Disparate Rates of Persistent Smoking and Drug Use During Pregnancy of Women of Hawaiian Ancestry

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Background: Significant disparity in smoking rates has been previously reported in pregnant and non-pregnant women of Native Hawaiian ancestry. Disparities in drug use rates have also been reported in non-pregnant women of Native Hawaiian ancestry.

Objective: We undertook this study to compare rates of smoking and drug use during pregnancy among women in Hawaii to see if these differences are associated with disparities in pregnancy complications among Native Hawaiian women.

Methods: Women were enrolled in the Pacific Research Center on Early Human Development study from July 2007 to January 2008, according to approved protocols. Persistent smoking was defined as self-reported smoking within 1 week of admission for labor. Drug use data was assessed by self-report, or if available, toxicology tests at the time of labor.

Results: There were 868 women enrolled in the study during this period. Women of Hawaiian/part-Hawaiian ancestry comprised 22% of the study population. Rates of persistent smoking and drug use among Hawaiian women were significantly higher than the remainder of the study population (21% and 8.3% vs 7.8% and 2.1%, respectively, $P<.001$ for both). Methamphetamine use was associated with an almost 5-fold increase in preterm birth and smoking a 3.4% decrease in birth weights.

Discussion and Conclusion: Women of Hawaiian ancestry continue to smoke and use illicit drugs during pregnancy at significantly higher rates than women of other ethnic groups in Hawaii. In addition to the immediate effects on pregnancy, long-term adverse outcomes of *in utero* exposures of the offspring remain an important health disparity. (*Ethn Dis*. 2010;20[Suppl 1]:S1-215–S1-218)

Key Words: Persistent Smoking, Native Hawaiians, Pregnancy, Drug Use, Health Disparities, Intrauterine Growth Restriction, Preterm Delivery, PRCEHD

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Introduction

Smoking and drug use during pregnancy are known to be harmful, contributing to many pregnancy complications, such as preterm birth, small for gestational age, placental abruption and stillbirth. Because of these known complications, many interventions are done to help mothers stop smoking and cease using drugs during pregnancy.[1] These interventions have been found to be helpful in reducing smoking rates and related complications.[2] Despite these interventions, however, many women continue to use these substances. In the United States, it is estimated that 8% of women continue to smoke during pregnancy[3] and 4–6% use other drugs.[4] Native Hawaiian women have been shown to have higher rates of smoking both before and during pregnancy[5] and higher rates of drug use,[6] but few studies have looked at the role of smoking and drug use as a factor in disparities in pregnancy complications.

Two studies have looked at smoking rates during pregnancy among different ethnic groups in Hawaii, both showing significant differences for Hawaiians and other ethnicities. Fuddy et al, in 1994–95, found that 46% of Native Hawaiian/part-Hawaiian women continued to smoke during pregnancy compared with 24.6% of other ethnic groups.[7] Goebert et al showed, in 2005, 35% of Hawaiian and part-Hawaiian women continued to smoke compared with 6.7% of other ethnicities.[8] While these studies did show a decrease in the percentage of Hawaiian women smoking during those 10 years, they also showed smoking rates among other ethnicities declined much further. Despite these disparities in use, little is known if these disparities are associated with increased pregnancy complications in Hawaiian women.

The current study looks at disparities in smoking and drug use rates among Native Hawaiian and all other women who deliver in the largest tertiary maternity hospital in Hawaii. We also assess whether or not these disparities are associated with disparities in pregnancy complications and adverse birth outcomes.

Materials and Methods

All women delivering at Kapiolani Medical Center for Women and Children (KMCWC) after January 2006 were approached for inclusion in the Pacific Research Center on Early Human Development (PRCEHD) study. The medical center is a tertiary care facility serving the entire Pacific basin, and does approximately 65 percent of deliveries in the state of Hawaii, including the majority of high-risk deliveries. The PRCEHD, an on-going and cross-sectional study, banks placental and blood samples from women at delivery, and links these samples with a database of prenatal, delivery and infant outcome information derived from medical record data and a separate questionnaire regarding ethnicity. Informed consent was obtained from all participants, and the study design was approved by the institutional review boards of both KMCWC and the University of Hawaii. We identified a subgroup of women in the PRCEHD study for whom we had information on smoking and drug use during pregnancy. The study participants from July

