Caspian J Reprod Med, 2025, 11 (2): 14 - 20

Caspian Journal of Reproductive Medicine

Journal homepage: www.caspjrm.ir

Original article

Exposure to secondhand smoke among pregnant women in Iran: a cross-sectional study on health beliefs

Razieh Abbasi[1], Fatemeh Bakouei[2,*], Hajar Adib-Rad[3], Mahdi Sepidarkish[3]

[1]Student Research Committee, Babol University of Medical Sciences, Babol, I.R. Iran
[2] Infertility and Reproductive Health Research Center, Health Research Institute, Babol University of Medical Sciences, Babol, I.R. Iran.
[3] Social Determinants of Health Research Center, Health Research Institute, Babol University of Medical Sciences, Babol, I.R. Iran.

Received: 18 Agu 2025 Accepted: 3 Sep 2025

Abstract

Background: Exposure to secondhand smoke (SHS) during pregnancy is linked to severe health risks for both mother and infant. This study evaluates the prevalence of SHS exposure among pregnant women in Tehran, Iran, and examines its association with sociodemographic factors and health belief model (HBM) constructs to inform public health interventions.

Methods: This cross-sectional study included 313 non-smoking pregnant women receiving prenatal care at health centers affiliated with Tehran University of Medical Sciences. Structured questionnaires assessed demographic characteristics, SHS exposure, and HBM constructs. Data were analyzed using Stata version 17, with statistical significance set at $p< 0.05$.

Results: Of the 313 participants, 102 (32.6%) reported SHS exposure during pregnancy. Most exposed women experienced low exposure levels, typically one cigarette per day and less than one hour of daily contact with smoke. Only "perceived susceptibility" showed a significant difference, with exposed women scoring lower than non-exposed women ($p = 0.04$). Logistic regression revealed that socioeconomic status (SES) was the only significant demographic predictor of SHS exposure; higher SES was associated with lower exposure (OR = 0.78, $p = 0.028$), a relationship that persisted after adjustment (OR = 0.78, $p = 0.011$).

Conclusion: Socioeconomic status significantly influences SHS exposure among pregnant women, highlighting the need for targeted interventions addressing structural inequalities.

Keywords: Female, Pregnancy, Menstrual Hygiene Products, Tobacco Smoke Pollution, Iran

Introduction

Exposure to secondhand smoke (SHS) involves inhaling smoke from burning tobacco or exhaled by smokers (1). Globally, tobacco use causes approximately seven million deaths annually from direct smoking and 1.2 million from SHS exposure (2). As smoking prevalence increases, non-smokers, including pregnant women, face heightened SHS risks, with nearly 50% of men worldwide using tobacco (3). Studies across 30 low- and middle-income countries (LMICs) report SHS exposure prevalence among pregnant women ranging from 6% (Nigeria) to 70% (Armenia) daily (4). In China, 60-70% of pregnant women are exposed to SHS (5). In Iran, despite low smoking rates among women, high male smoking prevalence increases women's SHS exposure risk (6). SHS exposure during pregnancy is associated with severe complications, including stillbirth, cesarean delivery, low birth weight (LBW), congenital anomalies, premature rupture of membranes, preterm labor, sudden infant death syndrome, neurodevelopmental issues, respiratory and renal diseases, and restricted fetal growth (5, 7). Pregnant women can reduce SHS exposure by avoiding smoky environments and prohibiting smoking nearby, yet preventive behaviors are often inadequate, especially when smokers are family members (8).

Sociodemographic factors, such as education, income, and occupation, influence health outcomes (9). Previous studies suggest that sociodemographic status correlates with both active smoking and SHS exposure (10, 11), though its impact on pregnant women remains debated. For example, higher education (>13 years) may reduce SHS exposure, while wealthier households

*Correspondence author: Dr. Fatemeh Bakouei, Infertility and Reproductive Health, Research Center, Babol-Amol old highway, after Mohammad hasan Khan bridge, Babol, Mazandaran, Iran. Tel: +98-11-32274881, Email: bakouei2004@yahoo.com

show lower exposure rates, but findings are inconsistent (5).

