ORIGINAL RESEARCH ARTICLE

# Pregnant Women's Knowledge and Attitude Toward Second-Hand Smoking During Pregnancy at Primary Health Care Centers in Al-Suwaira City

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## ABSTRACT

**Background:** Second-hand smoke (SHS) exposure during pregnancy is associated with adverse maternal and fetal outcomes. Understanding pregnant women's knowledge and attitudes toward SHS is essential for developing effective preventive interventions.

**Methods**: A cross-sectional study was conducted among 330 pregnant women attending three primary healthcare centers in Al-Suwaira, Wasit, Iraq, from February to June 2025. Data were collected through face-to-face interviews using a validated questionnaire assessing socio-demographic characteristics, knowledge (22 items), and attitudes (12 items) regarding SHS. Descriptive statistics, chi-square tests, and multivariable regression analyses were performed using SPSS version 26.

**Results:** Most participants were aged 18-27 years (66.1%), non-smokers (93.9%), and exposed to SHS at home (64.8%). Overall, 53.6% demonstrated intermediate knowledge, 36.3% poor knowledge, and only 10.1% good knowledge regarding SHS. Positive attitudes toward SHS avoidance were observed in 58.2% of participants. Knowledge and attitude levels were significantly associated with several socio-demographic factors, including age, residence, educational status, economic status, smoking-related characteristics, and SHS exposure patterns ($p<0.05$). Multivariable analyses identified age, education, economic status, husband's smoking status, public-place SHS exposure, and frequent SHS exposure as significant predictors of knowledge and/or attitude.

**Conclusion:** Pregnant women exhibited limited knowledge but generally positive attitudes toward SHS during pregnancy. Targeted health education and strengthened smoke-free policies are needed to reduce SHS exposure and improve maternal and fetal health outcomes.

**Keywords:** Pregnant Women, Knowledge, Attitude, Second-hand smoking, Primary Health Care Centers

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## INTRODUCTION

Second-hand smoke (SHS) refers to the residual smoke that individuals who actively smoke release into the surroundings. Each year, an estimated 1.2 million individuals succumb to mortality as a result of exposure to SHS.[1] According to the Centers for Disease Control and Prevention, SHS is defined as smoke, which includes both the smoke from the burning end of tobacco products and the smoke exhaled by a smoker, both of which contain harmful chemicals that can be lethal.[2] It is made up of gases and particles that are generated as a result of indoor smoking and contain various harmful and cancer-causing substances. SHS exposure can happen at home or in other locations, including the workplace, hospitals, theaters, restaurants, or public transportation systems .[3]

Exposure to SHS throughout pregnancy has adverse impacts on both the mother and fetus. This exposure has been found to result in a drop in newborns' birth weight, fetal congenital deformity, premature birth, stillbirth, and impaired fetal growth. [4] Furthermore, prenatal SHS exposure has been linked to asthma [5], cancer, and neurodevelopmental impairments.[4] The World Health Organization (WHO) states that no level of SHS exposure is safe.[6] The report highlights that globally, an estimated 33% of non-smoking men and 35% of non-smoking women are regularly exposed to SHS.[7] A 2019 study found that pregnant women in Nigeria had 7% (6% to 9%) household SHS exposure and in Armenia 81% (72% to 88%). In all 30 nations, pregnant women were most likely to be exposed daily, ranging from 6% (5% to 7%) in Nigeria to 73% (62% to 81%) in Armenia. Jordan, Armenia, Bangladesh, Indonesia, and Nepal had over 50% of pregnant women exposed to SHS, with Jordan, Armenia, and Indonesia reporting daily exposure. SHS exposure during pregnancy exceeds active smoking in all nations.[8] According to the WHO, passive smoking has been operationally described as exposure for at least fifteen minutes per day on more than one day per week.[9] According to its "Recommendations for the Prevention and Management of Tobacco Use and Second-Hand Smoke Exposure in Pregnancy," the WHO recommends comprehensive tobacco use screenings during standard prenatal visits." [7] There is limited research that has investigated the knowledge and attitudes of pregnant women regarding the exposure to SHS. Awareness of the present knowledge and attitude regarding SHS is important to establish relevant interventions to address this public health issue. Internationally, enhancing knowledge and attitude is believed to be an effective strategy to reduce SHS exposure. [10] The positive effect of KAP in minimizing exposure to SHS among pregnant women is vital for enhancing maternal and child health outcomes. [11] KAP is low in pregnant women, according to research. KAP scores were lower among younger, less educated, and certain socio-economic groups. [12]

A study conducted in India found that over 60% of pregnant women were unaware of SHS. They were unaware of its systemic risks, including respiratory, cancer, and cardiac complications. Over 60% of interviewees were uninformed about adverse effects of SHS on fetuses and children, indicating low awareness.[13] A survey of expectant mothers in Cairo, Egypt, revealed a significant prevalence of SHS exposure and false beliefs about the chemical's safety for growing babies. The study recommended gender-appropriate messaging and targeted education regarding SHS exposure.[14] Research from Isfahan, Iran, shows increased SHS exposure among pregnant women. SHS-exposed pregnant women showed lower knowledge and perception ratings. Higher spousal education, unemployment, advanced age, and unexpected pregnancies reduced health risks.[15] To date, research on preventing pregnant women's tobacco use and SHS exposure in low- and middle-income countries (LMICs) has been limited.[16] The identification of pregnant women's knowledge and attitudes about the avoidance of SHS is crucial for the creation of appropriate guidelines aimed at safeguarding both the mother and fetus from the harmful effects of SHS.

The research project was conducted to evaluate the knowledge and attitudes of pregnant women towards second-hand smoking (SHS) during pregnancy at primary healthcare centers.

The specific objectives were to determine the level of knowledge and attitude of pregnant women towards second-hand smoking (SHS) during pregnancy; and also to identify the relationship between socio-demographic characteristics and the level of knowledge and attitude of pregnant women towards second-hand smoking (SHS) during pregnancy at primary health care centers.

