of Dimes Foundation, 2017). However, given that non-Hispanic black women have lower incidence of smoking than non-Hispanic white women, it is likely that low birthweight among non-Hispanic blacks is primarily due to other factors besides smoking.

Women experience barriers to quitting during pregnancy, including a lack of control over their immediate environment (Ingall & Cropley, 2010), frustration with perceived judgmental treatment by health professionals (Ingall & Cropley, 2010), financial and psychosocial stress (Flemming, Graham, Heirs, Fox, & Sowden, 2013) and a sense of identity as a smoker (Flemming et al., 2013). Older pregnant women, women with lower socioeconomic status (SES), women with children before their current pregnancy, and women with high levels of tobacco consumption also find it harder to quit smoking (Schneider, Huy, Schutz, & Diehl, 2010). Partners/relationships influence women’s smoking during pregnancy, acting either as barriers or as facilitators to quitting (Flemming et al., 2013).

Women who do quit smoking during pregnancy are likely to relapse after giving birth; recent evidence estimates nearly 42% of women who quit smoking during pregnancy relapse (Rockhill, Tong, Farr, Robbins, D’Angelo, & England, 2016). Among women who quit smoking during pregnancy, qualitative data suggests that some return to smoking postpartum because they only intended to quit to protect the unborn child (Flemming et al., 2013), suggesting the possible need for interventions that help women recognize the importance of quitting on the infant’s health as well. The stress of caring for a baby, lack of sleep, and adjustment to a being a mother were also reported to be important reasons for relapse (Notley, Blyth, Craig, Edwards, & Holland, 2015). On the other hand, partner support and a sense of changed identity (being a mother) are cited as factors that prevent relapse (Flemming et al., 2013). Those who relapse postpartum tend to be young women who were heavy smokers before pregnancy and women who quit smoking late during pregnancy (in the third trimester) (Fang et al., 2004; Notley et al., 2015).

Tobacco smoking remains one of the most important preventable factors associated with complications in pregnancy and has serious long-term implications for women and babies. For BTFF, or any tobacco control program considering an important consideration is the cost-effectiveness of engaging in evidence-based cessation programs/activities that
specifically serve pregnant and postpartum women relative to promoting the use of existing general cessation services.

1.3 Florida Initiatives for Prenatal/Postpartum Cessation

The state of Florida is currently implementing several initiatives to promote smoking cessation among pregnant women. These include offering tailored counseling to pregnant smokers via the BTFF-funded state quitline and the BTFF partnership with local Area Health Education Centers (AHECs) to train OB/GYN practices on the Ask, Advise, Refer (AAR) protocol. They also include tailored counseling and health care provider training sponsored by Florida’s Healthy Start Initiative, which is funded by state revenue and the federal Maternal and Child Health Services Block Grant. Also, a few organizations are implementing the Baby & Me—Tobacco Free program, a trademarked evidence-based cessation program that uses a combination of counseling and incentives to encourage pregnant smokers to quit and stay quit postpartum.

BTFF administers the Florida Quitline, which is available 24 hours per day, 7 days per week. The Quitline offers telephone counseling in English and Spanish, and other languages through a translation service. Expanded services are offered to pregnant tobacco users who are ready to quit, including up to 10 telephone-based counseling sessions and a mailed quit kit brochure with pregnancy-specific content. A 2-week starter kit of NRT is available for women with a medical release. Quitline counselors aim to complete the first seven calls within 60 to 90 days of enrollment, the eighth call 30 days before the expected due date, and the last two calls approximately 15 and 45 days after delivery. However, this protocol is adjusted to correspond with where women are in their quit attempt. Women can also access Florida’s WebCoach online service or Text2Quit, a new service that sends supportive messages to tobacco users who are trying to quit (Florida Department of Health, 2016b). Maternal and Child Health Services helps promote the Quitline through the Healthy Start Program, and BTFF has plans to coordinate with Women, Infants, and Children (WIC) offices to implement systems to refer clients to BTFF’s “Quit Your Way,” which includes the call, click, come-in components, and some new, separate, “individualized” services.

Local AHECs work with health care organizations throughout the state to change health systems and policies to promote the AAR protocol. As part of this work, some local AHECs target health care organizations that serve pregnant women, such as OB/GYN offices. In addition to implementing the AAR protocol in these organizations, AHECs also offer training to prenatal health care providers on providing smoking cessation to pregnant women (Florida Statute 381.84).

BTFF’s media campaign included “Amanda’s Tip” from the Tips campaign in Q2 2015 and Q2 2016 (TV and radio). In the ads, Amanda describes how she smoked during pregnancy and that her baby was 2 months premature and weighed only 3 pounds at birth (CDC, 2017).
Florida’s Healthy Start initiative began in 1991 with the goal of reducing infant mortality by improving care for women at risk for poor birth outcomes. The program includes smoking cessation counseling for pregnant smokers. The Department of Health and Healthy Start coalitions provide tobacco education and cessation training to health care providers based on the behavioral change theory of J.O. Prochaska (Transtheoretical Model) (Prochaska & Velicer, 1997). Training also includes information about when to offer nicotine replacement therapy (NRT) and how to obtain nicotine patches through the county health departments (Florida Department of Health, 2009). The Maternal and Child Health section also provides Text4baby, a free service that sends text messages to pregnant women on a variety of health topics.

Recent Healthy Start statistics indicate the prevalence of tobacco use among pregnant women decreased from 17% in 1991 to 5.8% in 2015 (Florida Department of Health, 2016a), a reflection of the general trend among adult smokers. Although this statistic is noteworthy, several factors may have contributed to the observed decline in prenatal smoking, including the enactment of statewide legislation to prohibit smoking in all enclosed workplaces in 2003, Florida’s antitobacco media campaigns, and an increase in the cigarette tax from $1.00 to $1.34 in 2009. Healthy Start cessation services include counseling using the 5As (Ask, Assess, Advise, Assist, and Arrange) and offering NRT for heavier smokers (i.e., those who smoke 15 or more cigarettes per day and have not been able to quit using other behavioral strategies) (Florida Department of Health, 2009). Structured tobacco education and cessation counseling can be provided in individual or group sessions in a county health department, other health facility, in the participant’s home, or at community centers convenient to the participant. Counseling services are provided by individuals such as health care providers, nurses, social workers, health educators, and nutritionists who have been trained to provide behavioral counseling specific to tobacco cessation.

The Baby & Me—Tobacco Free Program, which uses a combination of counseling and incentives, is currently administered by four sites in Volusia County: Odessa Chambliss Center for Health Equity and the Florida Department of Health in Volusia County in Daytona Beach, Volusia Flagler Family YMCA in Deland, and Southeast Volusia Family YMCA in Edgewater. The Florida Department of Health (DOH) in Volusia County provides training and equipment for testing for tobacco use and partners with agencies that offer prenatal cessation services specifically for low-income women (Florida Department of Health, n.d.).
2. METHODS

This section presents our methods for conducting a review of current public health agency guidelines, a review of peer-reviewed literature, and an online search of evidence-based prenatal cessation programs implemented by state tobacco control programs.

2.1 Review of Public Health Agency Guidelines

As a first step toward understanding the current evidence regarding prenatal tobacco cessation interventions, we reviewed the guidelines from public health agencies (i.e., the U.S. Preventive Services Task Force [USPSTF], U.S. Public Health Service, American College of Obstetricians and Gynecologists [ACOG], World Health Organization [WHO], and Association of State and Territorial Health Officials [ASTHO]), regarding prenatal and/or postpartum smoking cessation interventions. We reviewed and abstracted information from these sources and categorized interventions by whether they exhibited strong evidence of effectiveness or insufficient evidence for treating tobacco use and dependence among pregnant women. We also abstracted information from the guidelines about types of activities conducted as part of each intervention, whether and how the intensity of the intervention affected quit rates, differential effects among specific populations, and cost savings, if available. Results from our review of these guidelines are presented in Section 3.1.

2.2 Review of Peer-Reviewed Literature

We also conducted an in-depth review of peer-reviewed literature to identify prenatal tobacco cessation interventions with strong evidence of effectiveness and interventions with insufficient evidence of effectiveness. This section describes our search strategy, inclusion criteria for articles, our process for abstraction and coding, and how we synthesized information.

2.2.1 Search Strategy

We developed a comprehensive search strategy using a combination of MeSH terms and key words to identify articles that assessed tobacco cessation interventions for pregnant and/or postpartum women. MeSH terms included the following:

- Cessation, tobacco OR cessation, tobacco use OR cessation, smoking OR smoking OR smoking cessation OR smoking, prevention & control
- Pregnant women OR pregnancy OR prenatal care OR preconception care OR prenatal education OR postnatal care or postpartum period
- Counseling OR public health systems research OR organizational change OR organizational innovations OR clinical trial OR intervention studies OR evaluation studies OR program evaluation
Keywords included the following:

- Quit smoking OR smoking (cessation) OR tobacco (cessation) OR tobacco dependence treatment OR nicotine dependence
- Quit attempts
- Pregnancy OR pregnant
- Prenatal health
- Prenatal care
- Evidence-based recommendations
- 5As
- Interventions or policies
- Systems change
- Counseling
- Quitline
- Birth outcomes
- Asthma
- Infant, newborn

The first search strategy we used in PubMed, Web of Science, CINAHL, PsycINFO, and Sociological Abstracts is provided in Appendix A. These initial search strategies yielded 192 results published from 2002 to 2017. Due to the large number of peer-reviewed manuscripts published on this topic, 36 systematic reviews served as the basis for most of our findings. However, to meet BTFF’s request for specific information on the cost-effectiveness of various interventions, we employed a second search strategy to identify economic evaluations of tobacco cessation interventions for pregnant and postpartum women because the first search strategy yielded only two articles with abstracts that explicitly mentioned cost information. We combined the initial search strategies used in each database with the following MeSH terms: cost, costs and cost-analysis, cost-benefit, cost-effectiveness, cost-benefit analysis, direct service costs, health care costs, and economics. This yielded 14 additional results published from 2002 to 2017.

We examined the remaining 156 articles that were not systematic reviews from the pool of 192 articles identified through our initial search strategies for complementary or incongruous findings. Finally, we employed a snowball approach to identify other relevant articles referenced in articles we obtained that were not captured via our search strategies to ensure that we conducted a thorough review of the evidence.

Finally, we conducted an online search for relevant gray literature from state tobacco control programs. We entered a combination of keywords (e.g., pregnant, prenatal, postpartum, and cessation) in the search feature of each state’s tobacco control program website, which in most cases was embedded within the state’s health department website. We reviewed results to identify prenatal cessation interventions that each state tobacco control program is currently implementing. We conducted a second online search to look specifically for outcome evaluations of the programs and policies that states have implemented. We compiled a list of the relevant programs identified during our first search and used a combination of terms in a general Google search to find published outcome evaluations. First, we searched using the terms “[State Name AND Name of program].”
Then, we searched more specifically using the terms “[State Name AND Name of program AND ("outcomes" or "evaluation")].”

### 2.2.2 Inclusion Criteria

Because the evidence regarding prenatal tobacco cessation interventions have been synthesized in a large number of systematic reviews, we initially included 36 systematic reviews and 16 cost studies (two identified from our initial search strategy and 14 identified from our second search strategy). The systematic reviews thoroughly covered a majority of intervention types (i.e., feedback, incentives, in-person counseling, NRT/pharmacotherapy, provider education, self-help materials, social support, and telephone counseling). To obtain more specific information on interventions for which we wanted more nuanced information (i.e., incentives) or for interventions or policies that were not well-covered in systematic reviews (i.e., systems change, text messaging, and web-based interventions), we reviewed references within the full pool of 192 results from our initial peer-reviewed literature search and included an additional 5 articles focused on incentives to better understand incentive thresholds; 4 articles that focused on text messaging interventions, which are relatively new and have limited evidence of effectiveness among pregnant and/or postpartum women; 3 articles that focused on systems change; and 2 articles focused on web-based interventions. We also searched for references within the pool of 192 results and included an additional 5 articles that mentioned special population(s) (i.e., African American, Hispanic/Latino, rural, SNAP participants, WIC participants, low-income, or Medicaid beneficiaries). Finally, we used a snowball approach to include other relevant articles referenced in the full-text systematic reviews and original research articles that were not captured via any of our search strategies.

### 2.2.3 Abstraction and Coding

We divided articles that met our inclusion criteria among four reviewers and abstracted the type of article (i.e., intervention study, cost study, systematic review, clinical practice guidelines, surveillance data), sample size, sampling strategy, study design, special population(s) addressed (i.e., African American, Hispanic/Latino, rural, SNAP participants, WIC participants, low-income or Medicaid beneficiaries), intervention type, intervention description, outcomes measures, cost information (if applicable), key findings, study limitations, and implications for this report into an Excel spreadsheet to facilitate synthesis of key findings.

