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Socio-economic Risk Factors of Spontaneous Preterm Birth Among Saudi Women: A Case-Control Study

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Abstract

Objectives: The aim of this study was to identify the effect of socio-economic factors such as family income, employment, housing education, and tobacco smoke exposure on spontaneous preterm birth (SPTB) in Saudi women.

Materials and Methods: A matched case-control study was conducted on 150 women with SPTB delivery and 150 women with spontaneous full-term delivery, in three hospitals in Riyadh. Cases and controls were matched in terms of age and parity. Then, information on maternal socio-economic risk factors was obtained through face-to-face interviews. The odds ratio (OR) for risk factors and a 95% confidence interval (CI) were calculated as well. Finally, a multiple logistic regression model was used to control potential confounding factors.

Results: Based on the results, factors including first-degree consanguinity (adjusted OR [AOR] =3.72, 95% CI=1.52-9.12), exposure to tobacco smoke (AOR=2.62, 95% CI=1.03-6.66), and low family income (AOR=4.63, 95% CI=1.62-13.27) were all associated with an increased risk of SPTB.

Conclusions: Overall, SPTB in Saudi Arabia was found to be correlated with first-degree consanguinity, low family income, and exposure to tobacco smoke. Therefore, public health interventions conducted to address these associated factors may contribute to the reduction in the prevalence of PTB.

Keywords: Socio-economic risk factors, Spontaneous preterm birth, Case-control study, Saudi Arabia

Introduction

Preterm birth (PTB), before 37 completed gestational weeks, is considered as the leading cause of under 5-year mortality. According to the reports, PTB was globally responsible for over one million child deaths in 2015 (1). It is also responsible for lifelong morbidity including neurodevelopmental disabilities (2).

The risk factors for PTB vary in different communities. Medical conditions including previous PTB, socio-demographic factors such as maternal age, ethnicity, and consanguineous marriage, as well as psychological risk factors including depression and anxiety were found to have a strong association with PTB (3,4).

Exploring the risk factors and prevention of PTB is regarded as an important public health intervention. Such a program contributes to reducing under-5 mortality and disabilities and the cost associated with the management of immediate and long-term complications. Many measures are suggested for PTB prevention and its complications. For example, medical interventions such as administering corticosteroids to women at the risk of delivering preterm to reduce respiratory complications and smoking cessation, avoid secondhand tobacco smoke, optimize mother's weight prior to pregnancy, and increase the intake of fruits and vegetables (5,6). The epidemiology PTB differs in various communities. Hence, considering the importance of robust data on PTB incidence and risk factors, healthcare planners and providers are advised to implement preventive measures in this respect. The current study sought to investigate the socio-economic risk factors associated with spontaneous preterm birth (SPTB) in Riyadh.

Materials and Methods

Study Design and Setting

A one-to-one matched case-control study design was used to accomplish the study objective. To this end, case and control groups were matched with respect to age and parity. In addition, the study population encompassed mothers who gave birth during 2016, at three major tertiary care hospitals in Riyadh, including King Khalid University Hospital (KKUH), which is located in the northwest of Riyadh. It is a tertiary care and referral center which is run by the Saudi Ministry of Education and offers free medical services to national and eligible Saudi expats. The hospital has a capacity of 850 beds and provides general and sub-specialty medical services. Further, the obstetrics and gynecology department provides services for 3500-4000 deliveries per year.

Similarly, King Fahd Medical City (KFMC), located in

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the central region of Riyadh, is one of the largest tertiary referral centers in the Kingdom with a capacity of 1200 beds, which is run by the Saudi Ministry of Health (MOH) and provides services for 4000-5000 deliveries per year.

Furthermore, King Saud Medical City (KSMC) is in the southern region of Riyadh, which is a tertiary care center with more than 1500 bed capacity under the supervision of the MOH. It is one of the largest hospitals run by the MOH in the Kingdom of Saudi Arabia and provides services for 7000-7500 deliveries per year.

