



## Framing pregnancy-related smoking cessation messages for women of reproductive age



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### ABSTRACT

**Introduction:** Communicating harms of smoking and benefits of quitting to tobacco users to motivate cessation is critical to reduce the burden of tobacco-related disease. Most messaging strategies focus on health risks of smoking using loss-framing; yet, gain-framed messages to increase confidence in quitting have shown promise for smokers with lower self-efficacy. This study examined the impact of message framing on perceived effectiveness of targeted, pregnancy-related smoking cessation messages among pregnant and not-pregnant smoking women of reproductive age.

**Methods:** An obstetrics-gynecological clinic-based sample of female, current smokers of reproductive age (18–44 years old) was recruited during January to May 2019 (n = 135). Participants self-reported ratings for 10 pregnancy-related cessation messages (half gain-framed) on a validated perceived effectiveness scale. Multivariable regression analyses were conducted using generalized estimating equations to account for clustering by message themes.

**Results:** Gain-framed messages were rated significantly higher (0.20;  $p < 0.01$ ) compared to loss-framed messages for perceived effectiveness, after accounting for quit intentions, self-efficacy to quit, health literacy, cessation risk perceptions, nicotine dependence, and pregnancy status.

**Conclusions:** Gain-framed health messages about cessation were deemed to be more effective than loss-framed messages among adult female smokers. Targeted, positively framed messages to highlight the benefits of quitting to women of reproductive age show promise as a strategy to promote smoking cessation.

### 1. Introduction

Tobacco use remains a primary contributor to morbidity and mortality in the U.S., accounting for every 1 in 5 deaths (U.S. Department of Health and Human Services, 2014) and is the leading modifiable cause of infant death (American College of Obstetricians and Gynecologists, 2020). Health messaging campaigns are a promising population-level intervention to promote smoking cessation (Durkin, Brennan, & Wakefield, 2012; Hammond, 2011; Salloum et al., 2018). Once developed and tested, effective messages can be delivered through various channels: warning messages on products and advertisements (Noar

et al., 2017), mass media campaigns (Stead et al., 2019), at health care clinics (Gonzales et al., 2020), and more.

An estimated 12% of women in the United States smoke cigarettes (Wang et al., 2018) and 54% of women who smoke before pregnancy quit smoking before or during pregnancy. It is estimated 7.2% of smokers persist in smoking during pregnancy (American College of Obstetricians and Gynecologists, 2017, 2020; Drake, Driscoll, & Mathews, 2018), although this behavior is known to be consistently underreported (Cnattingius, 2004). A recent evaluation of a general cessation campaign, *Tips from Former Smokers*, resulted in 7% population-level increase in cessation attempts among pregnant women

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(England et al., 2017), notably lower than the general population increase of 16% in cessation attempts (Davis et al., 2019). Smoking during pregnancy causes serious negative reproductive outcomes, including orofacial clefts, fetal growth restriction, placenta previa, low birth weight and perinatal mortality (American College of Obstetricians and Gynecologists, 2017, 2020; Office on Smoking and Health, 2001). Since an estimated 51% of pregnancies are unplanned and the most sensitive time for fetal organ development is 6–8 weeks of gestation, many pregnant women may not be aware of their pregnancy until after this time-sensitive window has closed. Smoking cessation messages targeting reproductive age women before and during pregnancy has the potential to reduce health risks to infants and mothers (American College of Obstetricians and Gynecologists, 2017; Finer & Zolna, 2014).

Cessation messages may be written with a positive (gain) or negative (loss) framing of the risks. For example, a gain-framed message may read, “Quitting smoking reduces your risk of lung cancer.” Alternatively, a loss-framed message may read, “Smoking increases your risk of lung cancer.” Although the majority of tobacco control campaigns focus on the risks of continued tobacco use (loss framing), a focus on positive benefits of quitting tobacco (gain framing) has been suggested as a beneficial intervention strategy to promote successful cessation among some tobacco users (Fucito, Latimer, Salovey, & Toll, 2010; Mays et al., 2015; Toll et al., 2008). Theory suggests that loss-framed appeals should be more persuasive when people are deciding whether to adopt a behavior that they perceive as risky or having unpleasant outcomes, and gain-framed appeals should be more persuasive when people are deciding whether to adopt a behavior that they perceive as relatively safe and free of unpleasant outcomes (Rothman, Bartels, Wlaschin, & Salovey, 2006; Schneider et al., 2001). Messages about smoking cessation are complex; users may perceive cessation as an unpleasant outcome (failure, craving), a neutral outcome with positive and negative implications, as well as a pleasant one (lower risk of pregnancy complications) making it unclear how messages are best framed to increase quit intentions and behaviors.