We developed the list of intervention types based on our review of public health agency guidelines and systematic review abstracts, including expansion of Medicaid coverage to cover cessation services for pregnant women, feedback, incentives, in-person counseling, NRT and pharmacotherapy, provider education, self-help materials, social support, systems change, telephone counseling, text messaging, tobacco control policies, and web-based
Interventions. Intervention types are listed below in alphabetical order with a brief description of each intervention:

- **Feedback.** "Feedback" involves giving information about the fetal health status or measurements of by-products of tobacco smoking to expectant mothers as part of a session with a health care provider.

- **Incentives.** Incentive-based interventions include those that provide pregnant women with financial incentives or vouchers (e.g., for diapers) for participating in a cessation program or for abstaining from smoking (measured by self-report and/or biological verification).

- **In-person Counseling with a Health Care Provider or Trained Counselor.** This category includes in-person sessions between a health care professional (e.g., physician, midwife, nurse) or trained counselor and patient, usually occurring during routine prenatal care appointments. Interventions incorporating the 5As (Ask, Advise, Assess, Assist, Arrange) framework are categorized as counseling interventions in this report because most studies that employed the 5As framework reported outcomes from counseling offered as part of the Assist step. Counseling may involve "motivational interviewing," which is a goal-oriented technique that aims to promote intrinsic motivation for behavior change.

- **Nicotine Replacement Therapy (NRT) and Pharmacotherapy.** NRT includes nicotine patches and gum, and pharmacotherapy includes stop-smoking medications (i.e., bupropion and varenicline) to support quit attempts among pregnant women.

- **Provider Education.** This category includes dissemination of interventions to providers via education or training as well as training providers to adopt the 5As or the AAR protocol to always ask, advise, and refer patients to other prenatal smoking cessation services, such as the state quitline.

- **Self-Help Materials.** Self-help materials include any educational materials, such as brochures, handbooks, and videos, designed to encourage pregnant women to stop smoking.

- **Social Support.** Social support interventions include those designed to provide personalized support for women trying to quit and to remain abstinent. Interventions to involve a pregnant woman’s partner in providing support for cessation are included in this category.

- **Systems Change.** Health systems change involves promoting modifications to health care organization’s (e.g., clinics, hospitals, dental offices, pharmacies, emergency departments) systems and policies that institutionalize tobacco use screening and dependence treatment into routine clinical care.

- **Telephone Counseling.** This category comprises telephone-based sessions between trained counselors and pregnant women offered by state quitlines or trained health care professionals as part of their patient follow-up protocol.

- **Text Messaging or Short Message Service (SMS).** Text messaging interventions include those designed to provide text messages to women trying to quit or remain abstinent from smoking during and after pregnancy.

- **Web-based.** Web-based interventions include websites designed to promote prenatal smoking cessation using a combination of tailored education, resources, and/or social support.
We also aimed to identify effects of policies on tobacco cessation among pregnant women and therefore we coded articles related to the expansion of Medicaid coverage to cover cessation services and other tobacco control policies. Specific definitions of each category are as follows:

- **Expansion of Medicaid Coverage.** The Affordable Care Act, implemented in 2010, mandated state Medicaid programs to cover tobacco cessation counseling and pharmacotherapy for pregnant women. Interventions or activities to promote the use of this coverage fall into this category.

- **Tobacco Control Policies.** Tobacco control policies include any policy designed to promote tobacco cessation in the general population, such as legislation to prohibit smoking in multi-unit housing or increases in tobacco excise taxes that may also have an effect on prenatal smoking rates.

### 2.2.4 Synthesis

RTI reviewers convened after abstracting assigned articles to discuss high-level findings and implications. We developed consensus regarding interventions with strong evidence of effectiveness and interventions with limited, weak, or inconclusive evidence of effectiveness. The quality of evidence was considered when assessing the strength of evidence. For evidence gathered from Cochrane Reviews or other systemic reviews, we report the strength of evidence based on the approach used to grade evidence in the particular review. Cochrane Reviews use the GRADE approach, which considers five criteria (study limitations, consistency of effect, imprecision, indirectness, and publication bias) to assess the quality of the body of evidence for each intervention strategy and outcome (Schünemann, Brožek, Guyatt, & Oxman, 2013). For other studies, randomized controlled trials (RCTs) of interventions that demonstrated evidence of effectiveness were considered approaches with strong research support. RCTs of interventions that demonstrated mixed, limited, or no evidence of effectiveness were considered approaches with limited, weak, or inconclusive support. Studies that employed a non-RCT design were also categorized as having limited, weak, or inconclusive support, even if results were promising. We then synthesized key findings from included peer-reviewed articles (i.e., systematic reviews and other articles) and gray literature by intervention type. Results from the peer-reviewed and gray literature are reported in Section 3.2. The types of interventions currently being employed to prevent postpartum relapse align with those designed to promote prenatal cessation. Where information is available, we identify differences in intervention effectiveness for prenatal cessation and postpartum relapse prevention.
3. RESULTS

Section 3.1 includes results from our search of public health agency recommendations for smoking cessation among pregnant women organized by evidence-based interventions and interventions with insufficient evidence of effectiveness. Section 3.2 includes results from our review of peer-reviewed literature and online search of state tobacco control programs regarding interventions with strong evidence of effectiveness and interventions with limited, weak, or inconclusive evidence of effectiveness. We include specific details from our online search of state tobacco control programs when available.

3.1 Summary of Agency Recommendations for Smoking Cessation among Pregnant Women

This summary is based on recommendations from USPSTF, U.S. Public Health Service, American College of Obstetricians and Gynecologists (ACOG), WHO, and Association of State and Territorial Health Officials (ASTHO). Table 3-1 presents a high-level summary of evidence-based interventions recommended by each agency and interventions with insufficient evidence to warrant recommendation. Interventions assessed by these organizations include in-person counseling, telephone counseling (including via quitlines), pregnancy-specific self-help materials, incentives, social support, tobacco control policies, and pharmacotherapy/ nicotine replacement therapy (NRT). Although we discuss tobacco control policies separately and do not consider them to be “interventions” in Section 3.2 (Results from Review of Peer-Reviewed Literature and State Evaluation Reports), we do include them here because they were considered “interventions” by some public health agencies.

3.1.1 Evidence-Based Interventions Recommended for Smoking Cessation among Pregnant and Postpartum Women

ASTHO (2013) translates current guidelines and evidence-based interventions into a comprehensive and coordinated approach for states to implement smoking cessation strategies for pregnant and postpartum women. An overview of these state-specific recommendations is provided in Figure 3-1. Specific tobacco control policies recommended include smoke-free home policies, especially in federally assisted and multi-unit housing, cigarette tax increases, and full worksite smoking bans.

Counseling pregnant women in-person or via telephone to stop smoking has strong evidence of effectiveness, and all agencies currently recommend it. The 5As (Ask, Advise, Assess, Assist, and Arrange) brief intervention is an evidence-based approach designed to be implemented by providers in a clinical setting that often includes a counseling
Table 3-1. Summary of Recommendations Regarding Prenatal Tobacco Cessation Interventions

<table>
<thead>
<tr>
<th>Agency</th>
<th>Evidence-Based Interventions Recommended</th>
<th>Interventions with Insufficient Evidence of Effectiveness</th>
</tr>
</thead>
</table>
| Association of State and Territorial Health Officials (ASTHO, 2013) | • Counseling (e.g., within the 5As framework)  
  • Telephone counseling via quitlines  
  • Promotion of Medicaid coverage of tobacco cessation services under the Affordable Care Act  
  • Smoke-free multi-unit housing policies  
  • Increased cigarette taxes | Not specified |
| U.S. Preventive Services Task Force (Siu & U.S. Preventive Services Task Force, 2015; U.S. Preventive Services Task Force, 2009) | • In-person counseling (e.g., the 5As behavioral or Ask, Advise, Refer framework)  
  • Telephone counseling via quitlines  
  • Pregnancy-specific self-help materials | Pharmacotherapy  
  Harm reduction using electronic nicotine delivery systems |
| U.S. Public Health Service (Fiore et al., 2008) | • Counseling  
  • Pregnancy-specific self-help materials  
  • Follow-up calls during pregnancy and after delivery  
  • Offering effective tobacco dependence interventions to pregnant smokers at the first prenatal visit and throughout the pregnancy | Pharmacotherapy |
| American College of Obstetricians and Gynecologists (2010) | • Counseling (e.g., within the 5As framework)  
  • Pregnancy-specific self-help materials  
  • Follow-up calls during pregnancy and after delivery | Pharmacotherapy |
| World Health Organization (WHO, 2013) | • Counseling  
  • Pregnancy-specific self-help materials  
  • Incentives  
  • Social support | Pharmacotherapy  
  Stages of Change approach (all women should be offered support irrespective of their intention to quit) |
Figure 3-1. Recommendations to Improve Smoking Cessation Before, During, and After Pregnancy

- Provide training and technical assistance to health care and public health providers on helping women quit using tobacco before, during, and after pregnancy.
- Extend pregnancy-specific and postpartum-specific quitline services to women during and after pregnancy.
- Promote awareness of cessation benefits and effectiveness of treatment by implementing coordinated media campaigns that specifically target women during childbearing years.
- Develop customized programs for specific at-risk populations of women who are smokers and of reproductive age.
- Include Women, Infants, and Children (WIC) sites as points for intervening with pregnant and postpartum women.
- Design and promote barrier-free cessation coverage benefits for pregnant and postpartum women in public and private health plans.
- Promote cessation service integration aimed at improving birth outcomes such as the Healthy Start program.
- Implement evidence-based tobacco control policies that augment tobacco cessation for women before, during, and after pregnancy.


component. Providers seeing pregnant women should be trained to discuss the effects of smoking on maternal and fetal health, and counseling may be more effective when combined with pregnancy-specific self-help materials (Fiore et al., 2008). Practical counseling that includes problem solving and skills-based approaches and providing social support during treatment are associated with significant increases in abstinence rates for the general population (Fiore et al., 2008). Counseling via quitlines is also recommended and should be tailored for pregnant and postpartum women (ASHO, 2013; Fiore et al., 2008).

Although more or longer counseling sessions are generally more effective up to a threshold, even short sessions of less than 3 minutes increased quit rates (USPSTF, 2009). The U.S. Public Health Service (2008) reported that quit rates plateau after 90 minutes of total counseling. Follow-up calls during pregnancy and after delivery are recommended to help prevent relapse in the postpartum period (ACOG, 2010; Fiore et al., 2008).

Multiple agencies also recommended pregnancy-specific self-help materials; they are most effective when combined with counseling (USPSTF, 2009). Self-help materials tailored to pregnant women are more cost-effective than providing generic self-help materials (WHO, 2013).

Interventions designed to improve assessment of tobacco use status (e.g., use of multiple choice questions as opposed to a simple yes/no question) can increase disclosure of tobacco use status among pregnant women by as much as 40% (Fiore et al., 2008). WHO (2013) also recommends offering financial incentives to support cessation among pregnant and
postpartum women and found interventions with incentives to be the most effective compared with other types of interventions, including counseling.

### 3.1.2 Interventions with Insufficient Evidence of Effectiveness

There is consensus among agencies that the use of pharmacotherapy (i.e., providing nicotine replacement medication) has insufficient evidence of effectiveness for treating tobacco use and dependence among pregnant women and is, therefore, not currently recommended by these agencies (ACOG, 2010; Fiore et al., 2008; Siu & Force, 2015; WHO, 2013). Furthermore, pharmacotherapy has the potential to cause adverse events, including increased rates of cesarean delivery, increased diastolic blood pressure, and skin reactions to the patch (Siu & U.S. Preventive Services Task Force, 2015). Additional research is needed to better understand the benefits and harms of pharmacotherapy for pregnant and breastfeeding women.

WHO (2013) recommends against using the Stages of Change approach (i.e., assessing the pregnant smoker’s readiness to quit). Instead, all pregnant smokers, regardless of their intention to quit, should be offered counseling (WHO, 2013).