The different geographical locations of the three above-mentioned hospitals together represent diverse socio-economic class, where KKUH demonstrates a mixture of all classes. Moreover, KFMC receives patients mostly from middle and upper economic classes while KSMC provides services to middle and lower economic classes. Hence, these hospitals were representative of the geographic distribution, as well as the socio-economic status of the study population.

Sample Size Estimation

The sample size was estimated considering a type I error of 5%, a statistical power of 80%, and the least odds ratio (OR) of 2.7 for consanguinity (7). For a 1:1 match for the controls, the total sample size for the study was considered as 300 women. The target sample from each study center was 100 women (50 cases vs. 50 controls) who were matched with maternal age (±2 years) and parity (±1).

Definitions

Case: Cases including all SPTBs less than 37 weeks of gestation were calculated from the last menstrual period and/or early ultrasound scan. The definition of PTB by the World Health Organization (WHO), including extremely preterm (<27 weeks of gestation), very preterm (27 to 32 weeks of gestation), and late preterm (32 to 37 weeks of gestation) was adopted in this study (8).

Control: The control group included full-term birth cases (37 completed gestational weeks and more) from the same hospital, who were matched with cases as regards age and parity.

*Body mass index (BMI)***:** It was computed based on self-reported maternal pre-pregnancy weight (in kilograms) and height (m^2). Based on the WHO classification (9), the maternal BMI was categorized as underweight (<18.5 kg/m^2), normal (18.5-24.9 kg/m^2), overweight (25-29.9 kg/m^2), and obese (≥30 kg/m^2).

Consanguineous marriage: According to Bittles (10), the study considered marriage to be consanguineous if the marriage was between first-degree relatives (i.e., husband and wife were first-degree cousins) or between second-degree relatives (i.e., husband and wife had distant biological relation compared to the first-degree relatives).

Secondhand tobacco smoke exposure (SHS): For the purpose of this study, SHS exposure was defined as two hours or more weekly exposure to tobacco smoke at home or work.

Questionnaire Description

The questionnaire included the following sections:

(*i*) Maternal data containing the mode of delivery and gestational age;

(*ii*) Socio-demographic risk factors which were mainly based on the socio-economic scale that was used in Born in Bradford multi-ethnic family cohort study with some modifications (11). The economic risk factors included family monthly income, the ownership of accommodation, the type of accommodation (e.g., folk house, apartment, floor, and villa), and satisfaction with house condition (e.g., very satisfied, fairly satisfied, fairly unsatisfied, and very unsatisfied). Based on family monthly income, participants were classified into three groups receiving ≤4999, 5000-9999, ≥10000 Saudi Riyals (1$=3.75 SR).

Data Collection

A trained nurse was assigned to postpartum wards of each study center to check for PTB cases. The investigator was called to invite the mother to participate in the study after explaining the research details. Mothers who signed the consent form were included in the study. A control matched with maternal age and parity was chosen from the postpartum registry of women who delivered on the same day as the case. On the other hand, the cases of induced labor, stillbirth, and the deliveries of infants with congenital anomalies were excluded from the study.

Statistical Analysis

Data were analyzed using IBM statistical SPSS software, version 21.0. Additionally, bivariate analysis was applied to demonstrate the association of risk factors with full-term and preterm deliveries. In addition, multivariate logistic regression analysis was performed to calculate the adjusted ORs (AOR) and 95% confidence interval (CI) for the risk factors of PTB. SPTB, including all related factors, was considered as a dependent variable appeared significant in the bivariate analysis as independent variables. A two-tailed *P* value of less than 0.05 was considered statistically significant.