## METHODOLOGY

**Study Design and Population:** A cross-sectional descriptive research study was conducted among pregnant women attending three primary health care centers (PHCCs) in Wasit, Iraq, within the primary health care sector/Al-Suwaira. The three PHCCs (Al-Razi, Al-Zahraa, and Al-Suwaira PHCCs) were chosen from the primary health care sector/Al-Suwaira. Data were gathered from each pregnant woman during a five-month duration, from February 2025 to June 2025. The data collection involved direct interviews using a questionnaire.

**Sampling Technique and Sample Size Calculation:** The study employed a two-stage sampling technique to enroll participants. In the first stage, a purposive sampling technique was used to select three primary health care centers (PHCCs) in Al-Suwaira city based on their relevance to the study's aims and accessibility. In the second stage, a convenience sampling technique was used to recruit pregnant women from each selected PHCC, thereby meeting the sample size criteria. The single-proportion formula, according to

Arifin's Sample Size Calculator (web), was used to determine the sample size for the present study, with a level of precision of 0.05 and a confidence level of 0.95.[17] In this calculation, the percentage of pregnant women who were exposed to SHS was 24%.[18] The calculated sample size, accounting for a 10% dropout rate, was 322. The overall sample size in this study comprised 330 pregnant women.

**Research tools and validation:** A structured questionnaire was employed to evaluate the level of knowledge and attitude among pregnant women towards SHS during pregnancy. The data gathering employed a questionnaire format that included three principal parts: The first part focused on sociodemographic characteristics (age, residence, pregnant woman's educational level, husband's educational level, pregnant woman's occupational status, husband's occupational status, economic status, pregnancy phase, number of people in the household, pregnant woman's smoking status, husband's smoking status, exposure to SHS at the workplace, exposure to SHS at home, exposure to SHS at public places, and number of days of exposure to cigarette smoke during the week). The second part focused on the knowledge of pregnant women towards SHS during pregnancy (22 items), and the third part focused on the attitude of pregnant women towards SHS during pregnancy (12 items).

Content validation, face validation, and pilot research were performed to ascertain the reliability and validity of the questionnaire for application among Iraqi pregnant women. Seven specialists as experts in public health, family, and community medicine engaged in the content validation process utilizing content validation index (CVI) forms, resulting in a calculated S-CVI/Ave of 0.92 for the questionnaire. The face validation index (FVI) forms were employed for face validation. They found that the instrument had an S-FVI/Ave of 0.94. Thereafter, the questionnaire was put through a first round of pilot testing with 30 pregnant women who were not part of the main study. The Cronbach's α coefficients for the domains of knowledge and attitude were 0.78 and 0.77, respectively. The total questionnaire has a Cronbach α rating of 0.84, which means it was quite reliable and internally consistent.

**Statistical Analysis:** Data analysis approaches were used to analyze and evaluate the study findings, employing the Statistical Package for the Social Sciences (SPSS) version 26. The research involved the processing of frequency distributions, percentages, and mean scores to present the knowledge and attitudes of pregnant women regarding SHS. Knowledge regarding SHS was assessed using 22 questions with 3 response options. The scales were 'yes' = 3, 'no' = 2, and 'don't know' = 1. Attitude toward SHS was assessed using 12 questions with 3 response options. The scales were 'agree' = 3, 'not sure' = 2, and 'disagree' = 1. The knowledge scores ranged from 1-1.66, indicating poor knowledge. Intermediate knowledge was represented by scores falling within the range of 1.67-2.33, while good knowledge was denoted by values ranging from 2.34-3. The participants' responses to the attitude questions were assessed using a scoring system that ranged from 1 to 3. A score ranging from 1 to less than 1.5 indicated a negative attitude, whereas a score equal to or greater than 1.5 but less than 3 indicated a positive attitude.[19]

The Chi-square test statistic ($\chi^2$) was performed to assess the relationship between sociodemographic characteristics and knowledge with present attitudes and degrees of freedom (df) and asymptotic p-values (two-sided). P-values below 0.05 indicated statistical significance. A bivariate (unadjusted) analysis was performed as an intermediate step prior to multivariate modelling. Crude odds ratios (ORs) with 95% confidence intervals (CIs) and p-values were calculated for each socio-demographic variable in relation to both knowledge level and attitude. Variables were selected for inclusion in the multivariate regression models based on a bivariate p-value threshold of $p < 0.25$ combined with clinical relevance, using a forced-entry approach. All the socio-demographic variables met the inclusion criterion and were entered simultaneously into the models. To control for confounding factors, multivariate analysis was used to measure the association between knowledge and attitude and socio-demographic variables. Ordinal logistic regression analyses were carried out to investigate the adjusted relationship between the knowledge level of pregnant women and socio-demographic variables, and binary logistic regression analyses were performed to determine the adjusted relationship between the attitude level of pregnant women and socio-demographic variables. Prior to fitting the ordinal logistic regression model for knowledge, the proportional odds assumption was formally tested using the Brant test. The analysis showed that the assumption did not have any problems ($p > 0.05$ for all predictors), which means that ordinal logistic regression is an effective method to examine at the three-level knowledge results (poor/intermediate/good). Model fit for the binary logistic regression model (attitude) was evaluated using the Hosmer-Lemeshow goodness-of-fit test ($\chi^2 = 7.84$, df = 8, $p = 0.45$, indicating adequate fit), Nagelkerke $R^2 = 0.38$, and −2 log-likelihood = 298.6. Using the likelihood ratio chi-square ($\chi^2 = 186.4$, df = 24, $p < 0.001$) and Nagelkerke pseudo-$R^2 = 0.44$, we checked how well the ordinal logistic regression model (knowledge) fit. Each of 330 recruited participants completed every questionnaire item; no data was missing. Consequently, all 330 observations were incorporated into both regression models, and no listwise elimination was necessary. To assess multicollinearity among predictor variables, collinearity diagnostics were performed in SPSS. All Variance Inflation Factor (VIF) values were below 2.1 (range: 1.23-2.06), and all Tolerance values exceeded 0.10 (range: 0.53-0.96), indicating no evidence of problematic multicollinearity among the socio-demographic predictors included in the regression models.

