



Psychosocial well-being and efforts to quit smoking in pregnant women of South-Central Appalachia

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ABSTRACT

Introduction: Psychosocial well-being variables from the Tennessee Intervention for Pregnant Smokers (TIPS) study, a longitudinal smoking cessation study in South-Central Appalachia, were investigated as potential predictors of smoking status.

Methods: A sample of 1031 pregnant women participated in an expanded 5A's (Ask, Advise, Assess, Assist, Arrange) program, from 2008 to 2011. Measures of stress, self-esteem, depressive symptoms, and disordered eating collected by interview during the first trimester, or during the third trimester in a combined interview if participants began prenatal care late, were hypothesized to differ among three groups of participants: pregnant women who never smoked, pregnant women who smoked but quit prior to birth, and pregnant women who smoked and did not quit prior to birth. Smoking status was measured throughout the study. Whether or not a participant quit smoking was assessed at delivery.

Results: Non-smokers were lowest in stress $F(2,1027) = 46.38, p < .001$ and depression $F(2,1028) = 39.81, p < .001$, and highest in self-esteem $F(2,1018) = 29.81, p < .001$. Only self-reported stress and self-reported self-esteem predicted quitting. Higher reported stress levels were related to a slightly lower likelihood of quitting (OR = 0.95, 95% CI 0.92, 0.98, $p = .003$) and higher reported self-esteem predicted a slightly higher likelihood of quitting (OR = 1.05, 95% CI 1.02, 1.08, $p = .001$).

Conclusions: Findings may lead to improved intervention programs and reduction of adverse health effects in children attributable to prenatal smoking. More research should be conducted on smoking cessation in rural pregnant women.

1. Introduction

Smoking during pregnancy can be dangerous to the health of the unborn fetus and has been extensively studied (“Smoking during pregnancy”, 2015; “Tobacco use and pregnancy”, 2017; Bailey, 2015). According to the Centers for Disease Control and Prevention (CDC), smoking during pregnancy can increase the likelihood of miscarriage and birth defects, disrupt the flow of oxygen and nutrients through the placenta, and cause premature and low birth weight babies (“Tobacco use and pregnancy”, 2017). Unfortunately, pregnant women continue to participate in this hazardous behavior, and some groups at higher rates, such as women living in the Appalachian region and earning incomes that fall below poverty level (Bailey, 2015). Rates of women who smoke during pregnancy in Appalachia range from 25%–49%, reaching a level more than triple the national average (Bailey, 2015). Not surprisingly, rates of preterm birth and low birth weight in this area

are also higher than the national average (Bailey, 2015). Pregnant women who already smoke can positively impact the life and health of their child by quitting the habit before delivery (“Smoking during pregnancy”, 2015; “Tobacco use and pregnancy”, 2017).

The aim of the Tennessee Intervention for Pregnant Smokers (TIPS) study was to develop and implement a smoking cessation intervention in South-Central Appalachia. Participating women who were no longer smoking at delivery had infants with higher birth weights, shorter hospital stays, and lower risk of neonatal mortality compared to the pregnant women who did not quit smoking (Bailey, 2015). In the current study, the psychosocial factors of stress, depression, self-esteem, and disordered eating, were examined to determine what factors predicted whether participants quit smoking. Some research has been done on the relationships between smoking, psychosocial factors, and disordered eating; however, most research focuses on the relationships among a select few instruments, such as smoking status and stress, and

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has often been conducted among adolescent populations. Additional research on the relationships among psychosocial factors, disordered eating, and smoking during pregnancy is needed in order to inform the development of effective intervention programs for pregnant smokers.