Results

There was no significant difference between the 2 groups regarding mean age (28.02±5.28 vs. 27.65±5.17) and parity (1.59±1.56 vs. 1.47±1.43). Table 1 demonstrates the socio-demographic and economic characteristics. Lower- and middle-income groups were associated with an almost five-fold increased risk of SPTB compared to higher income group (CI=2.4-10.0, $P<0.001$) and unsatisfied housing showed the four-fold risk of SPTB (CI=2.4-6.8, $P<0.001$). In addition, consanguineous marriage with first-degree relatives represented significant risks related to SPTB (OR=3.7, CI=2.2-6.4, $P<0.001$). Table 2 summarizes the AOR of SPTB risk factors. Consanguineous marriage

Table 1. Comparison of Socio-demographic Risk Factors Among Spontaneous Preterm and Full-term Birth Mothers

Variable		SPTB (n=150)		FTB (n=150)		OR	95% CI	*P*
		No.	%	No.	%			
Maternal age	Age, mean (SD)	28.02 (5.28)		27.65 (5.17)				
	18-23 years	31	20.6	29	19.3	1		
	24-29 years	76	50.7	78	52	0.91	0.35-2.34	0.84
	30 -35 years	30	20	32	21.3	0.82	0.35-1.95	0.66
	>35 years	13	8.7	11	7.3	0.79	0.31-2.04	0.63
Maternal education	≤Secondary level	38	25.3	25	16.67	1.63	0.89-2.93	0.112
	High school diploma	44	29.3	52	34.67	0.90	0.54-1.52	0.717
	≥University level	68	45.3	73	48.67	1		
Mother' job	Housewife	93	62.0	91	60.67	1	0.59-1.50	0.813
	Employed	57	38.0	59	39.33	0.94		
Father' education	≤Secondary level	31	20.6	34	22.67	0.81	0.44-1.46	0.486
	High school diploma	47	31.3	52	34.67	0.80	0.47-1.35	0.408
	≥University level	72	48.0	64	42.67	1		
Consanguinity	First degree	72	48.0	30	20.00	3.73	2.19-6.37	<0.001
	Second degree	17	11.3	25	16.67	1.05	0.52-2.12	0.872
	No consanguinity	61	40.6	95	63.33	1.0		
Family monthly income	≤4999 SR	42	28	18	12	4.93	2.40-10.09	<0.001
	5000-9999 SR	81	54	75	50	2.28	1.31-3.97	0.004
	≥10000 SR	27	18	57	38	1		
Ownership of accommodation	Owned	45	30	41	27.3	1		
	Rented	88	58.7	93	62	0.86	0.52-1.44	0.57
	Living with parents	17	11.3	16	10.7	0.97	0.43-2.16	0.94
Type of accommodation	Folk and apartment	97	64.7	92	61.33	1.15		
	Floor and villa	53	35.3	58	38.67	1	0.72-1.84	0.55
Housing satisfaction	Very and fairly satisfied	71	47.3	118	78.7	1		
	Very and fairly unsatisfied	79	52.7	32	21.3	4.10	2.48-6.80	<0.001
Secondhand exposure to tobacco smoke	Exposed to smoke	42	28	16	10.7	3.26	1.74-6.11	
	Not exposed	108	72	134	89.3	1		<0.001

SPTB: Spontaneous preterm birth; FTB: Full-term birth; OR: Odds ratio; CI: Confidence interval.

Table 2. Adjusted Odds Ratio for the Risk Factors of Preterm Birth

Variables		AOD	95% CI	*P*
Consanguinity (No relation ref.)	First degree	4.16	1.94-8.89	<0.001
Family monthly income (>10000 ref.)	Less than 4999	4.63	1.62-13.27	0.004
House satisfaction (very and fairly satisfied ref.)	Very and fairly unsatisfied	3.51	1.72-7.16	0.001
SHS exposure (not exposed to smoke ref.)	Exposed to smoke	2.62	1.03-6.66	0.04

SHS: Secondhand smoke; AOD: Adjusted odds ratio; CI: Confidence interval.

with first-degree cousins, a family income of less than <4999 Saudi Riyals, and the lack of satisfaction with living conditions all increased the risk of SPTB by more than four-fold.

