

The relationship between physical violence during pregnancy and stillbirth and neonatal mortality

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ABSTRACT

Background: Violence against women is one of the major public health issues and violation of women's human rights. Violence may affect women's health, especially during pregnancy. In addition to serious consequences for women's health, it will also impact the health of a growing fetus. **Material and Method:** This study was conducted to investigate the relationship between physical violence during pregnancy and stillbirth and neonatal mortality. This is a population base case-control study conducted on pregnant women attending public health centers in 10 provinces of Iran. The collected data were analyzed using SPSS (version 21), descriptive statistics and univariate and multivariate logistic regression analysis at a significance level of less than 0.05. **Results:** In this study, 193 participants (6.9%) had experienced physical violence including 104 controls (7.7%) and 89 cases (6.4%) and a significant relation was found between physical violence and stillbirth during pregnancy (OR=1.54, CI: 1.16-2.05). There was also a significant association between stillbirth and maternal lower educational level (OR=3.7, CI: 2.4-5.6), accidental blows on the mother (OR=5.83, CI: 3.09-10.98). No significant association was observed between physical violence during pregnancy and neonatal mortality. However, neonatal mortality was significantly related to the accidental blows (OR=15.25, CI: 8.2-28.38). **Discussion and Conclusion:** The results of this study showed that physical violence and accidental blows during pregnancy can cause stillbirth and neonatal mortality. Accordingly, it is recommended to take necessary measures through performing proper and routine screening for domestic violence during pregnancy and offering educational measures to empower women and raise men's awareness.

Keywords: Physical Violence, Pregnancy, Infant Death, Stillbirth, Iran, Social Issue.

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Introduction

Physical violence against pregnant women refers to the behaviors of their current intimate partners or ex-partners and may cause physical, sexual or psychological damages. Violence against women is a major public health issue and is understood as a violation of women's human rights^[1]. Prenatal care and delivery services, provide a good opportunity to identify women exposed to violence hence^[2]. Violence can occur both during pregnancy and during the perinatal period and it is strongly known as an important risk factor for maternal and newborn health^[3].

Pregnancy may be influenced by factors such as being a housewife mother, low economic status^[4], partner's low educational attainment, partner's drug addiction, partner's

unemployment^[5], which may lead to violence in pregnancy. The results of a study in Bangladesh showed that 75.6 percent of women were subjected to violence by their partners throughout their pregnancies. In this study, women's low educational level, poverty and believing in Islam were the main risk factors^[6]. Physical violence, is of great importance due to its high prevalence and creating negative consequences and injuries and health problems^[1] for the mother and baby^[4]. Such consequences include inadequate care during pregnancy^[7], premature infants, low birth weight^[5,8,9], neonatal complications^[8], perinatal and neonatal mortality^[9-11]. In another study, Asian race is reported as a risk factor for miscarriages among pregnant women^[12]. According to the latest facts and figures from Global Outbreak, approximately 1 in 3 women around the world have experienced physical or sexual violence or non-sexual violence within their lifetime^[1].

In a systematic review, prevalence of physical violence during pregnancy is estimated 18 percent and 23 percent throughout the world and within Iran, respectively^[13]. The results of various studies in Iran indicated that 14.5- 75.4% of the mothers had been victims of physical abuse in Khorramabad,^[14,15] another study in Sanandaj showed that 8.5 percent of women had experienced physical violence during pregnancy. Most of the women subjected to physical violence were housewives and had low economic status^[4]. Another study was reported, 16.7 percent which was linked with low birth weight and prenatal care^[16].

Material and Methods

Given that a limited number of studies have been carried out in this area in Iran and based on the Millennium Development Goals which include reducing deaths of children under 5 years of age as well as increasing maternal health, this study was carried out aiming to investigate the relationship between physical violence during pregnancy and stillbirths and neonatal mortality at the national level in Iran.

