Prevalence and Correlates of Secondhand Smoking Exposure Among Pregnant and Postnatal Chinese Women

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Abstract

Background

Inhalation of secondhand smoke during pregnancy and postnatal period is detrimental to developing infants and increases risk for health problems throughout the lifespan. This study examined the prevalence of exposure to secondhand smoke, its correlates, and its association with QOL among pregnant and postnatal Chinese women.

Methods

This multicenter, cross-sectional study was conducted between February and October 2019 in China. Participants were pregnant and postnatal women. We assessed associations of frequency and location of secondhand smoking with sample characteristics as well as depression and quality of life based on EPDS and WHOQOL-BREF, respectively.

Results

A total of 992 women participated in the study, of whom, 211 (21.3%, 95%CI=18.7-23.8%) had been exposed to secondhand smoking. Secondhand smoking was most common in public areas (56.4%), and residential homes (20.5%), while workplaces had the lowest rate of secondhand smoking (13.7%). Women with physical comorbidities were more likely to report secondhand smoking exposure, while younger women, women living in urban areas, and those with college or higher education level were less likely to report exposure to secondhand smoking.

Conclusion

The prevalence of exposure to secondhand smoking is becoming lower among pregnant and postnatal women in China compared to findings reported in previous studies. Due to the detrimental impact of secondhand smoking on physical health, legal legislation should be promptly enforced to establish smoke-free environments in both public and private urban/rural areas for protection of pregnant and postnatal women, especially those who are physically vulnerable and less educated.

Introduction

Both active smoking and exposure to secondhand smoking during pregnancy are well-known risk factors for compromised health and poor future health of infants. Studies have found that active smoking in pregnancy is associated with increased risk for low birth weight, small chest circumference, and sudden infant death syndrome, while exposure to secondhand smoking is associated with preterm delivery, fetal growth restriction, spontaneous abortion, and fetal death [1, 2].

Secondhand smoking refers to involuntary inhalation of tobacco smoke by a nonsmoker for more than 15 minutes per week [3]. Women's exposure to secondhand smoking during pregnancy has varied from

17% to 94% [4-7]. Previous studies have found that exposure to secondhand smoking is more common than active smoking among pregnant women. For instance, a cross-sectional study in Greece showed that 36% of women reported active smoking, but 94% of these women were exposed to passive smoking during pregnancy [7]. A similar study in Taiwan found that 7.2% of pregnant women smoked during pregnancy, and 40.6% of these women were exposed to secondhand smoking [1]. A study in southern China found that 2.63% of pregnant women had a history of smoking; of these, 52.15% were also exposed to secondhand smoke during their pregnancy [8].

Pregnant and postnatal women are more likely to be exposed to secondhand smoking in public place and home settings. A study from Jordan found that considerable percentages of pregnant women were exposed to secondhand cigarette smoke (51.4%), and waterpipe smoke (48.7%) at home and in public spaces (31.4% and 21.4%, respectively). Within the home environment, husbands were the most common source of secondhand smoking [9]. A Chinese study found that public spaces were the most common setting of exposure to secondhand smoking (35.9% before pregnancy, and 37.2% during pregnancy, respectively), and more than 70% of women were exposed to secondhand smoking for 15-59 min/day [3]. Frequent correlates of secondhand smoking exposure during and/or after pregnancy included lower education level, and poorer mental health status [6, 8-10].

Secondhand smoking is common in China, with approximately 740 million secondhand smokers nationwide [3]. Smoking behaviour is determined by sociocultural factors and economic status [11], therefore, findings derived from Western contexts may not be applicable to Chinese populations. Furthermore, although some relevant studies have been conducted in China, generalizations to the larger population cannot be made due to several limitations, such as small sample sizes and single-site study designs [12]. To the best of our knowledge, no studies to date have examined exposure to secondhand smoking among pregnant/postnatal women in China at multicenter settings [12]. In addition, quality of life (QOL) was defined as individuals' perception of their lives in terms of culture and value systems in their living environment in relation to their goals, expectations and concerns [13]. No specific studies on the association between exposure to secondhand smoking and QOL among pregnant/postnatal women were published in China. To address each of these gaps, we conducted this multicenter, cross-sectional study exploring the prevalence of exposure to secondhand smoking, its demographic correlates, and its association with QOL and depression among pregnant and postnatal women in China.