The relationship between smoking cessation and psychosocial factors in pregnant women is complicated. For example, psychological stress in pregnant mothers increases the likelihood of preterm births, low birth weights, and other adverse fetal outcomes (Adanu, Boama, Guinto, & Sosa, 2014), in addition to impairing the behavioral development of infants after they are born (Adanu et al., 2014; Davis, Glynn, Waffarn, & Sandman, 2010). Quitting smoking can reduce the likelihood of adverse fetal outcomes (“Tobacco use and pregnancy”, 2017). Stress during pregnancy also negatively affects the health of the pregnant woman, increasing the risk of pre-eclampsia and post-partum depression (Adanu et al., 2014). However, the process of quitting smoking could be related to existing stress levels, as a 2015 study published in the journal *Addictive Behaviors* reported a positive correlation between stress and nicotine withdrawal symptoms, with these negative symptoms more pronounced in women compared to men (Lawless, Harrison, Grandits, Eberly, & Allen, 2015). Additional research reviewing over twenty existing studies examined the relationship between stress and smoking during pregnancy and concluded that pregnant smokers have higher levels of stress than nonsmokers (Damron, 2017). Relevant to the TIPS demographic, women with low socioeconomic status are more likely to have a negative affect and stress during pregnancy compared to women of higher socioeconomic status (Businelle et al., 2012). This results in a higher likelihood of smoking during pregnancy, and a higher likelihood of postpartum relapse into smoking if the women are able to quit before birth (Businelle et al., 2012; Yang et al., 2017).

Similar to stress, self-esteem during pregnancy is predicted by many variables, such as marital status, level of physical activity, and level of social support (Macola, Vale, & Carmona, 2010). Additional evidence suggests that females are slightly more likely to experience low self-esteem when compared to males, and that adolescents have lower self-esteem when compared to adults (Zuckerman, Li, & Hall, 2016). A 2013 study reported that pregnant women with low self-esteem are more likely to smoke than pregnant women with high self-esteem, and the women who smoked were more likely to report “emotion-focused coping” in response to negative emotions, such as anxiety and depression (Varescon, Leignel, Gérard, Aubourg, & Detilleux, 2013). In the same vein, rates of smoking during pregnancy are higher among women of low socioeconomic status and low education levels compared to women with higher income, employment rates, and education levels (Boucher & Konkle, 2016; Yang et al., 2017). Boucher and Konkle conclude that smoking cessation intervention programs during pregnancy should be tailored for women’s economic and psychosocial status to increase effectiveness (2016). These findings are echoed by Yang and colleagues with the addition of depressive symptoms as a variable related to SES that should be targeted in intervention programs (2017). Furthermore, self-esteem, depression, weight gain, and other variables can contribute to body dissatisfaction during pregnancy, though research on this subject is inconclusive (Meireles, Neves, Carvalho, & Ferreira, 2015).

Self-esteem and depression are closely linked, particularly among women in rural areas. One study conducted in rural Appalachia, Ohio, found that depression and low SES were related most strongly in female smokers compared to other members of the population (Post et al., 2013). Specific to pregnant women in low-income rural areas, Jesse, Kim, and Herndon (2014) report that stress and depression soon before giving birth was regulated more by self-esteem than other factors, such as social support. Unfortunately, there is limited research on depression and smoking among rural pregnant women (Rhodes-Keefe, 2015). Much of the research done between smoking and depression involves adolescents, and the close relationship between the two variables is thought to be developed in adolescence and maintained throughout adulthood (Tjora et al., 2014). Without the criterion of rural, women

with depression are four times more likely to smoke during pregnancy compared to women without depression (Goodwin et al., 2017). Not only are women with depressive symptoms more likely to smoke during pregnancy, they are also less likely to quit smoking before delivery (Tong et al., 2016).

In addition to the psychosocial factors of stress, self-esteem, and depression, TIPS participants were also scored on patterns of disordered eating. Eating disorders are defined by the National Institute of Mental Health as medical illnesses associated with a variety of antagonistic psychosocial influences and outcomes (“Eating disorders: About more than food”, 2014). The habit of smoking is appealing to many women with body image issues because smoking can assist in weight loss (Udo et al., 2016). For example, female smokers with eating disorders, particularly binge eating disorder, tend to report smoking cigarettes as a means of appetite and weight control (Udo et al., 2016). These concerns are not unfounded, as research reports an association between smoking cessation and weight gain, and the fear of weight gain presents as a barrier to smoking cessation, particularly among individuals with existing psychiatric issues (Ganhao, Trigo, Paixao, & Cardoso, 2016). Among adolescents, perceived weight and changes in weight have been shown to predict smoking (Lange, Thamotharan, Racine, Hirko, & Fields, 2014).