This study is a case-control study on pregnant women attending public health centers in provinces like Fars, Hormozgan, Kermanshah, Hamedan, Kohgiluyeh and Boyer-Ahmad, Yazd, South Khorasan, Golestan and in cities such as Mashhad and Zahedan during 2015-2016. In Iran, rural healthcare centers are based in the villages and supervise the health houses of those villages and, mostly, the health houses of several neighboring villages. This center has a population of about 9,000 people and General Practitioners, holders of associate degree and bachelor's degree in Healthcare and holders of associate degree and bachelor's degree in Midwifery work in it. The center's main responsibility is to support the health houses, to monitor their performance, to accept the referrals and to communicate properly with higher levels. The urban healthcare center is located in urban areas and it supports the health posts. General Practitioners, holders of associate degree and bachelor's degree in Healthcare and holders of associate degree and bachelor's degree in Midwifery work in this center as well. The center covers a smaller population (12,500 people) and it also conducts all laboratory, radiology and medicinal activities. The information related to all covered households including information on the mother's status before pregnancy, during pregnancy and after pregnancy will be maintained in family health records in these centers.

Sampling and selection of cases and controls

In this study, two case groups and one control group were defined. The first case group included mothers who had recently experienced stillbirth with a sample size of 1162 participants and the second case group included mothers who had recently experienced neonatal death with a sample size of 1459 participants. The control group also included mothers with live births in their last pregnancy with a sample size of 1626 participants. According to the definition offered by CDC, stillbirths are further classified into three groups: early stillbirths (weeks 20 to 27 of pregnancy), and late stillbirths (weeks 28 to 36 of pregnancy), and term stillbirths (week 37 until delivery)^[17]. Neonatal mortality is also described as deaths within the first 28 days of life^[18].

The samples of the study were selected from 9 provinces based on the geographic location and four cities were chosen from each province (separately from North, South, East and West) and an urban center and a rural center were selected out of the healthcare centers of these cities.

Data collection method

Data collection instruments included a checklist and a questionnaire. The checklist was related to the demographic data including maternal age at birth, paternal age, maternal education (illiterate, elementary school, middle school, high school and university) - in this study all other classes were compared with the mother's higher education, paternal occupation (businessman, employee, farmer, rancher etc.), maternal occupation (housewife, employee, farmer, rancher, carpet weaver etc.), family relationship, ethnicity (Fars, Lur, Turk, Kurd, Arab, Baluch, Turkmen, etc.) - all the groups were compared with Fars people, unintended blows to pregnant women (e.g. falling down, having an accident, accidentally bumping into furniture, etc.) as well as the worst incidents occurred in their lives.

Questionnaire was about the information on pregnancy such as: Has your partner ever thrown you down or kicked you? Has your ever partner punch you, stabbed you or hit you with something else? Has your partner ever hurt you so that you wouldn't need any medical care? Has your partner ever hurt you in a way that you couldn't go to school or work? Has he ever prohibited you from sleeping? The questionnaire included "Yes / No" questions.

Reliability and validity of the questionnaire were already determined in a study by Zeighami et al. and Cronbach's alpha (0.78) was tested and confirmed^[19]. Data collection was performed by distributing questionnaires among the selected centers so the required information was collected. Since the healthcare centers' professionals are considered as the closest care line in Iran, the relevant questionnaires was distributed among them; and the required information was collected in accordance with the shared and coordinated instruction by reviewing the participants' files.

Data analysis method

Based on the conducted field studies, modeling was performed using all the demographic variables of parents (parental/maternal age, parent's education, parents' occupation, ethnicity), the variables associated with violence during pregnancy, accidental blows and domestic abuse and the worst incidents of life. Each of the above-mentioned variables that were significantly associated with neonatal mortality and

stillbirth were determined as potential intervening variables and their estimates of crude and adjusted odds ratios were compared in the model. Finally, in the multivariate model for stillbirth, the variables of paternal/maternal education, paternal occupation, and accidental blows on the pregnant mother, the loss of relatives, maternal age, physical violence, occupational factors and Fars ethnicity were entered in the model.

In the multivariate model for neonatal mortality, the variables of maternal education, paternal education, paternal occupation, accidental blows on the pregnant mother, ethnicity, maternal age, maternal occupation, the loss of the relatives, occupational factors, factors associated with economic position of an individual or a family, factors associated with an individual's or family's health, paternal age and physical violence were entered in the model.

In multivariate analysis, the results were reported based on the significance level of the test (P value), odds ratio and confidence limit. Accordingly, percentage and frequency were used to describe the variables and univariate and multivariate logistic regression analysis were used to describe the evaluated test. SPSS (version 19) was used to describe and analyze data and the hypothesis testing was regarded as statistically significant if the p-value was less than 0.05. All statistical evaluations were

performed to determine the relationship between physical violence and blows on the mother during pregnancy and stillbirths or neonatal mortality considering the possible impact of other intervening variable.