### 3.2 Results from Review of Peer-Reviewed Literature and State Evaluation Reports

In this section, we report evidence from the peer-reviewed literature regarding effectiveness of the interventions identified in our search with regard to promoting tobacco use cessation among pregnant and postpartum women. When available, we also report evidence of effectiveness with regard to neonatal health outcomes. When we found information regarding states’ experience with these interventions, we note findings from those reports as well, which results in some intervention types exhibiting more information than others. We categorize interventions according to two categories, those with strong research support and those with insufficient research support, based on criteria presented in Section 2.2.4. Table 3-2 provides a high-level summary of prenatal tobacco cessation interventions with strong and limited, weak, or inconclusive research support.
### Table 3-2. Summary of Prenatal Tobacco Cessation Interventions with Strong and Limited, Weak, or Inconclusive Research Support

<table>
<thead>
<tr>
<th>Intervention or Policy Type</th>
<th>High-Level Summary of Findings from Peer-Reviewed and Gray Literature</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interventions with Strong Research Support</strong></td>
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</table>
| In-Person Counseling with a Health Care Provider or Trained Counselor | - High-quality evidence indicates interventions that include an in-person counseling component can increase smoking cessation in late pregnancy compared with usual care and less intensive interventions (Chamberlain et al., 2017).  
  - In-person counseling is often delivered as one of multiple intervention components; counseling alone may not be sufficient for achieving smoking cessation in pregnant women (Filion et al., 2011).  
  - Evidence regarding the effectiveness of in-person counseling on preventing postpartum resumption of smoking is mixed; some systematic reviews have found counseling to be effective in preventing resumption of smoking in the postpartum period (Hoedjes et al., 2010), whereas others have not (Chamberlain et al., 2017). |
| Telephone Counseling (e.g., Pregnancy-specific Quitline Protocols) | - Evidence suggests that telephone counseling can facilitate cessation among pregnant women (Cummins, Tedeschi, Anderson, & Zhu, 2016; Tong, Thomas-Haase, & Hutchings, 2014)  
  - Telephone counseling has also been shown to be effective at preventing resumption of smoking up to 6 months postpartum (Tong et al., 2014) |
| Feedback | - Moderate-quality evidence indicates providing information about the fetal health status or measurements of by-products of tobacco smoking to expectant mothers is effective alone or in combination with other interventions such as counseling (Chamberlain et al., 2017). |
| Self-Help Materials | - Pregnancy-specific self-help materials are low cost and have been shown to be slightly more effective than usual care (e.g., advice to quit smoking); however, more intensive approaches may be necessary for heavy smokers ((Naughton, Prevost, & Sutton, 2008). |
| Incentives | - Moderate-to-high quality evidence indicates interventions that include an incentive (e.g., financial, vouchers for goods or services) contingent upon abstinence are effective for treating tobacco use and dependence among pregnant women (Cahill, Hartmann-Boyece, & Perera, 2015).  
  - Contingent incentives have shown promise in preventing resumption of smoking postpartum (Ierfino, Mantzari, Hirst, Jones, Aveyard, & Marteau, 2015).  
  - States have implemented incentive-based interventions, such as the Baby & Me—Tobacco Free and First Breath programs, with promising results (Berkowitz, 2016; Crume, Lambert, & Shapiro, 2015; Gadomski, Adams, Tallman, Krupa, & Jenkins, 2011; NACCHO, 2005; Runge & Adams, 2014; Rushing, Bailey, & Dresler, n.d.; Tennessee Department of Health, n.d.; Wisconsin Women’s Health Foundation, 2011, 2016). |

(continued)
### Table 3-2. Summary of Prenatal Tobacco Cessation Interventions with Strong and Limited, Weak, or Inconclusive Research Support (continued)

<table>
<thead>
<tr>
<th>Intervention or Policy Type</th>
<th>High-Level Summary of Findings from Peer-Reviewed and Gray Literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Systems Change/Provider Education</td>
<td>- Training and reminders for health care providers increased cessation rates significantly among pregnant smokers (Tran, Rosenberg, &amp; Carlson, 2010). Some states have partnered with WIC staff to promote enrollment in a smoking cessation program, and others have worked with primary care and obstetric practices to improve screening, referrals, and cessation counseling (e.g., Ask, Advise, Refer) with promising results (ASTHO, 2016; Child Fatality Task Force, n.d.; Graff, 2014; McFarland, Brogden, D’Oria, &amp; Dawson, n.d.).</td>
</tr>
<tr>
<td>Nicotine Replacement Therapy (NRT) and Pharmacotherapy</td>
<td>- NRT has insufficient evidence of safety and effectiveness to be recommended for routine treatment of tobacco use and dependence during pregnancy (Coleman, Chamberlain, Davey, Cooper, &amp; Leonard-Bee, 2015; Einarson &amp; Riordan, 2009; Jones, Lewis, Parrott, Wormall, &amp; Coleman, 2016; Leung &amp; Davies, 2015; Meernik &amp; Goldstein, 2015; Su &amp; Buttenheim, 2014).</td>
</tr>
<tr>
<td>- However, health care providers may consider offering NRT to pregnant women who are heavy smokers and have not been able to quit using other methods (Coleman et al., 2015).</td>
<td></td>
</tr>
<tr>
<td>- Bupropion and varenicline have insufficient evidence of safety and efficacy for use among pregnant and postpartum smokers (Coleman et al., 2015; Leung &amp; Davies, 2015).</td>
<td></td>
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<tr>
<td>Social Support Interventions</td>
<td>- Social support interventions have limited evidence of effectiveness among pregnant and postpartum women (Bullock, Everett, Mullen, Geden, Longo, &amp; Madsen, 2009; Chamberlain et al., 2017; Hemsing, Greaves, O’Leary, Chan, &amp; Okoli, 2012).</td>
</tr>
<tr>
<td>Text Messaging Interventions</td>
<td>- Evidence is limited regarding the effectiveness of text messaging interventions for treating tobacco use and dependence among pregnant smokers (Vodopivec-Jamsek, de Jongh, Gurol-Urganci, Atun, &amp; Car, 2012).</td>
</tr>
<tr>
<td>- However, text messaging interventions may hold promise for reaching blacks, Hispanics, and individuals who make less than $30,000 per year (Fitzgerald, 2012; Wen et al., 2014).</td>
<td></td>
</tr>
<tr>
<td>Web-based Interventions</td>
<td>- Evidence is very limited regarding the effectiveness of web-based smoking cessation interventions for pregnant women; more research is needed to determine the effectiveness of using the Internet as a modality for prenatal tobacco cessation interventions among adolescents, rural, and low-income populations that may not have access to a computer or smartphone.</td>
</tr>
</tbody>
</table>

(continued)
Table 3-2. Summary of Prenatal Tobacco Cessation Interventions with Strong and Limited, Weak, or Inconclusive Research Support (continued)

<table>
<thead>
<tr>
<th>Intervention or Policy Type</th>
<th>High-Level Summary of Findings from Peer-Reviewed and Gray Literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobacco Control Policies</td>
<td>• Tobacco control policies, including smoke-free workplaces and increasing cigarette taxes, have been shown to be effective in promoting cessation among pregnant women ((Adams, Markowitz, Kannan, Dietz, Tong, &amp; Malarcher, 2012; Colman, Grossman, &amp; Joyce, 2003; Hawkins &amp; Baum, 2014; Klein, Liu, &amp; Conrey, 2014; Lien &amp; Evans, 2005; Ringel &amp; Evans, 2001).</td>
</tr>
<tr>
<td>Expansion of Medicaid to Cover Cessation Services</td>
<td>• The Affordable Care Act began requiring states to provide tobacco cessation services without cost sharing for pregnant Medicaid beneficiaries in 2010. Providers serving Medicaid patients are unaware of their ability to be reimbursed for cessation services; promoting this benefit could reduce treatment barriers (Tong, England, Malarcher, Mahoney, Anderson, &amp; Schulkin, 2015).</td>
</tr>
</tbody>
</table>

### 3.2.1 Interventions with Strong Research Support

**In-person Counseling with a Health Care Provider or Trained Counselor**

There is a wealth of research about the effectiveness of counseling interventions for tobacco cessation; thus, our review of evidence for counseling interventions focuses heavily on Cochrane Reviews and other systematic review articles. In a recent Cochrane Review (Chamberlain et al., 2017) that included RCTs, cluster-randomized trials, and quasi-randomized controlled trials of psychosocial smoking cessation interventions during pregnancy, the authors reported that high-quality evidence demonstrated that counseling increased smoking cessation in late pregnancy compared with usual care (30 studies; average risk ratio [RR] 1.44, 95% confidence interval [CI] 1.19 to 1.73) and less intensive interventions (18 studies; average RR 1.25, 95% CI 1.07 to 1.47). This review confirms earlier versions of this review and others (Hoedjes et al., 2010; Miyazaki, Hayashi, & Imazeki, 2015) supporting counseling interventions. For example, Hoedjes et al. (2010) reviewed 5 in-person counseling interventions and found 4 to be effective. All of these interventions included some face-to-face interaction between a pregnant woman and a health care provider. Patnode, Henderson, Thompson, Senger, Fortmann, and Whitlock (2015) in a review of reviews, pooled analyses of 70 behavioral interventions among pregnant women, such as counseling, self-help materials, feedback, and financial incentives. There was a significant effect on validated cessation during late pregnancy (RR 1.45, 95% CI 1.27 to 1.64), and the authors noted that the effects were similar when the intervention type was limited to counseling (the most common intervention type). However, low participation rates and a lack of information about women who declined to participate were noted as limitations.
Psychosocial interventions, or non-pharmacological interventions that address cognitive, emotional, or social factors that influence tobacco use, may have multiple components, such as in-person counseling, self-help materials, and telephone support. Assessing the independent effect of each component can be difficult. In one meta-analysis of multicomponent interventions (Filion et al., 2011), the effect of counseling alone was modest. The absolute difference in abstinence between treatment and control groups reached a maximum of only 4%, suggesting that counseling alone may not be sufficient for achieving smoking cessation in pregnant women. When smoking cessation interventions were implemented as one component of a broader maternal health intervention rather than a smoking cessation trial, it was also unclear whether they were effective (Chamberlain et al., 2017); thus, the effects may not be replicated when counseling is implemented as part of routine pregnancy care or implemented at a population level. An important caveat is that smokers in the general population may be less motivated to participate in an intervention than smokers in a smoking-specific clinical trial.

In-person Counseling Interventions for Relapse Prevention

Although there is strong evidence that counseling interventions can reduce smoking rates during pregnancy, less is known about how to prevent relapse in the postpartum period. In the Cochrane Review covering psychosocial interventions (Chamberlain et al., 2017), the authors reviewed studies comparing counseling and usual care and concluded that it is unclear whether counseling interventions prevented smoking relapse among women who had stopped smoking spontaneously in early pregnancy. However, Hoedjes et al. (2010) found 4 of 8 smoking relapse prevention interventions reviewed to be effective. Although these studies all had control groups, they were not all RCTs; thus, this evidence is considered to be moderate in strength. Hajek, Stead, West, Jarvis, Hartmann-Boyce, and Lancaster (2013) reviewed randomized or quasi-RCTs of relapse prevention interventions with a minimum follow-up of 6 months. This study included smokers who quit on their own, underwent enforced abstinence, or participated in treatment. They included trials that compared relapse prevention interventions with a no-intervention control, or that compared a cessation program with additional relapse prevention components with a cessation program alone. The authors found no benefit of the relatively brief interventions, which typically included face-to-face counseling or telephone counseling along with written materials, mailings over a period of time, or the addition of a video. However, most of the included studies did not use experimental designs and had limited power to detect expected small differences between interventions. Su and Buttenheim (2014) conducted a systematic review that focused specifically on relapse prevention among nonsmokers (individuals who quit smoking because of an external intervention) to reveal differences in long-term response to interventions for this population compared with spontaneous quitters. The review included studies that did not have biochemical verification of self-reported smoking status. Although the quit rates were consistently higher in the intervention groups.
than the control groups, none of the intervention types produced a significant effect on relapse in the longer-term postpartum period. Likewise, Levitt et al. (2007), in a review of 3 RCTs, found no statistically significant benefits of advice materials and counseling interventions on relapse prevention. In summary, although evidence is strong that counseling interventions, when conducted as part of a focused trial, promote cessation, their effectiveness for relapse prevention is unclear.

Neonatal Health Outcomes Associated with Counseling Interventions

This section consists of evidence relating to effects of counseling interventions on neonatal health outcomes. A meta-analysis of 19 trials (Patnode et al., 2015) found somewhat higher mean birthweight among infants born to women who received a behavioral intervention for smoking cessation than those in a control group (40.78 g [95% CI 18.4 to 63.10 g]; I² = 0%). The study also showed a pooled 18% risk reduction for preterm birth before 37 weeks (RR 0.82 [CI 0.70 to 0.96]; I² = 0%; 14 trials). Although the majority of these behavioral interventions involved in-person counseling, these analyses covered all behavioral interventions. Chamberlain et al. (2017) also provided high-quality evidence from pooled results demonstrating that women who received psychosocial interventions had a 17% reduction in infants born with low birthweight, a significantly higher mean birthweight (mean difference [MD] 55.60 g, 95% CI 29.82 to 81.38 g higher) and a 22% reduction in neonatal intensive care admissions. However, the difference in preterm births and stillbirths was unclear in this study.

