Strategy of Science, Technology and Innovation (STI-EGY 2030), more particularly the theme of "Health and Population".

Materials and Methods

This Cross-sectional study was conducted at Damanhur National Medical Institute (DNMI) in Damanhur, El Beheira Governorate, Egypt. DNMI is the only educational hospital in El-Beheira governorate, and it provides medical services for patients from two governorates (El-Beheira and Kafr El-Sheikh). The fieldwork was completed in about 5 months, starting in July 2019 and ending in November 2019. It was followed by data entry and data analysis that took 4 months, ending in March 2020. The researcher got the approval of the Ethics Committee of the High Institute of Public Health for conducting this study and complied with the international research ethics guidelines. A written consent was obtained from the participants after explanation of the purpose of the study.

Based on a previous study, [25] the prevalence of ETS exposure among pregnant women was 31.7%. Using a margin of error 5% and alpha error of 0.05 the minimum required sample size was 340 pregnant women. Five more women were added to compensate for missing data, so the total sample size became 345. A convenient sample of the dyad (mother with her neonate) was taken from the postnatal ward until the sample size was completed.

The target population were mothers admitted to the postnatal ward of the obstetrics department at DNMI, giving birth to a viable single neonate with or without adverse birth outcomes (e.g., preterm birth, low birth weight, or congenital anomaly). Exclusion criteria were; smoking mothers, parents with a history of consanguinity, mothers with chronic medical conditions before and during pregnancy (such as hypertension, diabetes mellitus, heart disease and renal disease) and or family history of genetic diseases.

Data collection was carried out through an interviewing questionnaire, clinical examination of all participants and record review.

I- Interviewing technique

A pre-designed, pre-coded structured interviewing questionnaire in the Arabic language was used to collect data from the study population. The questions were taken or modified from similar previous researches [25-27].

A pilot study was performed over a period of 3 days on 20 mothers with their newborn babies admitted to the postnatal ward of the same hospital in which the questionnaire was pretested for validity and reliability. According to the results of this pilot study, some questions were omitted, rephrased or added to the questionnaire until the final version was developed.

The questionnaire included seven parts:

Part 1: Personal and Socio-demographic data: Name, address, age and level of education of mother and father, years of marriage, consanguinity, income, and crowding index.

Part 2: Data about maternal health, obstetric history and current pregnancy: Questions:

1- Health status of mother.
2- Gravidity, parity, and abortion of mothers.
3- Data on the last pregnancy: any associated complications.
4- Data on the current pregnancy: birth spacing interval, problems in the antenatal period and during delivery.

Part 3: Data on maternal occupation and occupational exposures: It included: duration of work (hours per week) and details on occupational exposure to stress factors, physical, chemical and/or biological hazards.

Part 4: Data on maternal exposure to some indoor and outdoor environmental risk factors:

1- Exposure to some indoor environmental risk factors: exposure to chemicals from strong cleaning agents and spot removers and exposure to insecticides.
2- Exposure to some environmental risk factors related to site of residence: Living near metal smelters or other sources of industrial emissions (large factories or smaller workshops), near agricultural areas where pesticides are regularly applied
3- Consumption of fish.

Part 5: Data about medical history of the father: whether the father was suffering from any chronic diseases or was on medication for a long time.

Part 6: Data about exposure to environmental tobacco smoke: ETS exposure is defined as being in the presence of passive smoke at least 15 minutes per day on more than one day per week [4]. Regular exposure to ETS is defined as being exposed most days and/or nights to ETS [5].

All participants were asked about exposure to environmental tobacco smoke (ETS) at home, in the workplace, in transportation, and in many public places (governmental institutes, hospitals or clinics, pharmacies, banks, cinemas, malls, restaurants, cafés, markets, bus or train stations, others. Specific questions included: number of persons smoking cigarettes (or other tobacco products), number of cigarettes (or other products) smoked per day, frequency and duration of exposure to ETS, presence of tobacco odor, size and ventilation at the designated place, exposure to ETS from nearby cafés, etc.

Part 7: Data about maternal knowledge of the risks of exposure to ETS during pregnancy: Assessment of the mother's knowledge about the risk of ETS exposure to maternal and neonatal health status.