Results

Stillbirth

According to the results of the study, among 118 participants that had experienced accidental blows, there were 106 cases and 12 controls. In this study, 92 percent of the mothers aged less than 35 years. 98.9 percent of the partners were also younger than 35 years. In this study, 193 participants (6.9%) had experienced physical violence including 104 controls (7.7%) and 89 cases (6.4%). They mostly belonged to Fars ethnic group who constituted 64.6 percent of the sample. Among fathers, 64.4 percent were self-employed .37.1 percent of the fathers had high school diploma, 90.9 percent of the mothers were housewives and 38.1 percent of them had high school diploma (Table 1).

Table 1. Demographic variables related to stillbirth in pregnant women referred to health centers in the provinces of Iran

	variable	controls	cases	total
Father's job	Self employed	993 (61.7 %)	787 (68.2 %)	1780 (64.4 %)
	Employee	298(18.5 %)	143 (12.4 %)	441 (16 %)
	Farmer	108 (6.7 %)	81 (7 %)	189(6.8 %)
	Rancher	26 (1.6 %)	19 (1.6 %)	45(1.6 %)
	Other	185(11.5 %)	124 (10.7 %)	309(11.2 %)
Mother's education	illiterate	68(4.2 %)	62 (5.4 %)	130(4.7 %)
	Primary	315(19.4 %)	280 (24.1 %)	595(21.4 %)
	Secondary school	347 (21.4 %)	309(26.6 %)	656 (23.6 %)
	High school	648 (39.9 %)	413 (35.5%)	1061 (38.1 %)
	Collegiate	246 (15.1 %)	94 (8.1 %)	340 (12.2 %)
Father's education	illiterate	52 (3.2 %)	54(4.7 %)	106(3.8 %)
	Primary	236 (14.5 %)	236 (20.5 %)	472 (17 %)
	Secondary school	434 (26.7 %)	368 (31.9 %)	802(28.9 %)
	High school	642(39.6 %)	389(33.7 %)	1031(37.1 %)
	Collegiate	259(16 %)	106 (9.2 %)	365(13.1 %)
accidental blows	Yes	12 (0.7 %)	106 (9.2 %)	118 (4.3 %)
	no	1613(99.3%)	1042 (90.8 %)	2655 (95.7 %)
Ethnic	Fars	1019(63.8%)	741 (65.7 %)	1760 (64.6 %)
	Lur	108 (6.8 %)	77 (6.8 %)	185 (6.8 %)
	Turk	250 (15.7 %)	170(15.1 %)	420 (18.4 %)
	Kurd	16 (1 %)	39 (3.5 %)	55 (2 %)
	Arab	16 (1 %)	14 (1.2 %)	30 (1.1 %)
	Baluch	101 (6.3 %)	40 (3.5 %)	141 (5.2 %)
	Turkmen	62 (3.9 %)	23 (2 %)	85 (3.1 %)
	Other	25 (1.6 %)	23 (2 %)	48 (1.8 %)
Age of mother	<35	1541 (94 %)	1035 (90 %)	2549 (92.3 %)
	35≤	97 (6 %)	115 (10 %)	212 (7.7 %)
Mother's job	housewife	1433(89.2%)	1074 (93.3 %)	2507 (90.9 %)
	Employee	135 (8.4 %)	45 (3.9 %)	180 (6.5 %)
	Farmer, Rancher, Carpet weavers	19 (1.2 %)	24 (2.1 %)	43 (1.6 %)
	other	19 (1.2 %)	8 (0.7 %)	27 (1 %)
Age of father	<35	1598(99.4%)	1120 (98.2 %)	2718 (98.9 %)
	35≤	9 (0.6 %)	20(1.8 %)	29 (1.1 %)
	Yes	104 (6.4 %)	89 (7.7 %)	2595 (93.1 %)

Physical Violence	No	1522(93.6%)	1037 (92.3 %)	193 (6.9 %)
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The results of this study (Table 2) showed that there is a significant association between maternal education and stillbirths ($p < 0/00$), and accidental blows during pregnancy were also associated with increased rate of stillbirths ($p < 0/00$). So that women who had experienced accidental blows were 5.83 times more likely to experience neonatal mortality compared with women without such experiences. The results indicated that Kurd ethnic groups had a 1.4 times higher chance of stillbirth compared with Fars ethnicity. Chance of stillbirth in women who were older than 35 years was 1.7 times higher than women

under 35 years of age. The results of this study showed that women who had experienced physical violence had a 1.54 times higher chance of stillbirth compared with women without such experiences. Chance of stillbirth in women who had mentioned the loss of relatives as the worst event of their lives were 1.57 times higher than the mothers who did not refer to the loss of relatives as the worst incident of the life. Chance of stillbirth in women who referred to the occupational problems as the worst incidents of their lives was 1.14 times higher than the rest of the mothers.