Interventions to reduce SHS exposure often utilize the health belief model (HBM), which emphasizes perceived susceptibility, severity, benefits, barriers, self-efficacy, and cues to action (12-14). The HBM posits that changing attitudes can alter health behaviors, with proven effectiveness in contexts like cancer screening and prevention (15-17). This study, conducted in Tehran, Iran, investigates SHS exposure prevalence among pregnant women and its association with sociodemographic factors and HBM constructs to guide effective public health strategies. Prenatal care at 24 health centers affiliated with Tehran University of Medical Sciences (TUMS) in municipal areas 10, 11, 16, 17, and 19. Convenience sampling was used, and the sample size provided a 95% confidence interval with a width of 0.100 for a proportion of 0.231. Inclusion criteria included non-smoking pregnant women willing to participate.

Materials & Methods

Study population and setting

This cross-sectional study, conducted from 2022 to 2023, assessed SHS exposure and HBM constructs among 313 non-smoking pregnant women receiving prenatal care at 24 health centers affiliated with Tehran University of Medical Sciences (TUMS) in municipal areas 10, 11, 16, 17, and 19 (fig 1). Convenience sampling was used, and the sample size provided a 95% confidence interval with a width of 0.100 for a proportion of 0.231. Inclusion criteria included non-smoking pregnant women willing to participate.

Measures

A validated questionnaire by Mahmoodabad et al. (13), based on HBM constructs, was used with permission in Persian. It included three parts:

1. Demographic and fertility information (e.g., age, education, occupation, gestational week, planned pregnancy).
2. SHS exposure (e.g., spouse's daily cigarette consumption, smoking frequency in the household/vehicle, duration of exposure, spouse's response to requests to quit).
3. HBM constructs, assessing knowledge (14 questions on SHS effects on pregnancy and fetus), attitudes (4 questions), perceived susceptibility (10 questions), severity (10 questions), personal barriers (7 questions), environmental barriers (5 questions), and self-efficacy (6 questions). Knowledge was scored dichotomously (correct=1, wrong/don't know=0), while other constructs used a five-point Likert scale (1=completely disagree, 5=totally agree). The questionnaire's reliability (Cronbach's alpha >0.8) and validity (CVR=0.6, CVI=0.81) were confirmed by eight reproductive health specialists.

3. HBM constructs, assessing knowledge (14 questions on SHS effects on pregnancy and fetus), attitudes (4 questions), perceived susceptibility (10 questions), severity (10 questions), personal barriers (7 questions), environmental barriers (5 questions), and self-efficacy (6 questions). Knowledge was scored dichotomously (correct=1, wrong/don't know=0), while other constructs used a five-point Likert scale (1=completely disagree, 5=totally agree). The questionnaire's reliability (Cronbach's alpha >0.8) and validity (CVR=0.6, CVI=0.81) were confirmed by eight reproductive health specialists.

Data collection

Self-administered questionnaires were completed voluntarily by participants, with anonymity ensured. The study, initiated in June 2022, followed ethical approval from Babol University of Medical Sciences (IR.MUBABOL.HRI.REC.1400.015) and permissions from TUMS. Written informed consent was obtained, and the study adhered to STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines and the Declaration of Helsinki.

Ethics Issues

Ethical approval was obtained from Babol University of Medical Sciences (IR.MUBABOL.HRI.REC.1400.015), with additional permissions from TUMS. Informed consent was secured, and all methods complied with ethical standards.

Statistical analysis

Data analysis used Stata version 17. Descriptive statistics summarized demographic, reproductive, and exposure characteristics. Chi-square tests compared categorical variables (e.g., age and education) between SHS-exposed and non-exposed groups. Independent t-tests compared HBM construct scores. Logistic regression (crude and adjusted) assessed SES and SHS exposure associations, with odds ratios (ORs) and 95%

confidence intervals (CIs). Significance was set at $p< 0.05$.