II- Clinical examination of mother and newborn

A pre-designed and pre-coded structured sheet was used to collect the data. It included:

1- Anthropometric measures: Mother`s height and weight were measured. The Body Mass Index (BMI) was calculated as weight in kilograms divided by the square height in meters [28].
2- Examination of newborn: weight (in grams) using a digital scale and rounded to the nearest 10 grams, height (in cm), head circumference (in cm) and examination for any congenital anomalies.

These measures were taken within 24 hours of birth. All measures were taken by the same researcher using only one adult and one infant weighing scales for all the participants.

III- Data collected from records:

1- Obstetric, gynecological and medical history of the mother.
2- Gestational age of the newborn according to date of the last menstrual period or ultrasound.

Statistical analysis.

- All data from the interviewing questionnaires were entered into the computer by the researcher using computer-based software for data-entry and analysis, the SPSS

(Statistical Package for Social Sciences) version 20, and graphs were conducted by excel software. Cross tabulation was used to compare the two groups under the study and"Odds Ratio (OR)" was calculated to measure the risk of the development of adverse birth outcomes with exposure to ETS and other various risk factors. The "95% confidence interval (CI)" was calculated for OR. A model of "stepwise logistic regression analysis" was used to determine significant associations between certain risk factors and adverse birth outcomes and to adjust for some potential confounders. the result was considered statistically significant when the significant probability was less than 5%.

Results

The study sample consisted of 345 mothers giving birth to singleton neonates. The socio-demographic characteristics of the studied sample are shown in tables (1).

Mothers in the current study reported exposure to ETS in different places: at home (for more than 15 minutes per day), in the workplace (for more than 15 minutes per day), in transportation means (for a mean of five minutes per day) and in public places (just for a couple of minutes).

Regularity was reported from mothers exposed to ETS at home and those exposed in the workplace. Regular ETS exposure in this study implies exposure at home and/or in the workplace.

Table (2) shows the relation between adverse birth outcomes and maternal exposure to different sources of Environmental Tobacco Smoke during pregnancy. The table reveals that mothers who reported regular exposure to ETS had two times more risk to experience adverse birth outcomes than mothers who reported no exposure (95% CI= 1.13-3.58).

Home exposure to ETS was significantly associated with adverse birth outcomes (X^2 =5.13, P= 0.02). Mothers who were exposed to ETS at home had 1.92 times risk to have baby with adverse birth outcomes than those who weren`t exposed at home (95% CI= 1.09-3.38).

Table (2) shows that the source of ETS at home was either cigarettes, shisha or both. Mothers exposed to both cigarettes and shisha had the highest risk to have adverse birth outcomes (OR=2.57, 95% CI= 1.08-6.07), followed by those who were exposed to cigarettes alone (OR=1.89, 95% CI= 1.06-3.41) and the lowest risk was for mothers who reported exposure to shisha alone, but this risk was not significant (OR=1.32, 95%)

There was no significant difference between exposure in window ventilated rooms and non-ventilated rooms regarding the risk of adverse outcomes (OR=0.47, 95% CI= 0.13-1.67).

Table (2) reveals that there was a dose-dependent effect; with an increase in the number of people smoking cigarettes at home, the risk for having adverse birth outcomes increased with statistically significant trend values X^2= 8.18, P=0.004. With the highest risk for mothers who reported exposure to cigarette smoke from 3 or more smokers at home (OR=5.92, 95% CI= 1.52-23.1). A dose dependent effect was also observed between the number of cigarettes smoked per day and the risk of adverse birth outcomes (X^2 for trend for OR =9.54, P=0.002) and the highest risk was for mothers who were exposed to ETS from 15 or more cigarettes per day (OR=2.77, 95% CI= 1.36-5.65).

Table (2) also shows that Mothers who were exposed to ETS from shisha at home had 1.26 times more risk to have adverse birth outcomes than those not exposed (95% CI= 0.68-2.31). There was no significant association between the reported number of shisha stones burnt per day at home and the risk of developing adverse birth outcomes in the newborn (X^2 for trend =1.83, P=0.18).

Exposure to ETS in the workplace was not significantly associated with the development of adverse birth outcomes (OR=1.2, 95% CI=0.15-9.77) and this can be explained by the small number of working mothers in the sample (only 19 mothers were employed during this pregnancy) and only five of those nineteen mothers reported exposure to ETS at work.