Telephone Counseling

Evidence for the effectiveness of counseling delivered by telephone is less consistent and less abundant than the evidence in support of in-person counseling, although participants in in-person and telephone trials may differ in terms of their readiness to quit. A two-group RCT with 1,173 participants tested the efficacy of pregnancy-specific quitline counseling that supplemented the regular protocol for adults with 4 additional counseling sessions (9 rather than 5). Compared with a control group that received self-help materials the intervention group had higher abstinence rates at the end of pregnancy (30-day abstinence, 29.6% vs. 20.1%; p < 0.001), 2 months postpartum (90-day abstinence, 22.1% vs. 14.8%; p = 0.001), and 6 months postpartum (180-day abstinence, 14.4% vs. 8.2%; p = 0.001) (Cummins et al., 2016). Others have also found positive, albeit limited, evidence to suggest that telephone counseling can facilitate cessation and prevent relapse for pregnant and postpartum women. In a 2014 literature review, Tong et al. (2014) reviewed six studies (one observational study and five RCTs) that examined telephone counseling for prenatal smoking cessation. Two of the six studies, one of which was an observational study analyzing quitline data from 10 states from 2006–2008, reported that pregnant women who received pregnancy-specific telephone counseling sessions had significantly higher quit rates than women who received no calls, although self-selection for number of phone calls and
lack of biochemical verification were study limitations. The remaining four RCTs did not find that telephone counseling had a significant effect on smoking cessation during pregnancy, however, low adherence and participation were limitations. In two of six RCTs that examined telephone counseling on postpartum relapse, telephone counseling was effective in reducing relapse in the early postpartum period (e.g., up to 6 months), but these positive findings were not sustained at longer follow-up times postpartum (e.g., up to 12 months). The authors concluded that research is needed to determine best practices (e.g., number of sessions, duration, or follow-up) for telephone counseling with this population and to improve uptake of and adherence to this type of intervention. Although a review of studies by Dennis et al. (2008) did not reveal effects of proactive telephone support on cessation by pregnant women and new mothers, two trials demonstrated a beneficial effect on relapse at 24 weeks postpartum.

**Feedback**

Feedback, the provision of information about the fetal health status or measurements of by-products of tobacco smoking to expectant mothers as part of a session with a health care provider, can be effective alone or in combination with other interventions such as counseling. In the Cochrane Review of psychosocial interventions, Chamberlain et al. (2017) reported moderate quality evidence from two trials that feedback provided by ultrasound or carbon monoxide monitoring significantly increased the odds of cessation (average RR 4.39, 95% CI 1.89 to 10.21) compared with usual care. However, results were not significant when feedback was compared with less intensive interventions (where the control group received “some of the intervention or an approximation of ‘usual care’ consistently provided by the research team” [p. 14]) (three studies; average RR 1.29, 95% CI 0.75 to 2.20).

**Self-Help Materials**

Naughton et al. (2008) conducted a meta-analysis that included 12 trials (RCTs and quasi-experimental) comparing efficacy of usual care (advice to quit smoking and brief written materials) vs. self-help materials (booklets [n=6]; video interventions [n=2]; booklets + additional components (a computer-tailored program; written prescriptions and letters of encouragement from health professionals; and medical letters, a “buddy” advice letter and tip sheet, a quarterly newsletter, and information leaflets) [n=4]. The median quit rates in the usual care and self-help groups of the 12 trials were 4.9% and 13.2%, respectively. The pooled OR from the random effects meta-analysis demonstrated a significant increase in quit rates for self-help materials over usual care (pooled OR=1.83, 95% CI 1.23 to 2.73). This results in an absolute difference between groups of approximately 5%. Trials that provided brief or no contact (<5 minutes), when pooled, had a smaller OR than those providing extended contact (>5 minutes) (OR=1.49, 95% CI 0.85 to 2.62; extended OR=2.19, 95% CI 1.37 to 3.48). The authors conclude that because self-help materials are low cost, they “should remain a pragmatic component in cost-effective best practice
recommendations, although more effective approaches are likely to be required for heavy smokers” (p. 577). These results differed from a review of three studies that involved provision of self-help manuals with no additional personal advice that demonstrated very modest, uncertain effects (average RR 1.09, 95% CI 0.80 to 1.50) (Chamberlain et al., 2017).

**Incentives**

Material or financial incentives have been used to encourage or reinforce behavior change. A growing body of evidence supports the efficacy and cost-effectiveness of financial incentives for smoking cessation among pregnant women.

In a recent (2015) Cochrane Review focusing solely on incentive-based cessation interventions for pregnant women, Cahill et al. (2015) reviewed 9 studies to determine whether incentives and contingency management programs result in higher long-term quit rates. Included trials were rated as moderate quality; they labeled only 2 of the 8 as having adequate randomization procedures. Incentives (vouchers for goods or services) were offered in addition to either counseling (5As; 3 trials), self-help materials (5 trials), or a 1-hour cessation session, 4 weekly phone calls, and free NRT upon request (1 trial; non-U.S.). The pooled OR for abstinence confirmed at or near the end of pregnancy was 3.79 (95% CI 2.74–5.25).

In the Chamberlain et al. (2017) systematic review of psychosocial interventions for pregnant smokers, authors also found high-quality evidence suggesting that contingent incentives are effective at increasing the rate of smoking cessation in late pregnancy compared with an equally intensive alternative intervention including incentives that were not contingent (4 studies; RR 2.36, 95% CI 1.36 to 4.09). This review concluded that incentives produced the largest overall treatment effects among the psychosocial interventions reviewed.

In a systematic review of studies published between 1990 and 2014 selected based on the levels of evidence presented by the Canadian Task Force on Preventative Health Care, incentives combined with behavioral therapy exhibited the most promise for promoting abstinence from smoking among pregnant women (Leung & Davies, 2015).

**Postpartum Relapse Prevention and Incentive-Based Interventions**

Su and Buttenheim (2014), in a systematic literature review of 32 relevant studies of pharmacological, behavioral, and incentives-based interventions, found that none of the intervention types prevented relapse in the longer-term (9 to 12 months) postpartum period. However, one study that used a mix of behavioral and incentives obtained a significantly higher abstinence rate in the longer-term postpartum period.
Gadomski et al. (2011) used a quasi-experimental design to evaluate the Baby & Me—Tobacco Free program, which combines prenatal and postpartum smoking cessation counseling and biomarker feedback with monthly postpartum incentives. At 1 year postpartum, mothers were biochemically tested every 3 to 4 weeks and were given a voucher for diapers upon testing negative. Using intent-to-treat analysis, the prenatal quit rate was 60%, while the postpartum quit rates varied by intervention model from 32% to 64% at 6 months postpartum. Ierfino et al. (2015) studied prolonged cessation in an unselected population of English pregnant smokers who were offered financial incentives for quitting and found prolonged cessation rates comparable to those reported in U.S. trials. Higgins et al. (2012) also specifically examined the postpartum period in a meta-analysis of three RCTs that examined contingent vs. noncontingent conditions. In one study, point-prevalence abstinence rates at 2-month-postpartum in the voucher and usual-treatment control conditions were 21% vs. 6%, respectively. Another study exhibited a difference at 3 months of 33% vs. 0%. The third study did not reveal significant differences at 3 months postpartum.

Neonatal Health Outcomes of Incentive-based Interventions

Studies also provide some evidence that incentives can have positive effects on neonatal health. Heil et al. (2008) examined whether there is an association between the provision of contingent vouchers and improved fetal growth. A total of 82 smokers entering prenatal care participated in the two-condition, parallel-group RCTs comparing contingent and noncontingent voucher conditions. In the contingent condition, women earned vouchers for biochemically verified smoking abstinence; in the noncontingent condition, they earned them regardless of smoking status. Contingent vouchers significantly increased point-prevalence abstinence at the end-of-pregnancy (41% vs. 10%) and at 12-weeks postpartum (24% vs. 3%). There was also significantly greater growth in estimated fetal weight, femur length, and abdominal circumference in the contingent compared with the noncontingent conditions.

Likewise, Zhang et al. found that participation in 3 to 4 prenatal smoking cessation sessions as part of the Baby & Me—Tobacco Free program was associated with significantly reduced odds of having a low birthweight infant (Zhang, Devasia, Czarnecki, Frechette, Russell, & Behringer, 2017). Participants with high session attendance had a high prenatal smoking cessation rate of 68.3%. These participants consumed, on average, 63% fewer cigarettes per day in the last 3 months of pregnancy compared with nonparticipants. However, this study was not a RCT, and therefore the strength of evidence is weak.

Our review found one study that did not find significant effects of incentives on health outcomes. Tuten, Fitzsimons, Chisolm, Nuzzo, and Jones (2012), in an RCT comparing contingent-behavioral incentives, noncontingent behavioral incentives, and treatment as usual, achieved significant smoking behavior reductions but did not achieve significant differences in birth outcomes.
Key Features for Effectiveness of Incentive-based Interventions

Regarding incentive thresholds, Higgins et al. (2012) report that Donatelle and colleagues (2004) saw a reduction in treatment effect when voucher size was reduced from $50 to $25 per month despite strengthening the intervention by including the 5As and feedback about potential harmful effects of smoking. The trials conducted at the University of Vermont involved voucher values equivalent to approximately $50 per month, but also a schedule involving more frequent monitoring of smoking status and associated opportunities for encouraging cessation.

Higgins et al. (2012) experimented with redistribution of the usual incentives so that higher values were available early in the quit attempt. They found that this modification did not affect abstinence levels.

States’ Experience with Incentive-based Interventions

Although these are not published RCTs, our search of the gray literature revealed many noteworthy descriptions of states’ implementation and results from the Baby & Me—Tobacco Free program, which uses a combination of counseling and incentives to promote cessation during pregnancy and discourage relapse in the postpartum period (Table 3-3). No details are provided about the method of recruitment, assignment to condition, or other limitations of these studies, however.

Aside from Baby & Me—Tobacco Free, other states have implemented a variety of incentive-based programs geared toward pregnant women:

- Arkansas conducted the Tobacco Prevention and Control Program Pregnancy Incentive Pilot; 62 enrollees (out of 138 eligible women) received brief counseling and referral to the state quitline along with financial incentives (Rushing et al., n.d.). The combined 3-month quit rate was 33%. The total cost was $18,111 (incentives: $10,124), and 55% of total incentives were paid to participants who had at least a 3-month quit rate.

- Maryland operates the MDQuit Pregnancy Incentive Program, which provides up to $90 in gift cards to pregnant/postpartum women who call the quitline (provided in four installments) (Berkowitz, 2016). Calls to the quitline increased from 2 callers in 2012 to 210 callers in 2015.

- Wisconsin’s First Breath program combines 5As, counseling, self-help, and incentives (Wisconsin Women’s Health Foundation, 2011, 2016). Participants in First Breath showed decreases in self-reported smoking between the enrollment and prenatal follow-up visits ($p < 0.05$). Women who expressed the strongest desire to quit at enrollment had the most long-term success. In 2011, 37.0% of women reported staying quit (19%) or quitting (18%) during their participation in First Breath. The incentive group achieved significantly higher point-prevalence abstinence at 6 months postpartum than did the control group: 14.7% vs. 9.2%, respectively. When self-reported outcomes were analyzed (with no biochemical confirmation), the abstinence rates for the incentive and control groups were 16% and 10.6%, respectively.
### Table 3-3. States’ Experience with the Baby & Me—Tobacco Free Program

<table>
<thead>
<tr>
<th>State</th>
<th>Experience</th>
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<tbody>
<tr>
<td>Colorado</td>
<td>Reported that more than half (53%) of their participants remained abstinent from smoking during pregnancy, and 78% were tobacco-free at their last prenatal visit before delivery. Among women who returned to the program after delivery, 75% remained tobacco-free for at least 3 months postpartum and quit rates at 3, 6, and 12 months postpartum were 92.5%, 72.5%, and 53.5%, respectively (Crume et al., 2015).</td>
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<tr>
<td>Indiana</td>
<td>Enrolled over 300 women with a quit rate of 70% (Runge &amp; Adams, 2014).</td>
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<tr>
<td>Louisiana</td>
<td>Is in the process of offering the program via a March of Dimes Community Grant Program.</td>
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<tr>
<td>New York</td>
<td>Reported a 70%+ quit rate at 6 months postpartum using 2006–2009 data. The program, which is not being offered statewide, reached approximately 37% of the pregnant women in Chautauqua County. The preliminary results show that 87% of the women enrolled in the program successfully quit while pregnant and remained tobacco-free for 3 months postpartum; 85% were still tobacco-free at 6 and 9 months. The cost of the program in New York is approximately $340 per participant (Gadomski et al., 2011).</td>
</tr>
<tr>
<td>Tennessee</td>
<td>Reported 67 counties participating with 1,244 pregnant women enrolled; 145 women completed all four prenatal counseling sessions; 85 of those women are receiving monthly vouchers for diapers for remaining tobacco-free; 74% of enrolled women were established patients of a local health department. A total of 137 deliveries took place; of those, 2 were low birthweight babies (1.5% compared to state 9.1% average). However, the program had a large dropout rate, which could bias the findings. A total of 363 women (28%) dropped out due to lack of family support, presence of other household smokers, stress, apathy/lack of motivation, transportation problems, or early delivery (Tennessee Department of Health, n.d.).</td>
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### Health Systems Change/Provider Education

Given the efficacy of the 5As framework and counseling interventions, it is important for state tobacco control programs to ensure that health care providers are adequately engaging pregnant and postpartum women who use tobacco. Our search of the literature found limited information specifically considering health systems change with regard to tobacco use cessation for pregnant women. However, some randomized studies have shown that training plus reminders for health care providers significantly increases cessation rates among pregnant smokers (Tran et al., 2010).