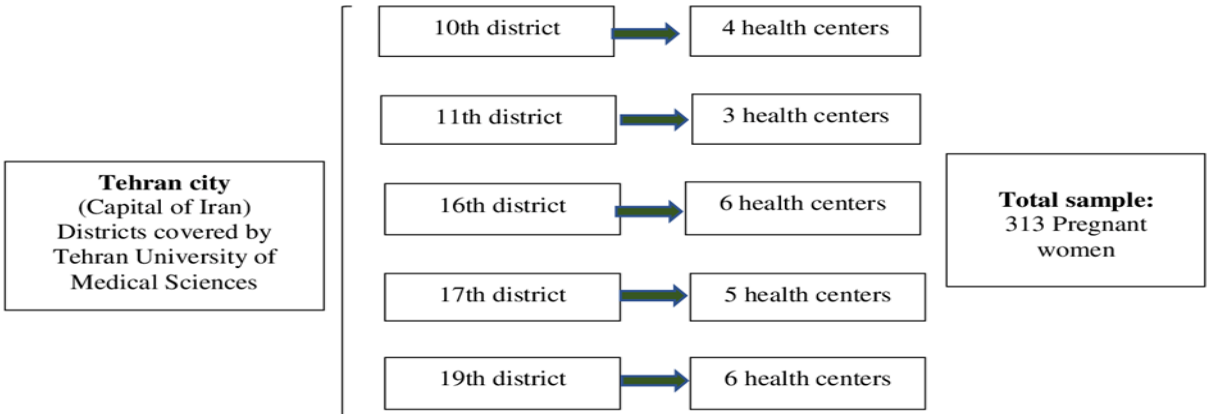

Figure1. The selection flowchart of the current study

Table 1 Characteristics of the pregnant women according to exposure to secondhand smoke (SHS) in Tehran (Iran)

Characteristic	Not exposed to SHS (%) n =211	Exposed to SHS (%) n =102	Total (%) n =313	Test value χ2; P-Value
Age (year)				
≤ 19	10 (4.7)	8 (7.8)	18 (5.9)	
20-24	45 (21.3)	17 (16.7)	62 (19.8)	
25–29	53 (24.1)	29 (28.4)	82 (25.6)	3.07; 0.384
30–34	54 (25.6)	34 (33.3)	88 (28.1)	
35 and above	49 (23.2)	14 (13.7)	63 (20.1)	
Education status				
Basic literacy	38 (18.0)	18 (17.6)	56 (17.9)	
High school or less	114 (54.0)	64 (62.7)	178 (57.1)	2.79; 0.248
University-level	59 (28.0)	20 (19.6)	79 (25.2)	
Employment				
Homemakers	189 (91.6)	96 (94.1)	285 (91.1)	2.79; 0.361
Employed	22 (10.4)	6 (5.9)	28 (8.9)	
Partner's education status				
Basic literacy	39 (18.5)	22 (21.6)	61 (19.5)	
High school or less	117 (55.5)	59 (57.8)	176 (56.2)	1.56; 0.454
University-level	55 (26.0)	21 (20.6)	76 (24.3)	
Gravidity				
1	69 (32.7)	39 (38.2)	108 (34.5)	0.31;0.858
2	73 (34.6)	31 (30.4)	104 (33.2)	
≥3	69 (32.7)	32 (31.4)	101 (32.3)	
Gestational week				
≤ 14 (First trimester)	31 (14.7)	15 (14.7)	46 (14.7)	0.96; 0.619
15-28 (second trimester)	100 (47.4)	54 (52.9)	154 (49.2)	
29-40 (third trimester)	80 (37.9)	33 (32.4)	113 (36.1)	
Planned pregnancy				
Yes	154 (73.0)	67 (65.7)	221 (71.6)	1.47; 0.225
No	57 (27.0)	35 (34.3)	92 (29.4)	
Attending childbirth classes				
Yes	23 (10.9)	7 (6.9)	30 (9.6)	2.90; 0.088
No	188 (89.1)	95 (93.1)	283 (90.4)	

Sample size: n=313 non-smoking pregnant women recruited via convenience sampling from 24 health centers in Tehran's districts 10 (4 centers), 11 (3 centers), 16 (6 centers), 17 (5 centers), and 19 (6 centers), affiliated with Tehran University of Medical Sciences.
Percentages: Calculated based on valid responses; minor rounding adjustments applied for accuracy.
Statistical Analysis: Chi-square (χ^2) tests used to compare categorical variables between SHS-exposed and non-exposed groups; $p<0.05$ indicates significance.

Results

Characteristics of study participants

Of 313 pregnant women, 102 (32.6%) reported SHS exposure. Most participants were aged 30–34 years (28.4%), had non-university education (57.1%), were homemakers (92.1%), and had husbands with non-university education (56.4%). The majority was in their second trimester (49.2%) and had planned pregnancies (71.6%). No significant demographic or reproductive differences were found between exposed and non-exposed groups (Table 1).