Regarding the frequency of exposure to ETS in transportation means (in hours), mothers who reported exposure for more than 20 hours in the whole current pregnancy had 5.35 times more risk of having adverse birth outcomes than mothers who reported exposure for less than 20 hours in the current pregnancy (95% CI= 1.19-24.03).

In spite of this significant association, the relation between exposure to ETS in transportation means in terms of (yes/no) and the risk of development of adverse birth outcomes was not significant (X^2=0.55, P=0.46) and this can be explained by the observation that the previous significant frequency (>20 hours/ pregnancy) was reported in only 8 women (about 7 % of the total exposed in transportation means) and the main bulk of exposed women were in the category of (<20 hours/ pregnancy) which is the least significant frequency.

Exposure to ETS in public places was significantly associated with adverse birth outcomes (X^2=4.93, P=0.02). Mothers who reported exposure to ETS in public places had 2.15 times more risk of having adverse birth outcomes than mothers who reported no exposure (95% CI= 1.08-4.27).

There was a dose dependent effect between the number of sources from which mothers were exposed to ETS (home, workplace, transportation means, or public places) and the risk for adverse birth outcomes (X^2 for trend for OR =3.99, P=0.04).

As regards the individual adverse birth outcomes, table (3) reveals that mothers who were regularly exposed to ETS during pregnancy had 1.36 times more risk of having preterm babies than mothers who were not exposed to ETS (95% CI= 0.59-3.09). The risk was highest in the (34-<36 weeks) group (OR=1.88, 95%CI:0.4-1.78).

Regarding weight for age, table (3) reveals that mothers regularly exposed to ETS during pregnancy had 1.97 times more risk of having SGA babies than non-exposed mothers (95% CI= 0.73-5.3). The risk was higher for full term SGA babies than preterm SGA babies (OR=2.18, 95% CI= 0.73-6.49) and (OR=1.13, 95% CI= 0.12-11.1) respectively.

Table (3) shows that low birth weight was significantly associated with exposure to ETS during pregnancy (t =3.23, P=0.001). Mothers regularly exposed to ETS during pregnancy were about 3 times more likely to have LBW babies than those not exposed to ETS (OR=2.74, 95% CI= 1.38-5.46).

Table (3) reveals that there was no significant difference between newborns of ETS exposed and non-exposed mothers regarding birth length and head circumference. It reveals that there was no significant association between exposure to ETS during pregnancy and the risk of congenital anomalies or neonatal NICU admission (X^2=0.069, p=1) and (X^2=0.116, p=0.75) respectively. The small number of congenital anomaly cases or NICU admitted cases in this study can explain this low risk.

Pearson correlation coefficient was computed to demonstrate the relation between the number of cigarettes smoked by household members per day and gestational age, and yielded a result of (r = - 0.190, P = 0.01), showing a negative, weak, and significant correlation; with the increase in the number of cigarettes smoked by household members per day the gestational age decreases, as demonstrated in Figure (1).

Table (4) shows the final multiple logistic regression model in which four factors had significant risk of having a newborn with adverse birth outcomes (regular ETS exposure, income, pregnancy related medical problems and standing for a long time). The dependent factor is adverse birth outcomes. The independent factors are regular ETS exposure, income, pregnancy related medical problems and standing for long time during current pregnancy.

Mothers who reported standing for long time during pregnancy had the highest risk with an Adjusted Odds Ratio (AOR) of 7.56 (95% CI=1.29-43.99), followed by mothers with pregnancy related medical problems like threatened abortion, accidental hemorrhage or poor weight gain with AOR of 3.36 (95% CI=1.76-6.43) and then regular ETS exposure during pregnancy with AOR of 2.43 (95% CI=1.31-4.51) and the least risk was for mothers who reported having just enough income (AOR=2.07, 95% CI= 1.26-3.39).

Discussion

The theory of fetal origins of adult diseases states that some intrauterine exposures can affect the programming of fetal cells and this is presented with health consequences either at birth or later in life. Environmental tobacco smoke has been proved to be one of those exposures that can influence fetal development and also post-natal life. In Egypt, half of women and half of children are exposed regularly to environmental tobacco smoke from a household member within the dwelling and 53% of women in Egypt are exposed to ETS at work. The present study aimed at studying the association between exposure to ETS during pregnancy and adverse birth outcomes in Damanhur, El Behera governorate. In order to fulfill this aim, this cross-sectional study was conducted in an educational hospital in Damanhur, El Behera Governorate.