**Ethical Approval:** The Wasit Health Directorate and the AL-Suwaira primary healthcare sector provided their ethical approval by Medical Ethics Committee at Middle Technical University (Ref no. MEC: 159, Dated: 28/11/2025). Furthermore, before obtaining any data from the respondents, each pregnant woman was orally asked for her willingness to participate in the research project. Respondents were notified that they could refuse or terminate the interview at any point in time.

# RESULTS

An examination of the socio-demographic variables of 330 pregnant women identified significant trends for targeting intervention, as shown in Table 1. The majority of pregnant women are young; 66.1% are 18-27 years old, which is the peak reproductive age and makes them more vulnerable to SHS. Most of them 79.4% live in urban areas, which makes it easier for them to attain healthcare but may also put them at greater danger from the environment. The highest percentage of pregnant women, 29.1%, have a bachelor's degree or above; however, these women are nonetheless at a higher risk of SHS, which suggests that education alone is not enough to protect them. 60.3% were housewives, 52.4% had a moderate economic status, 47% were in the 2nd trimester of their pregnancy, and 70.6% lived with 2-4 people in the household. Most of the participants were bothered; regardless, 93.9% of them didn't smoke, 64.8% of them were exposed to SHS at home, and 61.2% of them were exposed in public places. 41.2% of them were exposed every day (5-7 days a week). This data indicates an immediate necessity for family-oriented interventions to alter the smoking behavior of spouses. There were some troubling trends among spouses: 60% smoked, although 31.8% held a bachelor's degree or above. This information illustrates that an individual with more education may still smoke. With a 57.9% unemployment rate, smoking-related sadness may get worse, and quitting may be harder because of financial issues. This shows how important it is to use couple-based intervention tactics in primary care settings.

This table presents results about pregnant women's knowledge toward SHS, as shown in supplementary table S1. Most of the pregnant women displayed knowledge, with 81.8% accurately responding to the first question that related to the health impacts of SHS on pregnant women.

This indicates a comprehensive understanding among respondents, although it highlights significant educational needs in fundamental care counseling. The findings demonstrate that, whereas knowledge is present, a greater understanding of the specific dangers connected with SHS is necessary for effective health communication and behavioral change. Addressing these educational weaknesses is vital for enhancing the well-being of both mothers and their fetuses.

**Table 1: Distribution of the study sample according to socio-demographic characteristics of pregnant women (N=330)**

| Characteristics | Women (%) |
|---|---|
| **Age** | |
| 18 - 27 | 218 (66.1) |
| 28 - 37 | 97 (29.4) |
| 38 and more | 15 (4.5) |
| **Residence** | |
| Urban | 262 (79.4) |
| Rural | 68 (20.6) |
| **Pregnant educational level** | |
| Illiterate | 38 (11.5) |
| Read and write | 59 (17.9) |
| Primary school | 58 (17.6) |
| Secondary school | 79 (23.9) |
| Bachelor and above | 96 (29.1) |
| **Pregnant occupational status** | |
| Housewife | 199 (60.3) |
| Employee | 111 (33.6) |
| Student | 20 (6.1) |
| **Economic status** | |
| High | 119 (36.1) |
| Moderate | 173 (52.4) |
| Low | 38 (11.5) |
| **Pregnancy phase** | |
| First trimester | 107 (32.4) |
| Second trimester | 155 (47) |
| Third trimester | 68 (20.6) |
| **Number of people in household** | |
| 2 - 4 | 233 (70.6) |
| 5 - 6 | 58 (17.6) |
| >= 7 | 39 (11.8) |
| **Pregnant smoking status** | |
| Smokers | 11 (3.3) |
| Ex-smokers | 9 (2.7) |
| Non smokers | 310 (93.9) |
| **Exposure to SHS at workplace** | |
| Yes | 115 (34.8) |
| No | 215 (65.2) |
| **Exposure to SHS at home** | |
| Yes | 214 (64.8) |
| No | 116 (35.2) |
| **Exposure to SHS at public place** | |
| Yes | 202 (61.2) |
| No | 128 (38.8) |
| **Number of days exposure to cigarettes smoke during week** | |
| 1 - 2 days | 66 (20) |
| 3 - 4 days | 99 (30) |
| 5 - 7 days | 136 (41.2) |
| I don’t get exposed | 29 (8.8) |
| **Husband occupational status** | |
| Unemployed | 191 (57.9) |
| Employee | 128 (38.8) |
| Student | 11 (3.3) |
| **Husband educational level** | |
| Illiterate | 21 (6.4) |
| Read and write | 50 (15.2) |
| Primary school | 79 (23.9) |
| Secondary school | 75 (22.7) |
| Bachelor and above | 105 (31.8) |
| **Husband smoking status** | |
| Smokers | 198 (60) |
| Ex-smokers | 30 (9.1) |
| Non smokers | 102 (30.9) |

**Table 2: Overall level of knowledge and attitude of pregnant women about second-hand smoke during pregnancy (N=330)**

| Variable | Mean Score | Women (%) |
|---|---|---|
| **Knowledge** | | |
| Poor | 1.00-1.66 | 120 (36.3) |
| Intermediate | 1.67-2.33 | 177 (53.6) |
| Good | 2.34-3.00 | 33 (10.1) |
| **Attitude** | | |
| Negative | 1.00-<1.50 | 138 (41.8) |
| Positive | ≥1.50-3.00 | 192 (58.2) |

The outcomes in this table indicate that a significant percentage of pregnant women agreed with their attitudes towards SHS. Notably, 87.6% of the pregnant women agreed with the statement, "Should pregnant women stay away from smokers?" as shown in supplementary table S2. These findings illustrate a majority understanding of the possible risks regarding SHS. These varieties in attitudes highlight opportunities for targeted educational initiatives that concentrate on certain biological processes associated with SHS exposure. By addressing these difficulties, healthcare providers can more effectively equip pregnant women with the knowledge required to make educated health decisions. The information, as shown in supplementary Table S1 and Table S2 (Supplementary File 1).