Table 2. Factors associated with stillbirth in pregnant women referred to health centers in the * provinces of Iran

Variable	P-value	Adjusted			Crude		
		CI	RR	P-value	CI	RR	
Ethnic	Fars	0.013		1	0.001		1
	Lur	0.874	0.75 - 1.4	1.026	0.9	0.721 - 1.3	0.98
	Turk	0.612	0.84 - 1.3	1.059	0.544	0.753 - 1.1	0.935
	Kurd	0.002	1.4 - 5.2	2.748	0.000	1.8 - 6.0	3.352
	Arab	0.34	0.70 - 2.7	1.4	0.616	0.58 - 2.4	1.203
	Baluch	0.684	0.68 - 1.2	0.937	0.002	0.37 - 0.79	0.545
	Turkmen	0.202	0.88 - 1.8	1.27	0.007	0.31 - 0.83	0.510
Mother's education	illiterate	0.001	2.4 - 5.6	3.7	0.001	1.5 - 3.6	2.386
	Primary	0.001	2.05 - 3.6	2.75	0.001	1.7 - 3.1	2.326
	Secondary school	0.001	1.7 - 3.07	2.3	0.001	1.7 - 3.09	2.33
	High school	0.001	1.25 - 2.1	1.64	0.001	1.2 - 2.18	1.668
	Collegiate	0.001		1	0.001		1
Age of mother	<35	0.001		1	0.001		1
	35≤	0.001	1.28 - 2.24	1.69	0.001	1.3 - 2.29	1.73
accidental blows	Yes	0.001	3.09 - 10.98	5.83	0.001	7.48 - 24.96	13.67
	No	0.001		1	0.001		1
Physical Violence	Yes	0.003	1.16 - 2.05	1.54	0.19	0.9 - 1.62	1.21
	No	0.001		1	0.001		1
Loss of relatives	Yes	0.001	1.33 - 1.86	1.57	0.001	1.21 - 1.67	1.42
	No	0.001		1	0.001		1
Occupational factors	Yes	0.004	1.13 - 1.98	1.48	0.001	1.26 - 2.08	1.626
	No	0.001		1	0.001		1

* The definition of stillbirth: premature births (20 to 27 weeks of pregnancy), and stillbirth late (28 to 36 weeks of pregnancy), and stillbirth semester (37 weeks until delivery).

**Adjusted odds ratios in terms of maternal education, unintentional injury, worst things in life: the loss of close relatives, occupational factors, age, physical violence, and ethnicity.

Neonatal Mortality

Based on the results of the study (Table 3), among 82 participants (2.7%) who had experienced accidental blows, there were 70 cases and 12 controls. In this study, 91.1 percent of the mothers and 98.9 percent of the fathers aged younger than 35 years. 8.8 percent of the participants had experienced physical violence. Fars was the largest ethnic group which constituted 61.3 percent of the sample. 63.1 percent of the fathers were businessmen and 36.3 percent of them had high

school diploma. 90.9 percent of the mothers were housewives and 36.5 percent of them had high school diploma.

Table 3. Demographic variables neonatal death in pregnant women referred to health centers in the provinces of Iran

variable	controls	cases	total	
Father's job	Self employed	993 (61.7 %)	937 (64.6 %)	1930 (63.1 %)
	Employee	298 (18.5 %)	178 (12.3 %)	476 (15.6 %)