Regarding maternal exposure to environmental tobacco smoke during pregnancy, the majority of the study sample (81%) reported exposure to ETS either at home, in the workplace, in transportation means or in public places. Regular exposure was reported in home and workplace exposed mothers, constituting about 73% of the total sample. Mothers who reported regular exposure to ETS had two times more risk of experiencing adverse birth outcomes than mothers who reported no exposure (95% CI= 1.13-3.58) (table 2).

These results are consistent with a retrospective cohort study in 2011 in which ETS exposed women during pregnancy had a higher risk of adverse birth outcomes than non-exposed women [29]. A more confirming result was shown in an American study in which ETS exposed mothers during pregnancy had the same risk of having adverse birth outcomes as active smoking mothers; both were nearly 2.5 times more likely to have preterm birth babies compared to non-smoking women. Birth weight and birth length were reduced in ETS exposed women by 306 grams and 1.4 cm respectively compared to non-exposed women [30].

In a study in Jordan, mothers who reported a higher average number of ETS exposure hours per week from occupational exposure, home, or outside were at significantly greater risk for having a LBW neonate than women who reported a lower average number of ETS exposure hours [31].

According to our current study, home exposure to ETS was significantly associated with adverse birth outcomes (X^2 =5.13, P= 0.02). The source of ETS at home was either cigarettes, shisha or both. Regarding the frequency of exposure to ETS in transportation means (in hours), mothers who reported exposure for more than 20 hours in the whole current pregnancy had 5.35 times more risk for having adverse birth outcomes than mothers who reported exposure for less than 20 hours in the current pregnancy (95% CI= 1.19-24.03) (table 2).

Many studies concentrated on the effect of household exposure to ETS on the risk of adverse birth outcomes; a study in Africa revealed that exposure to ETS at home during pregnancy was associated with increased LBW risk mainly in male newborns. There was a positive trend regarding the level of exposure as mothers exposed to ETS daily had more risk of having LBW infants than those exposed weekly [32]. In a recent study in India, household ETS exposure during pregnancy was associated with higher risk of LBW in newborns compared to no ETS exposure (OR=3.78, 95% CI: 2.39-5.98) [33]. In a retrospective cohort study, self-reported exposure to ETS at home was associated with earlier delivery (-0.19 weeks; 95% CI: -0.32 to -0.05) and reduced birth weight (-56 g, 95% CI: -97 to -16 g) [34].

A study in Indonesia reported that the association between gestational ETS exposure from a spouse and adverse birth outcomes was only significant in the group of fathers who smoked more than 20 cigarettes per day. They had a higher risk of LBW infants (OR = 2.09, 95% CI: 1.38-3.17) with a 151 g decrease in birth weight and a higher risk of preterm birth (OR = 2.11, 95% CI: 1.38-3.23) than non-smoking parents [35].

On the other hand, two studies reported no significant association between maternal ETS exposure at home or at work and any adverse birth outcomes [36,37], Returning to the methodology of these two studies, they differed from the current study in the timing of data collection. In the first one, the questionnaire collecting the data about ETS exposure during pregnancy was administered any time between the 5^{th} to the 39^{th} weeks of gestation and in the second study they collected the maternal data in the 1^{st} antenatal visit (usually within the 1^{st} trimester) which does not indicate subsequent exposures during the rest of the pregnancy.

In the current study, concerning the individual adverse birth outcomes, birth weight was the only birth outcome significantly associated with gestational exposure to ETS (t =3.23, P=0.001) and low birth weight was the adverse birth outcome most affected by ETS exposure (OR=2.74, 95% CI= 1.38-5.46). Gestational exposure to ETS was also associated with a high risk of preterm birth (OR=1.36, 95%CI: 0.59-3.09) and small for gestational age (OR=1.97, 95%CI: 0.73-5.3) but these risks were not significant. The study revealed that there was no significant difference between newborns of ETS exposed and non-exposed mothers regarding birth length and head circumference. Also, there was no significant association between exposure to ETS during pregnancy and the risk of congenital anomalies or neonatal NICU admission (X^2 =0.069, P=1) and (X^2 =0.116, P=0.75) respectively (table 3).