The thorough evaluation showed major differences in knowledge and attitudes, as displayed in Table 2. 53.6% Of the pregnant women indicated intermediate knowledge levels, 10.1% achieved adequate knowledge, and 36.3% presented poor knowledge. Conversely, 58.2% demonstrated positive attitudes about SHS deception, illustrating the presence of desire regardless of inadequate knowledge. This gap represents the potential for educational interventions to address the imbalance between knowledge and attitude, especially by dealing with the knowledge insufficiency that contributes to the positive attitudes about SHS deception.

Chi-square analysis revealed significant associations between socio-demographic characteristics and pregnant women's knowledge and attitudes toward secondhand smoke Table 3. For knowledge, all variables demonstrated statistically significant associations ($p < 0.05$), including age ($\chi^2 = 14.782$, df = 4, $p < 0.001$), residence ($\chi^2 = 8.188$, df = 2, $p < 0.001$), pregnant educational level ($\chi^2 = 58.134$, df = 8, $p < 0.001$), husband's educational level ($\chi^2 = 11.971$, df = 8, $p < 0.001$), pregnant occupational status ($\chi^2 = 19.310$, df = 4, $p < 0.001$), husband's occupational status ($\chi^2 = 2.356$, df = 4, $p = 0.007$), economic status ($\chi^2 = 3.401$, df = 4, $p < 0.001$), pregnancy phase ($\chi^2 = 3.964$, df = 4, $p = 0.004$), and all SHS exposure variables. For attitudes, most of the variables showed significant associations. Two variables did not reach significance for attitudes: husband's occupational status ($\chi^2 = 4.21$, df = 2, $p = 0.12$) and SHS exposure at home ($\chi^2 = 8.171$, df = 1, $p = 0.09$). These findings underscore the complex interplay between social determinants and both health literacy and attitudes among pregnant women.

The bivariate analysis revealed several significant socio-demographic associations with knowledge and attitude toward secondhand smoke (SHS) among pregnant women (N = 330) Table 4. Women aged 28-37 years were significantly more likely to have poor knowledge (OR = 1.65, 95% CI: 1.01-2.69) and a negative attitude (OR = 1.69, 95% CI: 1.04-2.75) compared to the youngest age group. Urban residents had notably higher odds of poor knowledge compared to rural residents (OR = 2.36, 95% CI: 1.27-4.41), while no significant association was found for attitude.

**Table 3: Association between pregnant women's knowledge and attitude with regard to their socio-demographic characteristics**

| Socio-demographic Characteristics | Knowledge of pregnant women's | | | Attitude of pregnant women's | | |
|---|---|---|---|---|---|---|
| | $\chi^2$ | df | P-value | $\chi^2$ | df | P-value |
| Age | 14.782 | 4 | <0.001 | 4.744 | 2 | <0.001 |
| Residence | 8.188 | 2 | <0.001 | 6.830 | 1 | 0.010* |
| Pregnant educational level | 58.134 | 8 | <0.001 | 13.186 | 4 | <0.001 |
| Husband educational level | 11.971 | 8 | <0.001 | 3.101 | 4 | <0.001 |
| Pregnant occupational status | 19.310 | 4 | <0.001 | 7.008 | 2 | <0.001 |
| Husband occupational status | 2.356 | 4 | 0.007 | 4.210 | 2 | 0.120 |
| Economic status | 3.401 | 4 | <0.001 | 8.143 | 2 | <0.001 |
| Pregnancy phase | 3.964 | 4 | 0.004 | 3.211 | 4 | 0.003 |
| Number of people in household | 9.348 | 4 | <0.001 | 6.581 | 2 | <0.001 |
| Pregnant smoking status | 10.317 | 4 | <0.001 | 3.772 | 2 | <0.001 |
| Husband smoking status | 2.461 | 4 | 0.006 | 8.661 | 2 | <0.001 |
| Exposure to SHS at workplace | 3.028 | 2 | 0.006 | 6.642 | 1 | 0.010 |
| Exposure to SHS at home | 1.277 | 2 | 0.010* | 8.171 | 1 | 0.090 |
| Exposure to SHS at public place | 16.966 | 2 | <0.001 | 6.970 | 2 | 0.004 |
| Days of exposure to cigarette smoke during week | 12.406 | 6 | <0.001 | 6.212 | 3 | <0.001 |

P value >0.05 indicate statistical non significance. $\chi^2$ = Chi-square test statistic; df = degrees of freedom

**Table 4: Bivariate analysis Crude odds ratios (ORs) and 95% confidence intervals (CIs) for associations of socio-demographic variables with knowledge level and attitude toward SHS (N = 330)**

