

# Smoking during Pregnancy and Maternal and Neonatal Complications in Mashhad, Suburbs, and Subsidiary Villages: A Population-based Cross-Sectional Study

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## ABSTRACT

**Background:** Smoking is very important during pregnancy because of severe fetal and maternal complications. No community-based studies have been conducted on pregnant women in Iran. This study aimed to investigate the prevalence of smoking during pregnancy, as well as maternal and neonatal complications in Mashhad, Iran, during 2017.

**Methods:** This cross-sectional study reviewed the information of 1140 and 92,225 smoking and non-smoking pregnant women during pregnancy, respectively, and 3-5 days after delivery using Sina Electronic Health Record System in Mashhad, Iran, during 2017. All data were extracted, encoded, and entered into SPSS software (version 16).

**Results:** Out of the total of 93,365 pregnant women with a mean age of 22.36 years, the prevalence of smoking during pregnancy was significantly higher among those who live in the city (i.e., Mashhad), compared to individuals living in the suburbs or villages. The mean rates of stillbirth, prematurity, very-low-birth-weight, and low-birth-weight were higher in smoking pregnant mothers, compared to non-smoking ones ( $P < 0.0001$ ). The prevalence of smoking among literate and employed pregnant mothers was significantly higher than illiterate and unemployed pregnant women ( $P < 0.0001$ ). The mean birth weight of newborns of smoking mothers (1528gr) was less than the half mean of the birth weight (3180gr) of newborns of non-smoking mothers ( $P < 0.0001$ ).

**Conclusion:** The prevalence of smoking in mothers living in Mashhad, Iran, was 1.2%, which is less than the global average. The results of this study showed that smoking during pregnancy has many maternal and fetal complications.

**Keywords:** Cigarette, Fetal complications, Maternal complications, Pregnancy

## Introduction

Smoking, especially cigarettes, is a problem along with the concurrent spread of global economic development, which is converted to an epidemic across the world. The tobacco industry has targeted low- and middle-income countries and vulnerable groups, such as young people and women (1). In a study conducted by Ekblad et al. in the Nordic countries, the prevalence of maternal cigarette smoking in Denmark (2010), Norway (2009), and Sweden (2008) were obtained at 12.5%, 16.5%, and 9.6%, respectively (2). In a cross-sectional descriptive-analytical study conducted by Ramezanzadeh et al. in postpartum wards of hospitals affiliated to Tehran, Iran, and Shahid Beheshti Universities of

Medical Sciences, Tehran, Iran, 1.8% of the pregnant women were considered smokers (3). Smoking affects nearly all organs of the body. The health of mothers and infants reflects the health of the community. The World Health Organization uses mortality and morbidity statistics of mothers and infants as indicators of community health status. This statistics summarizes the social, political, healthcare, and medical implications of a geographic region. Smoking is very important during pregnancy. There is a dose-response relationship between smoking during pregnancy and generated injuries. Tobacco is a known carcinogen that can damage fetal development. The most important maternal complications

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Please cite this paper as:

Talebi M, Vakili V, Abbasi Shaye Z, Velayati M. Smoking during Pregnancy and Maternal and Neonatal Complications in Mashhad, Suburbs, and Subsidiary Villages: A Population-based Cross-Sectional Study. Iranian Journal of Neonatology. 2020 Dec; 11(4). DOI: [10.22038/ijn.2020.44916.1748](https://doi.org/10.22038/ijn.2020.44916.1748)

include placental abruption, eclampsia, ectopic pregnancy, spontaneous abortion, and premature rupture of membranes (4). Moreover, the most important fetal complications are intrauterine growth retardation, low-birth weight, sudden infant death syndrome, cleft lip, and cleft palate. This study aimed to determine the prevalence of maternal smoking during pregnancy and compared smoking pregnant mothers with non-smoking mothers living in Mashhad, Iran, in terms of maternal and fetal complications.

