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The Prevalence of Birth Defects and Related Factors in Zanjan City (Northwest, Iran) During 2015–2016

Arezoo Safaei Nezhad [1], Maryam Mahmoudi[1*], Roghieh Kharaghani [1*]

1. *Dept. of Midwifery and Nursing, Faculty of Midwifery and Nursing, Zanjan University of Medical Sciences, Zanjan, Iran*
2. *Center of Clinical Competency, Zanjan University of Medical Sciences, Zanjan, Iran*

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Corresponding Information:
Roghieh Kharaghani,
Dept. of Midwifery and Nursing, Faculty of Midwifery and Nursing, Zanjan University of Medical Sciences, Zanjan, Iran Email: r.kharaghani@yahoo.com

ABSTRACT

Background & Objective: Regional differences exist in the prevalence of birth defects. This study was undertaken to determine the prevalence and related factors with birth defects in Zanjan, Iran.

Materials & Methods: This descriptive analytic study was performed in Zanjan province during 2015–2016. Data included 41265 child births, which were extracted from the Iranian Mother and Newborn (IMAN) web system report of the Zanjan province hospitals (country electronic childbirth register system). Data was analyzed using descriptive, uni-variate, and multi-variate logistic regression tests.

Results: The prevalence of birth defects in Zanjan was 0.7%. Gestational age (odds ratio [OR]: 0.917, 95% CI: 0.869–0.967, *P*=0.002) and birth weight (OR=0.999, 95% CI: 0.999 – 1.000, *P*< 0.001) reduced the chance of birth defects, while consanguineous marriage of parents (OR: 1.745, CI 95%: 1.298–2.347, *P*<0.001), and mother's doctoral degree increased its prevalence (OR: 3.928, 95% CI: 1.058–14.584, *P*=0.041).

Conclusion: It seems that premarital counseling, screening tests before and during pregnancy, and education, especially for being pregnant in appropriate age and conditions, could be the suitable approaches for reducing birth defects.

Keywords: Congenital abnormalities, Prevalence, Risk factors, Iran

Introduction

Birth defects form by intrinsic, extrinsic or both pathologic processes and result in single or multiple structural, functional, or biochemical–molecular defects. Morphological abnormalities form by a structural, defect or abnormal formation of a tissue or an organ and functional abnormalities form by, cellular or enzymatic defects in the uterus. These abnormalities are diagnosed during prenatal period, during or after birth (during infancy) **(1-3)**. Birth defects are of the major causes of children's mortality. According to the global burden of disease study of the World Health Organization (WHO), 17% to 42% of infants' mortality occur due to the birth defects. Also, 77% of children with birth defects are born alive, but have major disabilities that require extensive treatment and rehabilitation **(4, 5)** revealed birth defects are one of the causes of Years of Life Lost (YLL) in Iran. Most birth defects have unknown and multifactorial etiologies, as predisposing genetic characteristics, along with environmental factors **(6)**. Thus, regional differences may play an important role in shaping patterns of birth defects and wide epidemiologic studies seem necessary to determine the prevalence and related factors with congenital abnormalities.

Significant differences are observed in the prevalence of birth defects in various populations of the world. The prevalence of birth defects in the Erbil is reported 3.06% **(7)**, in China 1.9% **(8)**, Lebanon 2.4% **(9)**, Saudi Arabia 5.2% **(10)**, India 1.2% **(11)**, and Turkey 2.9% **(12)**. In Iran, there are very limited studies on the prevalence of birth defects. A systematic review and meta–analysis reported the overall prevalence of birth defects in Iran was 2.3% **(13)**. Identifying the effective factors in the occurrence of birth defects can help reduce mortality and morbidity rates, promote health indicators of children and infants, and achieve a healthier and more efficient community. Based on the researcher's reviews and systematic studies on the prevalence of birth defects in Iran **(13, 14)**, only one study has been carried out in Zanjan; reported a high prevalence of nervous system defects in 2005 in Zanjan **(15)**. The main objective of this study was to determine the prevalence and related factors in province (2015-2016) in order to identify the best strategies for prevention.

