

Predictors of Secondhand Smoke Exposure During Pregnancy in Costa Rica, the Dominican Republic, and Honduras

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Abstract

Introduction. Secondhand smoke (SHS) exposure poses risks to pregnant women and children. Though smoking among pregnant women in many low- and middle-income countries is low, exposure to SHS might be higher. We examined the prevalence and predictors of SHS among pregnant women from Costa Rica, the Dominican Republic, and Honduras.

Methods. Postpartum women 18+ years old who completed pregnancy in past 5 years were surveyed in health care and community settings.

Results. Data for 1,081 women indicated low tobacco use (1.0%–3.7%), frequent exposure to active smokers (29.0%–34.0%), often being close enough to breathe others' smoke (49.4%–66.5%), and most having smoke-free home policies (70.8%–76.2%). Women reporting unintended pregnancy (adjusted odds ratio [aOR]: 1.44, 95% confidence interval [CI] 1.03, 2.00) and alcohol consumption (aOR: 1.92, 95% CI 1.34, 2.77) were more likely to be close enough to breathe others' smoke. Women with health problems during pregnancy (aOR: 1.48 95% CI 1.07, 2.06) were more likely to have home smoking policies. Tobacco use was associated with all SHS exposure outcomes.

Conclusions. SHS exposure was high during pregnancy; women with higher risk variables, that is, tobacco use, alcohol consumption, and unintended pregnancy were more likely to be exposed. Addressing SHS exposure in pregnancy in low- and middle-income countries can improve maternal health outcomes in vulnerable populations.

Implications: The study results suggest a cluster of multiple risk factors associated with a high prevalence of exposure to SHS among pregnant women in LIMCs from Latin America and Caribbean Region. Interventions, regulations, and policies need to address specific high-risk factors to change behaviors and improve maternal and child health outcomes especially in vulnerable populations.

Introduction

Secondhand smoke (SHS), the smoke from the end of a burning tobacco products and the exhaled smoke, is a well-known carcinogen.¹ SHS exposure poses particular risks to children and pregnant women. SHS during pregnancy represents a major health issue affecting fetal development and causing intrauterine growth restriction, low birth weight, preterm birth, neonatal complications, and child developmental delay.^{1,2} Hence, to avoid adverse pregnancy and child health outcomes, public health strategies and health professionals' priorities must address tobacco use and SHS exposure during pregnancy by reinforcing the existence of smoke-free legislation that protects individuals from exposure to SHS in indoor environments and public places. Smoke-free legislation

also encourages the adoption of smoke-free home (SFH) and automobile policies, denormalizes tobacco use, reduces tobacco consumption among smokers, and improves health outcomes, including the reduction of preterm births and low birth weight.³

Previous studies in the Latin America and Caribbean Region have shown that the prevalence of tobacco use and exposure to SHS varies widely across countries.⁴ High prevalence of current smoking among pregnant women was reported in Uruguay (18.3%), Argentina (10.3%), Brazil (6.1%), and the lowest levels in Ecuador and Guatemala (0.8%) (2004–2005).⁵ Similarly, Torres et al. reported 3% of pregnant women in the Dominican Republic (DR) were current smokers (2009)⁶ and Caleyachetty et al. reported

a prevalence of 0.7% of current smoking among pregnant women in Honduras (HON) (2001, 2012).⁷ The prevalence of SHS exposure reported during pregnancy also varies across countries, from 12.9% in Ecuador,⁵ 13.2% in Guatemala,⁵ 6% in the DR,⁶ 29.6% in Brazil,⁵ to 36% in Uruguay and Argentina.⁸ In terms of SFH policies, approximately 17%–55% of pregnant women reported smoking was allowed at home.^{5,6}

Worldwide, several factors have been associated with SHS exposure among pregnant women. Sociodemographic characteristics such as younger age,⁹ race, and ethnicity,⁹ low educational attainment,⁹ living with significant others who smoke, and living in rural areas are associated with higher likelihood of women being exposed to SHS during pregnancy.¹⁰ In addition, not having smoking rules at home has been associated with higher exposure to SHS.¹¹ Less is known about sociocognitive factors, for example, social support, defined as having a person to turn to in times of need, and locus of control or the degree to which individuals perceive their behavior depends on personal will (internality) or is under the control of chance or significant others (externality).¹¹ Moreover, understanding factors associated with the prevalence of SHS exposure during pregnancy has been used to design effective interventions to prevent the SHS deleterious effects,¹² especially in low- and middle-income countries (LMICs). Examining multiple interrelated and multilevel predictors of SHS exposure could potentially explain the wide variability in SHS exposure prevalence across countries. This study aims to examine the prevalence and predictors of SHS exposure among pregnant women from three LMICs in Latin America and Caribbean Region: Costa Rica (CR), the DR, and HON.

