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# Smoking Cessation and Pregnancy: Timing of Cessation Reduces or Eliminates the Effect on Low Birth Weight

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## Abstract

**Background** Women who smoke cigarettes while pregnant are at elevated risk of having low birth weight infants (LBW, < 2500 g) which increases risks of infant mortality and morbidity, including chronic conditions later in life.

**Objective** Smoking cessation during pregnancy can reduce the risk of poor birth outcomes. However, the effect that timing of smoking cessation has on the reduction of poor birth outcomes in term pregnancies is unknown.

**Study Design** This retrospective cohort study used birth certificate data from Missouri singleton, full-term, live births from 2010 to 2012 (N = 179,653) to examine the rates and timing of smoking cessation during pregnancy on birthweight. Smoking exposure was categorized as non-smoker, preconception cessation, first trimester cessation, second trimester cessation, and smoker. The outcome was low birth weight (LBW). Covariates included maternal race/ethnicity, age, education level, type of payment for the delivery, marital status, paternal acknowledgement, prenatal sexually transmitted infection (STI), comorbidities, and body mass index. Bivariate and multivariable analyses were used to assess relationships between smoking and LBW status.

**Results** Preconception cessation did not have a statistically higher risk for LBW than mothers who never smoked (aOR 1.12; 95% CI 0.98, 1.28). First trimester cessation (aOR 1.26; 95% CI 1.05, 1.52), second trimester cessation (aOR 2.00; 95% CI 1.60, 2.67), and smoker (aOR 2.46; 95% CI 2.28, 2.67) had increasing odds for LBW relative to mothers who did not smoke. All covariates had significant relationships with the smoking exposure.

**Conclusion** Preconception cessation yielded LBW rates comparable to non-smokers. The risk for LBW increased as smoking continued throughout pregnancy among full term births, an important new finding in contrast with other studies.

**Keywords** Smoking · Pregnancy · Low birth weight

## Significance

Women who smoke cigarettes while pregnant are at elevated risk of having low birth weight infants (LBW, < 2500 g) which increases risks of infant mortality and morbidity, including chronic conditions later in life. Smoking cessation during pregnancy can reduce the risk of poor birth outcomes. However, the effect that timing of cessation has on the reduction of smoking's effects on birth outcomes in term pregnancies is unknown. To our knowledge, by employing the methodology in our study that required the limiting of our sample to full term births, we were able to add to the literature that there are progressive increases to risks for LBW as smoking continues throughout the pregnancy.

## Introduction

Approximately 23% of women in Missouri smoke cigarettes (i.e., smoking) compared to 17.4% in the entire US, a rate that drops to only 17% among pregnant women (Center for Tobacco Policy Research [CTPR] 2007; Missouri Information for Community Assessment [MICA] 2014). Smoking is

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directly linked to having a low birth weight (LBW) baby, and LBW babies are more likely to die before their first birthday or suffer other physical and developmental morbidities than those infants that were not LBW (Dietz et al. 2010; Kim and Saada 2013; Osterman et al. 2011; Mazurek and England 2016; US Department of Health and Human Services 2013; Beyerlein et al. 2011; Grzeskowiak et al. 2015; Ko et al. 2014; Martin 2015; Mathews and MacDorman 2013; Xaverius et al. 2015). Healthy People (2020) has established a goal to reduce smoking among pregnant women to 1.4% by the year 2020 (CTPR 2007; Dietz et al. 2010; Kim and Saada 2013; Cnattingius et al. 1999; Lamminpää et al. 2013; Carter et al. 2006; Healthy People 2020).

A large meta-analysis shows a twofold increased risk for LBW when women smoke during pregnancy (Pereira et al. 2017). Smoking cessation during pregnancy is more likely for women who have a higher educational attainment, private insurance, or women of Asian and Hispanic races/ethnicities (Curtin and Mathews 2016; Wallace et al. 2017). The timing of smoking cessation during pregnancy is also important, however conflicting results have been reported when considering the relationship between timing of cessation and LBW. For example, some researchers have reported that when a woman quits smoking before pregnancy or in her first trimester, she has no additional risk for LBW than non-smokers (Yan and Groothuis 2015; Vardavas et al. 2009), preterm birth (Moore et al. 2015), and fetal growth restriction (Blatt et al. 2015; Polakowski et al. 2009). A significantly increased risk for adverse birth outcomes has also been reported when smoking continues into the second and third trimesters (Yan and Groothuis 2015; Blatt et al. 2015). In contrast, Wallace et al. (2017) report that women who quit smoking in their third trimester have a higher prevalence of LBW (48%) than women who smoked throughout their entire pregnancy (31%), among their sample of pregnant women who had a previous preterm birth (Wallace et al. 2017). Moore et al. (2015) report a lower odds for preterm birth among women who quit smoking before pregnancy when compared to women who never smoked, and a higher odds for preterm birth for women who quit smoking in their second trimester compared to women who smoked throughout their entire pregnancy (Moore et al. 2015). We hypothesize that the risk for LBW increases as smoking continues throughout pregnancy, and that by limiting our sample to full-term births only, all full-term babies will have had an equal chance of exposure to tobacco throughout the pregnancy.