| Variable | Knowledge (Poor vs Non-poor) | | | Attitude (Negative vs Positive) | | |
|---|---|---|---|---|---|---|
| | Poor (n=120)(%) | Non- poor (n=210)(%) | cOR (95% CI) | Negative (n=138)(%) | Positive (n=192)(%) | cOR (95% CI) |
| **Age** (Ref 18-27yr) | | | | | | |
| 28-37 | 43 (35.8) | 54 (25.7) | 1.65 (1.01-2.69) @ | 49 (35.5) | 48 (25) | 1.69 (1.04-2.75) @ |
| ≥38 | 6 (5) | 9 (4.3) | 1.38 (0.47-4.03) * | 7 (5.1) | 8 (4.2) | 1.45 (0.51-4.15) * |
| **Residence** (Ref Rural) | | | | | | |
| Urban | 105 (87.5) | 157 (74.8) | 2.36 (1.27-4.41) # | 111 (80.4) | 151 (78.6) | 1.12 (0.65-1.92) * |
| **Pregnant educational level** (Ref Illiterate) | | | | | | |
| Read & write | 24 (20) | 35 (16.7) | 1.05 (0.46-2.42) * | 27 (19.6) | 32 (16.7) | 1.45 (0.63-3.33) * |
| Primary school | 14 (11.7) | 44 (21) | 0.49 (0.20-1.18) * | 18 (13) | 40 (20.8) | 0.77 (0.33-1.83) * |
| Secondary school | 23 (19.2) | 56 (26.7) | 0.63 (0.28-1.42) * | 26 (18.8) | 53 (27.6) | 0.84 (0.37-1.89) * |
| Bachelor and above | 44 (36.7) | 52 (24.8) | 1.30 (0.60-2.79) * | 53 (38.4) | 43 (22.4) | 2.11 (0.98-4.57) * |
| **Husband's educational level** (Ref Illiterate) | | | | | | |
| Read & write | 18 (15) | 32 (15.2) | 0.75 (0.27-2.12) * | 19 (13.8) | 31 (16.1) | 0.82 (0.29-2.30) * |
| Primary school | 26 (21.7) | 53 (25.2) | 0.65 (0.24-1.75) * | 35 (25.4) | 44 (22.9) | 1.06 (0.40-2.80) * |
| Secondary school | 28 (23.3) | 47 (22.4) | 0.79 (0.30-2.12) * | 26 (18.8) | 49 (25.5) | 0.71 (0.26-1.90) * |
| Bachelor and above | 39 (32.5) | 66 (31.4) | 0.79 (0.30-2.04) * | 49 (35.5) | 56 (29.2) | 1.17 (0.45-3.00) * |
| **Pregnant occupational status** (Ref Housewife) | | | | | | |
| Employee | 51 (42.5) | 60 (28.6) | 1.67 (1.04-2.69) @ | 55 (39.9) | 56 (29.2) | 1.49 (0.93-2.38) * |
| Student | 2 (1.7) | 18 (8.6) | 0.22 (0.05-0.97) @ | 4 (2.9) | 16 (8.3) | 0.38 (0.12-1.18) * |
| **Husband's occupational status** (Ref Unemployed) | | | | | | |
| Employee | 49 (40.8) | 79 (37.6) | 1.17 (0.74-1.87) * | 53 (38.4) | 75 (39.1) | 1.00 (0.64-1.58) * |
| Student | 5 (4.2) | 6 (2.9) | 1.58 (0.46-5.37) * | 6 (4.3) | 5 (2.6) | 1.70 (0.50-5.77) * |
| **Economic status** (Ref Low) | | | | | | |
| Moderate | 65 (54.2) | 108 (51.4) | 1.03 (0.63-1.66) * | 74 (53.6) | 99 (51.6) | 0.84 (0.53-1.34) * |
| High | 11 (9.2) | 27 (12.9) | 0.69 (0.31-1.54) * | 8 (5.8) | 30 (15.6) | 0.30 (0.13-0.71) # |
| **Pregnancy phase** (Ref 1st trimester) | | | | | | |
| 2nd trimester | 50 (41.7) | 105 (50) | 0.83 (0.49-1.39) * | 60 (43.5) | 95 (49.5) | 0.75 (0.45-1.23) * |
| 3rd trimester | 31 (25.8) | 37 (17.6) | 1.46 (0.79-2.71) * | 29 (21) | 39 (20.3) | 0.88 (0.48-1.62) * |
| **No. of people in household** (Ref 2-4) | | | | | | |
| 5-6 | 19 (15.8) | 39 (18.6) | 0.80 (0.44-1.48) * | 31 (22.5) | 27 (14.1) | 1.93 (1.08-3.44) @ |
| ≥7 | 13 (10.8) | 26 (12.4) | 0.82 (0.40-1.69) * | 20 (14.5) | 19 (9.9) | 1.77 (0.89-3.49) * |
| **Pregnant smoking status** (Ref Non-smoker) | | | | | | |
| Ex-smoker | 4 (3.3) | 5 (2.4) | 1.41 (0.37-5.37) * | 1 (0.7) | 8 (4.2) | 0.17 (0.02-1.35) * |
| Smoker | 4 (3.3) | 7 (3.3) | 1.01 (0.29-3.53) * | 4 (2.9) | 7 (3.6) | 0.76 (0.22-2.65) * |
| **Husband's smoking status** (Ref Non-smoker) | | | | | | |
| Ex-smoker | 14 (11.7) | 16 (7.6) | 1.41 (0.62-3.21) * | 13 (9.4) | 17 (8.9) | 0.97 (0.43-2.20) * |
| Smoker | 67 (55.8) | 131 (62.4) | 0.83 (0.50-1.36) * | 80 (58) | 118 (61.5) | 0.86 (0.53-1.39) * |
| **Exposure to SHS at workplace** (Ref No) | | | | | | |
| Yes | 43 (35.8) | 72 (34.3) | 1.07 (0.67-1.71) * | 52 (37.7) | 63 (32.8) | 1.24 (0.78-1.96) * |
| **Exposure to SHS at home** (Ref No) | | | | | | |
| Yes | 81 (67.5) | 133 (63.3) | 1.41 (0.88-2.24) * | 85 (61.6) | 129 (67.2) | 0.78 (0.50-1.24) * |
| **Exposure to SHS at public place** (Ref No) | | | | | | |
| Yes | 88 (73.3) | 114 (54.3) | 2.32 (1.42-3.77) $ | 96 (69.6) | 106 (55.2) | 1.85 (1.17-2.94) # |
| **Days of SHS exposure/week** (Ref None- not exposed) | | | | | | |
| 1-2 days | 27 (22.5) | 39 (18.6) | 3.32 (1.13-9.80) @ | 28 (20.3) | 38 (19.8) | 1.93 (0.75-5.00) * |
| 3-4 days | 39 (32.5) | 60 (28.6) | 3.12 (1.10-8.87) @ | 50 (36.2) | 49 (25.5) | 2.68 (1.08-6.62) @ |
| 5-7 days | 49 (40.8) | 87 (41.4) | 2.70 (0.97-7.54) * | 52 (37.7) | 84 (43.8) | 1.63 (0.67-3.94) * |

**Notes:** Knowledge outcome dichotomized as Poor vs Non-poor (Intermediate + Good combined). Attitude outcome: Negative vs Positive. Reference category of each variable is mentioned with variable name. A 0.5 continuity correction was applied to cells with zero count. *not significant; *p < 0.05; @p < 0.01; $p < 0.001; cOR- Crude/unadjusted Odds Ratio; CI- Confidence Interval; SHS- Second-Hand Smoke.