Materials and Methods

This descriptive–analytic study included 41265 live or dead births with a gestational age of >22 weeks in Zanjan province, recorded in Iranian Mother and Newborn

(IMAN) system during 2015–2016. The IMAN is a web-based system for childbirth registration information in Iran. Registration of childbirth information is done by all Iranian hospitals in this system. All the birth data, related to 10 maternity hospital centers, including private, public, and social security hospitals in Zanjan city and its suburbs, including Abhar, Khorram–Darreh, Tarom, Mahneshan, Iijrod, Khodabandeh, and Soltanieh, as well as neonates born out of the hospital, like on the way, at home, and at rural birth centers were recorded. IMAN system is an important source for collection and evaluation of maternal and newborn health status in the country. For gathering data in the whole country, standard forms of the Iranian Ministry of Health and Medical Education Office are used. These forms completed by trained midwives and usually registered in the IMAN system by the one trained midwife. The IMAN data were matched with the provincial birth statistics, reported by the provincial civil registration office, for confirming the full coverage of data. These data included maternal characteristics, demographic data, infants' characteristics, and characteristics of stillbirth or dead neonates. This study was part of a protocol of the study which was approved by the Ethics Committee of Zanjan University of Medical Sciences by grant number of ZUMS.REC.1395.56.

Neonatal abnormalities are recorded in this system, based on the report of the midwife, obstetrician or gynecologist, when the newborn has visible abnormalities or positive signs in routine ultrasound report or genetics screening tests during pregnancy. To analyze the gathering data, they were described by mean, Standard Deviation (SD), frequency, and percentage. At first, the total newborns number with birth defects were extracted. Considering that some newborns had several birth defects, in order to check the kind, the birth defects, data was analyzed separately from the number of birth defects.

Then, for the analytic assessment, uni-variate and multi-variate logistic regression tests were used to determine the relationship between independent variables, using SPSS 16 (IBM Inc. Chicago, IL, USA). Multivariate logistic regression was performed by backward stepwise selection method. Variables that entered the final regression models included maternal education, parity, number of abortions, chronic hypertension, preeclampsia, neonates' sex, gestational age, birth weight, and consanguineous marriage of parents. The signify-cance level was P-value<0.05.

Results

The most common birth defect was related to musculoskeletal abnormalities (43.6%), followed by genitourinary and renal abnormalities (15.7%), and undefined (15.1%). Abnormalities of the eyes, ears, heart and vessels, Down syndrome, and chromosomal abnormalities had each a prevalence of 5.2% of the total abnormalities (Table 1). Of 41265 neonates born during 2015–2016 in Zanjan, 305 had abnormalities, resulting in the prevalence of birth defects at 0.6 to 0.7%. The mean age of mothers was 27.7 years. Most mothers had a diploma education (32.4%). In 11.4% of cases, parents had a consanguineous marriage (Table 2). Table 2 shows that based on uni-variate logistic regression, gestational age, birth weight, parental consanguineous marriage, preeclampsia or eclampsia, and maternal educational level had significant association with abnormalities (*P*s<0.05) (Table 2). Based on multi-variate logistic regression analysis, after adjustment for variables of the number of pregnancies, abortions, chronic hypertension, preeclampsia or eclampsia, and neonate's sex, the Odds Ratio (OR) of abnormalities declined 0.917 per week of gestational age (95% CI: 0.869–0.967, and *P* =0.002) and 0.999 per gram of birth weight (95% CI: 0.999–1.000, *P*<0.001). The consanguinity marriage between parents increased the risk of abnormalities 1.745-fold (95% CI: 1.298 – 2.347, and *P*<0.001). Abnormalities increased in women with doctoral educational level at 3.928 folds (95% CI: 1.058–14.584, and *P*=0.041) (Table 3).

