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## Perceptions of emerging tobacco products and nicotine replacement therapy among pregnant women and women planning a pregnancy☆

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### ABSTRACT

The increasing availability of emerging non-combusted tobacco products (snus, dissolvables, and electronic nicotine delivery systems or ENDS) may have implications for pregnant women and women of reproductive age. We conducted 15 focus groups to explore how women perceive emerging non-combusted tobacco products and nicotine replacement therapy (NRT) in general, and during pregnancy. Sessions were held in 2013 in four U.S. cities. Participants were 18–40 years old and were pregnant smokers, pregnant quitters, or smokers planning a pregnancy. Responses were coded and analyzed to identify key themes using NVivo 10.0 qualitative software (QSR). Several themes emerged from focus groups. Participants generally found snus unappealing, but viewed dissolvables as a discreet and stigma-free way to use tobacco during pregnancy. Participants perceived NRT as ineffective and having undesired side effects. ENDS were thought to offer advantages over cigarettes, including use in smoke-free areas, lower cost, appealing flavors, and fewer health effects, and were seen by some as a potential quit aid. Some participants, however, worried that the lack of natural stopping point could lead to excessive use. Many participants felt that the use of any tobacco or NRT product is harmful during pregnancy. Women seeking to reduce health risks or stigma related to smoking during pregnancy may perceive advantages of using some emerging products over cigarettes. These findings can inform future public health efforts to reduce risks associated with tobacco product use among women of reproductive age.

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### 1. Introduction

Smoking during pregnancy remains a major preventable cause of maternal and infant morbidity and mortality and is causally associated with ectopic pregnancy, preterm delivery, placental abruption, placenta previa, and perinatal mortality (U.S. Department of Health and Human Services, 2014). An estimated 10% of pregnant women in the U.S. smoke cigarettes, exposing over 400,000 fetuses annually to nicotine and other toxicants (U.S. Department of Health and Human Services, 2014; Tong et al., 2013). Nicotine is a reproductive toxicant (State of California Environmental Protection Agency, 2016), and has adverse effects on pregnancy outcomes and fetal brain and lung development (U.S. Department of Health and Human Services, 2014). Because

nicotine use during pregnancy in any form has health risks, nicotine replacement therapy (NRT) should only be considered if behavioral approaches fail and after discussion between a woman and her health care provider regarding the potential risks and benefits (Food and Drug Administration, 2016; American College of Obstetricians and Gynecologists, 2011).

The tobacco landscape has changed dramatically in recent years with the introduction and promotion of non-combusted products such as snus (moist snuff packaged in pouches that resemble small tea bags), dissolvable tobacco products (finely milled tobacco pressed into tablets, strips, or sticks), and electronic nicotine delivery systems (ENDS) (devices that utilize a heating element that vaporizes a liquid solution such as propylene glycol combined with nicotine and flavorings) including electronic cigarettes. Public health concerns related to the increased availability of non-combusted products include that they might appeal to individuals who otherwise would not have used tobacco products or to smokers who otherwise would have quit tobacco products entirely (U.S. Department of Health and Human Services, 2014). Furthermore, messages implying that non-combusted products are safe (often without discussing the health risks) appear frequently

*Abbreviations:* ENDS, electronic nicotine delivery systems; NRT, nicotine replacement therapy; FDA, Food and Drug Administration.

☆ Disclaimer: the findings and conclusions in this report are those of the authors and do not necessarily represent FDA or CDC positions or policies.

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in the media (Electronic Cigarette—cigarette: Featured on The Doctors TV Show, 2010; International Vape Group, 2016; Vapour Art, 2016; RJ Reynolds, 2016; Daily Mail, 2013; British American Tobacco, 2016) and could influence consumers' tobacco use behaviors.

Pregnant smokers are generally aware that smoking causes fetal harm and are motivated to quit smoking or reduce their exposure to harmful chemicals (Tong et al., 2008, 2013; Polen et al., 2105). Therefore, pregnant women and those planning a pregnancy may be particularly susceptible to messages regarding the health effects non-combusted products. Limited data suggest this is the case; in a 2015 survey of a convenience sample of pregnant women, 43% of the entire sample reported that electronic cigarettes are less harmful to a fetus than conventional cigarettes and 74% of ever-electronic cigarette users reported that reducing harm was a reason for past use (Mark et al., 2015).

