

Trends and Risk Factors of Secondhand Smoke Exposure in Nonsmoker Pregnant Women in Wisconsin, 2011-2016

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ABSTRACT

Background: Secondhand smoke exposure can lead to serious health effects in vulnerable populations, including pregnant women. Studies report lower birth weight in pregnant women exposed to secondhand smoke.

Methods: We examined trends and risk factors of secondhand smoke exposure during pregnancy among nonsmoker pregnant women in Wisconsin from 2011 to 2016 using data extracted from the Wisconsin Interactive Statistics on Health (WISH) query system.

Results: There has been a decrease in overall trends of secondhand smoke exposure in pregnant women during the study period, with higher risk among pregnant teens, minority populations, and women with a lower education level.

Conclusion: To improve pregnancy and birth outcomes, future prospective and preventive studies should target groups with a higher risk of secondhand smoke exposure to quantify the risk and limit exposure.

INTRODUCTION

Secondhand smoke causes heart disease and lung cancer in adults and increased risk for sudden infant death syndrome, respiratory infections, asthma, and slowed lung growth in children.^{1,2} Studies also show that maternal exposure to secondhand smoke can adversely affect fetal growth and lead to poor birth outcomes.^{3,4} There is no risk-free level of secondhand smoke exposure, and the Surgeon General recommends that eliminating smoking in indoor spaces is the only way to fully protect nonsmokers from secondhand smoke.¹

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Active smoking prevalence in Wisconsin decreased from 25% in 1990 to 21% in 2006 and leveled off at 19.1% in 2014, which mirrors national trends in smoking prevalence from 1999 to 2014.³ Yet, almost 58 million people were exposed to secondhand smoke nationwide from 1999 to 2012, with nearly 50% from a minority population and lower socioeconomic status.⁴ In Wisconsin, secondhand smoke exposure is 40% higher than the national average and disproportionately affects black individuals. Seven out of 10 black family members (especially children, pregnant women, and elderly) are being exposed to secondhand

smoke, compared to 2 out of 5 whites.⁵

Despite being aware of the impact of secondhand smoke exposure on health and birth outcomes, including low birth weight and fetal growth retardation, there are no effective strategies to eliminate indoor smoking and the impact of secondhand smoke exposure during pregnancy.^{1,6-9} Further, there are gaps in understanding sociodemographic risk factors related to secondhand smoke exposure in pregnant women in Wisconsin—information that can facilitate planning and directing targeted strategies to limit secondhand smoke exposure during pregnancy. Therefore, our study seeks to understand these trends and risk factors.

METHODS

We obtained data for nonsmoker pregnant women with and without secondhand smoke exposure in Wisconsin from 2011 to 2016 from the Wisconsin Interactive Statistics on Health (WISH) query system.⁷ Secondhand smoke exposure was defined as nonsmoker

pregnant women reporting living with a smoker. Sociodemographic data extracted for both groups included age, race, education, residence region, and birth data, including year of birth and adequacy of prenatal care. (Standard definitions for Kotelchuck index were used to define adequacy of prenatal care visits.)

We examined trends of secondhand smoke exposure in Wisconsin during the study period by mother's year of delivery, region, age, race, education, and prenatal care. Additionally, we performed an age stratified analysis (<20 and ≥20 years) for race, prenatal care, and education level (defined as "completed high school or above" for ages 18-19 years and "some college or above" for ages ≥20 years). For each study variable, we compared the prevalence of secondhand smoke exposure using prevalence odds ratio (OR), standard errors, and 95% confidence intervals (CI). Microsoft excel was used to store data and perform calculations. Calculations were verified using R-3.4.1 software.

RESULTS

Overall Trend

From 2011 to 2016, the overall percentage of nonsmoker pregnant women in Wisconsin that were exposed to secondhand smoke decreased 2% from 2011 to 2015 and 10% from 2015 to 2016. There was a 65% difference in the rate of secondhand smoke exposure among pregnant women less than 20 years compared to those age 20 to 45 years (26% vs 9%). There were also higher rates of secondhand smoke exposure in minority populations, lower education levels, and the Northern region of Wisconsin (Table 1).

Risk Factors for Secondhand Smoke Exposure

During the study period, we found the odds of secondhand smoke exposure were 3.5 times higher in nonsmoker pregnant teens versus pregnant women 20 years or older (OR 3.5; 95% CI, 3.4-3.6). Among American Indian women, the odds of secondhand smoke exposure during pregnancy were 3.6 times higher than for white women (OR 3.9; 95% CI, 3.6-4.2). The yearly trend revealed a decrease in odds of secondhand smoke exposure in black and younger pregnant women. No significant change in odds of exposure was noted over time in American Indians and those with less education. (See Table 2.)

Age stratification revealed higher odds of secondhand smoke exposure among pregnant American Indian teens with less education. For pregnant women 20 years or older with less education, the odds of exposure were 2.4 times higher (OR 2.4; 95% CI, 2.3-2.5). Among black women age 20 years or older, the odds of exposure were 1.3 times higher compared to white women in the same age group (OR 1.3, 95% CI, 1.3-1.4); and despite receiving adequate prenatal care, pregnant teens reported 20% higher secondhand smoke exposure. (See Table 3.)