	Farmer	108 (6.7 %)	104 (7.2 %)	212 (6.9 %)
	Rancher	26 (1.6 %)	30 (2.1 %)	56 (1.8 %)
	Other	185 (11.5 %)	201 (13.9 %)	386 (12.6 %)
Mother's education	illiterate	68 (4.2 %)	108 (7.4 %)	176 (5.7 %)
	Primary	315 (19.4 %)	395 (27.1 %)	710 (23.1 %)
	Secondary school	347 (21.4 %)	363 (24.9 %)	710 (23.1 %)
	High school	648 (39.9 %)	45 (3.2 %)	1123 (36.5 %)
	Collegiate	246 (15.1 %)	115 (7.9 %)	361 (11.7 %)
Father's education	illiterate	52 (3.2 %)	69 (4.7 %)	121 (3.9 %)
	Primary	236 (14.5 %)	290 (19.9 %)	526 (17.7 %)
	Secondary school	434 (26.7 %)	471 (32.4 %)	905 (29.4 %)
	High school	642 (39.6 %)	475 (32.6 %)	1117 (36.3 %)
	Collegiate	259 (16 %)	150 (10.3 %)	409 (13.3 %)
accidental blows	Yes	12 (0.7 %)	70 (4.9 %)	82 (2.7 %)
	no	1613 (99.3 %)	1388 (95.1 %)	3001 (97.3 %)
Ethnic	Fars	1019 (63.8 %)	830 (58.4 %)	1849 (61.3 %)
	Lor	108 (6.8 %)	93 (6.5 %)	201 (6.7 %)
	Turk	250 (15.7 %)	257 (18.1 %)	507 (16.8 %)
	Kurd	16 (1 %)	34 (2.4 %)	50 (1.7 %)
	Arab	16 (1 %)	19 (1.3 %)	35 (1.2 %)
	Baluch	101 (6.3 %)	99 (7 %)	200 (6.6 %)
	Turkmen	62 (3.9 %)	74 (5.2 %)	136 (4.5 %)
Age of mother	<35	1541 (94 %)	1257 (87.9 %)	2771 (91.1 %)
	35≤	97 (6 %)	173 (12.1 %)	270 (8.9 %)
Mother' job	housewife	1433 (89.2 %)	1339 (92.5 %)	2772 (90.8 %)
	Employee	135 (8.4 %)	65 (4.5 %)	200 (6.6 %)
	Farmer, Rancher, Carpet weavers	19 (1.2 %)	25 (1.7 %)	44 (1.4 %)
	other	19 (1.2 %)	18 (1.2 %)	37 (1.2 %)
Age of father	<35	1598 (99.4 %)	1400 (98.2 %)	2998 (98.9 %)
	35≤	9 (0.6 %)	25 (1.8 %)	34 (1.1 %)
Physical Violence	Yes	104 (6.4 %)	169 (6.4 %)	273 (8.8 %)
	no	1522 (93.6 %)	1290 (93.6 %)	2812 (91.2 %)

The results of neonatal mortality analysis indicated that (Table 4) chance of neonatal mortality among mothers who referred to occupational problems as the worst incidents of their lives was 2.74 times higher than the rest of the mothers. Mothers who believed that loss of relatives was the worst event of their lives were 2.1 times more likely to experience neonatal mortality compared with the rest of the mothers. Chance of neonatal mortality among mothers who referred to their personal economic problems or economic problems of their family as the worst incidents of their lives was 1.47 times higher than the rest of the mothers. Mothers who had declared that their families'

health problems were the worst incidents of their lives had a 1.43 times higher chance of neonatal mortality compared with the rest of the mothers.

Table 4. Factors associated with neonatal death * in pregnant women referred to health centers in the provinces of Iran

Variable	Adjusted			crude			
	P-value	CI	RR**	P-value	CI	RR	
Age of mother	<35	0.001		1	0.001	1	
	35≤	0.041	1.01 – 1.91	1.39	0.001	1.65 – 2.78	2.14
Ethnic	Fars	0.001		1	0.001	1	
	Lor	0.84	0.68 – 1.3	0.96	0.7	0.78 – 1.41	1.05
	Turk	0.002	0.51 – 0.85	0.66	0.02	1.03 – 1.53	1.26
	Kurd	0.002	1.47 – 5.23	2.78	0.002	1.43 – 4.76	2.6
	Arab	0.88	0.4 – 2.17	0.94	0.27	0.74 – 2.85	1.45