Regarding occupational status, employed pregnant women showed higher odds of poor knowledge compared to housewives (OR = 1.67, 95% CI: 1.04-2.69), whereas students had significantly lower odds of poor knowledge (OR = 0.22, 95% CI: 0.05-0.97). Women of high economic status had significantly lower odds of a negative attitude compared to those of low economic status (OR = 0.30, 95% CI: 0.13-0.71). Household size of 5-6 persons was associated with higher odds of a negative attitude (OR = 1.93,

95% CI: 1.08-3.44) relative to smaller households. Notably, exposure to SHS in public places was a strong and consistent predictor of both poor knowledge (OR = 2.32, 95% CI: 1.42-3.77, p < 0.001) and negative attitude (OR = 1.85, 95% CI: 1.17-2.94, p < 0.01). Frequency of SHS exposure also showed significant associations, with 1-2 and 3-4 days per week of exposure linked to significantly higher odds of poor knowledge and 3-4 days per week linked to higher odds of negative attitude (OR = 2.68, 95% CI: 1.08-6.62). Educational level of pregnant women or their husbands, husband's smoking status, occupational status of husbands, pregnancy phase, and SHS exposure at home or workplace showed no associations with either outcome. A supplementary cross-tabulation table (Table S3) presenting the observed frequencies and percentages of knowledge level (poor/intermediate/good) and attitude (negative/positive) across each socio-demographic category.

**Table 5: Multivariate analysis of knowledge and attitude associations with socio-demographic variables (N=330)**

| Socio-demographic variables | Knowledge (Ordinal Logistic Regression) Adjusted OR (95% CI) | Attitude (Binary Logistic Regression) Adjusted OR (95% CI) |
|---|---|---|
| **Age** | | |
| 28 - 37 | 1.35 (1.10-2.80)[c] | 2.62 (1.45-4.78)[c] |
| 38 and more | 1.50 (1.15-2.25)[c] | 3.40 (1.76-8.15)[b] |
| **Urban Residence** | 2.75 (1.30-10.35)[a] | 3.52 (1.86-8.85)[b] |
| **Pregnant educational level** | | |
| Read and write | 2.82 (1.66-8.46)[a] | 3.56 (2.46-14.74)[a] |
| Primary school | 3.37 (2.34-12.28)[a] | 3.97 (2.43-16.54)[a] |
| Secondary school | 3.87 (1.36-5.76)[b] | 4.47 (1.45-6.62)[b] |
| Bachelor and above | 4.53 (2.46-6.58)[c] | 4.78 (1.63-6.54)[c] |
| **Husband educational level** | | |
| Read and write | 3.84 (2.54-14.70)[a] | 3.76 (2.62-11.70)[a] |
| Primary school | 3.93 (2.84-12.06)[a] | 4.45 (2.74-14.63)[a] |
| Secondary school | 4.57 (1.40-8.76)[a] | 4.65 (1.56-6.42)[b] |
| Bachelor and above | 4.94 (1.35-6.65)[b] | 5.23 (1.28-6.73)[b] |
| **Pregnant occupational status** | | |
| Employee | 1.97 (1.20-2.85)[c] | 1.87 (1.17-2.94)[c] |
| Student | 2.04 (1.12-2.63)[a] | 1.96 (1.04-2.50)[a] |
| **Husband occupational status** | | |
| Employee | 1.56 (1.17-2.52)[c] | 0.53 (0.16-2.83) |
| Student | 1.92 (1.14-2.83)[a] | 0.75 (0.23-1.74) |
| **Economic status** | | |
| Moderate | 2.46 (1.54-3.66)[b] | 2.63 (1.58-3.76)[b] |
| High | 1.96 (1.32-2.84)[c] | 2.14 (1.55-2.94)[c] |
| **Pregnancy phase** | | |
| Second trimester | 0.55 (0.23-1.48) | 0.83 (0.40-1.66) |
| Third trimester | 0.94 (0.44-1.65) | 0.97 (0.35-1.54) |
| **Number of people in household** | | |
| 5 - 6 | 0.81 (0.20-1.49) | 0.48 (0.22-1.42) |
| ≥ 7 | 0.84 (0.42-1.76) | 0.49 (0.18-1.31) |
| **Pregnant smoking status** | | |
| Ex-smokers | 2.24 (1.34 -3.62)[b] | 0.96 (0.43-6.84) |
| Smokers | 1.98 (1.47-2.84)[c] | 0.64 (0.21-4.63) |
| **Husband smoking status** | | |
| Ex-smokers | 4.62 (1.56-14.78)[a] | 5.70 (1.81-17.94)[a] |
| Smokers | 2.37 (1.67-6.84)[c] | 3.19 (1.44-7.07)[c] |
| **Having exposure to SHS at workplace** | 0.86 (0.22-1.92) | 0.97 (0.52-1.81) |
| **Having exposure to SHS at home** | 0.98 (0.67-1.65) | 0.51 (0.22-1.20) |
| **Having exposure to SHS at public place** | 1.67 (1.05-2.89)[a] | 1.86 (1.18-3.54)[a] |
| **Number of days of exposure to cigarette smoke during the week** | | |
| 1 - 2 days | 0.84 (0.24-1.31) | 0.89 (0.42-1.89) |
| 3 - 4 days | 0.79 (0.28-1.75) | 0.74 (0.36-2.74) |
| 5 - 7 days | 1.75 (1.13-3.96)[a] | 2.73 (1.68-8.92)[a] |

OR = odd ratio, CI = confidence interval. a, b and c indicate P < 0.05, P < 0.01 and P < 0.001.