In the current study, we assessed women's perceptions toward emerging non-combusted tobacco and NRT products. Specifically, we conducted qualitative research among pregnant smokers, pregnant quitters, and female smokers planning a pregnancy to address two research questions: 1) How do women perceive emerging non-combusted tobacco products and NRT use in general and during pregnancy? and 2) How do women perceive the health risks associated with these products?

## 2. Methods

The authors developed a screening questionnaire and facilitator's guide and tested it in two pilot focus groups conducted in Atlanta, Georgia. Screening questionnaires were designed to collect basic demographic information and to ensure participants met inclusion criteria (age 18–40 years, currently smoking and pregnant or planning to become pregnant in the next year; pregnant and had quit smoking and remained abstinent for at least 30 days). Topics in the facilitator's guide included tobacco use history, familiarity with emerging tobacco products (snus, dissolvables, electronic cigarettes or ENDS) and NRT, general perceptions of emerging products and NRT, perceptions of emerging products and NRT when used during pregnancy, and health effects of emerging products and NRT in general and during pregnancy. Pilot study findings were used to refine the two instruments. Fifteen focus groups were conducted between September and November 2013 in Memphis, Tennessee; Philadelphia, Pennsylvania; Oklahoma City, Oklahoma; and Billings, Montana (Table 1). City selection was based on the prevalence of smoking among pregnant women. Two of the 15 groups were conducted in Spanish; the remaining groups were conducted in English. Committees for the Protection of Human Subjects from CDC and RTI International reviewed and approved the study protocol. Prior to participating in the focus group discussion, each participant signed an informed consent form agreeing to participate in the study and to have discussions observed and audio and video recorded.

Professional market research facilities recruited participants using their proprietary databases. All respondents were screened for eligibility by telephone. Because we relied on a convenience sample, data were not collected for nonparticipants. A total of 102 women were recruited, with an average of 7 women per group (groups ranged from 5 to 9 participants; one informant interview was conducted with a single participant). Except for the two groups conducted with Spanish-speaking Hispanic women, groups were not segmented by race or ethnicity. An

experienced female moderator conducted the focus groups, which were held at the market research facilities and lasted approximately 90 min. Study staff observed the groups via the video stream or from the facilities' observation room. Women were shown specific products at the time the product category was introduced into the discussion (Table 2). Products were introduced in rotating order to minimize order bias. At the conclusion of the groups, participants were given a brochure describing the health effects of smoking during pregnancy and resources for quitting or staying quit (including the National Quitline number 1-800-QUIT-NOW and online resources), and monetary compensation of \$75.

Researchers followed established procedures to analyze data (Krueger and Casey, 2000; Southwell et al., 2005). Audio tapes were transcribed and uploaded into a qualitative software program (QSR NVivo 10.0). Data were segmented into three groups: pregnant smokers, pregnant quitters, and smokers planning a pregnancy. The research team coded the responses according to a set of codes developed *a priori* that represented key constructs, including general perceptions related to non-combusted products and NRT and perceptions of health risks associated with non-combusted products and NRT. Emergent codes were developed for responses that did not fit with *a priori* codes. The research team identified key themes. To determine inter-coder reliability, three analysts independently coded segments from a transcript. We calculated Krippendorff's alpha (Hayes and Krippendorff, 2007) for each category and found adequate agreement with alpha exceeding 0.70 for all categories. The research team then organized the key themes around the two research questions. The goal of this formative study was to identify the range of perceptions surrounding the use of emerging tobacco products and NRT, and not to quantify the frequency of responses or consensus of opinion. Throughout the report, quotes from participants are used to illustrate the themes.