Several factors may influence an individual’s responsiveness to cessation message framing. In particular, one’s perception of risk from a smoking-related disease, perceived barriers and confidence in successfully quitting all impact whether a person prefers gain or loss framed messages (Gallagher & Updegraff, 2011; Rothman & Updegraff, 2010). For instance, if an individual has low self-efficacy in quitting, a greater sense of threat from a loss-framed message may result in rejection of the message (van’t Riet et al., 2009) while those with higher self-efficacy in quitting may increase their motivation to quit following exposure to loss-framed messages (Riet, Ruiter, Werrij, & De Vries, 2008). Additionally, nicotine dependence can modify reactions to messages, with gain-framed messages often more effective for those with low nicotine dependence or low confidence in quitting (Moorman & van den Putte, 2008).

Most tobacco control messaging efforts are “gender blind,” but some message framing examinations have identified gender differences in perceptions of cessation barriers, expectancies, and cessation success rates (Amos, Greaves, Nichter, & Bloch, 2012; Institute, 2018; Scharf & Shiffman, 2004). Pregnancy is a biological reason for sex-specific

targeting (Holbrook, 2016), and women’s motivation to quit during pregnancy may be higher due to known fetal health risks (American College of Obstetricians and Gynecologists, 2017). One gender-based study found that non-pregnant women who viewed gain-framed messages sustained cessation longer than men (Toll et al., 2007), and these findings support this potential avenue for message framing to reach female smokers of reproductive age. The goal of the present study was to examine the perceived effectiveness ratings for novel gain- versus loss-framed cessation-related health messages targeted on pregnant and non-pregnant adult women of reproductive age.

## 2. Methods

Participants were women recruited from an urban, campus-based women’s health clinic located in a large city in the state of Ohio. This state has one of the highest infant mortality rates in the United States, with a disproportionately high rate of African American infant mortality (Swoboda, Benedict, Hade, McAlearney, & Huerta, 2018). The clinic serves a racially diverse population of predominantly low-income women from throughout the city; roughly 1500 women are seen in the clinic annually, with 2/3 of the appointments pertaining to pregnancy.

During clinical visits between January to May 2019, recruitment was performed by three trained part-time research staff, each of whom typically recruited in clinic one day per week. Research staff recruited participants in the waiting area of the clinic, asking women to complete a screening survey for eligibility using a handheld tablet. Eligibility criteria were women of reproductive age (18–44), current smokers (every day/some days), ability to read and understand English and provide informed consent to participate. Once consent was provided, participants used the tablet to view and rate a series of 5 gain- and 5 loss-framed text-only cessation messages, presented in a random order. With input from a health communications researcher, messages were developed as brief statements based off existing cessation-related messages used in cessation campaigns, health warnings, and research interventions. Messages were grouped across 5 thematic categories: Control, freedom, infant health, long term health effects on children, and physician’s advice to quit (see Table 1). Participants received a \$20 gift card as compensation for their time. Human subject’s approval for the study was granted by the University Behavioral and Social Sciences Institutional Review Board.

The primary study outcome was perceived effectiveness of each health message using a validated measure for tobacco warning messages (Francis, Hall, Noar, Ribisl, & Brewer, 2017). Perceived effectiveness was rated on 7 items: “This warning message is believable”, “This warning speaks to people like me”, “This message makes me concerned about the health risks of smoking”, “This warning message makes me think about quitting”, “The message makes smoking seem unpleasant to me”, “The message discourages me from wanting to smoke”, and “The health messages caused me to think about the health problems caused by smoking.” Responses were scored on a 10-point scale anchored with “not at all” and “extremely.” The average rating was used as a perceived effectiveness score, with a higher score indicating a higher perceived effectiveness (Francis et al., 2017).