Methods

This secondary analysis incorporated data from a community-based exploratory survey that was conducted in economically disadvantaged settings from CR, DR, and HON, during the period of May–August 2017. Details regarding the parent study design can be found elsewhere.¹³ The study was approved by United States and in-country institutional review boards. Eligibility criteria included all women who were 18 years and older, had a completed pregnancy <5 years ago, were able to speak and understand Spanish and verbally consented to participate. A total of 133 surveys from Costa Rica were eliminated due to missing responses to the tobacco-related questions, leaving a final sample for the current analyses of 1,081 women.

Survey items used for the current analyses included demographic, social, and health. Variables map to the Social Ecological Model reflecting multiple levels of influence.¹⁴ Variables were assessed at the individual level (age, educational level, marital status, parity, current pregnancy, religion, general health, tobacco use, alcohol consumption), interpersonal level (adults and children living at home, perceived social support, multidimensional health locus of control, use of social media, decision making, unintended pregnancy, SHS exposure), community level (country, food insecurity, attendance to religious services), and institutional (internet access).

Tobacco use was defined as using any tobacco products during the last pregnancy. SHS exposure during last pregnancy was measured as three outcomes: *exposure to active smokers* (“during your last pregnancy, was anyone close to you who smoked tobacco products,” yes or no), *close enough*

to breathe other people’s smoke (“during your last pregnancy, how frequently were you close enough to breathe other people’s smoke”; never/almost never/rarely vs. sometimes/frequently), and *home smoking policies* (“during your last pregnancy, which of the following options best describes tobacco use in your home”; multiple options were dichotomized as smoking not allowed at all versus allowed anywhere or for some people).⁶ Using different SHS exposure outcomes that align with previous research^{6,15} improve results validity, facilitate comparison with other studies, and provide clinically and epidemiologically meaningful endpoints to evaluate interventions and track policy changes.

All analyses were conducted using SAS 9.4 software. Descriptive statistics were used to summarize the results for demographics, social, health, and tobacco-related variables. Bivariate analyses were conducted using chi-square tests and analysis of variance. In all analyses, the two-sided *p*-value of less than .05 was considered statistically significant to examine differences among all variables by country of residence. Stepwise binary logistic regression models were performed to evaluate predictors of SHS exposure in the total sample and by country. The latter were exploratory because of the smaller sample size for comparisons. For all multivariable analyses, after examining for multicollinearity, a two-sided *p*-value of .10 was set to select variables to enter the model and of .05 to stay in the model. Some variables were excluded for in-country models to improve the stability of the model due to low frequency variables. All analyses controlled for age and tobacco use during last pregnancy and for multiple comparisons (Tukey–Kramer approach). The Hosmer–Lemeshow test was used to assess the fit of each logistic model for all SHS exposure outcomes in the total sample and by country.

Results

The final sample size in this report was 1,081 (CR = 269, DR = 411, and HON = 401). A detail description of the participants is provided in [Supplementary Table 1](#).

Tobacco Use and SHS Exposure

[Table 1](#) shows the prevalence of tobacco use and SHS exposure among surveyed women. Only 2.5% of women (*n* = 27) reported using any tobacco product during their last pregnancy. Almost half of these users were found in the DR (*n* = 13). Approximately one-third of the participants reported being physically close to active smokers (29.0%–34.0%), with no statistically significant differences observed across countries (*p* = .365). Nearly 60% of the respondents reported being close enough to breathe other people’s smoke during their last pregnancy (49.4%–66.5%); differences across countries were observed, with 66.5% in HON, 61.5% in CR, and 49.4% in DR (*p* < .0001). SFH policies, defined as never allowing smoking in the home, were reported by 70.8%–76.2% of women, with no statistical differences across countries (*p* = .2886).