## 3. Results

Participant characteristics are described in Table 3. Forty-two percent of participants were smokers planning to become pregnant, 31% were pregnant smokers, and 26% were pregnant quitters. Nearly half (49%) were non-Hispanic white, 24% were non-Hispanic African American, and 22% were Hispanic. Almost two thirds (61%) had at least some college education. One third (33%) had tried or were currently using products other than traditional cigarettes, including snus, chewing tobacco, hookah, and electronic cigarettes. Demographic characteristics varied by pregnancy/smoking status (Table 3).

### 3.1. Prior experiences with tobacco and NRT

Most current smokers had tried in the past to quit; methods included NRT, electronic cigarettes, and "cold turkey." Women often cited stress as the reason for subsequent relapse. Motivations for quitting during the current pregnancy included a desire to protect the health of their babies and a decreased desire to smoke, often related to nausea.

Many current smokers reported that they had tried to quit in preparation for or after becoming pregnant, or had cut down on the number of cigarettes smoked per day.

**Table 1**  
Location and segmentation of focus groups, U.S., 2013.

Billings, MT		Oklahoma City, OK		Memphis, TN		Philadelphia, PA	
Pregnant	Planning	Pregnant	Planning	Pregnant	Planning	Pregnant	Planning
Smokers children	Smokers children	Smokers no children <sup>a</sup>	Smokers children	Smokers no children	Smokers children	Quitters children	Smokers no children
Smokers no children		Quitters children	Smokers no children <sup>a</sup>	Quitters children	Smokers no children		
Quitters no children		Quitters children					

<sup>a</sup> Spanish speaking.

**Table 2**  
Products viewed by study participants of focus groups, U.S. 2013.

Product	Brand
Electronic cigarettes/ENDS <sup>a</sup>	Blu Njoy E-Go-TTank
Snus	Camel Marlboro
Dissolvables	Camel orbs Camel sticks Camel strips
Nicotine gum	Nicorette NICOr relief
Nicotine patch	Nicoderm CQ Equate
Nicotine lozenges	Commit Generic brand

<sup>a</sup> Electronic nicotine delivery systems.

## 3.2. Perceptions related to non-combusted tobacco products and NRT

### 3.2.1. General, not specific to pregnancy

**3.2.1.1. Product familiarity.** Many participants were unfamiliar with snus. Those familiar with snus often associated it with chewing tobacco and spitting, and felt the product was intended for people who already used chewing tobacco, especially men. Others associated it with sports or the workplace (where smoking is prohibited). Very few participants were familiar with dissolvables, and none had tried them. In contrast, many participants were familiar with ENDS and NRT, through

advertising, use by family members or friends, past experimentation, or current use.

**3.2.1.2. Product appeal.** While most women expressed that snus was unattractive and unappealing, referring to it as “nasty” or “gross,” a few found it intriguing or noted that the lack of an odor would be an advantage over smoking. Women were divided on whether snus delivers more or less nicotine than smoking.

“So this [snus] wouldn’t appeal to me. Just - I don’t want that in my mouth.” (Pregnant quitter).

“And it’s not nasty, because it’s all contained in a sweet little pouch. It’s not like you got dip leaves coming up and - it’s more appealing to the ladies. If you dip with this, in the little pouch that you can just toss out...” (non-pregnant smoker).

Reactions to dissolvable products were also mixed. Women described them as “weird,” “cool,” and “like a mint,” or uninteresting/medicinal-looking. Many noted that these products would probably be most often used by smokers in places where smoking was not allowed. Some were concerned about high nicotine content in these products.

“I might be interested in using it. Only for the fact because I think you can be more discreet with it, and ... I think it’s convenient.” (pregnant quitter).

“I think it would also be too much nicotine all at once.” (pregnant smoker).

Participants were generally positive about the appearance of ENDS products, calling them “cute,” “cool,” or “like a new toy.” Participants reported trying ENDS for reasons such as the cheaper price, no ash or unpleasant odors, use in smoke-free areas, appealing flavors, or to help with smoking cessation. Others reported desirable similarities between ENDS and traditional cigarettes, including comparable hand-to-mouth motions, and being able to see the exhaled “vapor.” Some noted that ENDS are less harmful than regular cigarettes, and a few reported that they could use ENDS around their children instead of smoking.