**Table 1**  
Gain- and Loss-framed health warning messages and corresponding themes.

Gain-Framed	Loss-Framed	Theme
When you quit smoking you take control of your own health and the health of your baby.	If you don’t quit smoking, you are not taking control of your own health or the health of your baby.	Quit – Control
Start living. Stop smoking.	Stop hurting yourself. Stop smoking.	Quit – Freedom
Quitting smoking can prevent harm to you and your baby.	Smoking while pregnant can harm you and your baby.	Infant Health
There are lifelong benefits to children growing up in a smoke-free environment.	Children who grow up in a smoking environment suffer lifelong consequences.	Long Term Effects on Children
Talk to your doctor about quitting today—setting a goal make you more likely to quit.	If you don’t talk to your doctor about quitting, you are less likely to quit for good.	Quit – Doctor

Quit intention was endorsed if the participant indicated plans to quit in the next 30 days (yes versus no/don't know). Quit self-efficacy was derived from a single item, "If you decided to give up tobacco, including e-cigarettes, completely in the next six months, how sure are you that you would succeed?" measured on a 9-point scale from not at all to extremely; using a median split, participants who rated their success as 7–9 were dichotomized as high self-efficacy, while 1–6 was considered low self-efficacy in cessation. Cessation risk perceptions were measured with a 13-item index including six negative risks (e.g., feel more irritable, gain weight) and seven positive benefits (feel healthier, reduce chances of lung cancer) coded on a 7-point scale from "not at all likely" to "certain to happen," coded so that a higher score indicated greater negative risk perceptions of cessation (McKee, O'Malley, Salovey, Krishnan-Sarin, & Mazure, 2005). Health literacy was measured using a 4-item index (e.g., "How often do you have problems learning about your medical condition," rated on a 5-point scale from always to never) where a higher score is associated with higher health literacy (Chew, Bradley, & Boyko, 2004). Nicotine dependence was dichotomized as low if participants self-reported their first cigarette of the day was smoked after 30 min of waking (Baker et al., 2007).

For descriptive statistics, frequency, mean, and percentage data were used. For the unadjusted comparison of means, paired t-tests were used to compare the perceived effectiveness ratings across themes. Generalized estimating equation regression was used to examine the effect of framing as the predictor variable on the perceived effectiveness mean ratings as the outcome, with accounting for clustering by message themes. The multivariable model included several covariates: current pregnancy status (yes/no), quit intention (yes/no), cessation self-efficacy (high/low), mean cessation risk perceptions score (out of 7), health literacy score (out of 5), and message themes. The Quit - Doctor theme was used as the reference group in analysis because of the salience of this message because the participants were being recruited in the lobby of a physician visit. The model applied pairwise deletion so partially complete data were included in the model. Data were analyzed using SAS 9.4 (SAS Institute, Cary, NC).

### 3. Results

A total of 386 women were screened to obtain a sample of 135 eligible participants (35% eligible). As shown in Table 2, half of the sample (53%) was aged 25–34, with 51.2% being pregnant; most pregnant participants were in their third trimester. Over 96% of participants had not attained a 4-year college degree, and 26.1% of the sample had four or more children in their household.

In Table 3, the perceived effectiveness ratings were compared across gain and loss-framed themes. Two message themes – Control and Doctor – had statistically significantly higher ratings of effectiveness for gain-framing. For the other three themes, there was no significant difference in the mean ratings between gain- and loss-framing ( $p > 0.05$ ). In the unadjusted mean across all message themes, the gain-framed messages had rated 7.9 compared to 7.7 out of 10 ( $p = 0.0071$ ).

For the multivariable regression using a stepwise regression technique, each covariate was examined for a bivariate association with the outcome of perceived effectiveness rating; all covariates were statistically significantly associated with the primary outcome ( $p < 0.05$ ). The final models shown in Table 4. Compared to loss-framed messages, gain-framed messages received a 0.20 higher rating of perceived effectiveness after accounting for pregnancy status, quit intention, self-efficacy to quit, risk perceptions of cessation, nicotine dependence, and health literacy (CI: 0.06, 0.34;  $p < 0.001$ ). All covariates remained significantly associated with the perceived effectiveness ratings of the health messages ( $p < 0.05$ ), except for cessation self-efficacy and nicotine dependence ( $p > 0.05$ ). Pregnancy status was the only covariate negatively associated with perceived effectiveness, with both gain- and loss-framed messages rated as less effective by currently pregnant

**Table 2**

Demographics and tobacco use among female smokers (n = 135).