## Methods

This cross-sectional study reviewed all 93,365 pregnant women in Mashhad during 2017. The pregnant women were divided into two groups of smoking (exposure group, n=1140) and non-smoking (control group, n=92,225). The smoking history assessment was self-reported. Sampling was performed using the census method. The information was extracted from the Sina Electronic Health Record System and statistically analyzed. This information had been entered into the Sina Electronic Health Record System by healthcare professionals, midwives, and health care providers during pregnancy care and the first 3-5 days after delivery by self-report, examination, and feedback from specialists. The data and variables, such as age, education level, nationality, place of residence, underlying diseases, smoking, occupational status, delivery method, preeclampsia of the mother and stillbirth, cleft palate, prematurity, gender, and birth weight of the newborn were extracted without any changes and mentioning the names of the people present in the study. It should be mentioned that these data were encoded in cooperation with the Healthcare Observatory Staff of the Health Deputy of Mashhad University of Medical Sciences, Mashhad, Iran.

Since the type of this study is observational, no intervention was made on the subjects participating in the study. Subsequently, the data were analyzed in SPSS software (version 16) using descriptive statistics. The case (smoking mothers) and control (non-smoking mothers) groups were compared in terms of variables using Chi-square and Fisher's exact tests. Moreover, an independent t-test was used to compare the means. In total, 2766 cases with invalid information related to the birth weight of newborns were excluded from the study.

## Results

Table 1 summarizes the frequency and

percentage of variables, such as the number of neonates; neonates' gender; mothers' place of residence; smoking status of mothers; nationality and education level; method of delivery; mothers' underlying diseases, such as hypertension, hyperlipidemia, depression, and anemia; pregnant mothers' complications, including preeclampsia and stillbirth; supplementation consumption by pregnant mothers; newborns with cleft palate; and neonatal birth weight.

In total, 99.9% (n=1139) and 99.5% (n=91782) of the smoking and non-smoking pregnant mothers were Iranian, respectively; therefore, there was no significant statistical difference between them in this regard (P=0.055). Moreover, 62.8% (n=716) and 1.8% (n=1628) of the smoking and non-smoking pregnant mothers were literate, respectively, which shows a statistically significant difference between them (P<0.0001). Regarding the occupational status, 89.5% (n=1020) of the smoking pregnant mothers were employed, whereas only 6.5% (n=5989) of the non-smoking pregnant mothers were employed. This indicates a statistically significant difference between these groups in this regard (P<0.0001). Furthermore, 4.3% (n=49) and 3.9% (n=3604) of the smoking and non-smoking pregnant mothers were anemic, respectively, which shows no significant difference between them (P=0.499). In the case group, 1140 pregnant women were smokers, and there were 92,225 non-smoking mothers in the control group. Considering the place of residency, all smoking and 40.9% of the non-smoking pregnant mothers were living in Mashhad, Iran. On the other hand, none of the smoking and 26% of the non-smoking pregnant mothers were living in the suburbs. Moreover, none of the smoking and 32.5% of the non-smoking pregnant mothers were living in villages, which shows a significant difference between them in this regard (P<0.0001).

The mean±SD ages of smoking and non-smoking mothers were 15.56±8.225 and 29.17±6.43 years, respectively. All of the neonates of the smoking pregnant mothers were male (n=1140), whereas 51.4% of the non-smoking pregnant mothers (n=46372) gave birth to male neonates. Therefore, there was a significant difference between them in this regard (P<0.0001). In this study, there was no significant relationship between smoking pregnant mothers and preeclampsia disorder (P=0.99). In total, 1% (n=11) and 0.3% (n=286) of the smoking and non-smoking pregnant women had a stillbirth, respectively, which shows a significant difference