	Baluch	0.001	0.29 – 0.66	0.44	0.21	0.89 – 1.6	1.2
	Turkmen	0.004	0.26 – 0.77	0.45	0.03	1.03 – 2.07	1.46
	Other	0.47	0.41 – 1.51	0.78	0.35	0.38 – 1.4	0.737
Mother's job	Housewife	0.009		1	0.001		1
	Employee	0.003	0.36 – 0.81	0.54	0.001	0.38 – 0.69	0.51
	Farmer, Rancher, Carpet weavers	0.115	0.87 – 3.44	1.73	0.26	0.77 – 2.56	1.4
	other	0.59	0.31 – 1.94	0.77	0.96	0.53 – 1.94	1.01
Father's education	Illiterate	0.001	1.48 – 4.17	2.49	0.001	1.51 – 3.46	2.29
	Primary	0.001	1.67 – 3.31	2.35	0.001	1.62 – 2.76	2.12
	Secondary school	0.001	1.49 – 2.08	2.05	0.001	1.47 – 2.38	1.87
	High school	0.049	1.001 – 1.81	1.34	0.04	1.01 – 1.61	1.27
	Collegiate	0.001		1			1
Age of father	<35	0.001		1	0.001		1
	35≤	0.051	0.99 – 5.58	2.42	1.47	6.81	3.17
Accidental blows	Yes	0.001	8.2 – 28.36	15.25	0.001	3.65 – 12.55	6.77
	no	0.001		1	0.001		1
Loss of relatives	Yes	0.001	1.54 – 2.86	2.1	0.001	1.24 – 1.68	1.44
	no	0.001		1	0.001		1
Economic factors or family	Yes	0.026	1.04 – 20.8	1.47	0.13	0.7 – 1.04	0.86
	no	0.001		1	0.001		1
Occupational factors	Yes	0.001	1.86 – 4.04	2.74	0.07	0.97 – 1.59	1.24
	no	0.001		1	0.001		1
Factors related to their health or family	Yes	0.025	1.04 – 1.97	1.43	0.001	0.61 – 0.83	0.71
	No	0.001		1	0.001		1

* The definition of infant mortality: infant mortality in the first 28 days after birth.

**adjusted odds ratio: Parental education, father's occupation, unintentional injury, ethnicity, mother's age, mother's occupation, physical violence, the age of the father, worst things in life: the loss of a close relative, mother or economic factors family, occupational factors, and factors related to the health of the mother or family.

Chance of neonatal mortality among women who were older than 35 years was 1.39 times higher than the mothers aged less than 35 years. Employment of the mothers played a protective role against neonatal mortality. Chances of neonatal mortality in Turk, Baluch and Turkmen ethnic groups were 0.66, 0.55 and 0.54 times higher, respectively, compared with Fars ethnicity and played a protective role. While chance of mortality in Kurd ethnic group was 2.7 times higher than Fars ethnic group. Accidental blows increased the chance of neonatal mortality among the mothers by 15.2 times compared with the mothers without such experiences. Paternal education was also significantly associated with neonatal mortality.

Discussion and Conclusion

Pregnancy is a critical period for both mother and fetus. This period, for different reasons, such as reduction of sexual relations, misconceptions about pregnancy and the husband's abnormal feelings about pregnancy, may be a turning point toward domestic violence or sometimes, toward intensifying domestic violence against pregnant women^[20]. Accordingly, during this period of time, pregnant women must be protected from harms and injuries. In this study, the prevalence of physical violence is measured 6.9 percent (193 participants) and 7.7 percent (89 participants) of the controls and 6.4 percent (104 participants) of the cases had experienced violence and physical violence was associated with stillbirths ($P < 0.003$). The results

of a study conducted in Bangladesh were consistent with the results of this study^[6]. In a systematic review, prevalence of physical violence during pregnancy is estimated 18 percent and 23 percent throughout the world and within Iran, respectively^[13]. Whereas the prevalence of physical violence in the present study was 8.8 percent, the most important causes of differing results might be using different measurement tools in different studies as well as under-reporting because of different cultural beliefs among ethnic groups and religions of the Iran. In this regard, various studies conducted in Iran and across the world have reported different results; for example, the estimated prevalence of physical violence in a study in Sabzevar was 14.5 percent^[15]. While, in a study at the University of Texas in America, prevalence of physical violence was reported as high as 1.5 percent and the results also indicated that violence during pregnancy is associated with perinatal mortality^[9]. Results of a study conducted in India and Colombia also showed that violence during pregnancy increases the risk of perinatal mortality^[11,21]. A study conducted in Kurdistan also showed that physical violence was associated with higher rates of miscarriage^[4]. However, in some other studies no relationship was observed between violence during pregnancy and perinatal mortality and stillbirths^[16,22,23]. Various figures and numbers have been reported vis-à-vis physical violence, and variation of violence rates not only depends on different levels of conditions and communities but also associates with different methods of conducting the study, sampling techniques and cultural differences affecting the willingness of the respondents to

disclose their sexual experiences. In this study, although the interviews were conducted considering the conditions and positions of the individuals and after gaining their trust, given that physical violence is related to their personal lives, a number of respondents might have denied occurrence of violence for some reasons. This may happen due to various descriptions as well as women's different perceptions of violence which highlights the need for a unified and universal definition.