Okoli et al. (2010) performed a literature review to assess how health care providers engage women in smoking cessation and to examine system-level interventions that affect provision of services. They discovered that although more than half of health care providers ask pregnant women about their smoking status and advise them to quit, fewer than half assess readiness to change, assist in smoking cessation, or arrange for follow-up appointments/referrals. Barriers include self-efficacy for providing smoking cessation intervention, knowledge regarding patient counseling and referral to treatment, concerns about harming the patient/provider relationship, lack of time, lack of training, lack of
materials, lack of written protocols, and the inability to be reimbursed. Several interventions were shown to address these barriers and improve health care providers’ rates of engagement, including provider training that included information about brief intervention strategies, motivational interviewing, explanations of stages of change and system-level changes, such as developing a clinic-wide system for implementation.

Efforts to capitalize on existing programs/structures such as maternal and child health and WIC programs to counsel and refer pregnant and postpartum women for cessation services can also be considered system-level interventions. Our scan of state websites reveals examples of strategies to take advantage of existing structures and programs to reach this population (Table 3-4).

3.2.2 Interventions with Limited, Weak, or Inconclusive Research Support

Tobacco cessation interventions that currently have insufficient evidence of effectiveness for pregnant women include NRT and pharmacotherapy, social support, text messaging, and web-based interventions.

Nicotine Replacement Therapy (NRT) and Pharmacotherapy

Evidence regarding the safety and efficacy of NRT to support smoking cessation among pregnant smokers is mixed and based on very few RCTs. In concordance with current U.S. public health agency guidelines, NRT has insufficient evidence to be recommended for routine treatment of tobacco use and dependence during pregnancy (Coleman et al., 2015; Einarson & Riordan, 2009; Jones et al., 2016; Leung & Davies, 2015; Meernik & Goldstein, 2015; Su & Buttenheim, 2014). However, even though NRT and other pharmacological interventions lack sufficient evidence of safety and efficacy, the consensus is that health care providers may consider offering NRT to pregnant women who are heavy smokers and have not been able to quit using other evidence-based methods such as behavioral counseling (Coleman et al., 2015). The rationale behind this consensus is that NRT in controlled doses is safer than smoking (Benowitz et al., 2000). More RCTs are needed to determine the risks and benefits of using NRT and other pharmacological interventions during pregnancy.

A recent Cochrane review of nine RCTs, including eight NRT trials and one trial that offered bupropion in combination with behavioral support, concluded there is weak evidence that using NRT with behavioral support is effective among pregnant women (Coleman et al., 2015). The authors also found no evidence that NRT has a positive or negative impact on pregnancy and infant outcomes.
Table 3-4. States’ Experience with System-Level Interventions and Provider Training

<table>
<thead>
<tr>
<th>State</th>
<th>Experience</th>
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<tbody>
<tr>
<td>Idaho</td>
<td>In Idaho, health department staff conducted a quality improvement process using the Plan, Do, Study, Act improvement model to increase WIC client enrollment in the WIC smoking cessation program, which included quitline referrals. Staff streamlined the referral paperwork and added a fax referral to the Idaho QuitLine. WIC staff were trained on promoting client enrollment in the cessation program (Graff, 2014). Staff knowledge improved, and clients received enhanced tobacco cessation services through referral to the quitline. Although the quality of the evidence is weak, in FY 2013, the WIC smoking cessation program increased enrollment by 18%, and 36% of clients enrolled in the WIC smoking cessation program self-identified as no longer smoking at the end of the program (Graff, 2014). Staff reported increases in contacts between WIC clients and quitline staff after a simple intervention to encourage clients to save the quitline number in their phones so that they recognize the incoming call. Factors influencing the ability of WIC staff to provide a smoking cessation intervention for pregnant women included available time, clinic priorities, staff approaches to clients, and staff training.</td>
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<tr>
<td>New Jersey</td>
<td>New Jersey’s Mom’s Quit Connection (MQC) reported 75% to 85% increase in the use of the Ask, Advise, Refer (AAR) model after conducting clinician training regarding referral skills (McFarland et al., n.d.). The program includes a component that sends providers status updates on referred clients. During the intervention period, the average quit rate among MQC clients was 23%, while another 49% significantly reduced smoking during their pregnancy. In addition, on average, MQC’s Fax to Quit program receives annually between 400 and 500 referrals from its clinician partners. Sixty-nine percent of clients who sought more intensive case management through the program have either quit or substantially reduced their nicotine consumption. An increase in self-referrals followed the addition of an online registration option on the MQC website and Facebook page, which included a “Contact a Quit Coach” feature to encourage enrollment by women unwilling to admit their smoking to their doctor. Other recruitment efforts included two media campaigns, one regarding the dangers of secondhand smoke and the second targeting women who quit during pregnancy but resume postpartum (Southern New Jersey Perinatal Cooperative, 2016).</td>
</tr>
<tr>
<td>North Carolina</td>
<td>In 2011–2012, North Carolina’s You Quit, Two Quit program worked with 8 primary care and obstetric practices with 16 clinical sites to improve evidence-based tobacco use screening and cessation counseling for low-income women of childbearing age, including pregnant and postpartum women (Child Fatality Task Force, n.d.). At the beginning of the 6-month quality improvement initiative, none of the practices were routinely screening and treating women for tobacco use. During the initiative, 100% of pregnant women (n=408) were screened. Sixty-one percent of the pregnant smokers were ready to quit, and 98% of those received a brief counseling intervention. This is in contrast to a national survey of OB/GYNs that found that only 20% were routinely providing the full brief counseling intervention to women who use tobacco and were ready to quit (Coleman-Cowger, 2012).</td>
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There is insufficient evidence of safety and efficacy of bupropion for use among pregnant and postpartum smokers. The one RCT included in the Cochrane Review randomized 11 pregnant women only, and no participants in the intervention group reported abstinence from smoking 9 weeks after enrollment (Coleman et al., 2015). Leung and Davies (2015) reviewed four bupropion studies for safety outcomes, and, although bupropion has been
shown to have positive effects on smoking outcomes, safety during pregnancy remains unclear. One main safety concern is the risk of miscarriage; one quasi-experimental study reported significantly more miscarriages in the group taking bupropion compared with the control group (14.7% vs. 4.5%, \( p=0.009 \)). Although this study had a small sample size of 136 pregnant women, the authors noted that other studies assessing the safety of antidepressants during pregnancy have found similar rates of miscarriage (Chun-Fai-Chan et al., 2005).

Varenicline is another prescription medication used to treat nicotine dependence that has been found to be effective for use in nonpregnant populations but has insufficient evidence of safety and effectiveness in pregnant populations (Leung & Davies, 2015).

Social Support Interventions

Pregnant smokers cited support from family and friends as a facilitator to quitting smoking and staying quit after delivery (Flemming et al., 2015; Graham et al., 2014; Ingall & Cropley, 2010). Social support interventions, however, have limited evidence of effectiveness among pregnant and postpartum women.

A recent Cochrane review identified seven high-quality social support intervention studies and was not able to determine the efficacy of social support provided by a peer or partner on prenatal smoking (average RR 1.21, 95% CI 0.93 to 1.58) (Chamberlain et al., 2017). Another systematic review of partner support for smoking cessation during pregnancy corroborated this finding; three out of four studies included in the review found no effect of the intervention to increase partner support on quit attempts or smoking cessation among pregnant women (Hemsing et al., 2012). Although one cluster RCT found pregnant women enrolled in the intervention were significantly more likely to attempt quitting (38% vs. 23%, \( p < 0.05 \)) and report 7-day abstinence (21% vs. 12%), the authors were unable to isolate the effect of partner support on these outcomes (Hemsing et al., 2012).

Another RCT that evaluated individualized social support for poor rural pregnant smokers found no statistically significant differences in abstinence rates among participants who received pregnancy-specific self-help materials, participants who received a weekly telephone call and 24-hour access to a nurse via a toll-free telephone number, and participants who received both interventions or between participants in the intervention groups compared with the control group (Bullock et al., 2009). Postpartum abstinence among women who lived with a partner who did not smoke was significantly higher (28.1%) compared to women with smoking partners (11.1%), suggesting partner support is critical for maintaining abstinence after delivery and that more research is needed to determine the effectiveness of partner support interventions on preventing pregnant women from resuming smoking postpartum (Bullock et al., 2009). Fang et al. (2004) identified common characteristics of interventions that have been successful in preventing postpartum relapse,
Prenatal Tobacco Cessation Interventions

which include promoting cessation among other smokers that live in the same home and fostering social support among family and friends to remain abstinent.

Social support interventions currently lack evidence of effectiveness. However, considering the influence family and friends can have on supporting quit attempts and remaining abstinent, interventions that focus on helping partners quit and/or encourage partners to be supportive of quitting may hold promise for preventing postpartum relapse.

Text Messaging Interventions

Although text messaging has shown promise for treating tobacco use and dependence among nonpregnant smokers, evidence is limited regarding the efficacy of text messaging interventions for treating tobacco use and dependence among pregnant smokers (Vodopivec-Jamsek et al., 2012). Heminger, Schindler-Ruwisch, and Abroms (2016) identified and described seven mobile health programs promoting prenatal smoking cessation, including five text messaging programs (i.e., Quit4Baby, MiQuit, SMAT, Smoke-freeMOM, and one that used a scheduled gradual reduction approach [SGR]) and two mobile applications (i.e., Quit for You–Quit for Two and SmokeFree Baby). The five text messaging interventions included similar features, such as reminding participants to set a quit date, personalized and interactive messages, a smoking status-tracking feature, and messages to help participants deal with cravings or relapses. Three of the five text messaging interventions (Quit4Baby, MiQuit, and SGR) reported quit rates, feasibility, and satisfaction-related outcomes from pilot studies. Quit4Baby showed promise: 38% of participants reported they quit at the 2-week follow-up, and 54% reported they quit at the 4-week follow-up. However, this pilot study included a very small sample of 20 participants and abstinence was not biochemically verified (Abroms et al., 2015). Although the Quit4Baby pilot had a small sample and no control group, the program was designed as an add-on service to Text4baby, one of the largest text messaging programs in the United States, which may be an appealing recruitment mechanism to participants because they can enroll confidentially through an automated process (Abroms et al., 2015). Patnode et al. (2015) also described two relatively large trials that found effects for personalized text messages.

The MiQuit (N=207) and SGR (N=31) RCT pilot studies also found higher biochemically verified quit rates among the intervention group compared with controls (12.5% vs. 7.8% and 13.4% vs. 7.5%, respectively), but the difference was not statistically significant in either pilot study (Heminger et al., 2016). Results from SMAT, Smoke-free MOM, and the two mobile applications have not been published.