**Table 1.** Frequency and percentage of variables

Variables		Number	Percent (%)
Infants' gender N±(%)	Male	48512	52
	Female	44853	48
Mother's place of residence N±(%)	City	38895	41.7
	Suburbs	24516	26.3
	Village	29954	32.1
Mother's nationality N±(%)	Iranian	92921	99.5
	Non-Iranian	444	0.5
Mother's literacy N±(%)	Literate	91021	97.5
	Illiterate	2344	2.5
Mother's occupational status N±(%)	Employed	7009	7.5
	Un employed	86356	92.5
Mother's iron deficiency anemia N±(%)	Yes	3653	3.9
	No	89712	96.1
Mother's HTN N±(%)	Yes	183	0.2
	No	93182	99.8
Mother's depression N±(%)	Yes	507	0.5
	No	92858	99.5
Mother's hyperlipidemia N±(%)	Yes	135	0.1
	No	93230	99.9
Mode of delivery N±(%)	Vaginal delivery	52228	59.9
	Caesarian section	41137	44.1
Mother's smoking N±(%)	Yes	1140	1.2
	No	92225	98.8
Mother's drug use N±(%)	Yes	4620	4.9
	No	88745	95.1
Preterm labor N±(%)	Yes	1492	1.6
	No	91873	98.4
Mother's preeclampsia N±(%)	Yes	29	0.03
	No	93336	99.97
Stillbirth N±(%)	Yes	297	0.3
	No	93068	99.7
Infant's cleft palate N±(%)	Yes	13	0.01
	No	93352	99.98
Birth weight N±(%)	< 1500 gr	1181	1.3
	1500-2500gr	6234	6.9
	2500-4500gr	82640	91.2
	> 4500 gr	544	0.6

between them in this regard ( $P=0.001$ ). Regarding the mode of delivery, all ( $n=1140$ ) of the smoking pregnant mothers had a vaginal delivery, whereas 55.4% ( $n=51088$ ) of the non-smoking pregnant women had a vaginal delivery, which shows a significant difference between them in this regard ( $P<0.0001$ ).

Totally, 15.3% ( $n=174$ ) of the smoking pregnant mothers had a preterm birth, whereas

only 1.4% ( $n=1318$ ) of the non-smoking pregnant mothers had a preterm birth, which indicates a significant difference between them ( $P<0.0001$ ). In addition, 57.7% ( $n=631$ ) of the newborns of the smoking pregnant mothers had a birth weight less than 1500 g, whereas 0.6% ( $n=550$ ) of the neonates of the non-smoking pregnant mothers had a birth weight less than 1500 g, which shows a significant difference between them in this

**Table 2.** Comparison of the exposed and control groups in terms of frequency, percentage, and mean of variables

Variable		Mother's smoking				P.value
		Yes		No		
		Number	percent	Number	percent	
Mother's nationality N±(%)	Iranian	1139	99.9	91782	99.5	0.055
	Non Iranian	1	0.1	443	0.5	
Mother's place of residence N±(%)	City	1140	100	37755	40.9	<0.0001
	Suburb	0	0	24516	26	
	Village	0	0	29954	32.5	
Mother's literacy N±(%)	Literate	716	62.8	1628	1.8	<0.0001
	Illiterate	424	37.2	90597	98.2	
Mother's employment N± (Percent)	Employed	1020	89.5	5989	6.5	<0.0001
	Unemployed	120	10.5	86236	93.5	
Baby's gender N±(%)	Male	1140	100	47327	51.4	<0.0001
	Female	0	0	44853	48.6	
Method of delivery N±(%)	Vaginal delivery	1140	100	51088	55.4	<0.0001
	Cesarean section	0	0	41137	44.6	
Mother's iron deficiency anemia N±(%)	Yes	49	4.3	3604	3.9	0.499
	No	1091	95.7	88621	96.1	
Mother's preeclampsia N±(%)	Yes	0	0	29	0.03	1
	No	1140	100	92196	100	
Stillbirth N±(%)	Yes	11	1	286	0.3	0.001
	No	1129	99	91939	99.7	
Preterm labor N±(%)	Yes	174	15.3	1318	1.4	<0.0001
	No	966	84.7	90907	98.6	
Birth weight N±(%)	< 1500 gr	631	57.7	550	0.6	<0.0001
	1500-2500gr	419	38.3	5815	6.5	
	2500-4500gr	40	3.7	82600	92.3	
	> 4500 gr	3	0.3	541	0.6	
Birth mean±SD weight		1093	M1.528gr SD(0.615)	89506	M3.180gr SD(0.505)	<0.0001
Mother's mean±SD age		1140	M15.5 yrs SD(6.825)	92210	M29.17yrs SD(6.430)	<0.0001