In this study, as the maternal education level raised, stillbirth rates decreased and the chance of stillbirth among illiterate mothers was reported 2.38 times higher than mothers with university education which was consistent with the results of other studies [24-27]. Maternal lower education level may be related to higher number of pregnancies, lack of pregnancy care [28] as well as higher risk of gestational diabetes which are all associated with increased rate of stillbirths [25].

Accidental blows on mothers were also associated with stillbirth and mothers who had experienced accidental blows were 13.2 times more likely to have a stillbirth compared with other ones. In a study conducted in Atlanta, 51.6 percent of the mothers reported experiencing a fall, 36.4 percent had a motorcycle accident and 1.2 percent were struck by the objects [29]. In studies conducted in California and Nigeria, injuries during pregnancy were associated with stillbirths [30]. While some other studies reported that stillbirths were mostly associated with trauma resulting from accidents [31,32]. Blows on the mother during pregnancy may lead to preterm birth, placental abruption, maternal mortality, respiratory distress syndrome and low birth weight [33].

Results showed that mothers who were older than 35 years were more likely to have a stillbirth which was consistent with the results of studies conducted in Massachusetts, USA, Liverpool and Australia [24,26,34]. However, the results of a study in Karachi showed no significant relationship between stillbirth and maternal age [35]. On the one hand, the results of a study showed that young mothers were more likely to experience stillbirth [36]. The association between advanced maternal age and stillbirth might have been misunderstood due to some underlying medical conditions such as hypertension and diabetes which are known as two common health problems with severe side effects during pregnancy [34,37] that caused such inconsistencies in results of the studies.

The results of our study suggested that the stillbirth rate in Kurd ethnic group is higher than Fars ethnic group. This difference mostly depends on the culture of each ethnic group and can be caused by social determinants such as education level, economic status, health status and migration [38]. However, some foreign studies found an association between white and black races and stillbirth [26]. Another study also mentioned race as a risk factor for stillbirth [39]. In a study in New Zealand, violence rate against Asian mothers was estimated 3.5 times higher than the rate of violence against European mothers. The race was also associated with an increased rate of spontaneous abortion [12].

In this study, stillbirth rate among the mothers who mentioned the loss of their close relatives and occupational issues as the worst incidents of their lives was 42 and 62 percent higher than other mothers, respectively. In another study, stillbirth was associated with factors related to the mother's partner such as separation and divorce, too many arguments, physical violence and not being allowed to get pregnant; emotional factors such as imprisonment of the mother or her partner and financial factors such as the loss of a job and having loans and not being able to make installment payments [40]. A study conducted in London showed that stressful events during pregnancy were associated

with spontaneous miscarriage [41] while another study in Melbourne, Australia, about social health considered the stressful life events as risk factors associated with low birth weight [42]. Another study in Manchester also showed that mothers who had faced severe stressful life events, such as the loss of close relatives during pregnancy, had low birth weight infants [43]. In another study, mothers who had experienced two or more stressful life events during the prenatal period, were more likely to have a preterm birth [44].

In the present study, a significant association was found between neonatal mortality and accidental blows. Chance of neonatal mortality among mothers who had experienced accidental blows was 6.7 times higher compared with mothers without such experiences. Another study also reported that stillbirth was mostly associated with and a trauma resulting from accidents [45]. A Columbian study showed that illness, injuries and accidents during pregnancy were associated with low birth weight [46]. Accidental blows such as falls may be associated with adverse pregnancy outcomes [30].

The results of this study indicated that ethnicity was associated with neonatal mortality. Chance of neonatal mortality in Kurd ethnic group is 2.7 times greater compared with Fars ethnic group. While Turkmen, Baluch, Turk ethnic groups had a protective role and compared with Fars ethnic group, the chances of neonatal mortality among these groups were 45, 44, 66 percent lower, respectively. However, in a study in Pennsylvania no difference was found between white, black and Puerto Rican races in terms of neonatal mortality [47]. Moreover, in a study conducted in Golestan province, no relationship was observed between neonatal mortality and Turkmen and non-Turkmen ethnicity [45]. These differences might largely be the results of different beliefs and cultures of ethnic groups in the country.