“...the flavor kinds...I would almost rather do that than smoke a cigarette. It tastes so good...” (pregnant smoker).

“I think the idea behind it—is that because it’s water vapor you’re not getting some of the tar and some of the other things you get out of a regular cigarette.” (pregnant smoker).

“...you feel a little safer, being in the car maybe with your kids.” (pregnant quitter).

A few women who tried using ENDS to quit smoking reported becoming dual users. Others worried that they used their ENDS excessively.

“What threw me off with them [electronic cigarettes] was that there’s no end point. Like if I’m smoking a regular cigarette, I know I got five and a half, 6 minutes, then I’m out. But I could smoke [electronic cigarettes] all day long, and next thing I know, I been outside 30 minutes and I’m like oh God, I got to go back to work or whatever.” (non-pregnant smoker).

Women generally had negative views toward NRT. Many felt the products were not effective because they or someone they knew had tried them and had not been able to quit, and many complained about the bad taste or side effects, such as bad dreams, nausea, or rashes. Others commented that the products appear medicinal, are boring, taste bad, can deliver too much nicotine or can be addictive themselves, or do not replace aspects of smoking other than nicotine.

“I would not try those. I would rather quit cold turkey and be absolutely bat— crazy...than to trade one chemical for another chemical.” (non-pregnant smoker).

“If they want to make quitting smoking more exciting they need to make something that actually tastes good or something.” (non-pregnant smoker).

“The patch can give you a nicotine overdose, so it’s scary, smoking and wearing it.” (pregnant smoker).

A few women who had not tried NRT in the past said they were interested in trying it in the future to quit smoking. Regardless of their

**Table 3**  
Characteristics of focus group participants, pregnant smokers, pregnant quitters, and non-pregnant smokers planning a pregnancy, U.S. 2013 (N = 102).

Characteristic	Pregnant smokers (n = 32)	Pregnant quitters (n = 27)	Smokers planning to become pregnant (n = 43)
Location			
Billings, MT	53% (17)	30% (8)	19% (8)
Memphis, TN	22% (7)	19% (5)	28% (12)
Oklahoma City, OK	25% (8)	48% (13)	35% (15)
Philadelphia, PA	0% (0)	4% (1)	19% (8)
Have children at home	28% (9)	67% (18)	49% (21)
Days smoke per week			
1 to 2	6% (2)	NA	2% (1)
3 to 4	13% (4)	NA	19% (8)
5 to 6	16% (5)	NA	12% (5)
7	66% (21)	NA	56% (24)
Missing	0	0	12% (5)
Use other tobacco products <sup>a</sup>	28% (9)	19% (5)	47% (20)
Age			
18–23	41% (13)	7% (2)	14% (6)
24–29	44% (14)	22% (6)	37% (16)
30–35	13% (4)	33% (9)	28% (12)
36–40	3% (1)	37% (10)	21% (9)
Race/Ethnicity			
Caucasian, non-Hispanic	41% (13)	51% (14)	53% (23)
African American, non-Hispanic	19% (6)	29% (8)	23% (10)
Other, non-Hispanic	0% (0)	0% (0)	2% (1)
Native American	13% (4)	3% (1)	0% (0)
Hispanic or Latina	28% (9)	15% (4)	21% (9)
Education			
Less than HS	19% (6)	15% (0)	0% (0)
HS or equivalent	53% (17)	15% (5)	28% (12)
Some college	28% (9)	59% (16)	54% (23)
College graduate	0% (0)	22% (6)	19% (8)

<sup>a</sup> Other tobacco products used included electronic cigarettes, snus, chewing tobacco and hookah.

interest in using the products, women viewed NRT as designed to help people to stop smoking, and not to use concurrently with smoking.

### 3.2.2. During pregnancy

Some participants noted that snus and dissolvables could be used discreetly, thus, allowing women to avoid stigma from smoking while pregnant.

“Maybe you wouldn't get judged by people because you could hide it better than smoking. I don't like being judged by people, I hate that.” (pregnant smoker).