Predictors of SHS Exposure

Factors associated with reporting being close enough to breathe other’s smoke for the overall sample included unintended pregnancy (adjusted odds ratio [aOR]: 1.44, 95% confidence interval [CI] 1.03, 2.00) and alcohol consumption (aOR: 1.92, 95% CI 1.34, 2.77) ([Table 2](#)). In the case of home smoking policies, for the overall sample, participants who reported having high blood pressure, diabetes, or glucose in-

Table 1. Tobacco Use and Secondhand Smoke (SHS) Exposure Among Women During Their Last Pregnancy by Country of Residence

Variables	Country of residence			<i>p</i> *	
	Total sample	Costa Rica	Dominican Republic		Honduras
	<i>n</i> = 1,081	<i>n</i> = 269	<i>n</i> = 411		<i>n</i> = 401
Tobacco use, <i>n</i> (%)					
Users	27 (2.5)	10 (3.7)	13 (3.2)	4 (1.0)	.0501
Nonusers	1,044 (97.5)	258 (96.3)	395 (96.8)	391 (99.0)	
SHS exposure from active smokers, <i>n</i> (%)					
Exposed	328 (30.6)	91 (34.0)	122 (29.9)	115 (29.0)	.3654
Nonexposed	745 (69.4)	177 (66.0)	286 (70.1)	282 (71.0)	
Close enough to breathe someone else's smoke, <i>n</i> (%)					
Sometimes/often	629 (58.8)	164 (61.6)	201 (49.4)	264 (66.5)	<.0001
Never/almost never/rarely	441 (41.2)	102 (38.4)	206 (50.6)	133 (33.5)	
Household smoke-free policies, <i>n</i> (%)					
Allowed	296 (27.4)	64 (23.8)	120 (29.2)	112 (27.9)	.2886
Never allowed	785 (72.6)	205 (76.2)	291 (70.8)	289 (72.1)	

**p*-values correspond to chi-square tests.

tolerance during pregnancy (aOR: 1.49, 95% CI 1.01, 2.19) were more likely to allow smoking at home (Table 2). Overall, tobacco users were three times more likely to be exposed to active smokers (aOR: 3.52, 95% CI 1.54, 8.04), five times more likely to be close enough to other peoples' smoke (aOR: 5.04, 95% CI 1.71, 14.8), and at least six times more likely to allow smoking at home (aOR: 6.15, 95% CI 2.47, 15.29) (Table 2).

Discussion

The current analysis examined the prevalence and predictors of SHS among pregnant women from three LMICs in Latin America and Caribbean Region. The overall prevalence of tobacco use during pregnancy was low, and the exposure to SHS was high. As in previous studies, we have shown that the self-reported prevalence of exposure to SHS is higher than the prevalence of tobacco use among pregnant women in LMICs in Latin America and Caribbean Region.⁴⁻⁷

Overall, results showed that various sociodemographic factors and a generally higher risk profile, i.e., tobacco use, alcohol consumption, unintended pregnancy, and low perceived social support, were associated with greater exposure to SHS, though the specific patterns varied by country and outcome (Supplementary Table 2). Though SHS outcomes in the study were not able to quantify levels of exposure during pregnancy, assessing SHS exposure through different self-reported behavioral measures might improve the sensitivity of the estimates and provide a more accurate reflection of SHS during pregnancy. In this study, SHS measures showed differential sensitivity; whereas approximately 30% of women reported that during their last pregnancy, someone who smoked tobacco products was close to them, about 60% of women were sometimes or frequently close enough to breathe another person's smoke. Tobacco use was the single most consistent factor associated with SHS exposure across all outcomes. Our findings are consistent with previous studies showing tobacco users have higher odds of being exposed to SHS from others than nonusers.¹⁶ In prior research, homes with at least one smoker have lower odds of being smoke free than homes

with no smokers, especially in scenarios where public smoking bans are in place¹⁶ like CR, the DR, and HON. Women who reported alcohol consumption were more likely to be close enough to breathe other people's smoke. Alcohol and tobacco are often used together in social scenarios and are associated with low socioeconomic status.¹⁷ We argue alcohol consumption might play a role as part of an observed high-risk profile.

Our findings also highlighted differences among predictors of the specific SHS exposure outcomes in the total sample and by country (Supplementary Table 2). Unexpectedly, our results showed that *being exposed to active smokers* was less likely reported by women living with two or more adults. Though there is not clear explanation for this finding, future research might inform these findings. In our study, food insecurity was also a predictor of higher likelihood to be exposed to active smokers in CR. Poor socioeconomic status is a risk factor for tobacco use and exposure to SHS in adults and among pregnant women of HICs and LMICs.⁶ Unemployment, low income, and low educational level have been measured as proxy for poor socioeconomic status and have been related to low levels of social support and high rates of tobacco use, SHS exposure, and food insecurity.¹⁸ We did not observe association between educational level attained and reported SHS exposure in our study.