Characteristics	% (n = 135)*
<b>Age</b>	
18–24	26.7%
25–34	53.3%
35–44	20.0%
<b>Pregnancy status</b>	
Pregnant	51.2%
1st trimester	10.5%
2nd trimester	29.9%
3rd trimester	59.7%
<b>Race</b>	
Black or African American	48.8%
White	45.5%
Other	5.8%
<b>Education</b>	
< high school	22.3%
High school graduate	37.2%
Some college	37.2%
4-year degree +	3.3%
Mean health literacy score (SD)	4.2 (1.0)
<b>Children in household</b>	
0	11.8%
1	22.7%
2–3	39.5%
4+	26.1%
<b>Smoking characteristics</b>	
Daily smoker	67.9%
<i>Time to first cigarette</i>	
< 5 min	27.8%
6–30 min	40.0%
31–60 min	16.5%
> 60 min	16.7%

\* Totals may not sum to 100% due to rounding, missingness.

**Table 3**

Perceived effectiveness differences across cessation message themes (n = 135).

Message themes	Gain-frame mean (SD)	Loss-frame mean (SD)	p-value
Control	8.17 (2.06)	7.90 (2.26)	0.04
Freedom	7.56 (2.45)	7.83 (2.43)	0.10
Infant health	8.04 (2.10)	8.13 (2.26)	0.26
Long-term health effects for kids	8.12 (2.08)	7.89 (2.25)	0.18
Doctor	7.51 (2.37)	6.76 (2.39)	< 0.001
All messages	7.90 (1.97)	7.68 (2.02)	< 0.01

participants compared to a referent of non-pregnant women. We examined for effect modification by framing and message theme by including an interaction term in the model (framing\*theme). Since the interaction term was statistically significant ( $p < 0.05$ ) the multivariable results were presented stratified by framing in the second and third column of Table 4. For the loss-framed condition, the only gain-framed message that was not statistically significant was the Quit - Freedom message ( $p = 0.42$ ), using the Quit - Doctor message as a reference.

### 4. Discussion

Our study findings indicate a small but significant improvement in perceived efficacy from gain-framing in pregnancy-related smoking cessation messages among a clinic-based sample of women of reproductive age. Three messages were rated highest in perceived effectiveness: *When you quit smoking, you take control of your own health and the health of your baby*, *Quitting smoking can prevent harm to you and your baby*, and *There are lifelong benefits to children growing up in a smoke-free environment*. The gain-framed message on "freedom" was the only message not significantly different from the reference; we speculate this

**Table 4**

Multivariable estimates of perceived effectiveness ratings of tobacco health messages among smokers of reproductive age: Total model and stratified by framing status (n = 135).\*

Variables	Total Parameter estimates (95% CI)	Gain-frame Parameter estimates (95% CI)	Loss-frame Parameter estimates (95% CI)
Gain-framed (compared to loss-framed)	<b>0.20 (0.06, 0.35)</b>	–	–
<i>Health message themes</i>			
Quit – Control	<b>1.03 (0.49, 1.58)</b>	<b>0.82 (0.26, 1.38)</b>	<b>1.25 (0.63, 1.86)</b>
Quit – Freedom	<b>0.68 (0.11, 1.25)</b>	0.25 (–0.34, 0.85)	<b>1.11 (0.47, 1.75)</b>
Infant health	<b>1.11 (0.56, 1.65)</b>	<b>0.72 (0.17, 1.28)</b>	<b>1.49 (0.87, 2.11)</b>
Long term effects on children	<b>0.98 (0.43, 1.53)</b>	<b>0.72 (0.14, 1.29)</b>	<b>1.25 (0.63, 1.86)</b>
Quit – doctor (ref)	–	–	–
Cessation			
Plan to quit in the next 30 days (compared to no plans)	<b>1.13 (0.80, 1.46)</b>	<b>1.10 (0.77, 1.44)</b>	<b>1.15 (0.79, 1.52)</b>
High quitting self-efficacy (compared to low)	0.08 (–0.31, 0.48)	0.07 (–0.34, 0.47)	0.10 (–0.34, 0.54)
Currently pregnant	<b>–0.54 (–0.91, –0.16)</b>	<b>–0.58 (–0.97, –0.19)</b>	<b>–0.50 (–0.92, –0.08)</b>
Health literacy score (out of 5)	<b>0.31 (0.13, 0.49)</b>	<b>0.39 (0.19, 0.58)</b>	<b>0.23 (0.03, 0.42)</b>
Cessation risk perceptions (out of 7)	<b>0.70 (0.47, 0.94)</b>	<b>0.76 (0.53, 0.99)</b>	<b>0.64 (0.38, 0.91)</b>
Low nicotine dependence	–0.14 (–0.61, 0.33)	–0.20 (–0.68, 0.28)	–0.08 (–0.60, 0.44)

\* All bolded values are statistically significant at  $p < 0.05$ .

may be due to the use of general language rather than pregnancy-specific language. While additional examination is needed to consider the context and media to deliver these messages, these findings support the potential use of these messages to reach this target population.