DISCUSSION

Our study shows that secondhand smoke exposure rates in non-

Table 1. Trends in Secondhand Smoke Exposure Among Nonsmoker Pregnant Women by Sociodemographics and Birth Weight in Wisconsin, 2011-2016

Variable	Pregnant Nonsmoker Women Exposed to Secondhand Smoke	
	n	(%)
Year of birth		
2011	5,702	(9.9)
2012	6,082	(10.6)
2013	5,883	(10.3)
2014	5,715	(9.9)
2015	5,708	(9.7)
2016	5,097	(8.7)
Age		
<20 years	4,565	(25.5)
≥ 20 years	29,662	(8.9)
Race/ethnicity		
White	22,938	(9.1)
Black	3,984	(12.4)
American Indian	761	(28.4)
Hispanic	3,493	(9.6)
Laotian or Hmong	1,243	(14.2)
Prenatal care		
Adequate	27,157	(9.5)
Inadequate	6,009	(12.1)
Education level		
8th grade or less	883	(6.4)
9th-12th grade/no diploma	4,633	(20.3)
High school graduate	12,678	(17.1)
Some college credit/no degree	8,182	(12.7)
Associate degree	3,458	(8.6)
Bachelor's degree	3,398	(3.8)
Master's degree	707	(2.2)
Doctorate or professional degree	148	(1.6)
Region		
Southern	5,562	(8.4)
Southeastern	12,981	(9.6)
Northeastern	8,458	(12.0)
Western	4,279	(10.9)
Northern	2,906	(12.2)

smoker pregnant women in Wisconsin decreased 2% from 2011 to 2015 and 10% from 2015 to 2016. However, we found that pregnant women from minority populations with a lower education level had higher risk of secondhand smoke exposure. There was no significant change in these trends over time. In addition, age stratification revealed that pregnant teens who were American Indian and who had less education had higher exposure to secondhand smoke, despite receiving adequate prenatal care.

This study highlights the sociodemographic risk factors of secondhand smoke exposure during pregnancy, which potentially could be targeted in future studies and preventive efforts, particularly for younger women. Further, our study underscores a need for future prospective studies to further examine the burden and impact of secondhand smoke exposure on pregnancy and fetal outcomes.

Wisconsin is one of the few states with persistently high ever-smoking prevalence in nonwhite populations.^{2,4} This could explain our finding of higher odds of secondhand smoke exposure during

Table 2. Prevalence Odds Ratio of Secondhand Smoke Exposure Among Nonsmoker Pregnant Women by Sociodemographic Variables and Health Care Provided in Wisconsin, 2011-2016

Variable	Prevalence Odds Ratio (95% CI)					
	2011	2012	2013	2014	2015	2016
Age						
<20 years vs ≥20 years	3.7 (3.4-4.0)	3.7 (3.4-4.0)	3.4 (3.1-3.7)	3.6 (3.3-3.9)	3.6 (3.3-3.9)	3.3 (3.0-3.7)
Race						
Black vs white	1.3 (1.3-1.5)	1.4 (1.3-1.6)	1.5 (1.4-1.6)	1.4 (1.3-1.5)	1.4 (1.3-1.5)	1.1 (1.1-1.3)
American Indian vs white	3.8 (3.1-4.7)	3.9 (3.2-4.9)	4.2 (3.4-5.1)	4.2 (3.4-5.2)	3.5 (2.9-4.4)	4.0 (3.2-5.0)
Education						
<Degree vs ≥degree	3.6 (3.4-3.8)	3.6 (3.4-3.9)	3.6 (3.3-3.8)	4.0 (3.8-4.3)	3.9 (3.7-4.2)	3.6 (3.4-3.9)
Prenatal care						
Adequate vs inadequate	0.9 (0.8-0.9)	0.8 (0.9-1.0)	0.8 (0.8-0.9)	0.8 (0.7-0.8)	0.7 (0.7-0.8)	0.8 (0.8-0.9)

Table 3. Prevalence Odds Ratio (95% CI) for Secondhand Smoke Exposure for Sociodemographic Variables After Age Stratification

	<20 years		>20 years	
	OR	CI	OR	CI
Black vs white	0.5	(0.5-0.6)	1.3	(1.2-1.3)
American Indian vs white	1.9	(1.5-2.4)	0.4	(0.4-0.5)
Education (lower level vs at level)	1.2	(1.1-1.3)	2.4	(2.3-2.5)
Prenatal care (adequate vs inadequate)	1.2	(1.1-1.2)	0.9	(0.8-0.9)

Abbreviation: OR, odds ratio; CI, confidence interval.

pregnancy in American Indian and black women and no significant change in trend in these groups over time.

Additionally, in 2017, the Centers for Disease Control and Prevention reported that American Indian teens had the highest birth rate (32.9%) compared to other racial groups.¹⁰ This may explain the significantly increased risk of secondhand smoke exposure during pregnancy in American Indian teens compared to other racial groups in our study.

Finally, education is one of the social determinants of health and socioeconomic status, which may indicate why less education was a predictor of higher exposure to secondhand smoke among pregnant women, irrespective of age.

There are limitations to this study. First, the data query from WISH resulted in aggregate data and not individual, patient-level data. Therefore, a multivariable analysis was difficult to perform. However, we tried to perform stratified and bivariate analysis to rule out confounding from common variables, for example, age and year of birth. Further, we had fewer American Indian pregnant women, which could have affected some analysis. Finally, our study is based on vital record information and we were unable to ascertain true exposure. Therefore, future prospective studies are required to understand predictors of secondhand exposure and plan preventive strategies to target predisposing risk factors.

CONCLUSION

This analysis reveals a decrease in overall trends of secondhand smoke exposure in nonsmoker pregnant women in Wisconsin from 2011 to 2016, with higher risk of exposure among teens,

women from minority populations, and those with less education. Future prospective and preventive studies should target these populations to quantify risk and limit exposure to improve pregnancy and birth outcomes.

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