Table 2. The distributions of the responses to questions about the exposure to secondhand smoke in the pregnant women in Tehran (Iran)

Question	Response	N (%)
Number of cigarettes consumed by husband per day		
	0	211 (67.4)
	1	16 (5.1)
	2-5	35 (11.2)
	6-10	21 (6.7)
	> 10	30 (9.6)
Number of cigarettes exposed to their smoke per day		
	0	211 (67.4)
	1	50 (16.0)
	2-5	29 (9.3)
	6-10	13 (4.2)
	> 10	10 (3.2)
Hours of exposure to cigarette smoke per day		
	Not exposed	211 (67.4)
	<1	49 (15.7)
	1-2	12 (3.8)
	> 3	41 (13.1)
Husband' reaction to your request to quit smoking? (n=102)		
	Put out the cigarette	22 (21.6)
	Opened the window	6 (6.9)
	Went to another place	51 (50.0)
	Requested that I go to another place	6 (5.9)
	Indifference	17 (16.7)

Sample size: n=313 non-smoking pregnant women for all questions except "Husband's reaction" (n=102, exposed women only), recruited via convenience sampling from 24 health centers in Tehran's districts 10 (4 centers), 11 (3 centers), 16 (6 centers), 17 (5 centers), and 19 (6 centers), affiliated with Tehran University of Medical Sciences. Percentages: Calculated based on valid responses; adjusted for accuracy with one decimal place. Percentages for "Husband's reaction" are based on n=102. Note: "Number of cigarettes consumed by husband" refers to total daily consumption, not necessarily in the wife's presence.

Exposure to secondhand smoke

Of the participants, 67.4% reported no SHS exposure from partners daily. Among exposed women, 16.0% reported exposure to one cigarette per day, and 15.7% experienced less than one hour of daily exposure. When asked to stop smoking, 50.0% of partners relocated, while 16.7% disregarded requests (Table 2).

Exposure and Health Belief Dimensions

Only perceived susceptibility showed a significant difference, with exposed women scoring lower than non-exposed women (p=0.045). No significant differences were observed in knowledge, attitude, perceived severity, barriers, or self-efficacy (Table 3).

Table 3. The comparison of mean score of health beliefs dimensions based on exposure to secondhand smoke in the pregnant women in Tehran (Iran)

Structures	Exposed	Mean ± SD	P-Value
Knowledge			0.564
	Yes	4.941	
	No	5.206	
Attitude-emotional dimension			0.276
	Yes	15.500	
	No	15.881	
Perceived susceptibility			0.045
	Yes	33.754	
	No	35.300	
Perceived severity			0.088
	Yes	33.058	
	No	34.187	
Perceived barriers			0.605
	Yes	39.245	
	No	39.660	
Self-efficacy			0.281
	Yes	21.274	
	No	21.812	

Relationship between SHS Exposure and Sociodemographic Factors

Logistic regression identified SES as the only significant predictor of SHS exposure. Higher SES was associated with lower exposure in both crude (OR=0.78, 95% CI: 0.62-0.97, p=0.028) and adjusted models (OR=0.78, 95% CI: 0.64-0.94, p=0.011) (Table 4).

Table 4 Crude and adjusted logistic regression model results on the associations between socio-demographic and pregnancy-related factors and exposure to secondhand smoke (SHS) in pregnant women in Tehran (Iran)

Characteristics	Crude OR (95% CI)	P-Value	Adjusted OR (95% CI)	P-Value
Age	0.98 (.94, 1.02)	0.428	1.03 (0.80, 1.33)	0.765
Mother education	0.84 (0.58, 1.21)	0.360	1.15 (0.69, 1.93)	0.575
Mother occupation	0.66 (0.25, 1.72)	0.400	0.86 (0.303, 2.47)	0.789
Partner education	0.97 (0.93, 1.01)	0.148	0.85 (0.31, 2.30)	0.753
Partner occupation	0.74 (0.26,2.12)	0.584	1.17 (0.74, 1.85)	0.499
Gravidity	0.80 (0.59, 1.09)	0.164	0.83(0.58, 1.19)	0.329
SES*	0.78 (0.62, 0.97)	0.028	0.78 (0.64, 0.94)	0.011

* Socioeconomic status

Discussion

This study found that 32.6% of pregnant women in Tehran are exposed to SHS, higher than some prior Iranian studies (13, 18) but lower than others (19). Exposure levels were generally low, with most women exposed to one cigarette daily for less than one hour, consistent with previous findings (13, 20, 21). Globally, the highest rates of exposure to SHS are found in Eastern Europe, the Western Pacific region and Southeast Asia with exposure rates surpassing 50% of the population (22). A study conducted in China reported even higher rates, indicating that 75% of non-smoking pregnant women are exposed to their husbands' secondhand smoke (23). Likewise, in Egypt, the widespread acceptance of tobacco use in homes and public spaces has resulted in an alarming exposure rate of approximately 80% among pregnant women (24). Social stigma or underreporting may lead to underestimated exposure rates, necessitating robust methodologies (25).