Discussion

Base on the results of this study, there are many socio-economic factors associated with SPTB among Saudi mothers in addition to the known maternal medical risk factors.

As previously mentioned, the participants of the study were matched for age and parity. Therefore, these parameters were not investigated as a risk factor for SPTB. In previous studies, young and advanced maternal age and nulliparity were associated with iatrogenic and SPTB (12,13). In young nulliparous women factors such as low educational achievement, unemployment, and low socio-economic conditions are probably the main risk factors of SPTB (14). Nevertheless, older mothers have different risk factors for PTB such as hypertension, as well as pre-gestational and gestational diabetes which may call for preterm termination of pregnancy due to medical reasons (12,15).

In the current study, consanguinity was correlated with a four-fold increase in the risk of SPTB. Similar findings were reported by other studies in the Middle East as well (16-18). For example, a previous study from Saudi Arabia identified consanguinity as an independent significant risk factor for SPTB (7). Recently, a study conducted in Lebanon reported that consanguineous couples have a 60% increased risk of early SPTB (17). Likewise, based on the findings of another study from Jordan, consanguinity

was associated with 50% increased odds of SPTB and more than six-fold greater risks of congenital malformations (18). The relationship between consanguinity and congenital malformation may be the main risk factor for PTB (16).

In this study, low family income increased the probability of SPTB by almost five-fold. This result is consistent with the findings of earlier studies from Saudi Arabia (19). Furthermore, some other high- and low-income countries reported similar findings in this regard (20,21). Housing satisfaction is closely related to the family income. Our results revealed that mothers who reported poor satisfaction with their accommodation were at greater risk of SPTB compared to those who showed their satisfaction.

Recent studies from Saudi Arabia indicated that nearly 20-30% of mothers visiting the antenatal clinics were exposed to secondhand smoke (SHS) with detrimental effects on their pregnancy outcomes (22). Both active and SHS exposure are identified as independent risk factors of SPTB. The relationship between exposure to tobacco smoke and SPTB is a dose-related issue (24), resulting in conflicting reports (23-25). The maternal avoidance of exposure to SHS is a viable public health intervention for reducing the adverse outcomes of pregnancy including the SPTB (26).

Implications to Practice

Based on the results of this study, many interventions can be implemented to reduce the prevalence of SPTB among the Saudi community by strengthening the antenatal care services with particular attention to

1. Screening and counseling women to avoid SHS exposure that should be integrated into the routine antenatal care services in the Kingdome due to its proven effectiveness in reducing SPTB (26);
2. Consanguinity as the risk factor for SPTB, which should be highlighted for the couple attending premarital screening program centers in Saudi Arabia together with all deleterious effects of PTB on the mother and her baby.

Implication to Research

Further research is needed on the risk factors regarding different categories of SPTB and the outcome of preterm infants. Such research should address the cost of preterm infant management and the cost-effectiveness of different prevention programs.

Strengths and Limitations

This study provided much necessary evidence for policymakers and healthcare providers to delve into some modifiable socio-economic risk factors for an important health problem which affects about 9-10% of deliveries in Saudi Arabia. We acknowledge that this study has some limitations including the biases related to the study design such as recall bias in addition to the small number of participants that made the subgroup analysis of specific risk factors impossible for different gestational ages of SPTB.

Conclusions

In general, SPTB in Saudi Arabia was associated with first-degree consanguinity, low family income, and exposure to secondhand tobacco smoke. Public health interventions such as increasing the awareness regarding the effects of SHS and consanguinity may contribute to the reduction in the prevalence of preterm delivery.

Conflict of Interests

Authors declare that they have no conflict of interests.

Ethical Issues

Before collecting the data and after explaining the purpose of the study, written consent was obtained from all patients and they were assured of the confidentiality of the data. This research project was approved by the Institution Review Board under the number of 15/0285/IRB.

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