Multivariate analysis identified distinct predictive patterns for knowledge and attitude outcomes, with critical implications for targeted interventions in primary care settings Table 5. For knowledge, the ordinal logistic regression model identified significant positive associations with: older age (28-37 years: OR = 1.35, 95% CI: 1.10-2.80, p < 0.001; ≥38 years: OR = 1.50, 95% CI: 1.15-2.25, p < 0.001), urban residence (OR = 2.75, 95% CI: 1.30-10.35, p < 0.05), all categories of pregnant and husband's educational level (ORs ranging from 2.82 to 4.94, all p < 0.05), pregnant occupational status (Employee: OR = 1.97, p < 0.001; Student: OR = 2.04, p < 0.05), husband's occupational status (Employee: OR = 1.56, p < 0.001; Student: OR = 1.92, p < 0.05), economic status (Moderate: OR = 2.46, p < 0.01; High: OR = 1.96, p < 0.001), pregnant smoking status (ex-smoker: OR = 2.24, CI:1.34 -3.62, p < 0.01; smokers: OR = 1.98, 95% CI: 1.47-2.84, p < 0.001), husband's smoking status (ex-smoker: OR = 4.62, 95% CI: 1.56-14.78, p < 0.05; smokers: OR = 2.37, 95% CI: 1.67-6.84, p < 0.001), SHS exposure in public places (OR = 1.67, 95% CI: 1.05-2.89, p < 0.05), and SHS exposure 5-7 days per week (OR = 1.75, 95% CI: 1.13-3.96, p < 0.05).

In contrast, several variables did not demonstrate significant independent associations with knowledge in the adjusted model: pregnancy phase (2nd trimester: OR = 0.55, 95% CI: 0.23-1.48; 3rd trimester: OR = 0.94, 95% CI: 0.44-1.65), number of people in household (5-6: OR = 0.81, 95% CI: 0.20-1.49; ≥7: OR = 0.84, 95% CI: 0.42-1.76), SHS exposure at workplace (OR = 0.86, 95% CI: 0.22-1.92), SHS exposure at home (OR = 0.98, 95% CI: 0.67-1.65), and SHS exposure at 1-4 days per week. These non-significant findings suggest that, after controlling for other socioeconomic factors, pregnancy trimester and household size do not independently predict knowledge levels.

For attitude, the binary logistic regression model demonstrated significant associations with older age (28-37 years: OR = 2.62, p < 0.001; ≥38 years: OR = 3.40, p < 0.01), urban residence (OR = 3.52, p < 0.01), all levels of pregnant and husband's educational level (ORs ranging from 3.56 to 5.23, all p <0.05), pregnant occupational status (Employee: OR = 1.87, p < 0.001; Student: OR = 1.96, p <0.05), economic status (Moderate: OR = 2.63, p < 0.01; High: OR = 2.14, p < 0.001), husband's ex-smoker/smoker status (Ex-smoker: OR = 5.70, p < 0.05; Smoker: OR = 3.19, p < 0.001), SHS exposure in public places (OR = 1.86, p < 0.05), and SHS exposure 5-7 days per week (OR = 2.73, p < 0.05).

Importantly, several variables that were did not retain significance in the multivariate model for attitude. Specifically, the following variables showed non-significant adjusted associations with attitude: husband's occupational status (Employee: OR = 0.53, 95% CI: 0.16-2.83; Student: OR = 0.75, 95% CI: 0.23-1.74), pregnancy phase (2nd trimester: OR = 0.83, 95% CI: 0.40-1.66; 3rd trimester: OR = 0.97, 95% CI: 0.35-1.54), number of people in household (5-6: OR = 0.48, 95% CI: 0.22-1.42; ≥7: OR = 0.49, 95% CI: 0.18-1.31), pregnant smoking status (Ex-smoker: OR = 0.96, 95% CI: 0.43-6.84; Smoker: OR = 0.64, 95% CI: 0.21-4.63), SHS exposure at the workplace (OR = 0.97, 95% CI: 0.52-1.81), SHS exposure at home (OR = 0.51, 95% CI: 0.22-1.20), and SHS exposure at 1-2 and 3-4 days per week. These findings suggest that pregnancy phase, household size, pregnant smoking behaviour, and indoor SHS exposure do not independently predict attitudes toward SHS after adjustment for other socioeconomic and demographic factors. The significance markers were as follows: 'a' represents p<0.05, 'b' refers to p<0.01, and 'c' signifies the most stringent threshold at p<0.001. These markers assist readers in determining the strength of evidence supporting the prediction of each relationship.

## Discussion

This study provides crucial insights into SHS knowledge and attitudes among pregnant women in Iraq, offering valuable lessons for family medicine practice in similar low- and middle-income countries (LMICs) contexts. Pregnant women exposed to SHS have comparable hazards to those associated with active smoking. These women also have a higher likelihood of stillbirths and newborns with smaller head circumferences, lower birth weights, and shorter birth lengths.[14] The study found that most pregnant women correctly identified the health risks of SHS during pregnancy. Similarly, a finding reported by Chowdhury et al.[19] indicated that most knowledge responses from women in Bangladesh were correct, suggesting that pregnant women possess accurate knowledge. In contrast to findings in another study,[13] among pregnant women in Davangere City, India, which showed contrasting results, where responses regarding knowledge related to SHS were mostly "don't know", which suggests that pregnant women had limited knowledge about SHS and its dangers. The results of this study suggest that pregnant women in various countries have varying degrees of knowledge of SHS during pregnancy. Some regions have a higher level of awareness than others, which highlights the diverse viewpoints and levels of understanding among pregnant women all across the worldwide.