Methods

This study was conducted between February and October, 2019. Participants were consecutively recruited from eight territory hospitals located in eight municipality and provinces in China (i.e., Beijing, Xinjiang, Liaoning, Guangdong, Qinghai, Hubei, Jiangsu and Sichuan). Patients who were undertaking treatment in the participating hospitals during the study period were invited to take part in this study. Eligibility criteria included: 1) age 18 years or older, 2) currently pregnant or postnatal period (i.e., 1 week after child birth), and 3) ability to understand Chinese and provide written informed consent. Patients were excluded if they had severe physical diseases of any kind. Ethical approvals were obtained from respective hospitals. All

participants were approached and invited by research nurses who explained the study aims and procedure. After obtaining written informed consent, face-to-face interviews were conducted.

A predesigned data collection sheet was used to collect basic demographic information (i.e., maternal age, education level, marital status, employment status, gestation, personal monthly income, history of miscarriage, placenta proposition, and physical comorbidities). Secondhand smoking was assessed by querying 1) frequency of exposure to secondhand smoking (≥ 15 min/day) in the last 12 months via three options: '0' = < 1 day/week, '1' = 1-3 days/week, and '2' = 4-7 days/week. Those who endorsed option 1 or 2 were considered to be 'secondhand smokers'. Location of secondhand smoking (i.e., home, workplace, or public space) were also assessed [14].

The 10-item Edinburgh Postnatal Depression Scale (EPDS), Chinese version, was used to assess severity of self-reported depressive symptoms in the past week during pregnancy or the postnatal period [15]. Total EPDS scores range from 0 to 30, with higher scores indicating more severe depressive symptoms. The Chinese version of the EPDS has demonstrated excellent psychometric properties [16].

The World Health Organization Quality of Life Questionnaire (WHOQOL-BREF) was used to evaluate quality of life in physical, psychological, social and environmental domains [17]. Each item was scored from 1 to 5, with higher total scores indicating higher QOL. The Chinese version of the WHOQOL-BREF has satisfactory psychometric properties [18].

Data analysis

Kolmogorov-Smirnov tests were performed to examine normality in distributions of continuous variables. Differences in basic demographics and clinical variables between pregnant/postnatal women exposed to secondhand smoking versus unexposed peers were assessed using independent samples t-tests, Chi-square tests or Mann-Whitney U tests, as appropriate. Multiple logistic regression analysis was performed to examine the independent demographic and clinical correlates of exposure to secondhand smoking. Secondhand smoking was the dependent variable, while measures on which there were significant group differences in univariate analyses were entered as independent variables. Group differences in QOL between women exposed to secondhand smoking and unexposed women were examined using analyses of covariance (ANCOVA) controlling for other variables on which these groups differed in univariate analyses. Data analyses were performed using SPSS V24.0. The significance level was set at 0.05 (two-tailed) for each analysis.

Results

A total of 1,140 women were invited to join this study and 992 (87.02%) completed all measures. From the entire sample, 211 women (21.3%, 95%CI=18.7-23.8%) suffered from secondhand smoking. Secondhand smoking exposure was more common in public areas (56.4%) than home environment (20.5%). Demographic and clinical characteristics of participants are presented in Table 1.

In univariate analyses, women who were younger ($P<0.001$) or in their third trimester ($P=0.015$), and those with physical comorbidities ($P=0.023$) were more likely to report secondhand smoking exposure. Those living in urban areas ($P<0.001$), having higher education levels ($P<0.001$), and earning higher monthly incomes ($P=0.011$) were less likely to report secondhand smoking exposure. Finally, there were no significant differences in depressive symptoms or QOL domains between women who were exposed to secondhand smoking exposure and non-exposed peers.

Multiple logistic regression analysis revealed that women who reported physical comorbidities were more likely to report secondhand smoking exposure (OR=1.801, 95%CI=1.172-2.769, $P=0.007$), while younger women (OR=0.942, 95%CI=0.903-0.982, $P=0.005$), women living in urban areas (OR=0.552, 95%CI=0.370-0.825, $P=0.004$), and those with college or higher education levels (OR=0.657, 95%CI=0.464-0.929, $P=0.017$) were less likely to report secondhand smoking exposure. Additionally, proportionately fewer pregnant women in their second trimester reported exposure to secondhand smoking (OR=0.504, 95%CI=0.275-0.921, $P=0.026$) though there were no differences for other trimesters or the postnatal period.