We examined the timing of smoking cessation during pregnancy—i.e., non-smoking, preconception cessation, and cessation by trimester—as related to LBW. Because babies that are born preterm (< 37 weeks gestation) are typically LBW as a result of having a shorter gestation period, we decided to remove all preterm births and focus solely on those pregnancies that had an equal chance of tobacco exposure throughout an entire pregnancy (Mohlman and Levy 2016). In addition, we explored paternal acknowledgement and Medicaid utilization, two social and health factors that could potentially confound the relationship between timing of tobacco cessation and LBW.

## Methods

This retrospective cohort study examined all Missouri live singleton, full term (37–46 weeks) births from 2010 to 2012. Exclusions were made based on implausible birth weight (> 8000 g, N = 388) and missing data on smoking cessation (N = 1581), BMI (N = 2974) race/ethnicity (N = 5421), age (N = 10), education (N = 329), paternity acknowledgement (N = 286), and marital status (N = 45). Missing data resulted in a total reduction of 5.7% (meeting the 10% rule posed by Bennett 2001) from the original sample (N = 194,387), yielding a final sample of 183,353 births. With the exceptions of birth weight and gestational age, all measures are self-reported on birth certificates shortly after the birth of the child.

### Exposure

The primary exposure variable was smoking status of the mother during before and during pregnancy, classified into one of five categories: non-smoker; smoked pre-pregnancy but quit before pregnant (preconception cessation); did not smoke beyond the first trimester (1st trimester cessation); did not smoke beyond the second trimester (2nd trimester cessation); and smoked in the third trimester (smoker throughout pregnancy). If a woman was in a smoking category later in pregnancy, that also represented consistently smoking earlier in the pregnancy, with few exceptions. However, there were 1371 women (0.8% of the sample) that reported sporadic smoking patterns, and they were placed into the category that represented the last trimester in which they smoked.

### Outcome

The primary outcome was LBW, defined as a birth weight < 2500 g.

### Covariates

Covariates included maternal race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, and Other), maternal age (≤ 19, 20–34, and ≥ 35), maternal education level (< HS, HS or GED, some college, or college degree or higher), type of payment used to pay for the delivery (Medicaid, private insurance, or other), maternal marital status at the time of

delivery (married/unmarried), paternal acknowledgement (yes/no), maternal sexually transmitted infection (STI) during pregnancy [e.g. HIV, gonorrhea, syphilis, Hepatitis B or Hepatitis C (yes/no)]; maternal chronic disease [pre-pregnancy diabetes, gestational diabetes, pre-pregnancy hypertension, gestational hypertension, or preeclampsia/eclampsia (yes/no)]; and maternal body mass index (BMI) in four categories (underweight BMI ≤ 18.5, normal weight if BMI is 18.5–24.9, overweight if BMI is 25.0–29.9, and obese if BMI is ≥ 30.0).

### Analysis

All analyses were conducted using SPSS. Chi square tests were used to assess the distribution of the five categories of the smoking exposure among the covariates. Bivariate logistic regressions were used to assess the crude relationships between the covariates and LBW status with odds ratios (ORs) and 95% confidence intervals (CIs). Multivariable logistic regression included all covariates in the model with the exception of marital status which was collinear with paternity acknowledged, and thus excluded from the model. Models also included a three-way interaction term for cessation, paternity acknowledged, and Medicaid status (because this was found to be significant), rather than stratified, to ensure accuracy of the data and to ensure the results of this study are comparable with the findings reported in previously published literature, which was a statistically significant, p = .05. This secondary analysis of de-identified data was deemed exempt by the Saint Louis University, Intuitional Review Board (IRB).