Being consistent with the current results, Qiu et al. 2014 [38], reported that ETS exposure during pregnancy was slightly and insignificantly associated with an increased risk of overall preterm birth (OR = 1.12, 95% CI: 0.95-1.32). Maternal exposure to ETS during pregnancy was associated with higher risk of preterm birth in some previous studies [39,40]. However, other studies found no effect of gestational ETS exposure on the gestational age or the risk of preterm birth [41, 42].

The risk of SGA was significantly higher in the ETS exposed cohorts in many previous studies [40, 41, 43]. However, according to Hoyt et al. 2018 [44], the risk of SGA babies was not statistically significant among ETS exposed women (OR=0.63 (CI: 0.27–1.46).

Our results were also consistent with many previous studies in which birth weight was the most affected birth outcome by ETS exposure during pregnancy and low birth weight was the most frequent adverse birth outcome in the ETS exposed group [45-47].

In a Korean study, there was a dose response relationship between environmental tobacco smoke exposure during pregnancy and the risk of decreased neonatal birth weight [48]. Self-reported exposure to ETS in pregnancy was associated with a 35 g decrease in birth weight in newborns [25].

Contrary to our results, a cross-sectional study on 263 pregnant women based on serum cotinine levels, 50 of them were exposed to ETS during pregnancy also revealed that there was no significant association between ETS exposure and birth weight [49].The serum cotinine concentration in those fifty women ranged from 0.2 to 14.9 ng/mL and only four of them had concentration above 1.0 ng/mL. There is no approved precise cotinine cutoff value in the literature to distinguish non-smokers, ETS exposed, and active smokers. However, some studies suggest that < 3.0 ng/mL indicates low exposure to ETS and >12 ng/mL indicates high exposure to ETS [50]. From these data we can conclude that the majority of those 50 ETS exposed women in the study were exposed to very limited levels of ETS, which can explain the limited effect on birth weight.

Gestational exposure to ETS was significantly associated with smaller head circumference and shorter neonatal length in some previous studies [29,41,51]. In a study on 147 neonates, the newborns of ETS exposed mothers had lower anthropometric indices, but the differences were not statistically significant [52]. An odd result was documented in a meta-analysis in which neonates of ETS exposed pregnant women were longer at birth by 1.75 cm (95% CI:1.37–2.12 cm) in 9 studies. However, the authors explained this unusual increased length to be incidental [42].

Study limitations:

Being a cross sectional study can highlight an association between the study variables without confirming the causation. Moreover, it is associated with recall bias.

The sampling technique in the current study (convenient sample) is considered as a limitation. However, this sampling technique was used because of the difficulty of randomization as there was no clear frame of cases before starting the data collection. Besides, the discharging time was not fixed in the hospital so the number of cases in the ward was variable at each visit.

Study Strengths:

To the best of our knowledge, this is the first study to address the problem of ETS exposure in pregnancy and its effects on the birth outcomes in El-Beheira governorate, Egypt.

Conclusion

Regarding maternal exposure to environmental tobacco smoke during pregnancy, the majority of the study sample (81%) reported exposure to ETS either at home, in the workplace, in transportation means, or in public places. Mothers regularly exposed to ETS had two times more risk for adverse birth outcomes compared to non-exposed. Birth weight was the only birth outcome significantly associated with gestational exposure to ETS and low birth weight was the adverse birth outcome most affected by ETS exposure. It was also associated with a high risk of preterm birth and small for gestational age, but these risks were not significant.

Recommendations:

Egypt has one of the highest rates of tobacco consumption levels in the Eastern Mediterranean region. With the weak enforcement of the tobacco control laws, more women and children are involuntarily exposed to environmental tobacco smoke. Gestational exposure in particular carries triple risk; for the mother herself, for the fetus affecting the intrauterine development, and for the infant during his postnatal period and later in life. This emphasizes the need for interventions to decrease the exposure of pregnant women to ETS for the sake of protecting and promoting the health of this vulnerable group, and providing a healthy environment for our children to grow in.