Table 1. Study demographics and substance use*

	Hawaiian *n*=193	Non-Hawaiian *n*=679	odds ratio (95% confidence interval)	*P*-value
Age (standard deviation)	**26.9 (6.2)**	**29.1 (6.3)**		**<.0001**
Gravidity (SD)	**3.2 (2.2)**	**2.8 (2.0)**		**.02**
Parity (SD)	**1.5 (1.7)**	**1.1 (1.4)**		**.001**
Gestational age, weeks (SD)	38.6 (2.0)	38.4 (2.0)		.26
Birth weight, grams (SD)	**3258 (510)**	**3170 (563)**		**.04**
Never smokers (%)	**132 (68.4)**	**559 (82.3)**	**.46 (0.3–0.7)**	**<.0001**
Persistent smoking (%)	**40 (20.7)**	**53 (7.8)**	**2.9 (1.9–4.5)**	**<.0001**
Quit smoking before pregnancy (%)	14 (7.3)	41 (6.0)	1.2 (0.6–2.3)	NS
Quit smoking during pregnancy (%)	7 (3.6)	26 (3.8)	.9 (0.4–2.2)	NS
Drug user (%)	**16 (8.3)**	**14 (2.1)**	**4.3 (2.1–8.9)**	**<.0001**
Methamphetamine user (%)	**11 (5.7)**	**10 (1.5)**	**4.0 (1.7–9.7)**	**.0007**
Marijuana user (%)	**5 (2.6)**	**3 (.4)**	**6.0 (1.4–25)**	**.0057**

* *n* unless specified otherwise.
Significant values are in bold.
Persistent smoking is self-admitted smoking within one week of delivery.

2007 through January 2008 were included in this subset analysis.

Extensive ethnicity data was collected from each participant after delivery, asking each woman her own ethnicity as well as the ethnicities of each of her four grandparents. As the majority (64%) of the participants were of mixed ethnicity and no women were of pure Hawaiian ancestry (defined as having 4 grandparents of Hawaiian ancestry),[9] women were classified as of Hawaiian ancestry if they selected Hawaiian as any part of their ancestry as is customary in Hawaii. Smoking history was by self-report. Patients were classified as: 1) never smokers, 2) quit before pregnancy, 3) quit during pregnancy, or 4) persistent smokers if still smoking at the time of labor and delivery. Drug history was based on self-report or urine toxicology, if available. A woman was considered positive if she admitted drug use during pregnancy or if she had a positive toxicology at the time of delivery. Urine toxicology was done at the discretion of the attending physician and thus was not available on every woman.

Statistical analysis was done using *t*-test and chi-square for univariate analyses and stepwise linear and logistic regression for multivariate analyses using SAS 9.1 (SAS Inc., Cary, NC). Logistic and linear regressions were done for preterm delivery and birth weight using known confounding variables (stated in table) by backward elimination model with a 0.1 significance level required to remain in the model.

RESULTS

A total of 868 women were enrolled in the study during this time period. Demographic data is presented in Table 1. Native Hawaiian participants were significantly younger and had higher average gravidity and parity. They were three times as likely to continue to smoke during pregnancy. They had more than four times the prevalence of methamphetamine and/or marijuana use during pregnancy than any other group. Despite this fact, they had significantly higher birth weights.

Pregnancy complication data is presented in Table 2. Hawaiian women were three times more likely to be obese, a known risk factor for macrosomia. They also had a trend towards less preterm births despite their increased substance use.

To examine whether smoking or substance use contributed to increased pregnancy complications, stratified analysis by logistic regression was done. The results of this analysis are presented in Table 3. Methamphetamine use was associated with an almost 5-fold increase of delivery before 37 weeks. Being Hawaiian trended to being even more protective for preterm delivery after controlling for smoking and drug use.

Linear regression (Table 4) reveals that persistent smoking is associated with a decrease in birth weight of 116 grams (a 3.5% decrease) when controlled for maternal age, drug use, parity, gestational age, diabetes, obesity and no prenatal care. Hawaiian women had a 31 gram higher birth weight, when controlled for these variables.

DISCUSSION

Our research shows a significant disparity remains in smoking and drug use in Native Hawaiian women in Hawaii. Though the persistent smoking rate has decreased since 1995 and 2005,[7,8] it still remains more than twice the rate of most other ethnic groups. While a paradoxical decrease in the risk of preeclampsia with smoking has been known since 1959,[10,11] this risk is more than offset by the increased risk of other pregnancy complications. This disparity could be contributing to an excess rate of preterm delivery in the state, as well

Table 2. Pregnancy complications*

	Hawaiian *n*=193	Non-Hawaiians *n*=679	odds ratio (95% CI)	*P*-value
Preeclampsia	10 (5.2%)	33 (4.9%)	1.1 (.5–2.2)	NS
Diabetes	22 (11.4)	91 (13.4)	.8 (.5–1.4)	NS
Any hypertension	24 (12.4)	65 (9.6)	1.3 (.8–2.2)	NS
Preterm <37 weeks	24 (12.4)	107 (15.8)	.8 (.5–1.2)	NS
Very preterm <32 weeks	3 (1.6)	11 (1.6)	1.0 (.3–3.5)	NS
LBW	**11 (5.7)**	**74 (10.9)**	**.5 (.3–0.9)**	**.02**
IUGR	2 (1.0)	12 (1.8)	.6 (.1–2.6)	NS
C/S	51 (26.8)	201 (29.7)	.9 (.6–1.2)	NS
Over 4000g	12 (6.2)	36 (5.3)	1.2 (.6–2.3)	NS
Obesity	**9 (4.7)**	**11 (1.6)**	**3.0 (1.2–7.3)**	**.01**
Asthma	10 (5.2)	22 (3.2)	1.6 (.8–3.5)	NS
Late prenatal care	24 (12.4)	65 (9.6)	1.3 (.8–2.2)	NS
No prenatal care	2 (1.0)	6 (.9)	1.2 (.2–5.9)	NS

Significant values are in bold.