regard ( $P<0.0001$ ). In the same line, 38.3% ( $n=419$ ) of the infants of the smoking pregnant mothers had birth weight between 1,500 and 2,500 g, whereas 6.5% ( $n=5815$ ) of the neonates of the non-smoking pregnant mothers had birth weight between 1,500 and 2,500 g. Therefore, there was a significant difference between them in this regard ( $P<0.0001$ ). The mean birth weight of the infants of smoking mothers was  $1528\pm0.615$ g, whereas the mean birth weight of the infants of non-smoking mothers was  $3180\pm0.505$ g ( $P<0.0001$ ) (Table 2).

## Discussion

Smoking during pregnancy causes maternal and neonatal complications. To the best of our knowledge, the current study is the first study in

the country that collected data from Sina Electronic Health Record System, the total population using the self-report method, face-to-face interviews, and physical examination with the cooperation of health workers and skilled health care providers.

In this study, information about pregnant mothers and their newborns in Mashhad, the suburbs, and subsidiary villages during 2017 was extracted from the Sina Electronic Health Record system and analyzed. This study shows that the prevalence of smoking in pregnant mothers during 2017 was 1.2% in Mashhad, Iran. In a study conducted by Ekblad et al. in the Nordic countries, the prevalence rates of smoking in Denmark (2010), Norway (2009), and Sweden (2008) were 12.5%, 16.5%, and 6.9%,

respectively. This indicates that over 10 years, the prevalence of smoking has decreased significantly during pregnancy (2). Despite the higher prevalence of smoking in advanced societies, compared to Iran, the prevalence of smoking has significantly decreased with an increase in the awareness level of these communities regarding smoking side effects (5). However, in our country, with relatively growing advances in addition to lower levels of smoking, it seems the curve is increasing significantly. Moreover, according to a systematic review conducted by ElieAkl et al. (2011), the prevalence rate of hookah smoking among Lebanese pregnant women has been estimated at 5%-6% (6). In 2016, in a study performed by Drake et al. in the United States, 7.2% of the pregnant women were smokers (7). In another cross-sectional study conducted by Kataokain in Brazil during 2012, the prevalence of smoking during pregnancy was obtained at 13.4% (8). Similarly, in a cross-sectional descriptive-analytical study performed by Ramezanzadeh et al. in postpartum wards of hospitals affiliated to Tehran, Iran, and Shahid Beheshti Universities of Medical Sciences, Tehran, Iran, 1.8% of the pregnant women were smokers (3). This finding is in line with the results of our study and suggests that in societies with similar developing levels, the results are roughly the same. In the present study, the rate of stillbirth among smoking mothers is significantly higher than that among non-smoking pregnant mothers. In a cross-sectional study conducted by Varner et al. in New York from 2006 to 2008, a dose-response relationship was found between smoking by mothers and stillbirth (9).

In this study, there was no significant relationship between smoking pregnant mothers and preeclampsia disorder. In a systematic review and meta-analysis conducted by Wei et al. in 2015, there was a reverse relationship between smoking and preeclampsia (10), and it seems that smoking has a protective effect on preeclampsia. It is worth mentioning that further studies are required to be conducted in this regard. In this study, there was a significant relationship between smoking by mothers and preterm labor. In a study carried out by Ion and Bernal in England, the results showed a causal relationship between smoking pregnant women and preterm delivery (11).