During pregnancy, weight concerns and eating disorders are more common than researchers previously thought and are actually increasing due to Western influences (Cardwell, 2013; Easter et al., 2013). Infertility is common among women with eating disorders, and research reveals that these women are at an increased risk for negative birth outcomes when they do conceive (Barron & Ward, 2014; Linna et al., 2014). Pregnant women who have eating disorders tend to show a significant decrease in symptoms during pregnancy; however, symptoms of disordered eating often return after delivery (Easter et al., 2013; Fogarty, Elmir, Hay, & Schmied, 2018). Women with anorexia nervosa are more likely to deliver premature and low birth weight babies, and bulimia during pregnancy increases the likelihood of maternal hypertension, abnormally large infants, and other health complications (Linna et al., 2014). Though one research study reports that targeting smoking during pregnancy may improve birth outcomes for pregnant smokers with anorexia nervosa, there is limited research examining the relationship between disordered eating and smoking cessation during pregnancy (Micali, Larsen, Strandberg-Larsen, & Andersen, 2015). The aforementioned studies support the hypothesis that women with disordered eating patterns are less likely to quit smoking than women who do not exhibit disordered eating patterns, and the lack of existing data amplifies the need to examine these factors together.

All of the variables of interest have been studied in various combinations. This particular constellation of variables has not been studied together in a rural pregnant population.

2. Materials and methods

2.1. Participants

Participants for the TIPS study were 1063 pregnant women recruited through convenience sampling from five prenatal practices in South-Central Appalachia. The final sample contained 1031 participants (468 pregnant women who never smoked, 227 women who smoked but quit prior to birth, 336 women who smoked and did not quit prior to birth) who had complete data. Women whose pregnancies did not continue past 20 weeks and who delivered with fewer than four weeks of prenatal care were excluded. The sample consisted of predominantly White (93.9%, $n = 968$), low income (78.8%, $n = 802$ no insurance or public health insurance; e.g., Medicaid, TennCare) pregnant women between the ages of 14 to 45 years of age ($M = 24.73$ years of age; $SD = 5.87$). Only 5.8% ($n = 59$) were between the ages of 14 and 17. Participants reported varied levels of education (18.3% did not graduate from high school, 42.2% graduated from high school, 23.2%

possessed some college education, and 16.2% graduated from college), and varied marital status (42.5% were married, 39.7% were not married or living with a partner, and 17.8% were unmarried but living with a partner). In addition, participants reported the number of living children to whom they had given birth ($M = 0.92$, $SD = 1.14$). The majority reported zero (45.7%, $n = 468$) or one child (30.8%, $n = 315$) with a range 0 to 10. Participants received a \$20 incentive payment for each interview.

2.2. Materials

An intervention using an expanded 5A's (Ask, Advise, Assess, Assist, Arrange) model and motivational interviewing was implemented by trained health educators over the course of 4 prenatal visits (typically occurring monthly in the first and second trimesters of pregnancy). A variety of instruments were completed including, but not limited to, stress and self-esteem subscales of the Prenatal Psychosocial Profile (PPP) (Curry, Burton, & Fields, 1998), Center for Epidemiologic Studies Depression Scale (CESD-10) (Radloff, 1977), and Eating Attitudes Test-26 (EAT-26) (Garner, Olmsted, Bohr, & Garfinkel, 1982). In addition to the mental health and social issues instruments, interviews included demographic, smoking, and substance use questionnaires.

The PPP consists of three subscales, two of which are used in the current study: stress and self-esteem (Curry et al., 1998). The stress subscale of the PPP consists of 11 items scored on a 4-point Likert-type scale. Scores range from 1 (*no stress*) to 4 (*severe stress*). Summed scores range from 11 to 44, with higher scores indicating higher levels of stress. Cronbach's alpha for the self-esteem subscale was 0.79, which is well within the acceptable range.

The self-esteem subscale of the PPP follows a similar pattern, with responses ranging from 1 (*strongly agree*) to 4 (*strongly disagree*). This subscale consists of the complete 10-item Rosenberg Self-Esteem Scale (Rosenberg, 1965). One additional item "Feel like you have control over your life" was added to the original scale for the PPP, resulting in a total of 11 items (Curry et al., 1998, p. 212). Higher scores indicate lower levels of self-esteem. Cronbach's alpha on the self-esteem subscale was 0.85 for the positive self-esteem items and 0.84 for the negative self-esteem items, both of which are well within the acceptable range.