Although there is insufficient evidence regarding the efficacy of text messaging interventions to improve smoking cessation among pregnant women, results from these three pilot studies with relatively small sample sizes indicate that participants liked these types of interventions. Quit4Baby participants agreed that the program was helpful, especially messages that asked participants to track their smoking, messages that provided
social support from a fictitious “quitpal,” and messages that offered behavioral alternatives to smoking (Abroms et al., 2015). Most participants (88%) reported they received just the right number of messages at the 2-week follow-up survey (Abroms et al., 2015). Furthermore, participants’ confidence in their ability to quit increased from baseline to follow-up (Abroms et al., 2015). Satisfaction was also high for participants in MiQuit and SGR; most participants in the MiQuit pilot study (81% to 96%) rated each program feature as “helpful,” and 78% of participants in the SGR pilot reported the highest possible satisfaction rating (Heminger et al., 2016). We identified one other article discussing the development of a text messaging intervention (Txt2commit) to prevent postpartum smoking relapse specifically among inner-city women (Wen et al., 2014). This was a formative paper and did not report smoking outcomes; however, the authors noted the importance of using formal language in text messages to improve perceived credibility (Wen et al., 2014).

Text messaging interventions designed to help pregnant women stop smoking and refrain from smoking after delivery hold promise and warrant further investigation to determine their efficacy and cost-effectiveness. Pew Research Center (2015) found that 95% of Americans own a cell phone and 77% own smartphones. Rates of cell phone ownership are similarly high among blacks (94%), Hispanics (98%), and individuals who make less than $30,000 per year (92%) (Pew Research Center, 2015), suggesting text messaging programs may be particularly useful for reaching vulnerable populations (Wen et al., 2014). Fitzgerald (2012) reported that young Latinos aged 16 to 25 frequently use mobile technology to communicate with their friends, and since 50% of young Latinos send text messages daily, text messaging may hold promise for reaching this vulnerable population.

Web-based Interventions
There is very limited evidence regarding the effectiveness of web-based smoking cessation interventions for pregnant women. We identified one systematic review of evidence-based tobacco cessation strategies with pregnant Latina women that discussed the use of technology (Fitzgerald, 2012), one peer-reviewed article that described the development of a web-based intervention designed to support smoking cessation among pregnant adolescents (Comer & Grassley, 2010), and one that assessed a home-based smoking cessation program for rural pregnant smokers that included a web-based incentives component, which is included in our discussion of incentives as an evidence-based intervention (Harris & Reynolds, 2015).

Fitzgerald (2012) identified one RCT that included a tobacco cessation website in both English and Spanish. Seven-day, self-reported abstinence rates at 12 months were 20.2% for Spanish speakers and 21.0% for English speakers; however, this trial did not report pregnancy status among participants and, therefore, cannot be generalized to pregnant Latina women.
Comer and Grassley (2010) note that web-based tobacco cessation interventions were effective in treating tobacco use and dependence among nonpregnant adolescents and college students and, therefore, hold promise for pregnant adolescents. More research is needed to determine the effectiveness of using the Internet as a modality for prenatal tobacco cessation interventions among special populations, including adolescents, rural, and low-income populations that may not have access to a computer or smartphone.
4. EFFECTS OF POLICY ON TOBACCO CESSION AMONG PREGNANT WOMEN

In this section, we discuss the effects of policy on tobacco cessation among pregnant women, including tobacco control policies such as workplace bans and increases in tobacco taxes, as well as policies relating to Medicaid coverage. Although these approaches are often beyond the control of a tobacco control program, a tobacco control program may have the ability to advocate for policy change.

4.1 Tobacco Control Policies

We scanned studies that specifically evaluated the effects of comprehensive smoke-free policies prohibiting smoking in public places or workplaces on tobacco use among pregnant or postpartum women. In one study, Klein et al. (2014) found that the Ohio Smoke-free Workplace Act was associated with a small, but statistically significant reduction in the odds of preconception smoking in Women, Infants, and Children (WIC) participants.

Although counseling, self-help materials, and incentives are ways to specifically target pregnant smokers, population-based interventions also target and increase cessation rates and would be expected to affect pregnant women. For example, Hawkins et al. (2014) found that smoking cessation rates among pregnant women significantly decreased by half a percentage point for every $1.00 increase in cigarette taxes, equivalent to a 4.8% decrease in the mean smoking rate. Other studies (Adams et al., 2012; Colman et al., 2003; Lien & Evans, 2005; Ringel & Evans, 2001) report similar findings. Colman et al. (2003) estimated that a 10% increase in cigarette taxes produced a 10% increase in the probability that a pregnant woman will quit smoking. This percentage holds when controlling for education, parity, and prepregnancy smoking among various combination of states. Adams et al. (2012) examined the independent effects of higher cigarette taxes and prices, smoke-free policies, and tobacco control spending on maternal smoking before, during, and after a pregnancy during a period in which states changed their policies. They found that a $1.00 increase in taxes and prices increased third-trimester quitting by between 4 and 5 percentage points and a worksite smoking ban increased quitting by the third trimester by an estimated 5 percentage points. Cumulative spending on tobacco control had no effect on pregnancy smoking rates overall.

4.2 Expansion of Medicaid to Cover Cessation Services

The Affordable Care Act (ACA) requires states to provide tobacco cessation services without cost-sharing for pregnant traditional Medicaid beneficiaries effective October 2010. McMenamin, Halpin, and Ganiats (2012) summarized the impact of the ACA provisions on Medicaid coverage of tobacco dependence treatments for pregnant women. From 2009 to 2010, coverage for tobacco-dependence treatments increased from 43 to 51 programs.
covering pharmacotherapy treatments and from 30 to 38 programs covering tobacco cessation counseling. States added additional coverage for counseling in 2011 and 2012. As of 2015, Florida’s Medicaid program covered the nicotine patch, gum, and lozenges; coverage for individual and group counseling varied by plan (Singleterry et al., 2015). The authors concluded that to maximize these benefits, Medicaid programs need to conduct outreach to inform Medicaid-enrolled pregnant smokers of this coverage.

Jarlenski, Bleich, Bennett, Stuart, and Barry (2014) studied the effects of offering presumptive Medicaid eligibility (giving temporary Medicaid coverage) for Medicaid to pregnant women. They found that in the 3 states that adopted presumptive eligibility during the study, presumptive eligibility led to an 11% increase (95% CI 5.916.0; p < 0.01) in smoking cessation after the policy was adopted. Adoption of presumptive eligibility allows for early initiation of prenatal care, because the policy allows women to receive care while their Medicaid applications are pending, thus increasing the likelihood of obtaining cessation services. The authors noted that adoption of presumptive eligibility is associated with earlier receipt of prenatal care and adequate care. However, states that adopt presumptive eligibility or other expedited eligibility procedures would be required to officially modify their Medicaid programs with the federal government, requiring an increased level of cooperation between state Medicaid agencies and providers who serve Medicaid beneficiaries.

The extent to which health care providers are aware of Medicaid tobacco cessation benefits may affect the provision of services to pregnant women. Tong et al. (2015) assessed the awareness of Medicaid tobacco cessation benefits among OB/GYNs, including their knowledge of reimbursement opportunities. In a survey administered to a national stratified random sample of OB/GYNs, they found that 83% of respondents were unaware of their ability to be reimbursed for cessation services. One-third (36.1%) of respondents serving pregnant Medicaid patients reported that reimbursement for cessation services influenced them to increase their cessation services. The authors concluded that wide promotion of the Medicaid tobacco cessation benefit could reduce treatment barriers.

McCallum, Fosson, and Pisu (2014) build a case that funding smoking cessation treatment for Medicaid-eligible populations results in state-level savings. They assessed potential health care savings from tobacco dependence treatments for pregnant women, mothers exposing young children to secondhand smoke, and other adult Medicaid beneficiaries by applying published cost estimates to state-specific data. They showed short-term positive returns on investment for all three groups. Including counseling and NRT, estimated net savings were $157,000 annually for pregnant women and their newborns in Alabama.
Limited information is available regarding the cost-effectiveness of smoking cessation interventions for pregnant women, and studies use a variety of approaches to calculate costs and benefits, making programmatic recommendations based on comparisons of cost-effectiveness across interventions difficult. In a recent systematic review that included 18 studies, Jones et al. (2015) noted that there are few high quality economic studies. Acknowledging that many of the studies included in their review had methodological shortcomings, the authors reported that although one study found that a counseling intervention provided no additional benefit in quality-adjusted life years (QALYs) compared with the usual care, all other studies reviewed found that self-help materials and counseling, independently and combined, provided higher benefits than the cost of the interventions. Another review of economic evaluations of tobacco control programs reported that small investments in cessation programs for pregnant women can cut the incidence of low birthweight in half (Kahende, Loomis, Adhikari, & Marshall, 2009.). Researchers conducting cost-benefit analyses have found positive cost-benefit ratios of up to 1:3 for every dollar spent on interventions, $3 are saved in health-related costs (Ruger & Emmons, 2008).

There is limited economic analyses of financial incentives. However, two studies conducted in the United Kingdom provide some evidence that incentive-based interventions are promising from a cost-effectiveness perspective (Boyd, Briggs, Bauld, Sinclair, & Tappin, 2016; Meernik & Goldstein, 2015).

Cost-effectiveness of interventions might vary for different groups of smokers. For example, as Rugter and Lazer (2012) point out, brief physician’s advice or self-help materials may be most cost-effective for smokers already motivated to quit or for those who categorize themselves as casual or light smokers. However, more intensive interventions that involve the clinician’s time for counseling and resources, such as pharmacotherapy or incentives, may be more cost-effective for smokers who are in a high-risk group.
6. EQUITY CONCERNS RELATING TO SMOKING CESSION AND BIRTH OUTCOMES AMONG PREGNANT AND POSTPARTUM WOMEN

Of particular interest to BTFF is evidence to guide policy and practice regarding interventions that hold promise for increasing equity with regard to birth outcomes, such as low birthweight that can be affected by tobacco use cessation. It is unclear to what extent tobacco use rates contribute to observed racial disparities in birth outcomes; however, studies indicate that disparities in rates of tobacco use by SES are marked. Women who are of lower SES and have lower education levels have the highest smoking prevalence before (34.4%), during (17.6%), and after pregnancy (24.3%) (Tong et al., 2013). Women of lower SES also have lower quit rates during pregnancy (Shipton, Tappin, Vadiveloo, Crossley, Aitken, & Chalmers, 2009). Efforts to reach low-income women may hold promise for improving equity in tobacco use. Low income women are more likely to be enrolled in Medicaid and are therefore more likely to be affected by interventions that inform Medicaid-enrolled pregnant smokers about the availability of cessation coverage, increase state Medicaid and Early and Periodic Screening, Diagnostic and Treatment (EPSDT) programs’ adherence to Public Health Service guidelines, offer presumptive eligibility for Medicaid to pregnant women, or increase awareness among providers of Medicaid tobacco-cessation reimbursement benefits. Low-income women may also be more susceptible to changes in cigarette prices. Hawkins et al. (2014) found that for every $1.00 cigarette tax increase, low-educated white and black mothers decreased smoking by nearly 2 percentage points and smoked between 14 and 22 fewer cigarettes per month. However, although high cigarette excise taxes have been shown to be an effective way to promote cessation, they can impose a significant financial burden on low-income smokers. To reduce the hardship on low-income smokers, efforts to raise cigarette excise taxes may be best combined with specific programs that help low-income smokers quit (Farrelly, Nonnemaker, & Watson, 2012). Women with limited resources are also more likely to respond to incentive-based interventions, such as Baby & Me—Tobacco Free. Indeed, Fitzgerald (2012) asserts that the use of financial incentives may be particularly important for Latina immigrants who are undocumented or uninsured and are unable to visit a health care provider or purchase resources for cessation.

The recent systematic review by Chamberlain et al. (2017) included an equity analysis of the effect of psychosocial interventions among pregnant women categorized as low SES, ethnic, or other vulnerable group, consistent with PRISM-Equity reporting guidelines. Authors found that the pooled effects for behavioral interventions on smoking outcomes were similar when the interventions were provided to women who were poor. The authors also noted that a clear effect was seen with interventions among women from ethnic minority groups, except among indigenous women (four studies). Thus, for the vast majority of Florida’s population, one can assume that significant tailoring of existing
evidence-based interventions is unnecessary. However, interventions are not currently being used by ethnic minority groups at the same rate as whites; therefore, increased targeting of at-risk groups may improve reach and therefore outcomes. According to the Centers for Disease Control and Prevention (CDC), more non-Hispanic whites (34.3%) used counseling and/or medications than did non-Hispanic blacks (28.9%) or Hispanics (19.2%). More whites (60.2) also received a health professional’s advice to quit than did non-Hispanic blacks (55.7%) or Hispanics (42.2%) (Babb, Malarcher, Schauer, Asman, & Jamal, 2017). One potential explanation for this disparity is that pregnant smokers, especially socially disadvantaged women, have reported feeling stigmatized by providers and therefore hesitant to disclose their smoking status (Burgess, Fu, & van Ryn, 2009; Ingall & Cropley, 2010), which would affect referrals and enrollment in cessation programs. This suggests that providers need additional training to avoid stigmatizing their patients.