Discussion

This is the first multicenter, large-scale study to examine the prevalence of secondhand smoking and its association with QOL among pregnant and postnatal women in China. Over one-fifth (21.3%) of pregnant and postnatal women experienced secondhand smoking in the sample, a rate that is noticeably lower than figures reported by previous research based on single study sites [8, 10, 19]. For example, Wen *et al.* (2016) reported that 52.1% of pregnant Chinese women had been exposed to secondhand cigarette smoking during their pregnancy while Yang *et al.* [10] found that 75.1% of non-smoking pregnant women reported regular exposure to secondhand smoking through their smoking husband. Caution is warranted in interpreting generalizability of findings from previous studies based on participants recruited from only one Chinese province [12]. In more recent years, there seems to be a heightened awareness of harmful effects of smoking on perinatal health and health of unborn infants [20], so pregnancy is considered to be a golden opportunity for smoking cessation [21]. In addition, comprehensive tobacco control policies and anti-nicotine educational campaigns have been well-developed and implemented in China over the past few years. Anti-smoking policy development and heightened public awareness may explain the relatively lower prevalence of secondhand smoking in this study compared to past work.

Physical comorbidities were positively associated with secondhand smoking, a finding that echoes previous research linking secondhand smoking during pregnancy to various negative health outcomes, such as preterm delivery, fetal growth restriction, spontaneous abortion, birth defects, and fetal death [1, 2]. Secondhand smoking can also increase risk for atherosclerosis and cardiovascular diseases, lung cancers, oral and esophageal cancers, and bone marrow myeloid leukemia [9]. Potential mechanisms for physical comorbidities include decreased oxygen supply and the enhanced production of free radicals [22] that impair cellular constituents, influence protein oxidation, and even cause damage to the DNA.

Dovetailing with results of previous studies [7, 8, 10], we found that less educated women were more likely to be exposed to secondhand smoking than women with higher education levels. People with higher education levels often have more awareness of potential harm induced by passive smoking behaviors [7]. Based on this assumption, anti-nicotine educational programs targeting at women of reproductive age and their spouses to decrease tobacco consumption behaviour and provide a smoke-free environment may be especially useful for reducing exposure to secondhand smoking among pregnant/postnatal women and their infants.

Associations between residence and women's active and passive (secondhand smoking) behaviors have been inconsistent. Some studies have found that pregnant women in rural areas are more likely to be exposed to secondhand smoking [3, 7], which other research has found no such relationship [19]. In this large-scale study, women in urban areas were less likely to report secondhand smoking during pregnancy than did rural cohorts. One plausible hypothesis that may contribute to this difference is that women and their spouses living in rural area may receive less public health advice and guidance about negative health outcomes of smoking behaviour during pregnancy. In addition, tobacco control policies and measures are more often poorly enforced in rural areas. Taken together, these contentions suggest geographical region and anti-smoking policy enforcement may play a pivotal role in active and secondhand smoking behavior among pregnant and postnatal women. Previous research has not found significant associations between pregnancy phase and secondhand smoking [3, 9, 19]. However, in this study, women in their second trimester were less likely to experience secondhand smoking. In light of its novelty, this finding warrants additional attention in future work to evaluate its replicability.

Finally, there were no statistically significant differences between women exposed to secondhand smoking and non-exposed peers in relation to self-reported depressive symptoms or QOL domains. Our findings conflict with results from two systematic reviews that have linked exposure to secondhand smoking during pregnancy to increased risk for depressive symptoms, which could impede QOL [23, 24]. This discrepancy could be due to variations in sample size, use of different assessment tools, and socioeconomic status differences between studies. Arguably, the WHOQOL-BREF is a generic measure that may not be sensitive enough to detect minor changes of QOL in pregnant and postnatal women. Conversely, given that theoretical bases for links between exposure to secondhand smoking and QOL are not well developed, other correlates of exposure such as socioeconomic status may be more critical influences on this relationship.

