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

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## 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, Pregnant Women, 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

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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.1400.075), 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%



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

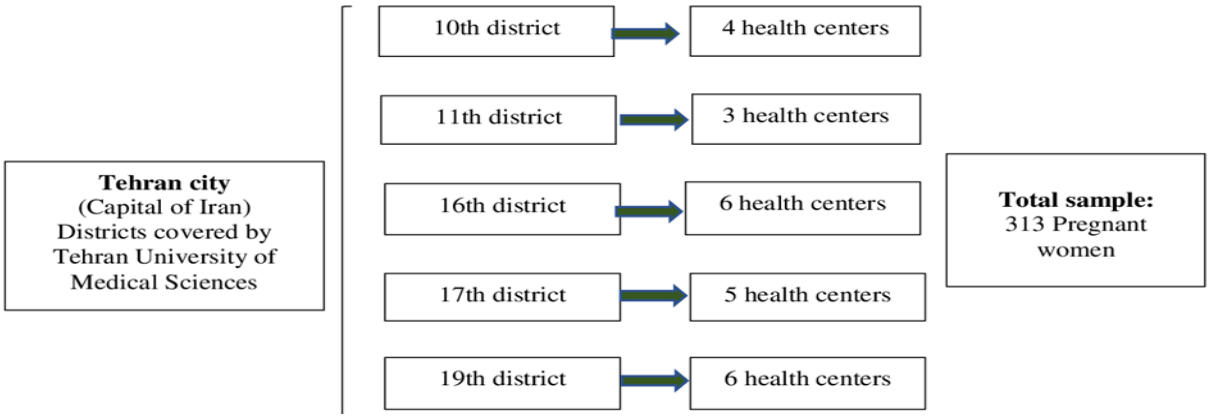


**Figure1.** The selection flowchart of the current study

**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 ($\chi^2$) tests used to compare categorical variables between SHS-exposed and non-exposed groups; $p<0.05$ indicates significance.

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## 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).

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**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.

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## Conflicts of Interest

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

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