As noted previously, text messaging interventions may also hold promise for increasing health equity because rates of cell phone ownership are high among blacks, Hispanics, and low-income individuals. These interventions warrant further investigation to determine their efficacy and cost-effectiveness.

Our search did not locate studies describing media campaigns to promote quitlines designed to target high-risk pregnant women, but a recent study among the general population in 10 states found differences by race/ethnicity in how people learn about quitline services. Asian Americans/Pacific Islanders and Hispanics appeared more likely to report hearing about quitlines from media than the other race/ethnic groups (Marshall, Zhang, Malarcher, Mann, King, & Alexander, 2016). This suggests that culturally appropriate tailored campaigns might be warranted to reach certain populations that are unaware of the quitline and in greater need of services. Kennedy et al. (2013) demonstrated that a social marketing campaign tailored to African American women was able to increase calls to the quitline in Richmond, Virginia.
7. DISCUSSION

Our review of the literature was generally consistent with the public health agency guidelines supporting behavioral interventions, such as in-person counseling within the 5As behavioral framework; telephone counseling via quitlines; and pregnancy-specific self-help materials, many of which have been shown to be cost-effective interventions when considering cost savings resulting in the avoidance of health problems in mothers and newborns. WHO is the only public health agency that currently recommends using incentive-based interventions, but our review of the literature reveals that incentives are effective and cost-effective. WHO also recommends social support interventions, whereas our review of the peer-reviewed literature did not reveal sufficient evidence to recommend them.

Our review revealed that even though some interventions help women quit using tobacco during pregnancy, they often relapse after giving birth; hence, the postpartum period is a critical time in which to take advantage of a mother’s efforts to quit using tobacco for the sake of her baby. Fang et al. (2004), in a review of postpartum relapse prevention, concluded that, to be most effective, clinical and social intervention cessation programs should address the needs of the individual woman, address her social network, and be incorporated into routine health care. Health care providers should tailor programs to the individual woman by distinguishing between women with concrete plans to prevent relapse and those who have not considered the possible challenges, and by assessing the dynamics of a couple’s relationship before engaging the woman’s partner in activities to support cessation. Coleman-Cowger (2012) recognize the importance of extending coverage for prenatal smoking cessation services to all pregnant women on Medicaid but note the continued need for relapse prevention in the postpartum period. They suggest a more formal continuing care approach. Programs offering counseling and other behavioral approaches, combined with incentives, appear to be the most promising with regard to preventing relapse in the postpartum period when many women return to smoking. The Baby & Me—Tobacco Free program provides a model of such a continuing care approach.

Although interventions such as counseling and incentives have high efficacy, they may have limited impact due to limited reach. It is also unclear whether they are effective in real-world situations, apart from a randomized trial. However, BTFF can use a health systems change model, which is cost-effective and better able to reach large populations, to encourage health care organizations within the state to incorporate approaches such as counseling and self-help materials that demonstrate high efficacy into their regular practice, while also encouraging a focus on the postpartum period. More intensive interventions with limited reach, such as the Baby & Me—Tobacco Free program, may be worthwhile approaches for low-income, high-risk populations.
8. RECOMMENDATIONS FOR BTFF

Based on the literature reviewed, we make the following recommendations:

In general, we recommend that BTFF focus its efforts on public health interventions that have relatively broad reach and low cost, as recommended in CDC’s Best Practices for Comprehensive Tobacco Control Programs guiding principles for cessation interventions (CDC, 2014) that specify that

"population-wide cessation efforts—specifically, policy, systems, or environmental changes—are most efficient and effective at reaching many people....Although it is appropriate and necessary for comprehensive state tobacco control programs to fund and provide certain cessation treatment services (i.e., to directly deliver cessation counseling and medications through population based approaches such as state quitlines) to certain populations, particularly groups that would otherwise not have access to these services (e.g., the uninsured), the programs’ focus should remain on population-level, strategic efforts to reconfigure policies and systems in ways that normalize quitting and that institutionalize tobacco use screening and intervention within medical care” (p. 40).

Such activities should represent the bulk of the effort to reduce smoking during pregnancy. However, for socioeconomically disadvantaged women and heavier smokers, a more intensive intervention involving incentives may be worthy of consideration.

To maximize effects of Florida’s state resources, we offer the following recommendations for BTFF:

- Continue to work with health care organizations to support incorporation of the AAR protocol and counseling interventions as part of routine prenatal and postpartum care such that healthcare providers routinely assess smoking status and provide pre- and post-natal smoking cessation services to their patients and referrals to BTFF-provided services (i.e. quitline with pregnancy-tailored counseling). This includes systems change interventions and training currently offered by AHECs to increase use of the AAR protocol within health systems and BTFF’s plans to implement the AAR framework within WIC offices. Proceed with BTFF’s current plan to work with WIC on electronic referral systems to the Quitline.

To prevent relapse, postpartum care providers, in particular, should address barriers and stresses experienced by women. Health care providers should be trained to recognize that women with low SES, low educational attainment, Medicaid insurance, and women who are heavier smokers and who, historically, have had less success with quitting (e.g., African American women) may need more intensive interventions. Meernick and Goldstein (2015) suggest that clinicians use a risk assessment tool to identify high-risk women (e.g., women intending to remain smoke-free only during pregnancy or living with another smoker) for more intensive support. Make systems-level interventions and training accessible to larger numbers of prenatal care providers and other providers who attend to women and infants during the postpartum period. When working with OB/GYN practices and other providers who
Prenatal Tobacco Cessation Interventions

cater to pregnant and postpartum women, offer pregnancy-specific cessation training, including training that specifically addresses how to work with socioeconomically disadvantaged women to minimize stigma and help them overcome barriers. Support the implementation of automated electronic referral systems to the state quitline.

- Consider additional outreach to promote the pregnancy-specific counseling available through Florida’s quitline (for example, updating the website to include information about services available for pregnant women and downloadable self-help guides tailored for pregnant women).

- Consider offering a combination of behavioral and incentive strategies for socioeconomically disadvantaged women, such as the Baby & Me—Tobacco Free cessation program currently operating in select sites within Florida, to reduce the high rate of relapse that occurs during the postpartum period. BTFF could partner with organizations that serve socioeconomically disadvantaged women (e.g., WIC) to promote Baby & Me—Tobacco Free, or a similar program, to women who are at highest risk. If such a program is offered, it would be important to conduct an evaluation. The evaluation could examine optimal types and amounts of incentives for the population being served. The evaluation should also include smoking and pregnancy outcomes of women who chose not to enroll or who were not successful in the program.

- Revisit text messaging interventions once more efficacy research is published. Although text messaging interventions may hold promise, particularly for reaching special populations, they can be very expensive to develop and test.

- Inform Medicaid subscribers about the ACA mandate requiring Medicaid to cover cessation services for pregnant women. Conduct a campaign to ensure that prenatal and postpartum care providers are aware of Medicaid reimbursement for tobacco cessation services and that pregnant Medicaid enrollees are aware of the coverage.

- Continue to support comprehensive tobacco-free policies and review secondary data (e.g., PRAMS) before and after implementation of new policies to determine their effects on prenatal smoking rates. Florida’s current cigarette tax of $1.34 per pack increased by $1.00 per pack in 2009, but is still less than the national average of $1.69 per pack (Campaign for Tobacco-Free Kids, 2017).
REFERENCES


References


Appendix A:
Peer-Reviewed Literature Search Strategies by Database

First Search for Prenatal Tobacco Cessation Interventions

**PubMed**


#2 Add Search ((("Smoking/therapy"[Mesh] OR "Tobacco Use/therapy"[Mesh]) OR "Tobacco Use Disorder/therapy"[Mesh]) OR "Tobacco Use Cessation"[Mesh]) OR "Smoking prevention and control"[Mesh]) NOT (#1 OR #2)) Filters: Publication date from 2002/01/01; English 293
Prenatal Tobacco Cessation Interventions


Web of Science

#4 73 TITLE: ((nicotine OR tobacco OR smoking OR smokeless OR cigarette* OR "smoke free" OR smoker*) AND (cessation* OR quit* OR stop* OR treat* OR therap* OR prevent* OR policy OR policies) AND (pregnan* OR prenatal* OR pre-natal* OR preconception OR postnatal* OR post-natal* OR postpartum OR post-partum OR newborn* OR mother*) AND (quitline* OR assess* OR program* OR intervention* OR policy OR policies OR 5As OR "5A's" OR "5 A's" OR "5 A's" OR "evidence based" OR "systems change*" OR recommend* OR counselling OR counseling OR "public health systems research" OR "organizational change*" OR "organizational innovation" OR trial* OR "intervention stud*" OR "evaluation stud*" OR "program evaluation*" OR evaluat* OR organization*)) AND LANGUAGE: (English) Refined by: COUNTRIES/TERRITORIES: ( USA ) AND DOCUMENT TYPES: ( ARTICLE ) Indexes=SCI-EXPANDED, SSCI, CPCI-S, CPCI-SSH Timespan=2002-2017

#3 102 TITLE: ((nicotine OR tobacco OR smoking OR smokeless OR cigarette* OR "smoke free" OR smoker*) AND (cessation* OR quit* OR stop* OR treat* OR therap* OR prevent* OR policy OR policies) AND (pregnan* OR prenatal* OR pre-natal* OR preconception OR postnatal* OR post-natal* OR postpartum OR post-partum OR newborn* OR mother*) AND (quitline* OR assess* OR program* OR intervention* OR policy OR policies OR 5As OR "5A's" OR "5 A's" OR "5 A's" OR "evidence based" OR "systems change*" OR recommend*
OR counselling OR counseling OR "public health systems research" OR "organizational change*" OR "organizational innovation" OR trial* OR "intervention stud*" OR "evaluation stud*" OR "program evaluation*" OR evaluat* OR organization*) AND LANGUAGE: (English) Refined by: COUNTRIES/TERRITORIES: ( USA ) Indexes=SCI-EXPANDED, SSCI, CPCI-S, CPCI-SSH Timespan=2002-2017

#2 18 TITLE: ((nicotine OR tobacco OR smoking OR smokeless OR cigarette* OR "smoke free" OR smoker*) AND (cessation* OR quit* OR stop* OR treat* OR therap* OR prevent* OR policy OR policies) AND (pregnan* OR prenatal* OR pre-natal* OR preconception OR postnatal* OR post-natal* OR postpartum OR post-partum OR newborn* OR mother*) AND (quitline* OR assess* OR program* OR intervention* OR policy OR policies OR 5As OR "5A's" OR "5 As" OR "5 A's" OR "evidence based" OR "systems change*" OR recommend* OR counselling OR counseling OR "public health systems research" OR "organizational change*" OR "organizational innovation" OR trial* OR "intervention stud*" OR "evaluation stud*" OR "program evaluation*" OR evaluat* OR organization*)) AND LANGUAGE: (English) Refined by: DOCUMENT TYPES: ( REVIEW ) Indexes=SCI-EXPANDED, SSCI, CPCI-S, CPCI-SSH Timespan=2002-2017

#1 196 TITLE: ((nicotine OR tobacco OR smoking OR smokeless OR cigarette* OR "smoke free" OR smoker*) AND (cessation* OR quit* OR stop* OR treat* OR therap* OR prevent* OR policy OR policies) AND (pregnan* OR prenatal* OR pre-natal* OR preconception OR postnatal* OR post-natal* OR postpartum OR post-partum OR newborn* OR mother*) AND (quitline* OR assess* OR program* OR intervention* OR policy OR policies OR 5As OR "5A's" OR "5 As" OR "5 A's" OR "evidence based" OR "systems change*" OR recommend* OR counselling OR counseling OR "public health systems research" OR "organizational change*" OR "organizational innovation" OR trial* OR "intervention stud*" OR "evaluation stud*" OR "program evaluation*" OR evaluat* OR organization*)) AND LANGUAGE: (English) Indexes=SCI-EXPANDED, SSCI, CPCI-S, CPCI-SSH Timespan=2002-2017

CINAHL

S2 TI (nicotine OR tobacco OR smoking OR smokeless OR cigarette* OR "smoke free" OR smoker*) AND (cessation* OR quit* OR stop* OR treat* OR therap* OR prevent* OR policy OR policies) AND (pregnan* OR prenatal* OR pre-natal* OR preconception OR postnatal* OR post-natal* OR postpartum OR post-partum OR newborn* OR mother*) AND (assess* OR program* OR intervention* OR policy OR policies OR quit* OR treat* OR 5As OR "5A's" OR "5 As" OR "5 A's" OR "evidence based" OR "systems change*" OR recommend* OR counselling OR counseling OR "public health systems research" OR "organizational change*" OR "organizational innovation" OR trial* OR "intervention stud*" OR "evaluation stud*" OR "program evaluation*" OR evaluat* OR organization*) Limiters - Published Date: 20020101-20171231; English Language; Exclude MEDLINE records 54