The CESD-10 is comprised of 10 items scored on a 3-point Likert-type response scale (Radloff, 1977). Participants respond to each item based on its relevancy during the week preceding the survey, such as "I was bothered by things that usually don't bother me." Questions 5 and 8 are scored based on a scale ranging from 3 (*rarely or some of the time*) to 0 (*most or all of the time*). All other items were scored in the reverse manner, from 0 (*rarely or none of the time*) to 3 (*most or all of the time*). A sum of the 10 items totaling greater than or equal to 10 indicated that the individual is depressed. The test should not be scored if more than two items are left unanswered. Cronbach's alpha for the CESD-10 was 0.65, which was slightly lower than desired; however, analyzing alpha with items removed would have been above the desired 0.70 if either positively related items were removed (i.e., *I feel hopeful...*, *I was happy*).

The EAT-26 is comprised of 26 items scored on a 3-point Likert-type response scale (Garner et al., 1982). The first 25 items are scored on from the following scale: 3 (*always*), 2 (*usually*), 1 (*often*) and 0 (*sometimes, rarely, or never*). An item example is "Find myself preoccupied with food." The final item ("Enjoy trying new rich foods.") is scored on a reverse scale, from 0 (*always, usually, or often*), 1 (*sometimes*), 2 (*rarely*), and 3 (*never*). The sum of all responses is used to assess one's risk of having an eating disorder. Final scores greater than or equal to 20 are considered significant, and individuals who score in this range are recommended to consult a mental health or other medical professional with experience diagnosing eating disorders. Cronbach's alpha on the EAT-26 was 0.87, which is well within the acceptable range.

Smoking status was assessed via self-report, cotinine urinalysis, and exhaled carbon monoxide levels measured using a carbon monoxide

monitor. If any of the aforementioned smoking assessments (self-report, exhaled carbon dioxide, urinalysis) were positive for smoking, the woman was considered to be a current smoker. Internal consistency was not calculated for smoking status as data came from several different measures.

2.3. Procedures

Procedures for TIPS were approved by the East Tennessee State University institutional review board, and all participants provided with informed consent. Participants were interviewed in the first and third trimester, at 6 weeks postpartum, 6–8 months postpartum, and were interviewed for the final time 15 months postpartum. Prenatal and birth medical records were also reviewed.

Participants who smoked received an intervention that was tailored to match their willingness to quit smoking within the next 30 days. Intervention participants indicated willingness to quit smoking during their first prenatal visit. Women rated their willingness to quit on a scale of 1 to 10. Those with a value greater than or equal to 3 were presented with an expanded 5 A's intervention program by a trained health educator. Additionally, participants who smoked were provided with a self-help book designed for the TIPS study, which the interviewers discussed at the initial meeting and encouraged participants to utilize throughout their pregnancy. The intervention was personalized to the needs of each participant, though every intervention explored discrepancies between current behavior, personal goals, and health recommendations (Bailey, 2015). Stress, self-esteem, depressive symptoms, and disordered eating measures were administered during the first trimester, or during the third trimester in a combined interview if participants began prenatal care late. Detailed methods have been published in *Health Education and Behavior* (Bailey, 2015).

2.4. Analysis

A total score was calculated for each measure (i.e., two subscale scores of the PPP: self-esteem and stress, score on the CESD-10, and score on the EAT-26). One-way Analysis of Variance (ANOVA) was conducted to compare the stress and self-esteem subscales of the PPP, CESD-10 scores, and EAT-26 scores among the three groups: pregnant women who never smoked, pregnant women who smoked but quit prior to birth, and pregnant women who smoked and did not quit prior to birth. Logistic regression was conducted to predict odds of smoking cessation in pregnant smokers in Appalachia, including only the subgroup of women ($n = 563$) who were smokers when they entered the study.

3. Results/discussion

Women's stress levels differed by smoking status [$F(2,1027) = 46.38$, $p < .001$, see Table 1]. Those who never smoked reported significantly lower stress levels ($M = 17.31$, $SD = 4.38$) than women who quit by delivery ($M = 19.28$, $SD = 4.95$), and women who quit by delivery reported stress levels that were significantly lower than women who did not quit ($M = 20.61$, $SD = 5.38$).