The results of this study showed that the rate of neonatal mortality increased among women older than 35 years ($p < 0.041$). The results of different studies conducted in Tehran and Bangladesh also showed this relationship [48,49]. On the contrary, the results of other studies indicated that young maternal age was associated with a higher risk of neonatal mortality [50-52] while some other studies found no association between maternal age and neonatal mortality [45,53]. Increased rate of neonatal mortality associated with advanced maternal age might be the result of the mother's impatience, mother's negligence to her infant due to numerous life challenges, larger number of children and changes in the mother's genital tract. Therefore, the risk of neonatal mortality among mothers experiencing high-risk pregnancies is associated with the risk factor of aging greater than 35 years which shows the importance of paying special attention to high-risk mothers [54].

In this study, maternal employment was associated with neonatal mortality and neonatal mortality rate was 0.54 times lower among working mothers compared with the housewives which is consistent with the results of the studies conducted in Indonesia and India [55,56]. However, according to a study conducted in Golestan province, no relationship was found between maternal employment and neonatal mortality. The evidences indicate that the obtained results do not suggest an association between a higher risk of neonatal mortality and maternal unemployment; while, the number of working mothers, especially in rural population, is low [45]. In a study conducted in the United Kingdom, maternal employment was found associated with an increase in neonatal mortality which was not consistent with the results of this study. Maternal employment might have a negative impact on infant care and

lack of timely and personal care during infancy such as lower consumption of breast milk might increase the rate of neonatal mortality^[57].

The results of this study showed that neonatal mortality rate is higher in families with fathers older than 35 years. There are different assumptions about the relationship between paternal age and adverse pregnancy outcomes. An association was observed between advanced maternal and paternal age and chromosomal abnormalities which might be considered as one of the causes of high fetal and neonatal mortality rate^[58]. There are also concerns about aging and its effect on quality of the mother's oocytes, ovaries and womb^[59]. Some changes may also occur in the chromosomes of the sperm with increasing paternal age^[60].

In this study, the worst incidents of maternal life were associated with an increase in neonatal mortality rate. In a study conducted in the United States of America no relation was found between stressful life events during pregnancy and having preterm or term neonates^[61]. A study conducted in Colombia showed that experiencing severe life events such as physical conflicts with the partner and suffering from illnesses, injuries or accidents was associated with having a low birth weight infant^[46]. Another study in Manchester also found a relationship between severe life events and low birth weight^[62]. Stressful events during pregnancy may greatly affect the mother by increasing uterine contractions followed by a premature labor through triggering hormone release. Premature labors are followed by an increase in neonatal mortality rate^[63].

Conclusion

Results of this study showed that physical violence during pregnancy is associated with many problems and might cause stillbirth and neonatal mortality. Moreover, the results point out that physical violence occurs in all societies, regardless of education level, socio-economic status and ethnicity. High prevalence of violence among women covered by healthcare centers highlights the importance of routine screening and referral of victims of violence as a health priority. Therefore, given that domestic violence is a social problem which threatens the health of women, newborns and children, further research to determine other variables associated with its occurrence among pregnant and non-pregnant women in other provinces is recommended. Identifying those at risk for domestic violence, providing trainings to help prevent such incidents and offering emotional, physical, financial, social and legal support for women during pregnancy to improve maternal and newborn health are necessary.

Limitations of the Study

Mother's nutritional status during pregnancy was likely to affect other items and the pregnancy outcomes. Moreover, unwillingness of the mothers to disclose their domestic violence experiences and lack of honest answers to the questionnaire were items that could not be controlled by the researcher.

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Conflict of Interest Disclosure

The authors declare that they have no competing interests.

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Availability of data and materials

The dataset(s) supporting the conclusions of this article is (are) available on request from the journal cited.

Abbreviations

CI: Confidence interval; OR: Odds ratio; BMI: Body mass index.

Ethics approval and consent to participate

Ethical approval was granted by Shiraz university of Medical Sciences Research Ethics Committee (Ir.sums.rec. 1394.f330). All participants provided written informed consent prior to interview; this included permission to use anonymised quotations in publications.

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