Strengths of this study included its multicenter design, large sample size, and use of standardized measurements on depressive symptoms and QOL. However, several limitations should be noted. First, casual relationships between sociodemographic, clinical variables and secondhand smoking cannot be established due to the cross-sectional design. Second, the impact of recall biases on findings cannot be ruled out given that data were collected using self-reported instruments. Third, unmeasured correlates of secondhand smoking behaviors, such as, interpersonal relationships, violence experience, and family support were not investigated in this study but have potential relevance to exposure [25, 26].

Conclusion

In conclusion, the prevalence of exposure to secondhand smoking was lower among pregnant and postnatal Chinese women in this study compared to findings reported in previous studies based on smaller, less general samples. Considering the detrimental impact of secondhand smoking on health of pregnant and/or postnatal women and their infants, it is important to establish smoke-free environments in both public and private places for this group, particularly for those who are less-educated, living in rural areas, and have physical comorbidities. Anti-smoking education and tobacco control policies should extend beyond urban areas to rural areas of China. Psychosocial interventions to facilitate smoking cessation should also be considered given that beneficial health outcomes may result for mothers, infants, and their families.

Declarations

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Tables

Table 1 Demographic and clinical characteristics of the participants (N=992).

Variable	Secondhand Smoking						Univariate analyses		
	Total (N=992)		No (N=781)		Yes (N=211)		χ^2/Z	df	P
	N	%	N	%	N	%			
Urban Area	837	84.4	681	87.2	156	73.9	22.163	1	<0.001
Pregnancy phase							10.473	3	0.015
First trimester	180	18.1	138	17.7	42	19.9			
Second trimester	218	22.0	188	24.1	30	14.2			
Third trimester	491	49.5	380	48.7	111	52.6			
Postnatal	103	10.4	75	9.6	28	13.3			
College and above	674	67.9	556	71.2	118	55.9	17.776	1	<0.001
Employed	612	61.7	493	63.1	119	56.4	3.180	1	0.075
Have four and more family members	492	49.6	376	48.1	116	55.0	3.103	1	0.078
Monthly Income $\geq$ 5000 RMB	481	48.5	395	50.6	86	40.8	6.411	1	0.011
First Delivery	571	57.6	452	57.9	119	56.4	0.148	1	0.700
Adverse Pregnant Experience	131	13.2	102	13.1	29	13.7	0.068	1	0.795
Previous natural Miscarriage	180	18.1	136	17.4	44	20.9	1.323	1	0.250
Previous abortion by drugs	288	29.0	217	27.8	71	33.6	2.773	1	0.096
Placental Preposition	61	6.1	46	5.9	15	7.1	0.428	1	0.513
Having physical comorbidities	132	13.3	94	12.0	38	18.0	5.139	1	0.023
	Total (N=992)		No (N=781)		Yes (N=211)		Univariate analyses		

	Mean	SD	Mean	SD	Mean	SD	T/Z	df	P
Age (years)	29.384	4.173	29.684	4.066	28.272	4.382	4.403	990	<0.001
BMI	24.130	4.229	24.095	4.258	24.258	4.124	-0.494	990	0.621
Physical QOL	15.214	2.062	15.237	2.098	15.129	1.927	0.673	990	0.501
Psychological QOL	15.276	2.435	15.317	2.350	15.125	2.729	1.011	990	0.312
Social QOL	15.578	2.406	15.624	2.327	15.410	2.678	1.148	990	0.251
Environmental QOL	15.079	2.486	15.154	2.430	14.801	2.672	1.832	990	0.067
EPDS Total score	5.414	4.365	5.270	4.216	5.947	4.852	-1.371	_a	0.170
Note: BMI=Body mass index; EPDS=Edinburgh Postnatal Depression Scale; QOL=Quality of life; In bold: P<0.05; a: Mann-Whitney U test									

Table 2. Independent correlates of exposure to secondhand smoking.

	Multivariate logistic regression		
Variable	OR	95% CI	P
Age (Years)	0.942	0.903-0.982	0.005
Urban	0.552	0.370-0.825	0.004
Pregnancy phase	-	-	-
First trimester	0.990	0.555-1.765	0.973
Second trimester	0.504	0.275-0.921	0.026
Third trimester	0.937	0.562-1.561	0.803
Postnatal	ref	-	-
College and above	0.657	0.464-0.929	0.017
Monthly Income ≥ 5000 RMB	0.809	0.582-1.126	0.209
Having physical comorbidities	1.801	1.172-2.769	0.007
Note: In bold: P<0.05; CI=Confidence Interval			