Women's self-esteem differed by smoking status, with nonsmokers reporting higher self-esteem [$F(2,1018) = 29.81$, $p < .001$, see Table 1]. Women who never smoked reported significantly higher self-esteem ($M = 36.99$, $SD = 5.46$) than women who quit by delivery ($M = 35.47$, $SD = 5.61$), and women who quit by delivery reported significantly higher self-esteem than women who did not quit ($M = 33.81$, $SD = 6.16$).

Women's number of reported depressive symptoms differed by smoking status, with nonsmokers reporting fewer depressive symptoms [$F(2,1028) = 39.81$, $p < .001$, see Table 1]. Women who never smoked reported significantly fewer depressive symptoms ($M = 8.03$, $SD = 4.93$) than women who quit by delivery ($M = 10.36$, $SD = 5.59$)

Table 1
One-way between-subjects ANOVA analysis.

Dependent variables	ANOVA			Descriptives by group					
	F	MSE	η^2	Non-smoker		Quit by delivery		Still smoking at delivery	
				M	SD	M	SD	M	SD
PPP stress scores	46.38*	23.53	0.08	17.31	4.38	19.28	4.95	20.61	5.38
PPP self-esteem scores	29.81*	32.81	0.06	36.99	5.46	35.47	5.61	33.81	6.16
CESD scores	39.81*	27.96	0.07	8.02	4.93	10.36	5.59	11.26	5.55
EAT 26 scores	0.29	14.35	0.001	1.19	3.59	1.35	4.51	1.38	3.51

Note:
* $p < .001$.

or women who did not quit by delivery ($M = 11.26, SD = 5.55$), but the two smoking groups did not differ significantly on number of reported depressive symptoms.

EAT-26 scores did not differ by smoking status ($F(2,1028) = 0.29, p = .75$). Nonsmokers' EAT-26 scores ($M = 1.19, SD = 3.59$) did not differ from EAT-26 scores of women who quit by delivery ($M = 1.35, SD = 4.51$) or women who did not quit by delivery ($M = 1.38, SD = 3.51$).

Logistic regression, controlling for age, was performed on the subsample of women who were smoking in the first trimester of pregnancy to determine which of the variables of interest best predict whether women who smoke during pregnancy will quit by delivery (see Fig. 1). Of the 563 women who smoked at the first trimester interview, 227 quit prior to delivery. Only self-reported stress and self-reported self-esteem predicted quitting. Higher reported stress levels were related to a slightly lower likelihood of quitting ($OR = 0.95, 95\% CI 0.92, 0.98, p = .003$) and higher reported self-esteem predicted a slightly higher likelihood of quitting ($OR = 1.05, 95\% CI 1.02, 1.08, p = .001$). Depressive symptoms and EAT-26 scores did not predict quitting among women who were smoking in the first trimester of pregnancy.

Existing literature that examines the variables of interest in pregnant smokers is limited, though relevant research generally supports the results of the current study. Increased levels of stress and low self-esteem have been shown to predict the likelihood of smoking. Like stress and self-esteem, existing research findings support the increased likelihood of smoking among individuals who have a history of depressive symptoms when compared with those who do not have a history of depressive symptoms, and this finding was partially supported by the current study. Women's depression scores did differ by smoking status, but depression was not a significant predictor of quitting likelihood according to logistic regression analysis. Depression was measured in the first trimester while smoking cessation was measured at

birth. The fact that the results were not predictive could be that depression symptoms changed during pregnancy. Additionally, because smokers reported more depressive symptoms, and the logistic regression focused only on smokers, there was reduced variance in EPDS scores for this subsample, reducing power to find an effect.