* *n* (%) unless specified otherwise.

Any hypertension=preeclampsia, pre-gestational and gestational hypertension.

LBW=low-birth weight (<2500g), IUGR=intrauterine growth restriction (<10% for gestational age), C/S=Cesarean delivery.

as other complications of low birth weight. Estimates indicate that eliminating smoking during pregnancy would reduce infant deaths by 5% and reduce the proportion of low birthweight singleton births by 10%.[12,13] In addition, multiple studies have shown increased morbidity throughout the lifetime of children of women who smoked throughout pregnancy, including increased risks of obesity, asthma, allergies, attention deficit hyperactivity disorder and sudden infant death syndrome.[14–18] In contrast to our data, Kieffer et al showed, in 1994, that Native Hawaiian women in Hawaii had worse outcomes than White women, notably higher rates of preterm birth, low birthweight and neonatal mortality among normal birth-weight infants.[19] Our data shows that increased smoking and drug use rates (especially methamphetamine) may have been associated with these poorer outcomes, as the methamphetamine epidemic started in Hawaii and California during the 1980's.[20] After controlling for smoking and drug use, Hawaiian women actually have lower rates of preterm delivery and low-birth weight. The increased obesity rates that have occurred in the past 20 years, especially among Native Hawaiian women, may have a role in the increased birth weights of their infants and now lower rates of low-birth weight infants.

This study is also one of the first to look at the role of methamphetamine in adverse pregnancy outcomes in Hawaiian and non-Hawaiian women. The Infant, Development, Environment and Lifestyle (IDEAL) study does have Honolulu as one of its study sites.[20] The IDEAL study did show decreased birth weight in children of women who used methamphetamine throughout their pregnancies, but no increase in other adverse pregnancy outcomes. The numbers in our study are too small to make any definitive conclusions about the effects of methamphetamines in pregnancy, other than a strong association with preterm delivery and a possible association with preeclampsia. In the future, with additional enrollment in the PRCEHD study, we should be able to provide additional data on these pregnancy complications.

A study limitation is that smoking status is obtained by maternal self-report and drug use data is obtained in a non-systematic way. Certainly many of the control women could be drug users, which would definitely bias the data, and account for lack of effect of methamphetamine on birth weight, as has been seen in previous studies. Native Hawaiian women are more likely to obtain care from community health centers and are thus more likely to get screened for substance use disorders, which could definitely bias the prevalence data. In future studies, we hope to correlate this information with testing on umbilical cords for drug levels as well as cotinine.

Interventions are necessary to help women stop smoking both before and during pregnancy. Efforts to prevent adolescents from smoking are also essential. In addition, screening and treatment for other addictive behaviors during pregnancy is paramount in preventing adverse pregnancy outcomes. Hawaiian women deserve special consideration for these interventions as they smoke at higher rates both before and during pregnancy and use drugs at higher rates during pregnancy. Also, as Native Hawaiian women are more likely

Table 3. Associated variables for preterm delivery (before 37 weeks)

	adjusted odds ratio	95% confidence interval	*P*-value
No prenatal care	**14.5**	**2.5–111**	**.004**
Preeclampsia	**7.9**	**3.9–16**	**<.0001**
Methamphetamine use	**4.8**	**1.7–13.4**	**.003**
Persistent smoking	1.1	.6–2.2	.7
Part-Hawaiian	.7	.4–1.2	.16
Maternal age	**1.03**	**1.005–1.064**	**.02**

Significant values are in bold.

Other variables removed from the model as being non-significant included diabetes, hypertension, late prenatal care, and parity.

Table 4. Birth weight associations with selected potential covariates

		95% Confidence Interval		*P*-value
Dependent mean	3333 g			
Smoking	**−116 g**	**−217**	**−14**	**.03**
Maternal age	−5 g	−9	.11	.06
Part-Hawaiian *	31 g	−41	102	.4
Parity	**55 g**	**33**	**77**	**<.0001**
No prenatal care *	44 g	−304	393	.8
Methamphetamine use *	133 g	−65	331	.19
Gestational age	**171 g**	**156**	**184**	**<.0001**
Diabetes	**181 g**	**94**	**269**	**<.0001**
Obesity	**215 g**	**21**	**408**	**.03**

Significant values are in bold.

* values were forced into the model. Methamphetamine use became non-significant when controlled for gestational age and no prenatal care.

to present late for prenatal care, additional work is needed to identify the reasons for late prenatal care and work to address them. Community-based participatory research may be helpful to investigate the reasons for these disparities of smoking, substance abuse and late prenatal care and work to reverse them.

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