## Results

All covariates were significantly distributed differently between smoking cessation groups. Non-Hispanic, White women made up 86.8% of the mothers who smoked throughout pregnancy while mothers aged 35 and older comprised only 5.8% of women who smoked throughout their pregnancy. Similarly, mothers with a college degree or higher made up 35.4% of non-smokers. The proportion of non-smoking was highest among births to married women (67.6%) and even higher among births when paternity was acknowledged (89.3%). Adequate prenatal care (42.1) was associated with the highest proportion of women who did not smoke. Proportions of sexually transmitted infections (STIs) were nearly four times higher in women who smoked throughout pregnancy (2.4%) than in women who did not smoke at all (0.6%). Among smokers, 10.6% had at least one chronic condition, a rate that slightly rose within the preconception cessation (11.8%), 1st trimester cessation (11.7%) and 2nd trimester cessation (11.9%), but decreased slightly among smokers (9.8%). Distributions of smoking trends across covariates are displayed in Table 1.

Bivariate logistic regression found that relative to non-smokers, preconception cessation was associated with a 16% (cOR 1.16, 95% CI 1.02, 1.32) increased odds for LBW, with the odds increasing to 48% (cOR 1.48, 95% CI 1.24, 1.76), 156% (cOR 2.56, 95% CI 2.07, 3.16) and 186% (cOR 2.86, 95% CI 2.68, 3.06) for 1st trimester cessation, 2nd trimester cessation and smoking throughout pregnancy. Demographic characteristics significantly associated LBW, included African American, Hispanic race/ethnicity (cOR 2.51, 95% CI 2.34, 2.68) and lower education attainment (< High school: cOR 3.06, 95% CI 2.77, 3.37; High school or GED cOR 2.39, 95% CI 2.17, 2.63; some college cOR 1.70, 95% CI 1.54, 1.87). Relative to teenage mothers, older age was associated with a decreased odds of LBW (20–34 years cOR 0.61, 95% CI 0.56, 0.67; 35 and ≥ 35 years cOR 0.56, 95% CI 0.49, 0.64). Women with private or self-pay health insurance had a 55% decreased odds of having a LBW baby in reference to women with Medicaid (cOR 0.45, 95% CI 0.42, 0.48). Non acknowledgement of paternity was associated with a 101% increased odds for LBW (cOR 2.10, 95% CI 1.95, 2.25). Increasing levels of prenatal care were associated with decreased odds for LBW (intermediate: cOR 0.72 95% CI 0.63, 0.82; adequate: cOR 0.45, 95% CI 0.41, 0.50; adequate plus: cOR 0.86, 95% CI 0.79, 0.94). Finally, a 112% increased odds for LBW was reported when a woman was diagnosed with an STI (cOR 2.12, 95% CI 1.70, 2.64) and a 69% increased odds when a woman had a chronic condition (cOR 1.69, 95% CI 1.56, 1.83).

Multivariable logistic regression demonstrated that mothers who quit smoking prior to conception were not statistically different than mothers who never smoked in terms of their odds for having a LBW baby (aOR 1.12, 95% CI 0.98, 1.28). Mothers who quit smoking in their first trimester (aOR 1.26, 95% CI 1.05, 1.52), second trimester (aOR 2.00, 95% CI 1.60, 2.50), or smoked through their third trimester (aOR 2.46, 95% CI 2.28, 2.67) had respectively increasing odds for LBW status in reference with mothers who did not smoke. Table 2 contains the findings of the logistic regression.

After adjustment non-Hispanic Black women remained at a significantly higher risk to having a LBW baby when compared to non-Hispanic White women (aOR 2.37, 95% CI 2.19, 2.56). Compared to teen-aged women (≤ 19 years), women aged 20–34 remained at a significantly decreased risk for LBW (aOR 0.90, 95% CI .82, 0.99). As educational attainment decreased, odds for LBW remained significantly higher (some college: aOR 1.12, 95% CI 1.01, 1.25; high school or GED: aOR 1.27, 95% CI 1.14, 1.42; and < high school aOR 1.39, 95% CI 1.23, 1.57, in reference with college grad or higher). Self or private pay of prenatal care remained at significantly decreased odds of