Overall, this study found that SHS exposure in pregnancy was generally associated with a high-risk profile, that is, food insecurity, poorer health, unintended pregnancy, and low levels of social support, though the specific risk variables differed across outcomes and across countries. The relatively small sample sizes for some in-country comparisons may limit the generalizability of the findings to the participant countries; however, consistency with previous studies in the same countries and similar settings might support our results reflecting in-country parameters.^{6,7,10,19} SHS exposure biochemical measurements were beyond the scope of the parent study, though prior research has demonstrated reasonable sensitivity and specificity for self-reported SHS, especially in low-income settings,²⁰ even when considering misclassification and recall bias. Our results provide a deeper understanding on how to explain differences in tobacco-related variables across

Table 2. Predictors of Secondhand Smoke Exposure During Last Pregnancy Among Women in Costa Rica, Dominican Republic, and Honduras

Predictors	SHS outcomes		
	Exposure to active smokers ^a	Close enough to breathe smoke ^b	Home smoking policies: smoking allowed ^c
	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)
Age	0.97 (0.95–1.00)	1.00 (0.98–1.03)	1.00 (0.97–1.02)
Country			
Costa Rica	Reference	Reference	Reference
Dominican Republic	0.92 (0.59–1.42)	1.06 (0.62–1.82)	1.25 (0.78–1.99)
Honduras	0.98 (0.63–1.53)	0.88 (0.55–1.41)	1.30 (0.84–2.00)
Pregnancy intention			
At that time	—	Reference	Reference
Later/no	—	1.44 (1.03–2.00)	1.24 (0.87–1.77)
Alcohol consumption			
No	—	Reference	Reference
Yes	—	1.92 (1.34–2.77)	1.12 (0.76–1.66)
Health problems during pregnancy			
No	Reference	—	Reference
Yes	1.28 (0.94–1.75)	—	1.49 (1.01–2.19)
Tobacco use			
Nonusers	Reference	Reference	Reference
Users	3.52 (1.54–8.04)	5.04 (1.71–14.8)	6.15 (2.47–15.29)

Table shows statistically significant predictors for each SHS outcome (bold); no data are shown for predictors not included or not used in the model. Variables included in the model for each SHS outcome are as follows:

^aAge, country of residence, tobacco use during pregnancy, marital status, religion, attendance at religious services, food insecurity, total adults living at home, health problems, decision making. Hosmer–Lemeshow goodness-of-fit test p -value = .6773.

^bAge, country of residence, tobacco use during pregnancy, religion, attendance at religious services, food insecurity, total adults living at home, parity, alcohol consumption, general health, desire to become pregnant, PSS significant others, PSS family, PSS friends, PSS total score, MCHL powerful on others, MCHL internality, MCHL chance. Hosmer–Lemeshow goodness-of-fit test p -value = .2085.

^cAge, country of residence, tobacco use during pregnancy, educational level, can read and write, religion, attendance at religious services, total adults living at home, internet access, use of social media, alcohol consumption, general health, health problems during pregnancy, desire to become pregnant, PSS friends, PSS total score. Hosmer–Lemeshow goodness-of-fit test p -value = .6626.

geographically similar countries, by examining patterns of predictors among pregnant women within each country. Further research might qualitatively explore how these predictors intersect and influence the adoption of SFH policies. Addressing SHS exposure in pregnancy in LMICs by encouraging SFH policies and tailoring interventions to country-specific high-risk factors may improve maternal and child health outcomes in these vulnerable populations.

Supplementary Material

A Contributorship Form detailing each author's specific involvement with this content, as well as any supplementary data, are available online at <https://academic.oup.com/ntr>.

Funding

This work was supported by the United States National Institutes of Health-Fogarty International Center grant R25TW009697. Dr. Quiñones is a trainee in the University of Rochester's Translational Biomedical Science PhD Program, which is supported by grant 2TL1TR002000-05 from the National Center for Advancing Translational Sciences, National Institutes of Health. Dr. Quiñones is additionally funded by grant #BWF1014095 from the Burroughs Wellcome Fund. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Acknowledgments

The authors thank the first cohort of MundoComm participants for their input on pretesting the survey and the community leaders and participants in the study for their time and valuable participation. The authors are grateful for the leadership and support of Dr. Ramón Valladares, Hospital Santo Hermano Pedro in Honduras.

Declaration of Interests

None declared.

Data Availability

Due to the confidential nature of this research, participants of this study did not agree for their data to be shared publicly, so supporting data are not available.

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