S1 (MH "Smoking+/TH/PC" OR MH "Smoking Cessation Programs" OR MH "Smoking Cessation") AND (MH "Expectant Mothers" OR MH "Pregnancy+" OR MH "Prenatal Care" OR MH "Postnatal Period+" OR MH "Postnatal Care+" OR MH "Prepregnancy Care" OR MH "Postpartum Care (Saba CCC)") AND (MH "Professional Practice, Evidence-Based+" OR MH "Organizational Change" OR MH "Intervention Trials" OR MH "Hospital Policies" OR MH "Policy Studies" OR MH "Organizational Policies" OR MH "Public Policy" OR MH "Health Policy
Prenatal Tobacco Cessation Interventions

Studies" OR MH "Policy Making" OR MH "Health Policy" OR MH "Counseling+" OR MH "Clinical Trials+" OR MH "Evaluation" OR MH "Program Evaluation" OR MH "Evaluation Research") Limiters - Published Date: 20020101-20171231; English Language; Exclude MEDLINE records

PsycINFO
S2 (MM "Prenatal Care" OR MM "Pregnancy" OR MM "Adolescent Pregnancy" OR MM "Postnatal Period") AND MM "Smoking Cessation" AND (MM "Evidence Based Practice" OR MM "Behavior Modification" OR MM "Prevention" OR MM "Health Care Policy" OR MM "Policy Making" OR MM "Counseling" OR MM "Treatment" OR MM "Organizational Change" OR MM "Innovation" OR MM "Clinical Trials" OR MM "Intervention" OR MM "Treatment Effectiveness Evaluation" OR MM "Program Evaluation" OR MM "Educational Program Evaluation" OR MM "Mental Health Program Evaluation") AND ZY "us" Limiters - Publication Year: 2002-2017; English 26

S1 TI ( (nicotine OR tobacco OR smoking OR smokeless OR cigarette* OR "smoke free" OR smoker*) AND (cessation* OR quit* OR stop* OR treat* OR therap* OR prevent* OR policy OR policies) AND (pregnancy* OR prenatal* OR "pre-natal*" OR preconception OR postnatal* OR post-natal* OR postpartum OR post-partum OR newborn* OR mother*) AND (assess* OR program* OR intervention* OR policy OR policies OR quit* OR treat* OR 5As OR "5A's" OR "5 As" OR "5 A's" OR "evidence based" OR "systems change*" OR recommend* OR counselling OR counseling OR "public health systems research" OR "organizational change*" OR "organizational innovation" OR "evaluation stud*" OR "program evaluation*" OR evaluat* OR organization*) ) AND ZY "us" Limiters - Publication Year: 2002-2017; English 55

Sociological Abstracts
S1 TI (assess* OR program* OR intervention* OR policy OR policies OR quit* OR treat* OR 5As OR "5A's" OR "5 As" OR "5 A's" OR "evidence based" OR "systems change*" OR recommend* OR counselling OR counseling OR "public health systems research" OR "organizational change*" OR "organizational innovation" OR trial* OR "intervention stud*" OR "program evaluation*" OR evaluat* OR organization*) AND TI (nicotine OR tobacco OR smoking OR smokeless OR cigarette* OR "smoke free" OR smoker*) AND TI (cessation* OR quit* OR stop* OR treat* OR therap* OR prevent* OR policy OR policies) AND TI (pregnancy* OR prenatal* OR "pre-natal*" OR preconception OR postnatal* OR "post-natal*" OR postpartum OR "post-partum" OR newborn* OR mother*)

Limited by: Date: From 2002 to 2017 Language: English 6

S2 SU (assess* OR program* OR intervention* OR policy OR policies OR quit* OR treat* OR 5As OR "5A's" OR "5 As" OR "5 A's" OR "evidence based" OR "systems change*" OR recommend* OR counselling OR counseling OR "public health systems research" OR "organizational change*" OR "organizational innovation" OR trial* OR "intervention stud*" OR "program evaluation*" OR evaluat* OR organization*) AND SU (nicotine OR tobacco OR smoking OR smokeless OR cigarette* OR "smoke free" OR smoker*) AND SU (cessation* OR quit* OR stop* OR treat* OR therap* OR prevent* OR policy OR policies) AND SU (cessation* OR quit* OR stop* OR treat* OR therap* OR
Second Search to Identify Economic Evaluations of Prenatal Tobacco Cessation Interventions

**PubMed**


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prevent* OR policy OR policies) AND TI (pregnan* OR prenatal* OR "pre-natal*" OR preconception OR postnatal* OR "post-natal*" OR postpartum OR "post-partum" OR newborn* OR mother*) Limited by: Date: From 2002 to 2017 Language: English 9
Prenatal Tobacco Cessation Interventions

Resources/economics"[Mesh] OR "Health Resources/utilization"[Mesh] OR "Health Promotion/economics"[Mesh]]) Filters: Publication date from 2002/01/01; English 36


Web of Science

#4 83 TOPIC: ((nicotine OR tobacco OR smoking OR smokeless OR cigarette* OR "smoke free" OR smoker*) AND (cessation* OR quit* OR stop* OR treat* OR therap* OR prevent* OR policy OR policies) AND (pregnan* OR prenatal* OR pre-natal* OR preconception OR postnatal* OR post-natal* OR post-partum OR post-partum OR newborn* OR mother*) AND ("cost benefit*" OR "cost effectiveness" OR cost* NEAR/2 implement*)) AND LANGUAGE: (English) Indexes=SCI-EXPANDED, SSCI, CPCI-S, CPCI-SSH Timespan=2002-2017

#3 14 TITLE: ((nicotine OR tobacco OR smoking OR smokeless OR cigarette* OR "smoke free" OR smoker*) AND (cessation* OR quit* OR stop* OR treat* OR therap* OR prevent* OR policy OR policies) AND (pregnan* OR prenatal* OR pre-natal* OR preconception OR postnatal* OR post-natal* OR post-partum OR post-partum OR newborn* OR mother*) AND (cost OR costs OR economic*)) AND LANGUAGE: (English) Indexes=SCI-EXPANDED, SSCI, CPCI-S, CPCI-SSH Timespan=2002-2017

#2 53 TOPIC: ((nicotine OR tobacco OR smoking OR smokeless OR cigarette* OR "smoke free" OR smoker*) AND (cessation* OR quit* OR stop* OR treat* OR therap* OR prevent* OR policy OR policies) AND (pregnan* OR prenatal* OR pre-natal* OR preconception OR postnatal* OR post-natal* OR post-partum OR post-partum OR newborn* OR mother*) AND (quitline* OR assess* OR program* OR intervention* OR policy OR policies OR 5As OR "5A’s" OR "5 As" OR "5 A’s" OR "evidence based" OR "systems change*" OR recommend* OR counselling OR counseling OR "public health systems research" OR "organizational change*" OR "organizational innovation" OR trial* OR "intervention stud*" OR "evaluation stud*" OR "program evaluation*" OR evaluat* OR organization*) AND (cost OR costs OR economic*)) AND LANGUAGE: (English) Refined by: DOCUMENT TYPES: ( REVIEW ) Indexes=SCI-EXPANDED, SSCI, CPCI-S, CPCI-SSH Timespan=2002-2017

#1 345 TOPIC: ((nicotine OR tobacco OR smoking OR smokeless OR cigarette* OR "smoke free" OR smoker*) AND (cessation* OR quit* OR stop* OR treat* OR therap* OR prevent* OR policy OR policies) AND (pregnan* OR prenatal* OR pre-natal* OR preconception OR
postnatal* OR post-natal* OR postpartum OR post-partum OR newborn* OR mother*) AND (quitline* OR assess* OR program* OR intervention* OR policy OR policies OR 5As OR "5A’s" OR "5 As" OR "5 A’s" OR "evidence based" OR "systems change*" OR recommend* OR counselling OR counseling OR "public health systems research" OR "organizational change*" OR "organizational innovation" OR trial* OR "intervention stud*" OR "evaluation stud*" OR "program evaluation*" OR evaluat* OR organization*) AND (cost OR costs OR economic*) AND LANGUAGE: (English) Indexes=SCI-EXPANDED, SSCI, CPCI-S, CPCI-SSH Timespan=2002-2017

**CINAHL**

S2 (nicotine OR tobacco OR smoking OR smokeless OR cigarette* OR "smoke free" OR smoker*) AND (cessation* OR quit* OR stop* OR treat* OR therap* OR prevent* OR policy OR policies) AND (pregnan* OR prenatal* OR pre-natal* OR preconception OR postnatal* OR post-natal* OR postpartum OR post-partum OR newborn* OR mother*) AND (cost OR costs OR economic*) Limiters - Published Date: 20020101-20171231; English Language; Exclude MEDLINE records 72

S1 (MH "Smoking+/TH/PC" OR MH "Smoking Cessation Programs" OR MH "Smoking Cessation") AND (MH "Expectant Mothers" OR MH "Pregnancy+" OR MH "Prenatal Care" OR MH "Postnatal Period+" OR MH "Postnatal Care+" OR MH "Prepregnancy Care" OR MH "Postpartum Care (Saba CCC)") AND (MH "Costs and Cost Analysis" OR MH "Cost Benefit Analysis" OR MH "Economics" OR MH "Health Care Costs" OR MH "Smoking/EC" OR MH "Smoking Cessation Programs/EC") Limiters - Published Date: 20020101-20171231; English Language; Exclude MEDLINE records 15

**PsycINFO**


S1 TI ( (nicotine OR tobacco OR smoking OR smokeless OR cigarette* OR "smoke free" OR smoker*) AND (cessation* OR quit* OR stop* OR treat* OR therap* OR prevent* OR policy OR policies) AND (pregnan* OR prenatal* OR pre-natal* OR preconception OR postnatal* OR post-natal* OR postpartum OR post-partum OR newborn* OR mother*) AND (cost OR costs OR economic*) ) OR SU ( (nicotine OR tobacco OR smoking OR smokeless OR cigarette* OR "smoke free" OR smoker*) AND (cessation* OR quit* OR stop* OR treat* OR therap* OR prevent* OR policy OR policies) AND (pregnan* OR prenatal* OR pre-natal* OR preconception OR postnatal* OR post-natal* OR postpartum OR post-partum OR newborn* OR mother*) AND (cost OR costs OR economic*) ) OR KW ( (nicotine OR tobacco OR smoking OR smokeless OR cigarette* OR "smoke free" OR smoker*) AND (cessation* OR quit* OR stop* OR treat* OR therap* OR prevent* OR policy OR policies) AND (pregnan* OR prenatal* OR pre-natal* OR preconception OR postnatal* OR post-natal* OR postpartum OR post-partum OR newborn* OR mother*) AND (cost OR costs OR economic*) ) Limiters - Publication Year: 2002-2017; English 20
Sociological Abstracts

S1 ti((cost OR costs OR economic*) AND (nicotine OR tobacco OR smoking OR smokeless OR cigarette* OR "smoke free" OR smoker*) AND (cessation* OR quit* OR stop* OR treat* OR therap* OR prevent* OR policy OR policies) AND (pregnan* OR prenatal* OR "pre-natal*" OR preconception OR postnatal* OR "post-natal*" OR postpartum OR "post-partum" OR newborn* OR mother*)) AND la.exact("English") AND pd(2002-2017) 0

S2 su((cost OR costs OR economic*) AND (nicotine OR tobacco OR smoking OR smokeless OR cigarette* OR "smoke free" OR smoker*) AND (cessation* OR quit* OR stop* OR treat* OR therap* OR prevent* OR policy OR policies) AND (pregnan* OR prenatal* OR "pre-natal*" OR preconception OR postnatal* OR "post-natal*" OR postpartum OR "post-partum" OR newborn* OR mother*)) AND la.exact("English") AND pd(2002-2017) 0

S3 ab((cost OR costs OR economic*) AND (nicotine OR tobacco OR smoking OR smokeless OR cigarette* OR "smoke free" OR smoker*) AND (cessation* OR quit* OR stop* OR treat* OR therap* OR prevent* OR policy OR policies) AND (pregnan* OR prenatal* OR "pre-natal*" OR preconception OR postnatal* OR "post-natal*" OR postpartum OR "post-partum" OR newborn* OR mother*)) AND la.exact("English") AND pd(2002-2017) 15