**Table 1** Smoking trends by covariates—183,353

| Smoking trend | Non-smoker | Smoker | | | | *p* value |
|---|---|---|---|---|---|---|
| | | Preconception cessation | 1st trimester cessation | 2nd trimester cessation | Smoker | |
| | *N* = *136,140* (%) | *N* = *12,701* (%) | *N* = *5039* (%) | *N* = *2068* (%) | *N* = *27,405* (%) | |
| Total | 74.25 | 6.93 | 2.75 | 1.13 | 14.95 | |
| Race/ethnicity | | | | | | < 0.0001 |
| Non-Hispanic White | 77.37 | 84.04 | 81.70 | 79.50 | 86.75 | |
| Non-Hispanic Black | 15.64 | 11.52 | 13.87 | 16.20 | 10.59 | |
| Hispanic | 6.20 | 3.51 | 3.47 | 3.14 | 1.86 | |
| Other | 0.78 | 0.93 | 0.95 | 1.16 | 0.79 | |
| Age | | | | | | < 0.0001 |
| ≤ 19 | 8.67 | 11.46 | 15.42 | 16.92 | 11.73 | |
| 20–34 | 79.87 | 83.03 | 79.76 | 79.11 | 82.44 | |
| ≥ 35 | 11.46 | 5.51 | 4.82 | 3.97 | 5.83 | |
| Education | | | | | | < 0.0001 |
| < HS | 12.18 | 13.87 | 20.06 | 26.69 | 33.85 | |
| HS or GED | 20.28 | 31.15 | 36.10 | 38.64 | 37.20 | |
| Some college | 32.17 | 41.52 | 37.59 | 31.62 | 26.60 | |
| College grad or higher | 35.37 | 13.47 | 6.25 | 3.05 | 2.35 | |
| Married | | | | | | < 0.0001 |
| Yes | 67.56 | 45.99 | 32.13 | 28.63 | 33.14 | |
| No | 32.44 | 54.01 | 67.87 | 71.37 | 66.86 | |
| Paternity acknowledged | | | | | | < 0.0001 |
| Yes | 89.26 | 85.55 | 78.77 | 76.02 | 77.55 | |
| No | 10.74 | 14.45 | 21.23 | 23.98 | 22.45 | |
| Payment method | | | | | | < 0.0001 |
| Medicaid | 35.15 | 49.61 | 62.51 | 70.94 | 75.41 | |
| Private | 60.43 | 45.57 | 32.78 | 25.15 | 21.15 | |
| Other | 4.42 | 4.82 | 4.70 | 3.92 | 3.44 | |
| Prenatal care index | | | | | | < 0.0001 |
| Inadequate | 11.32 | 10.92 | 16.45 | 20.94 | 21.10 | |
| Intermediate | 6.86 | 6.85 | 7.56 | 8.90 | 8.82 | |
| Adequate | 42.09 | 41.74 | 35.98 | 33.17 | 33.67 | |
| Adequate plus | 30.29 | 31.53 | 30.20 | 26.93 | 27.17 | |
| Unknown | 9.43 | 8.96 | 9.80 | 10.06 | 9.25 | |
| BMI | | | | | | < 0.0001 |
| Normal weight | 48.54 | 46.16 | 46.22 | 45.21 | 44.20 | |
| Overweight | 24.11 | 24.59 | 23.48 | 23.45 | 23.23 | |
| Obese | 23.97 | 24.53 | 24.49 | 24.95 | 25.39 | |
| Under weight | 3.39 | 4.72 | 5.81 | 6.38 | 7.18 | |
| STI | | | | | | < 0.0001 |
| No | 99.38 | 99.16 | 98.65 | 98.07 | 97.57 | |
| Yes | 0.62 | 0.84 | 1.35 | 1.93 | 2.43 | |
| Chronic disease | | | | | | < 0.0001 |
| No | 89.37 | 88.25 | 88.29 | 88.15 | 90.19 | |
| Yes | 10.63 | 11.75 | 11.71 | 11.85 | 9.81 | |
| LBW (< 2500 g) | | | | | | |
| No | 98.17 | 97.88 | 97.32 | 95.45 | 94.94 | < 0.0001 |
| Yes | 1.83 | 2.12 | 2.68 | 4.55 | 5.06 | |