Table 1. Frequency of birth defects in Zanjan province during 2015-2016

Birth defect type	Number (N = 305) [a]	Percent
Neural tube defects	20	6.5
Other anomalies of the nervous system	15	4.9
Genital, urinary and kidney	48	15.7
Cleft palate / cleft lip	21	6.8
Cardiovascular	16	5.2
Musculoskeletal	133	43.6
Digestive	21	6.8
Eyes and ears	16	5.2
Face and neck	32	10.4
Down syndrome and chromosomal abnormalities	16	5.2
Other not defined anomalies	46	15.1

Table 2. Test-retest reliability of the participation dimensions for each areas of occupations (N= 55)

Variable	Number	Percent	Odds Ratio	CI %95	P-value
Mothers age*	27.7	6.1	1.007	0.989, 1.026	0.456
Mothers education	1274	3.1	1	-	-
Illiterate	9149	22.2	0.804	0.454, 1.422	0.453
Elementary School	9609	23.3	0.547	0.304, 0.983	0.044
Guidance and High School	13380	32.4	0.630	0.358, 1.108	0.109
Diploma	7521	3.1	0.627	0.346, 1.134	0.122
University	80	0,2	3.506	0.987, 12.461	0.052
PHD	1274	3.1	1	-	-
Others	252	0.6	0.514	1.452, 4.447	0.514
Consanguineous Marriage (yes)	4702	11.4	1.797	1.345, 2.400	<0.001
Place of Residence (rural)	16195	39.2	0.990	0.786, 1.248	0.934
Insurance					
Urban Health Insurance	1934	4,7	0.720	0.336, 1.545	-
Rural Health Insurance	7058	17,1	0.631	0.334, 1.192	0.399
Social Security Insurance	11202	27,1	0.621	0.337, 1.146	0.156
Others*	2602	6,3	0.822	0.408, 1.658	0.128
Imam Khomeini Insurance and without Insurance	1118	4.0	1	-	0.584
Gravidity*	2.0	1.0	1.100	0.999, 1.211	0.053
Parity*	o.8	0.9	1.089	0.968, 1.226	0.154
Abortion*	0.2	0.5	1.169	0.965, 1.415	0.110
Gestational Age*	38.4	2.0	0.817	0.798, 0.836	<0.001
Birth Weight*	3144.7	531.5	0.999	0.999, 0.999	<0.001
Newborn Sex (boy)	21165	51.3	1.152	0.917, 1.447	0.223
Mother's Underlying Illness	479	1.1	2,015	0.947, 4.286	0.069
Chronic Hypertension	1072	2.6	1.814	1.058, 3.112	0.031
Preeclampsia or Eclampsia	1038	2.5	1. 454	0.794, 2.664	0.225
Diabetes	1373	3.3	1.191	0.667, 2.127	0.553
Thyroid Disease	255	0.6	0	0	0.995
Heart Disease	198	0.4	0	0	0.995
Anemia	9	0.0	0	0	0.999
HIV or VDRL Positive Test	1099	2.6	0	0	1
Others	0	0	1.241	0.428, 1.518	0.504
Mother's Underlying Illness	479	1.1	2,015	0.947, 4.286	0.069

* mean ± Standard deviation
a: Armed Forces, Oil, and Bank employer-based Insurances

Table 3. Factors related to birth defects based on multi-variate regression

Variable	Odds Ratio*	%95 CI	P-value
Gestational age	0.917	0.869, 0.967	0.002
Birth weight	0.999	0.999, 1.000	<0.001
Consanguineous marriage (yes)	1.745	1.298, 2.347	<0.001
Mothers education			
Illiterate	1	-	-
Elementary school	0.918	0.515, 1.636	0.772
Guidance and high school	0.642	0.354, 1.162	0.143
Diploma	0.741	0.417, 1.315	0.305
University	0.757	0.414, 1.383	0.366
PHD	3.928	1.058, 14.584	0.041
Others	1.963	0.630, 6.116	0.245

* Adjusted for maternal age, mother's education, type of insurance, place of residence, gravida, abortion, mother's underlying illness, forceps or vacuum delivery, and sex

Discussion

The prevalence of birth defects in Zanjan- Iran was 0.7% with the highest prevalence for musculoskeletal and genito–urinary abnormalities. There was a significant association between birth defect and gestational age, birth weight, consanguineous marriage of parents, and maternal educational level (All *P*s<0.05).