Only perceived susceptibility differed significantly, with exposed women perceiving lower risk. In other dimensions of health beliefs including "knowledge" "attitude-emotional" "perceived severity" "perceived barriers" and "self-efficacy" no significant differences between groups, indicating that the sample was relatively homogeneous in these aspects. This contrasts with studies linking low awareness to higher exposure (19, 23), suggesting that knowledge alone may not reduce exposure (26). Social, cultural, and environmental factors, like household smoking norms, likely outweigh cognitive factors. Interventions should integrate smoke-free policies, family engagement, and community initiatives to address these barriers.

Lower SES was the primary predictor of SHS exposure, aligning with studies showing SES influences health behaviors (10, 27, 28). Unlike some research (11), education level was not significant, nor were age or employment status (5, 30, 31), though other studies report conflicting findings (32). These results emphasize SES as a critical determinant, urging interventions that address socioeconomic disparities alongside behavioral strategies.

Limitations

Reliance on self-reported SHS exposure may introduce bias. Future studies should use larger, random samples and biochemical markers (e.g., urine cotinine) for accuracy.

Conclusion

This study confirms that 32.6% of pregnant women in Tehran face SHS exposure, with lower SES as the primary risk factor. Only perceived susceptibility differed significantly among HBM constructs. Targeted interventions addressing socioeconomic inequalities, combined with smoke-free policies and community education, are essential to reduce SHS risks for pregnant women and their fetuses. Future longitudinal research should explore evolving smoking behaviors and beliefs to inform culturally tailored prevention strategies.

Acknowledgements

The authors hereby thank the honorable Research Vice-Chancellor of Babol University of Medical Sciences, Student Research Committee, the staff of Tehran University of Medical Sciences as well as the women who participated in the study.

Conflicts of Interest

The authors have no conflicts of interest to declare for this study.

References

1. Sahebi Z, Kazemi A, Loripoor Parizi M. The relationship between husbands' health belief and environment tobacco smoke exposure among their pregnant wife. J Matern Fetal Neonatal Med 2017; 30: 830-833.
2. Tan S, Courtney LP, El-Mohandes AA, et al. Relationships between self-reported smoking, household environmental tobacco smoke exposure and depressive symptoms in a pregnant minority population. Matern Child Health J 2011;15 Suppl 1: S65-74.
3. Nwosu C, Angus K, Cheeseman H, Semple S. Reducing Secondhand Smoke Exposure Among Nonsmoking Pregnant Women: A Systematic Review. Nicotine Tob Res 2020; 22: 2127-2133.
4. Reece S, Morgan C, Parascandola M, Siddiqi K. Secondhand smoke exposure during pregnancy: a cross-sectional analysis of data from demographic and health surveys from 30 low- and middle-income countries. Tob Control 2019; 28: 420-426. https://doi: 10.1136/tobaccocontrol-2018-054288
5. Zhou W, Zhu X, Hu Z, et al. Association between secondhand smoke exposure in pregnant women and their socioeconomic status and its interaction with age: a cross-sectional study. BMC Pregnancy Childbirth 2022; 22: 695.
6. Karimiankakolaki Z, Gerayllo S, Mahmoodabad SSM. The effect of training male smokers about the effects of secondhand smoke on their pregnant wives' self-efficacy. J Fam Reprod Health 2023; 17: 250-254.
7. Quiñones Z, Li D, McIntosh S, et al. Predictors of Secondhand Smoke Exposure During Pregnancy in Costa Rica, the Dominican Republic, and Honduras. Nicotine Tob Res 2022; 24: 909-913.
8. Chansaeng S, Boonchieng W, Naksen W. Secondhand smoke prevention through the perceptions of pregnant women with smoking family members: a study in Thailand. Int J Qual Stud Health Well-Being 2024; 19: 2326109.
9. Farah MJ. Socioeconomic status and the brain: prospects for neuroscience-informed policy. Nat Rev Neurosci 2018; 19: 428-438.
10. Smedberg J, Lupattelli A, Mårdby A-C, Nordeng H. Characteristics of women who continue smoking during pregnancy: a cross-sectional study of pregnant women and new mothers in 15 European countries. BMC Pregnancy Childbirth 2014; 14: 213.
11. Madureira J, Camelo A, Silva AI, et al. The importance of socioeconomic position in smoking, cessation and environmental tobacco smoke exposure during pregnancy. Sci Rep 2020; 10: 15584.
12. Wahabi HA, Massis A, Fayed AA, Esmaeil SA. Effectiveness of health education in reducing secondhand smoke exposure among pregnant women attending antenatal clinics in Saudi Arabia: a randomized controlled trial. Indian J Public Health 2020; 64: 102-108.
13. Mahmoodabad SSM, Karimiankakolaki Z, Kazemi A, et al. Exposure to secondhand smoke in Iranian pregnant women at home and related factors. Tob Prev Cessation 2019; 5: 7.
14. Masoudiyekta L, Rezaei-Bayatiyani H, Dashtbozorgi B, et al. Effect of Education Based on Health Belief Model on the Behavior of Breast Cancer Screening in Women. Asia Pac J Oncol Nurs 2018; 5: 114-120.
15. Herrmann A, Hall A, Proietto A. Using the health belief model to explore why women decide for or against ovarian removal to reduce their cancer risk. BMC Women's Health 2018; 18: 184.
16. Lau J, Lim TZ, Wong GJ, Tan KK. The health belief model and colorectal cancer screening in the general population: a systematic review. Prev Med Rep 2020; 20: 101223.
17. Jeihooni AK, Dindarloo SF, Harsini PA. Effectiveness of the health belief model on oral cancer prevention in smoker men. J Cancer Educ 2019; 34: 920-7. 18. Eftekhar M, Pourmasumi S, Sabeti P, Mirhosseini F. Relation of secondhand smoking and effects on pregnancy outcomes and newborn parameters. Women's Health Gynecol. 2016; 2: 022.
19. Bahiraii A, Faghihi RS, Mirmohammad AM, Kazem NA. Predictors of home smoking ban in pregnant women. Payesh. 2012; 11: 511-7.
20. Bayrami R, Ebrahimi S, Rasouli J, Feizipour H. The effect of couple's motivational interviewing on exposure to secondhand smoke among pregnant