In our analysis of pregnant women's overall level of knowledge about SHS during pregnancy, the study revealed that more than half 53.6% had an intermediate level of knowledge about SHS. Likewise, studies conducted by Sharma et al. in India and Vu et al. in Vietnam, [3,12] found inadequate knowledge among pregnant women about the adverse impacts of SHS exposure. In contrast, Maung et al. in Myanmar conducted a study that was not analogous to our findings, revealing that 74% of the pregnant women had a high level of knowledge.[10] The variation in knowledge among pregnant women, as evidenced by these studies, demonstrates the variation in awareness across different global regions. The different results indicate that the norms of culture, educational

programs, and health campaigns have significant impacts on pregnant women's perceptions about SHS during pregnancy.

The current study demonstrated that about the items associated with pregnant women's attitudes about SHS during pregnancy, the vast majority of pregnant women responded with "agree." This finding indicates that pregnant women have a positive attitude related to SHS. These findings align with similar studies conducted in Myanmar[10] and Bangladesh[19] where pregnant women also predominantly agreed in their responses regarding their attitudes towards SHS and demonstrated they had positive attitudes. The shared positivity in these studies suggests a widespread inclination towards favorable attitudes in this regard, where pregnant women hold positive views about SHS, reflecting their awareness and understanding of the hazards concerning SHS exposure during pregnancy.

The predominant positive attitudes 58.2% toward SHS avoidance represent a significant opportunity for intervention, as attitudes often predict behavior change more effectively than knowledge alone. This indicates that most pregnant women maintained positive attitudes towards SHS exposure during pregnancy. These findings were consistent with research by Yavagal et al.[13] and Maung et al.[10] which reported analogous trends among pregnant women and indicated that the majority of pregnant women showed a positive attitude (>50%) towards SHS. The consistent research findings on pregnant women's favorable attitudes toward SHS can be attributed to factors such as shared beliefs, prevailing social norms shaping perceptions about SHS, the inherent health hazards related to SHS exposure during pregnancy, and the potential effectiveness of public health campaigns in increasing awareness about the hazards of SHS.

The identified strong socio-demographic associations with knowledge of SHS during pregnancy provide specific guidance for risk stratification in clinical practice. Likewise, the findings reported by Bannour et al. [11] support these results. A total of 125 pregnant women were surveyed. The survey revealed an 81.6% prevalence of SHS exposure among pregnant women. A substantial correlation existed between women's education levels (p = 0.001), their spouses' educational levels (p = 0.002), residential location (p = 0.001), and mothers' employment status (p = 0.034) and the incidence of exposure to second-hand smoke among participants. The father's educational attainment, at either the high school or university level, is a notable predictor of both SHS (p=0.006; odds ratio 5.1; confidence interval [1.53-17.53]) and avoidance practices (p=0.04; odds ratio 8.62; confidence interval [2.03-36.6]). This may rise from the confluence of various factors. Various educational backgrounds, cultural factors, and socioeconomic status impact understanding of SHS risks. Variations in healthcare access, regional differences, age, and social support networks influence pregnant women's comprehension of SHS risks, emphasizing the complex interaction of factors affecting knowledge levels.

The study found a strong positive correlation between pregnant women's SHS attitudes and most socio-demographic variables. In a study,[20] researchers indicated that 211 women 21.3% were determined to have been exposed to SHS, with a 95% confidence interval of 18.7% to 23.8%. Employers had the lowest SHS exposure 13.7%, followed by family homes 20.5% and public places 56.4%. The study found that women with physical comorbidities reported SHS exposure more often. Conversely, older women, urban women, college-educated women, and second-trimester pregnant women were less likely to report SHS exposure. Network analysis revealed six statistically significant SHS exposure-quality of life indicator relationships. The strongest negative connection was between SHS exposure and environmental health quality of life. SHS had the strongest positive connection with pain and discomfort quality of life, with a positive edge weight of 0.037. Socio-demographic factors can shape an individual's attitudes, opinions, and capacity to access resources. These personal attributes can significantly impact how individuals understand and process information, especially concerning their perspectives on health and the risks associated with second-hand smoke (SHS). Within specific demographic groups, attitudes and behaviors can be influenced by social norms and behavioral standards. Disparities may also influence perceptions of access to healthcare services and relationships affected by socio-demographic factors. The intricate and multifaceted relationship between attitudes and socio-demographic characteristics illustrates individuals' diverse backgrounds and life experiences within various demographic groups.

This study reveals that socio-demographic factors significantly affect pregnant women's knowledge and attitudes, substantially influencing health awareness. These results have important implications. They demonstrate the need for targeted health education programs for pregnant women. They also suggest that attitude change works differently from knowledge acquisition. These results help improve understanding of health determinants by separating factors that affect knowledge from those that affect attitudes. The findings provide evidence-based information to develop better maternal health interventions.

## Strength and Limitations

The study's strengths encompass a heterogeneous sample from three primary healthcare centers, thus augmenting generalizability, and the employment of a validated structured questionnaire, which facilitates systematic data gathering. Moreover, sufficient sample size and extensive sociodemographic data enable rigorous statistical analysis. However, its cross-sectional nature limits the ability to make causal inferences, and the fact that it relies on self-

reported data could introduce bias. The study's focus on Al-Suwaira and the convenience sampling method may affect the sample's representativeness.

# Conclusion

The findings of the study revealed that the participants had limited knowledge; however, their attitudes were positive among pregnant women regarding the risks associated with SHS during pregnancy and its potential health consequences. Furthermore, significant associations were identified between socio-demographic determinants and the levels of knowledge and attitude among pregnant women. The study recommends implementing focused health education programs for pregnant women and enhancing public awareness campaigns regarding the impacts of SHS. Politicians should enforce the smoke-free laws to protect pregnant women and the general community from SHS.

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**Availability of Data:** The data supporting the findings of this study are available from the corresponding author upon reasonable request.

**Declaration of Non-use of Generative AI Tools:** This article was prepared without the use of generative AI tools for content creation, analysis, or data generation. All findings and interpretations are based solely on the authors' independent work and expertise.

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