Although, the prevalence of abnormalities is different in the world, its prevalence in developing countries is similar to developed countries. The prevalence of abnormalities in Iran is reported at about 2.3% with 95% CI of 1.8 to 2.9%. The prevalence of abnormalities in this study was less than the rate of the entire country, but close to the prevalence of 1.12% reported in Tabriz **(16)**, 0.82% in Ardabil **(17)**, and 0.01% in Urmia **(18)**. The difference in the prevalence of birth defects can be due to the difference in genetic, cultural, racial factors, socio–economic status, diagnostic methods, and failure to register. The prevalence of birth defects may be underestimated in this study.

The highest prevalence of birth defects in the present study were musculoskeletal, followed by genito–urinary abnormalities. These results are consistent with other studies conducted in other cities in Iran **(13, 17, 19, 20)**. It may be because of the fact that these abnormalities are visible after birth. Accurate diagnosis of congenital abnormalities, depending on the type of abnormality, may besides physical examination require ultrasound before birth, echocardiography, etc. But, the results of the present study are only based on documents registered in IMAN system, registering cases based on the examination of the birth team and pediatricians. Ajibola *et al.* (2017) showed in a longitudinal study that 40% of birth defects were not recognizable at birth and were discovered in subsequent Follow–ups **(21)**. It is suggested that the prevalence of birth defects in infancy and childhood be assessed with appropriate diagnostic methods and reported in an appropriate surveillance system.

Gestational age and birth weight had significant relationship with birth defects that are consistent with other studies in this area **(9, 19, 22)**. It seems that fetuses with birth defects grow less and are born sooner than other babies. Similar to previous studies **(9, 17)**. Considering that growth and developmental disorders are more common in birth defects, there is a significant relationship between the prevalence of birth defects with low birth weight and gestational age. Parents with consanguineous marriage were about twice more likely than other parents to have a child with birth defect. In Iran, 37.4% of marriages are consanguineous **(22)**. Consanguineous marriage plays a vital role in expression of hidden genes, which can cause genetic abnormalities. Saki–Malehi *et al.* (2017) showed in Iran those women who had consanguineous marriages were 4.4 times more likely to give birth to infants with microcephaly **(23)**. Therefore, the role of premarital counseling, especially in people with a consanguineous marriage, should be considered more than ever. For preventing birth of neonates with abnormality, factors like premarital counseling, preconception counseling, and screening during pregnancy, especially in consanguineous marriages should be considered and their efficiency in the prevention of abnormalities should be evaluated.

The birth defects correlated with doctoral degree of maternal education in women. In multi-variate regression, abnormalities were significantly correlated with maternal education, so that increased years of education, compared to illiterates, decreased the abnormalities sharply, while abnormalities increased in women with doctoral degree. The association between education and abnormalities has been shown previously **(24)**. It is expected that increased awareness of people with higher education decrease the abnormalities, despite this, abnormalities increased in

women who had a doctorate degree that is alarming for the society and may reflect the effects of age. It seems that delayed conception because of education or any other reason can increase the risk of abnormalities, so serious warning should be given to couples in terms of appropriate age and conditions for conception. Public education about appropriate age for fertility can be effective.

Conclusion

The prevalence of birth defects in this study was lower than the country rates. Health planning and policy–making to control the risk factors and identifying high–risk people, like parent with consanguineous marriage, could lead to further decline in congenital abnormalities. Also, premarital counseling for appropriate ages and conditions of conception, preconception counseling, and screening during pregnancy may reduce congenital abnormalities. In a general assessment, the findings of this study are considerable because of registration of all births in the province during two consecutive years. But this study was conducted based on the data recorded in IMAN system, according to the reports of the midwife, obstetrician or pediatrician, which could be a limitation of this study.

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Conflict of Interest:

The authors declared no conflict of interest regarding to this paper.

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