All p-values calculated using Chi square analysis

**Table 2** Crude and adjusted odds ratios for low birth weight status

| | cOR | 95% CI | | aOR | 95% CI | |
|---|---|---|---|---|---|---|
| Smoking pattern | | | | | | |
| Non-smoker | 1.00 | Reference | | 1.00 | Reference | |
| Preconception cessation | **1.16** | 1.02 | 1.32 | 1.12 | 0.98 | 1.28 |
| 1st trimester cessation | **1.48** | 1.24 | 1.76 | **1.26** | 1.05 | 1.52 |
| 2nd trimester cessation | **2.56** | 2.07 | 3.16 | **2.00** | 1.60 | 2.50 |
| Smoker | **2.86** | 2.68 | 3.06 | **2.46** | 2.28 | 2.67 |
| Race/ethnicity | | | | | | |
| Non-Hispanic White | 1.00 | Reference | | 1.00 | Reference | |
| Non-Hispanic Black | **2.51** | 2.34 | 2.68 | **2.37** | 2.19 | 2.56 |
| Hispanic | 0.96 | 0.83 | 1.12 | 1.02 | 0.87 | 1.19 |
| Other | **1.43** | 1.04 | 1.95 | **1.35** | 0.98 | 1.85 |
| Age category | | | | | | |
| 19 and younger | 1.00 | Reference | | 1.00 | Reference | |
| 20 to 34 | **0.61** | 0.56 | 0.67 | **0.90** | 0.82 | 0.99 |
| 35 and older | **0.56** | 0.49 | 0.64 | 1.00 | 0.87 | 1.15 |
| Education level | | | | | | |
| < High school | **3.06** | 2.77 | 3.37 | **1.39** | 1.23 | 1.57 |
| High school or GED | **2.39** | 2.17 | 2.63 | **1.27** | 1.14 | 1.42 |
| Some college | **1.70** | 1.54 | 1.87 | **1.12** | 1.01 | 1.25 |
| College grad or higher | 1.00 | Reference | | 1.00 | Reference | |
| Paternal acknowledgement | | | | | | |
| Yes | 1.00 | Reference | | 1.00 | Reference | |
| No | **2.10** | 1.95 | 2.25 | **1.13** | 1.04 | 1.23 |
| Payment method | | | | | | |
| Medicaid | 1.00 | Reference | | 1.00 | Reference | |
| Private/self-pay/other | **0.45** | 0.42 | 0.48 | **0.80** | 0.73 | 0.87 |
| Unknown | **0.62** | 0.53 | 0.73 | 0.93 | 0.78 | 1.01 |
| Prenatal care index | | | | | | |
| Inadequate | 1.00 | Reference | | 1.00 | Reference | |
| Intermediate | **0.72** | 0.63 | 0.82 | **0.85** | 0.75 | 0.97 |
| Adequate | **0.45** | 0.41 | 0.50 | **0.72** | 0.65 | 0.79 |
| Adequate plus | **0.86** | 0.79 | 0.94 | **1.27** | 1.16 | 1.40 |
| Unknown | **0.78** | 0.69 | 0.87 | 1.02 | 0.91 | 1.15 |
| BMI category | | | | | | |
| Underweight | **2.19** | 1.96 | 2.45 | **1.77** | 1.59 | 1.99 |
| Normal weight | 1.00 | Reference | | 1.00 | Reference | |
| Overweight | **0.85** | 0.79 | 0.92 | **0.78** | 0.72 | 0.84 |
| Obese | **0.86** | 0.80 | 0.93 | **0.69** | 0.63 | 0.74 |
| STI status | | | | | | |
| Yes | **2.12** | 1.70 | 2.64 | 1.11 | 0.88 | 1.39 |
| No | 1.00 | Reference | | 1.00 | Reference | |
| Chronic disease status | | | | | | < 0.0001 |
| Yes | **1.69** | 1.56 | 1.83 | **1.75** | 1.61 | 1.91 |
| No | 1.00 | Reference | | 1.00 | Reference | |

Numbers in bold indicate significant odds ratios

Multivariate model also included a three way interaction between payment method and paternal acknowledgment and smoking cessation, as well as maternal race/ethnicity, age, education level, payment method, paternal acknowledgement, adequacy of prenatal care, sexually transmitted infection (STI), chronic disease status, and body mass index

LBW in reference with Medicaid (aOR 0.80, 95% CI 0.73, 0.87). Lack of paternal acknowledgement remained at a significantly increased odds for LBW (aOR 1.13, 95% CI 1.04, 1.23). Intermediate and adequate prenatal also remained at a reduced risk for LBW in reference with inadequate prenatal care (aOR 0.85, 95% CI 0.75, 0.97; aOR 0.72, 95% CI 0.65, 0.79). While the increased risk for LBW no longer held after adjustments regarding STI, the risk for LBW strengthened after adjustments for those with a chronic condition (aOR 1.75, 95% CI 1.61, 1.91).