Several individual factors in our study produced unexpected results. Our findings indicate that risk perceptions, health literacy, and cessation intention drove higher ratings for gain-framed messages; current pregnancy, quitting self-efficacy, and nicotine dependence were not significantly associated with perceived effectiveness ratings. Other studies of pregnant women who smoke report this is a population where self-efficacy for successful cessation may be low (Ingall & Cropley, 2010; Ludman et al., 2000). Yet, self-efficacy in the present population was moderate, and significantly higher for those who were pregnant (6.5 versus 5.7 mean score out of 9: data not shown). Higher self-efficacy has been shown to produce stronger responses to traditional health warning labels on cigarettes (Thrasher et al., 2016), but this responsiveness may be mitigated for those with lower health literacy (Stewart et al., 2014). Perhaps the higher health literacy in our sample (4.2 out of 5) and higher self-efficacy reveal the delicate interplay between these factors to encourage receptiveness to framed messages. Lastly, despite 67.8% of our sample being moderate to highly dependent, the lack of responsiveness to framing differs from other studies in this population (Moorman & van den Putte, 2008). It warrants future examination to determine whether differences are driven by these individual characteristics or pregnancy course. With so little study of pregnant women as a target population, more data may be needed to characterize the interrelationships more precisely between quit intention, self-efficacy, risk perception, and dependence in pregnant women at the population level.

To create effective health messages, Rothman and colleagues emphasize the importance of matching messaging to the targeted person or situation (Rothman, Desmarais, & Lenne, 2020). Specific to smoking cessation, recommendations are to use a sequence of messages to attract and maintain attention from users, to encourage elaboration or thinking about the message, and to encourage action and ultimately maintenance of that action (Strahan et al., 2002). The present study represents a core part of the first two steps in this development sequence. Cornacchione and colleagues found that gain-framed messages were most effective at influencing those who were considering quitting but not yet preparing to do so (Cornacchione & Smith, 2012). Future work is needed to understand how gain framed messages can encourage users to think about the messages, take actions to quit, and maintain that action.

This research provides a focus on a priority population of reproductive-aged female smokers, including those who are pregnant and minorities. Yet, there are limitations. Our study sample was identified

using a convenience sampling strategy with potential for selection bias. The study participants, however, were demographically representative of the clinical site, which mitigates such concerns. The use of design with randomization addresses potential bias associated with order effects of the messages. Five themes were used in the present research to examine novel pregnancy-related messages, but further validity and reliability testing of a larger pool of health messages, including themes regarding health conditions, such as birth defects, or employing factual versus emotional appeals, is warranted. This study used a single exposure to text-based messages on smoking, but messages tailored to other tobacco products may be warranted. An examination of pictorial imagery or subsequent recall or memory of warnings and their impact on cessation for women in pregnancy and of reproductive age is needed. Lastly, the role of how and where these messages are delivered to reproductive age women (e.g. on products, online, from a health care provider) warrants evaluation.

Nearly 20 years have elapsed since the Surgeon General's Report called for "reporting of gender-specific results from studies of influences on smoking behavior, smoking prevention and cessation interventions, and the health effects of tobacco use, including use of new tobacco products" (Office on Smoking and Health, 2001). Our findings heed that call and provide new evidence for consideration of gain-framed messages targeting female smokers. In order to reach the Healthy People 2020 Objective, where 30% of women quit tobacco during their first trimester, effective interventions need to be tested (U.S. Department of Health and Human Services; Office of Disease Prevention and Health Promotion, n.d.). We believe these novel messages represent a new direction to examine potential interventions to support and promote cessation among women of reproductive age.

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## Contributors

EGK was responsible for study conceptualization, funding acquisition, methodology, formal analyses, supervision of data collection, and the original draft, review and editing; BW assisted in supervision, contributed to funding acquisition, and writing and editing; AL contributed to the methodology, reviewing and editing; AO, JM, and AB

were responsible for data curation and manuscript review and editing.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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