Compliance with Ethical Standards

Author Contributions: Conceptualization, A.S.M., M.F.H. and M.H.A.; Methodology and Data collection, A.S.M., A.M.S. and S.S; Statistical Analysis, A.S.M.; Writing–Original Draft Preparation, S.S. and A.S.M; Reviewing & Editing, M.F.H., M.H.A. and A.M.S. All authors have read and agreed to the published version of the manuscript.

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Ethical Approval: The study was approved by the ethical committee of faculty of medicine Alexandria University, Egypt.

Informed consent: was take/n from each candidate in the study

Data sharing: Data available on request due to privacy/ethical restrictions

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Table (1): Distribution of the study sample according to some socio-demographic characteristics.

Variables		n (%)
Mothers' age distribution	Mean ± SD (Median)	26.8±5.7 (26)
(on years)	Range	From 15 to 45
	< 20	27 (7.8)
	20 -	210 (60.9)
	30 -	101 (29.3)
	40 +	7 (2.0)
Fathers` age distribution	Mean ± SD (Median)	33± 6.7 (32)
(in years)	Range	From 19 to 60
	< 30	101 (29.3)
	30 -	188 (54.5)
	40 +	56 (16.2)
Years of marriage	Mean ± SD (Median)	6.6± 4.7 (5)
	Range	From 1 to 21
	< 5	141 (40.9)
	5 -	112 (32.5)
	10 -	87 (25.2)
	20 +	5 (1.4)
	Illiterate	25 (7.2)
Mothers' education		
	Read & Write	13 (3.8)
	Primary	42 (12.2)
	Preparatory	55 (15.9)
	Secondary	181 (52.5)
	University	29 (8.4)
Fathers' education	Illiterate	25 (7.2)
	Read & Write	41 (11.9)
	Primary	33 (9.6)
	Preparatory	36 (10.4)
	Secondary	178 (51.6)
	University	32 (9.3)
Income	Not enough + Loan	62 (18)
	Just enough	145 (44.6)
	Enough + Saving	129 (37.4)
Household members	Mean±SD (Median)	3.6± 1.4 (3)
	Range	From 2 to 14
	< 5	273 (79.1)
	5	54 (15.7)
	6+	18 (5.2)
Crowding Index	< 1	98 (28.4)
	1-	228 (66.1)
	2+	19 (5.5)
Residence	Rural area	293 (84.9)
	Urban area	52 (15.1)
Mothers' occupation	Housewife	326 (94.4)
	Working mothers	19 (5.6)
Working mothers (n=19)	Professional work	7 (36.84)
	Elementary occupations	4 (21.04)
	In agriculture	1 (5.3)
	Service & Sales workers	4 (21.04)

	In medical field	3 (15.78)
Hours of Work per Week (n=19)	Mean±SD (Median)	33.5± 18.1 (30)
	Range	From 4 to 84
	< 30	7 (36.8)
	30 -	7 (36.8)
	40 -	3 (15.8)
	50 +	2 (10.5)

Table (2): The relation between adverse birth outcomes and maternal exposure to environmental tobacco smoke during pregnancy

Maternal ETS exposure	Normal N=244 No.	%	Adverse outcomes N=101 No.	%	Test of significance	OR	95% CI
Sources of ETS exposure							
No exposure	52	21.3	14	13.9	X^2 for trend for OR =3.99*	1	
One source	124	50.8	53	52.5		0.63	0.32-1.23
Two sources	58	23.8	25	24.8		0.62	0.29-1.32
Three sources	10	4.1	9	8.9	P=0.04	0.29	0.1-0.87
Regular ETS exposure							
No	74	30.3	18	17.8	X^2=5.71*	2.0*	1.13-3.58
Yes	170	69.7	83	82.2	P=0.01		
ETS exposure at home							
No	75	30.7	19	18.8	X^2=5.13*		
Yes	169	69.3	82	81.2	P=0.02	1.92*	1.09-3.38
Exposure in							
ventilated rooms	164	97	77	93.9	X^2=1.42	0.47	0.13-1.67
Enclosed rooms	5	3	5	6.1	P=0.3		
Type of smoke at home							
No (ref.)	75	30.7	19	18.8	X^2=6.53	1	
Cigarette	131	53.7	63	62.4	P=0.08	1.89*	1.06-3.41
Shisha	18	7.4	6	5.9		1.32	0.46-3.77
Both	20	8.2	13	12.9		2.57*	1.08-6.07