Moreover, in a cross-sectional study conducted by Mahin Kamali Fard et al. (2009) in Alzahra Hospital, Tabriz, Iran, the effect of lifestyle was investigated on preterm delivery, which confirmed the role of smoking during pregnancy in preterm delivery (12). In this study, there was

no significant relationship between smoking during pregnancy and cleft palate in the newborns. However, a cross-sectional study conducted by Martelli et al. during 2015 in Brazil showed a positive correlation between smoking by mother and cleft palate in males (13). Due to the presence of non-homogeneous studies, further studies are required to investigate the effects of other effective variables. In this study, a significant difference was observed between maternal literacy and smoking during pregnancy. Therefore, smoking was more in literate pregnant women, compared to illiterate ones, which shows a significant difference between them in this regard. In a study conducted by Drake et al. during 2016 in the United States, the highest prevalence rate of smoking during pregnancy was reported among women who were graduated from high school (7). Moreover, in a cross-sectional study conducted by Janne Smedberg et al. in 15 European countries from 2011 to 2012, it was shown that smoking was ranked first among pregnant women who graduated from high school (5). This suggests that with the development of societies, smoking initially increased among upper class to represent a higher social class; however, over time, with increasing awareness of these people regarding the harmful effects of smoking, the consumption curve will decrease.

On the contrary, in societies with lower social and economic well-being, it will increase (2, 5). In this study, there was a significant relationship between the mother's occupational status and smoking. In a population-based cross-sectional study conducted by Sperlich during 2014 in Germany, mother's employment was one of the known environmental factors associated with smoking by mothers (14). In this study, there was a significant relationship between low birth weight and smoking during pregnancy. Moreover, the mean birth weight of the infants of the smoking mothers was 1528 g, whereas the mean birth weight of the infants of non-smoking mothers was 3180 g.

In a cross-sectional study performed by Caricati et al. during 2012 in Brazil, the birth weight of the full-term infants decreased proportionally to an increase in the number of cigarettes consumed by the smoking mother during pregnancy. The mean birth weight of the infants of mothers who smoked 6-10 cigarettes per day during pregnancy was 320 grams lower than those of non-smoking mothers. Moreover, the mean birth weight of infants of mothers who smoked 11-40 cigarettes per day during

pregnancy was 435 g lower than those of non-smoking mothers (8).

### **Limitations of the Study**

In this study, the data were extracted from Sina Electronic Health Record System. Therefore, the statistics of the smoking pregnant mothers were obtained through self-report, which seems the statistic regarding the number of smoking pregnant mothers is more. Moreover, the Sina Electronic Health Record System is designed to ask the mother only about smoking and other methods of smoking, such as hookah. It is worth mentioning that second-hand smokers, the number of daily cigarette smoking, and the contact of the pregnant mother with smoke at home (the smoker's spouse) were not taking into account in this study. Due to the discrepancy of the referral system and the lack of access to the system by specialists at the time of the study, all maternal and neonatal complications caused by tobacco smoking and hospital data were not recorded in this system. Moreover, clear feedbacks were not sent to the health workers; therefore, they were not used in this study.

### **Strengths of the Study**

One of the strengths of this study was the high sample size that included all annual information of mothers and infants. Moreover, since these two groups of the population were important for the health system, continuous care of these two groups has been highlighted. In addition, the health status of these two groups was recorded in the Electronic Health Record System in detail. Furthermore, studies have been carried out by those who have had many years of experience in the health system at the first level and are aware of the importance of these two groups of populations.

### **Suggestions**

Since this study made use of the data from the Electronic Health Record System, the inclusion of the variables, such as hookahs, daily use of tobacco, and smoking by the spouse in the system, will help further studies in this regard. Moreover, by integrating a referral mechanism into this recognition system, which was not accessible in this study, respected specialists will be able to explore maternal and neonatal complications more comprehensively. Therefore, these revisions can be generalized to other electronic health record systems in Iran, such as the Sib Electronic Health Record System. Accordingly, we can obtain

full data on smoking during pregnancy from the whole country divided by provinces for more comprehensive studies.

### **Conclusion**

The prevalence of smoking among pregnant mothers in Mashhad, Iran, was 1.2%, which is lower than the global average. The results of this study showed that smoking during pregnancy has many maternal and fetal complications. By educating women of reproductive age and increasing their awareness regarding the complications of smoking during pregnancy for mothers and neonates, the prevalence of smoking and its complications can be reduced during pregnancy.