Some women described an intention to use ENDS as a cessation aid so they could quit before becoming pregnant while others suggested that they might use them during pregnancy if they were not able to quit on their own.

“This [electronic cigarettes] would be my step down...I want to be smoke-free when I'm pregnant, so it's like if I need to be serious about quitting smoking then that might be my option to be able to do that before I get pregnant or I find out I'm pregnant.” (non-pregnant smoker).

Most women did not like the idea of taking unnecessary medicines during pregnancy and felt it would be better to quit cold turkey than to use NRT.

“I don't want any type of medicine intake in my body when I'm pregnant... Any type of medicines.” (non-pregnant smoker).

### 3.2.3. Health risks associated with smoking, non-combusted tobacco products, and NRT

3.2.3.1. *General, not specific to pregnancy.* Women attributed different health risks to different types of tobacco products, but most thought all products have at least some risks. Many women felt the health effects of snus are similar to those of smoking cigarettes, such as causing cancer. Some thought snus and/or dissolvables might be more harmful than cigarettes.

“I kind of equate it [dissolvables] with being similar to chewing tobacco, like you're putting it in your mouth...when they do that, you're so much more at risk for - tongue and mouth and gum cancer. Esophageal cancer, because if you're swallowing it, if you're sucking on it, that would be breaking down your throat.” (pregnant quitter).

Women's responses were divided regarding the health effects of ENDS. Some were concerned that because ENDS are new, there is not much known about safety, while others believed them to be less harmful than cigarettes.

“Scary, because there's no research on those, those vapor things.” (pregnant quitter).

“I'd rather be addicted to nicotine without having to take in the carcinogens and tar, because nicotine is a stimulant like coffee, but it's not like the carcinogen and tar kind of stuff, you're not getting.” (non-pregnant smoker).

Women were also divided on their perceptions of the health risks of NRT, and many expressed concern about the amount of nicotine delivered.

“Bowel problems because, you know, the lozenges, it's going in and maybe it'll cause bowel cancer, or whatever you call that, colon cancer.” (pregnant smoker).

“You could easily maybe overdose on those...” (pregnant smoker).

### 3.2.4. During pregnancy

Participants consistently reported that tobacco and products with nicotine are harmful during pregnancy. Responses regarding which products are most harmful varied, some felt all were equally dangerous and some singled out a particular product as being relatively more or less dangerous. Some pregnant smokers who were not already using ENDS were considering trying to switch, but others wanted to quit without the assistance of other products.

“...anything that's in your blood system goes to that baby, caffeine, nicotine, all of it.” (non-pregnant smoker).

“You already take enough pills and medicine to try to keep your baby happy and this [NRT] seems like it would work against it. I think it's just delivering too...it's too much and if it's getting in you it's definitely getting in the baby.” (pregnant quitter).

Many women felt that using snus and dissolvables were especially dangerous for pregnant women because the product is used orally and saliva is swallowed.

“It's kind of like feeding it [dissolvables] to your baby directly. You're feeding it cigarettes. It's crazy.” (pregnant smoker).

“And the cigarettes, you don't really know exactly where it's going. But when you swallow that [dissolvables], you know it's going to go to the baby.” (pregnant smoker).

Many pregnant quitters reported that they were committed to remaining tobacco free during pregnancy and were not enticed by any tobacco products or NRT. However, some women expressed an intention to try a different product after delivery.

“I know that I'll probably try the vapor [after the baby is born], the blu, the e-cig or—I know I'll try those because I'm curious.” (pregnant quitter).

Although many women were skeptical about using any nicotine-containing products during pregnancy, some viewed individual products as potentially less harmful than the others. Women most often mentioned ENDS as being least harmful, but a few singled out NRT or dissolvables.

“... I feel like if I had a desperate moment during pregnancy I wouldn't worry so much about the e-cigarette the way I would about the tobacco.” (non-pregnant smoker).