Further, existing literature supports a strong relationship between smoking and disordered eating patterns among adolescents, though little research has explored these variables during pregnancy. The current study shows no relationship between smoking cessation rates and disordered eating patterns in this sample of pregnant smokers. These results are inconsistent with the hypothesis and existing research on adolescents, but the differing demographic, specifically pregnant women, does not make the discrepancy surprising. Previous research has shown that disordered eating tends to improve during pregnancy, and this could be true in the current study (Easter et al., 2013; Fogarty et al., 2018). A potential explanation for this theory is that a woman may feel greater incentive to maintain a nutritionally adequate diet for the sake of nourishing her unborn child, therefore leading to improvement in disordered eating patterns that are present when the woman's food intake is only nourishing herself. Limitations of the current study include a lack of standardized script during personalized interventions with participants, inherent limitations of self-report measures, lack of diversity in the primarily White, Appalachian population, and a sample size limited to patients from five prenatal practices. The Appalachian population is a unique demographic in which rates of pregnant smoking are alarmingly high, and future research should be done to explore whether the discovered relationships among stress, self-esteem, depression, and smoking cessation are true for populations in other areas. Much of the research has been conducted with adolescents, revealing known differences between adolescents and adults (Mueller, Cromheeke, Siugzdaite, & Boehler, 2017), however, the proportion of adolescents in the current sample was not adequate for comparisons

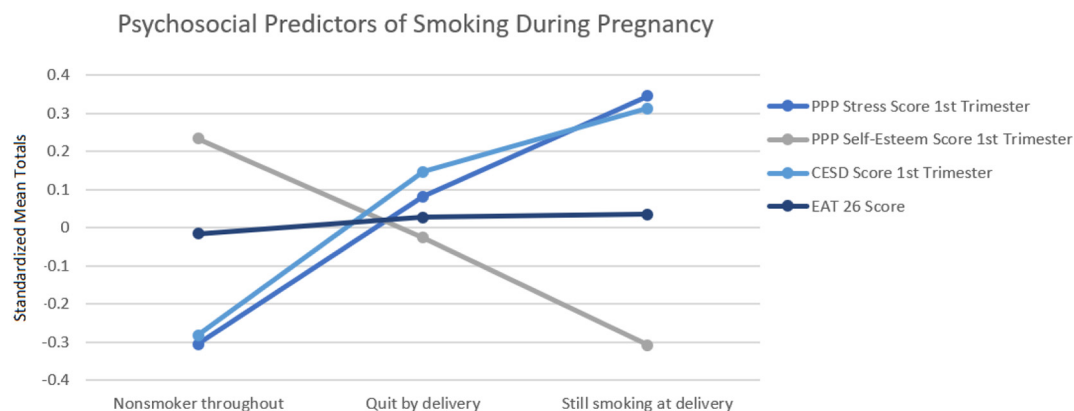


Fig. 1. Psychosocial predictors of smoking during pregnancy.

between adolescents and adults. Adolescence is a sensitive period of brain development (Fuhrmann, Knoll, & Blakemore, 2015), and adolescents process emotions with different parts of the brain (Mueller et al., 2017). Therefore, significant differences exist between adolescents and adults regarding psychological and psychosocial research and should be considered in future studies.

4. Conclusion

Studying the psychosocial well-being and disordered eating patterns of TIPS participants revealed relationships among stress, self-esteem, depression, and efforts to quit smoking in pregnant women of South-Central Appalachia. Variables that directly predicted quitting include self-reported stress and self-reported self-esteem. Results of the original TIPS study demonstrated more positive birth outcomes for women who successfully stopped smoking when compared with women who did not quit before delivery; therefore, understanding how psychosocial well-being relates to quit rates may help tailor future intervention programs. More research should be done with intervention programs targeted toward pregnant smokers with significantly high levels of stress and low levels of self-esteem. Screening women for these characteristics at prenatal healthcare visits may help identify women at risk for smoking or identify women who do smoke who may difficulty quitting. Though depression did not predict quitting, depression scores did differ by smoking status and measuring depression throughout pregnancy, as opposed to only during the first trimester, would be an improvement to future studies. As stated previously, smoking while pregnant is associated with an array of adverse health effects on the unborn fetus, and rates of smoking in pregnant women are significantly higher than the national average in Southern and Central Appalachia ("Tobacco use and pregnancy", 2017; Bailey, 2015). Perhaps, if confirmed by future intervention studies, addressing underlying factors that affect psychosocial well-being in pregnant smokers could assist a greater number of pregnant smokers to quit smoking before delivery and subsequently improve the health of their infants.

Declarations of interest

None.

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