women at home. J Fam Reprod Health 2022; 16: 139-46.
21. O'Sharkey K, Xu Y, Cabison J, et al. A Comparison of Measured Airborne and Self-Reported Secondhand Smoke Exposure in the MADRES Pregnancy Cohort Study. Nicotine Tob Res 2024; 26: 669-677.
22. Oberg M, Jaakkola MS, Woodward A, et al. Worldwide burden of disease from exposure to secondhand smoke: a retrospective analysis of data from 192 countries. Lancet 2011; 377: 139-46.
23. Kazemi A, Ehsanpour S, Zahraei NS, et al. Impact of health belief modification on intention to make smoke free home among pregnant women. J Res Med Sci 2011; 16: 724-32.
24. Shaikh UU, Asif Z. Persistence and dropout in higher online education: review and categorization of factors. Front Psychol 2022; 13: 902070.
25. Mohammadi S, Amini M, Shidfar F, Kabir-Mokamelkhah E. The effect of active and passive smoking on hearing loss in noise-exposed metal workers. Med J Islam Repub Iran 2023; 37: 74.
26. Hassanein ZM, Murray RL, Bogdanovica I, Langley T. Healthcare professionals' knowledge, attitudes, and counseling practice regarding prevention of secondhand smoke exposure among pregnant women/children in Assiut, Egypt. Int J Public Health 2022; 67: 1605073.
27. Chen T, Wang MP, Cheung YTD, et al. Increasing Trends of Household Secondhand Smoke Exposure and Widening Socioeconomic Disparities in Hong Kong Adolescents, 2010-2020. Am J Prev Med 2025; 68: 735-744.
28. Mishra GA, Kulkarni SV, Gupta SD, Shastri SS. Smokeless tobacco use in urban Indian women: prevalence and predictors. Indian J Med Paediatr Oncol 2015; 36: 176-82.
29. Ren S, Xie S, Li X, et al. The association between maternal exposure to secondhand smoke during pregnancy and their children's cerebral palsy, Shandong, China. Tob Induc Dis 2020; 18: 87.
30. Azimi C, Lotfi M. Association of smoking habits of mothers during pregnancy with pregnancy outcomes. Iran J Public Health. 2013; 42: 748-57.
31. Wahabi HA, Alzeidan RA, Fayed AA, et al. Effects of secondhand smoke on the birth weight of term infants and the demographic profile of Saudi exposed women. BMC Public Health 2013; 13: 341.
32. Alghamdi AS, Jokhadar HF, Alghamdi IM, et al. Socioeconomic determinants of exposure to secondhand smoke among pregnant women. Int J Womens Health Reprod Sci 2016; 4: 59-63.