## 4. Discussion

In this study of women's perceptions toward emerging non-combusted tobacco products and NTR, women were generally unfamiliar with snus and dissolvable products, but did note some potential advantages of these products, such as use in smoke-free areas and the ease of hiding these products from others. These findings raise concerns that pregnant smokers who feel stigmatized may be particularly attracted to products that can be used discreetly. Interestingly, some women perceived that inhaled tobacco from cigarette smoking is safer than oral tobacco, believing that oral use results in more direct exposure of the fetus. Participants had greater familiarity with ENDS and NRT, and a substantial number had used or were using ENDS. Of those who had used ENDS, a few had intended to quit smoking, but became dual users instead. Some women also expressed concern that ENDS are easy to “overuse.” Because many women reduce the number of cigarettes smoked per day when they become pregnant (Tong et al., 2008), it is possible that some women could increase their nicotine exposure through dual use or increased use of ENDS, especially if they perceive ENDS to be less harmful than smoking. This could have important implications for maternal and fetal health. In addition, although many women who had quit smoking expressed strong intentions to avoid all tobacco and nicotine-containing products during pregnancy, a few did verbalize interest in using ENDS after delivery.

As previously stated, the American College of Obstetrics and Gynecologists recommends NRT for consideration in pregnant smokers if behavioral therapy fails, after consideration of the potential risks and benefits (American College of Obstetricians and Gynecologists, 2011). In our study, while NRT products were seen as “legitimate” products specifically designed for smoking cessation rather than for use concurrently with smoking, many women felt NRT products were ineffective and/or had unacceptable side effects. Many women viewed all NRT and tobacco products as hazardous during pregnancy and expressed a preference to quit without assistance from other tobacco or medicinal products. However, some women viewed non-combusted products, particularly ENDS, as less hazardous than smoking. This finding is

consistent with the study by Mark et al. (2015) in which three fourths of pregnant women who had tried electronic cigarettes did so in order to reduce harm. Regulating health and therapeutic claims while intensifying efforts to educate women of the risks of these products could reduce misperceptions about product safety among women of reproductive age.

The current study has a number of limitations. Qualitative studies such as this one are not generalizable to entire populations because of their small sample size and limited geographic distribution of participants. Second, perceptions regarding non-combusted products likely are changing rapidly in response to evolving advertising and marketing strategies by tobacco companies as well as state and local tobacco policies. Our results reflect knowledge and perceptions for the fall of 2013 in the selected cities. Third, our study design and limited sample size precluded comparisons of subgroups, such as those based on age, race/ethnicity, or education.

The 2011 College Committee Opinion on tobacco use instructs providers to screen for tobacco use in any form, including smokeless tobacco and electronic cigarettes (American College of Obstetricians and Gynecologists, 2011). However, the Opinion does not include specific information about the risks of these products. Our findings could be used to inform efforts to better educate pregnant women about the risks of nicotine and tobacco exposure during pregnancy. For example, we found that some women were misinformed about how the route of nicotine exposure affects fetal health, believing that oral tobacco or oral NRT reaches the fetus more directly than inhaled tobacco. Future research could generate additional information to guide the development of educational materials for pregnant women addressing this issue.

Our findings could also be used to inform future research related to women's behaviors and exposure to tobacco and NRT. Future work could investigate whether a desire to decrease the stigma associated with smoking during pregnancy influences women to actually use non-combusted tobacco products, and if so, to what extent; whether pregnant women's positive attitudes toward ENDS and their negative attitudes toward NRT make them more likely to use ENDS over NRT when attempting to quit; to what extent pregnant smokers who try ENDS become dual users; whether the use of ENDS in pregnant women increases or decreases fetal nicotine exposure; and to what extent ENDS contribute to postpartum relapse among quitters. In addition, surveillance of use of emerging tobacco products among women of reproductive age and pregnant and postpartum women is needed to monitor trends in product use.

## 5. Conclusions

Women seeking to reduce health risks or stigma related to cigarette use during pregnancy may perceive advantages to using some emerging non-combusted products over cigarettes. These findings can inform future research related to tobacco and NRT use among women of reproductive age.

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## Declaration of interests

None declared.

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