Home cigarettes exposure							
No	93	38.1	25	0.8			
Yes	151	61.9	76	75.2	X^2=5.67* P=0.01	1.87*	1.11-3.15
Number of people smoke cigarettes at home	**226**		**95**		X^2 for trend for OR =8.18* P=0.004		
No (ref.)	75	33.2	19	20		1	
1	126	55.7	58	61.1		1.82*	1.01-3.28
2	21	9.3	12	12.6		2.26	0.95-5.38
3+	4	1.8	6	6.3		5.92*	1.52-23.1
Frequency of exposure in transportation means (in hours)					X^2=5.68* P=0.03	5.35*	1.19-24.03
<20	77	96.2	24	82.8			
20+	3	3.8	5	17.2			
Exposure in public places					X^2=4.93* P=0.02	2.15*	1.08-4.27
No	223	91.4	84	83.2			
Yes	21	8.6	17	16.8			
Frequency of exposure in public places (in hours)					X^2=0.17 P=1	0.59	0.05-7.17
<5	19	90.5	16	94.1			
5+	2	9.5	1	5.9			

Table (3): The relation between individualized adverse birth outcomes and regular ETS exposure.

Adverse birth outcomes	No exposure N=92		Exposed N=253		Test of significance	OR	95% CI
	No.	%	No.	%			
Gestational age							
Full term	84	91.3	224	88.5	X^2=0.539		
Preterm	8	8.7	29	11.5	P=0.46	1.36	0.59-3.09
Preterm categories							
36 - <37 weeks	3	3.3	14	5.5		1.75	0.49-6.24
34 - <36weeks	2	2.3	10	4.0	X^2=1.86	1.88	0.40-8.74
<34 weeks	3	3.3	5	2.0	MCP=0.6	0.63	0.15-2.67
Full term (ref.)	84	91.3	224	88.5			
Weight for age							
Appropriate (ref.)	83	90.3	219	86.6			
SGA	5	5.4	26	10.3	X^2=2.14	1.97	0.73-5.3
LGA	4	4.3	8	3.2	P=0.34	0.76	0.22-2.58
SGA according to term	**88**		**245**				
preterm SGA	1	1.1	3	1.2	X^2=2.05	1.13	0.12-11.1
full term SGA	4	4.5	23	9.4	P=0.32	2.18	0.73-6.49
Appropriate for GA (ref.)	83	94.4	219	89.4			
Birth weight							
Normal (ref.)	80	87	183	72.3		1	
LBW	11	11.9	69	27.3	X^2=9.28*	2.74*	1.38-5.46
Macrosomia	1	1.1	1	0.4	^{MC}P=0.008		

						0.44	0.03-7.08
Anthropometric measures						**P value**	
BW Mean ± SD	2928.86±563.24		2725.18±499.81		3.23*	0.001	
Length Mean ± SD	47.27±2.52		47.19-2.02		-0.273	0.78	
Head circumference Mean±SD	33.81±1.87		34.01±1.61		-0.961	0.34	
Congenital anomaly					X^2=0.069		
No	91	98.9	251	99.2	P=1	0.73	0.06-8.1
Yes	1	1.1	2	0.8			
NICU admission							
No	88	95.7	244	96.4	X^2=0.116		
Yes	4	4.3	9	3.6	P=0.75	0.81	0.24-2.7

*P< 0.05. ^{MC}P: P value of Monte Carlo test.

Table (4): Logistic regression results for the variables affecting Adverse Birth Outcomes (DNMI, 2020).

Independent variables	**Coefficient B**	**p-value**	**Adjusted Odds Ratio (AOR)**	**95% CI (LL-UL)**
Regular ETS exposure	0.889	0.005	2.43	1.31-4.51
Income (Just enough)	0.726	0.004	2.07	1.26-3.39
pregnancy related medical problems	1.21	0.000	3.36	1.76-6.43
Standing for long time during current pregnancy	2.02	0.02	7.56	1.29-43.99
Constant	-2.158	0.000		

Classification accuracy of the model was 72.2%

Figure 1. Correlation between number of cigarettes smoked by household members per day and gestational age is negative, weak, and significant