### **Acknowledgments**

The authors would like to thank Mashhad University of Medical Sciences, Mashhad, Iran, for its contribution to conduct and provide funding for this study.

### **Conflicts of interest**

All authors declare that they have no conflict of interest.

### **Authors' Contribution**

Study concept and design: Mahdi Talebi; Acquisition of data: Mahmoud Velayati; Analysis and interpretation of data: Veda Vakili and Zahra Abbasi Shaye; Drafting of the manuscript: Mahmoud Velayati and Zahra Abbasi Shaye; Critical revision of the manuscript for important intellectual content: Mahdi Talebi; Administrative, technical, and material support: Veda Vakili; Study supervision: Mahdi Talebi.

### **Funding**

This study was funded by Mashhad University of Medical Sciences, Mashhad, Iran.

### **References**

1. Pierce JP, Gilpin E, Burns DM, Whalen E, Rosbrook B, Shopland D, et al. Does tobacco advertising target young people to start smoking? evidence from California. *JAMA*. 1991; 266(22):3154-8.
2. Ekblad M, Gissler M, Korkeila J, Lehtonen L. Trends and risk groups for smoking during pregnancy in Finland and other Nordic countries. *Eur J Public Health*. 2013; 24(4):544-51.
3. Ramezanzadeh F, Tavafian S, Vahdaninia M, Shariat M, Montazeri A. Maternal and fetal outcomes of narcotic substance abuse, cigarette smoking, and unsafe drugs. *Hakim Res J*. 2007; 10(3):9-16.
4. Meyer MB, Tonascia JA. Maternal smoking,

- pregnancy complications, and perinatal mortality. *Am J Obstet Gynecol.* 1977; 128(5):494-502.
5. Smedberg J, Lupattelli A, Mårdby AC, 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(1):213.
  6. Akl EA, Gunukula SK, Aleem S, Obeid R, Jaoude PA, Honeine R, et al. The prevalence of waterpipe tobacco smoking among the general and specific populations: a systematic review. *BMC Public Health.* 2011; 11(1):244.
  7. Drake P, Driscoll AK, Mathews T. Cigarette smoking during pregnancy: United States, 2016. *NCHS Data Brief.* 2018; 305:1-8.
  8. Kataoka MC, Carvalheira AP, Ferrari AP, Malta MB, Carvalhaes MA, de Lima Parada CM. Smoking during pregnancy and harm reduction in birth weight: a cross-sectional study. *BMC Pregnancy Childbirth.* 2018; 18(1):67.
  9. Varner MW, Silver RM, Rowland Hogue CJ, Willinger M, Parker CB, Thorsten VR, et al. Association between stillbirth and illicit drug use and smoking during pregnancy. *Obstet Gynecol.* 2014; 123(1): 113-25.
  10. Wei J, Liu CX, Gong TT, Wu QJ, Wu L. Cigarette smoking during pregnancy and preeclampsia risk: a systematic review and meta-analysis of prospective studies. *Oncotarget.* 2015; 6(41):43667-78.
  11. Ion R, Bernal AL. Smoking and preterm birth. *Reprod Sci.* 2015; 22(8):918-26.
  12. Kamali Fard M, Alizadeh R, SehatiShafaei F, Gojzadeh M. The effect of lifestyle on the rate of preterm birth. *J Ardabil Univ Med Sci.* 2010; 10(1):55-63.
  13. Martelli DR, Coletta RD, Oliveira EA, Swerts MS, Rodrigues LA, Oliveira MC, et al. Association between maternal smoking, gender, and cleft lip and palate. *Braz J Otorhinolaryngol.* 2015; 81(5):514-9.
  14. Sperlich S. Health risks in different living circumstances of mothers. Analyses based on a population study. *Bundesgesundheitsblatt, Gesundheitsforschung Gesundheitsschutz.* 2014; 57(12): 1411-23.