## Discussion

This study demonstrates that timing of smoking cessation reduces the effect of smoking on LBW in full-term pregnancies. By limiting our sample to full term births, we were able to add to the literature that that there are progressive increases to risks for LBW as smoking continues throughout the pregnancy. Mothers who quit smoking during their pregnancy had a 30.4%, 108%, and 149% increased odds of delivering a LBW baby in reference to non-smokers, depending upon quitting during the first or second trimester, or not quitting at all, respectively. These findings are biologically plausible, as nicotine constricts blood vessels, restricts blood flow to the placenta, and decreases the ability of red blood cells to carry oxygen. These effects can result in reduced oxygen delivery to the developing baby, which in turn can restrict growth. Our findings indicate a dose response for this effect, the longer a mother smokes during pregnancy, the greater the risk of giving birth to a LBW baby. These findings are consistent with previous studies Blatt et al. (2015) that reported an association between smoking cessation and birth weight restriction, strengthening the evidence that smoking cessation at any trimester during pregnancy can significantly reduce one's risk for having a LBW baby (Blatt et al. 2015).

Also notable in this study are the significant social, economic and maternal health contributions to LBW. Comparable to other studies, LBW babies had an increased odds of being born to Black non-Hispanic mothers, mothers with a high school degree or less, teenage mothers, mothers with inadequate prenatal care, and mothers with a chronic health condition. Utilization of prenatal care and having chronic conditions also contributed to an increased risk for LBW, although the additional risk for LBW for those women with an STI disappeared after adjustments. Targeting higher-risk groups when planning prenatal interventions may have the greatest impact on reducing LBW. Importantly, the paternity acknowledgement-Medicaid-smoking interaction that emerged warrants further exploration. This may indicate an important interplay between interpersonal support systems as they impact individuals living within poverty. Future work should explore the differences among these categories in a stratified analysis.

This study's large sample size (n = 183,353) provides statistical power that strengthens the confidence in our findings. In addition, by limiting the sample to full-term births we were able to remove the influence of preterm bias on LBW, in order to isolate the influence of smoking throughout a pregnancy. Focusing in full term births is important because prior studies that examined the effects of smoking on birth outcomes included both preterm and full-term births, and lack of adjustment for gestational age/preterm birth could introduce bias that leads to inaccurate estimates of the effects of smoking on LBW. The fact that a positive association exists between smoking and LBW even when restricted to term births emphasizes the risk of smoking and importance of smoking cessation for all pregnant women.

In spite of the aforementioned strengths, several limitations have been identified with this study. Because smoking was self-reported, and because many women know that they should not smoke while pregnant, women may have underreported their smoking history due to social desirability. If under-reporting occurred, the negative effects of smoking would be counted as non-smoking, and the study's findings would be biased towards the null, suggesting our current estimates would be conservative. Additionally, the omission of alcohol and drug use during pregnancy may also confound the relationship between smoking cessation and LBW; because these variables are not available on MO birth certificate date, and a better understanding of the role that alcohol and drug play when a woman smokes during pregnancy remains an avenue for future study. Lastly, beyond the dichotomous classification of smoking during each trimester, the frequency of smoking and depth of inhaling likely has a differential impact across smokers.

Significantly increased risk for LBW as smoking continues throughout pregnancy has important clinical and public health implications. Importantly, when a woman quits smoking before pregnancy, she has no additional risk for LBW when compared with a women who never smoked. This underscores the importance of modifying health behaviors before pregnancy, that is, preconceptionally. This further supports the CDC recommendation that the first prenatal visit should be preconceptionally, a practice not yet widely adopted. Similarly, the relationship between smoking duration and odds of LBW shows that quitting smoking during the first trimester of pregnancy, while not quite as good as non-smoking, is still better than continuing to smoke into the second and third trimesters (Polakowski et al. 2009; Ngui et al. 2009). The association of LBW with both paternal acknowledgement and Medicaid suggests that future studies should explore the role that social support and access to care have on the health of women. Finally, at the policy level, higher cigarette taxes (Missouri has lowest tax rate

in the country), minimum purchase ages, smoke-free environments, and improved cessation interventions can help reduce smoking prevalence (Tobacco Free Kids 2017). Targeting smoking cessation on high risk groups such as those pregnant women on Medicaid, of younger ages, with lower education, and/or with chronic conditions may help in determining how to allocate limited resources for this important public health problem (Moore et al. 2015).

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