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Original article

The study of Maternal Mortality Rate and its Causes among Iranian Women in 2014-2015

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Abstract

Background: In developing countries, maternal mortality ratio (MMR) is regarded as a key indicator of socioeconomic development and health. The aim of the present study was to investigate maternal mortality reported in Iran as well as its epidemiologic and etiologic characteristics.

Methods: This cross-sectional study reviewed the medical files of maternal death cases, between March 10, 2014 and March 10, 2015, obtained from the Iranian Ministry of Health and Medical Education. The data were evaluated using a specially designed questionnaire and included the demographic data, cause of the death, risk factors, patient symptoms, and laboratory results for all cases of maternal death. The MMR was calculated by dividing all the recorded cases of maternal deaths in one full year of Iranian calendar by the total recorded live births in the same time-period.

Results: According to maternal mortality reported in Iran, 250 maternal deaths occurred in one year in Iran. The majority of cases (74.8%) were in 18-35-year-old age category. The total MMR for this time period was 16.3 per 100.000 live births. The most common causes of maternal death were hemorrhage in 87 cases (34.8%), hypertension- preeclampsia in 60 cases (24%), and heart diseases in 47 cases (19%). Provinces of West Azerbaijan, Qazvin, Markazi, Kohgiluyeh and Boyer-Ahmad, Bushehr, Hormozgan and Sistan and Baluchestan were high risk provinces with a maternal mortality rate of above 20 per 100.000 live births.

Conclusion: Although Iran has had a successful track in reducing its maternal mortality rate, there is still a recognizable disparity in MMR between and among provinces, which should be addressed. Also, preventable conditions like bleeding and hypertension still play a significant role in causing maternal mortality in Iran and need more attention.

Keywords: Maternal Mortalities, Epidemiologic study characteristics, Causalities, Iran

Introduction

The maternal mortality ratio (MMR), which is the number of maternal deaths per 100,000 live births, is an important public health indicator reflecting both the quality of health care services and the status of women in the society (1). According to the tenth revision of the International Classification of Diseases (ICD-10), maternal mortality is defined as the death of a woman while pregnant, or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management (direct or indirect obstetric death), but not from accidental or incidental causes. [1]. The importance of reducing the MMR is highlighted by choosing it as one of the millennium development goals of the United Nations (2).

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Although MMR had dropped by about 38% worldwide, from 342 deaths to 211 deaths per 100,000 live births between 2000 and 2017, about 295,000 women died due to pregnancy and childbirth complications in 2017. This indicates that despite a downward global trend in maternal mortality, most countries are still behind their MDG targets by 2015 (3,4). This reduction in maternal mortality rate has also been less significant in developing countries with black race showing 2 to 6 times maternal mortality rate compared to the white race, and Sub-Saharan Africa and Southern Asia accounting for approximately 86% of the estimated global maternal deaths in 2017 (3, 5).

Iran has had a successful track in reducing its MMR in last several decades (6). Among ninety-five countries with a relatively high MMR of over 100 in 1990, the greatest relative reduction in MMR occurred in nine countries (Bhutan, Cambodia, Cabo Verde, the Islamic Republic of Iran, the Lao People's Democratic Republic, Maldives, Mongolia, Rwanda and Timor-Leste). [6] Iran has seen a reduction from 123 in 1990 to 17 in 2015, indicating more than 85% reduction rate (7-10).

This dramatic reduction in MMR might be attributed to many factors including improved nationwide accessibility to health services, improved hygiene and nutrition, and focused investments in area of health policies and systems (11). Bayati et al. studied the effective factors on maternal mortality in Eastern Mediterranean Region in 2016 and found that improved income, increased resources allocated to the health sector, improved delivery services in primary care centers, and higher level of women's education and knowledge are the key factors in the reduction of maternal mortality rate (12).

Despite this considerable achievement, the current MMR in Iran as well as its main causes and risk factors are still worthy of consideration, since there is evidence suggesting that the preventable causes are still a major factor for maternal death in Iran (8). In our search of the literature, we found two systematic reviews studying the causes of maternal mortality in Iran conducted in the last five years (8, 13). In the first systematic review by Dadipoor et al. (2017), nineteen previous articles were reviewed and the authors reported that direct causes accounted for 73.85% of all cases of maternal mortality (13). [13] The main direct causes were bleeding (34.89%), eclampsia (16.97%), pregnancy related infection (9.17%), and embolism (7.79%). Among the indirect causes of mortality, underlying diseases, excluding heart diseases, ranked first (6.33%), while heart-related diseases (4.08%) ranked second. Overall, the foremost rate of mortality was induced by direct causes (10). In the second systematic review conducted by Zalvand et al. (2019), twenty-four previous studies were evaluated (8). The authors reported that 69.9% of maternal mortality was caused by direct causes including bleeding, accounting for 30.7% of the total deaths followed by hypertensive disorders (17.3%) and pregnancy related infection (7%) (8).

As noted by Zalvand et al., most existing literature regarding the maternal mortality rate and its causes in Iran suffer from relying on limited data from specific areas, including particular groups of women, or limited period of the study (8). To address these shortcomings, we decided to undertake the present study by including all maternal mortalities reported in Iran in year 2014 (from March 10, 2014 until March 10, 2015) to achieve a better understanding of its epidemiology in different parts of the country and its etiologic characteristics.

Materials & Methods

This cross-sectional study investigated the maternal death cases in Iran between March 10, 2014 and March 10, 2015. The study was approved by the ethics committee of Shahid Beheshti University of Medical Sciences (Ethic ID: IR.SMBU.RETECH.REC.1396.186). Medical files of maternal death cases were received from the Maternal Health Department of the Iranian Ministry of Health and Medical Education with the commitment to maintain confidentiality. The data for each maternal mortality case was evaluated using a specially designed questionnaire including the demographic data, causes of death, risk factors, patient symptoms, and laboratory examinations results. In developing the questionnaire, four main causes of maternal death in scientific texts including bleeding, blood pressure, infection and embolism were emphasized. To perform data extraction from patients' files, first a midwife was trained to review the files and filled out 10 questionnaires with the supervision of one of the researchers and then the questionnaires were completed and randomly monitored by the same

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researcher for quality control. We divided the provinces into three groups based on their MMR: the first group or low risk provinces had a MMR of below 10 per 100,000 live births, the second group or medium risk provinces had a MMR of between 10 and 20, and the third group of high risk provinces had an MMR of more than 20 per 100,000 live births. Patients were considered as high-risk or low risk pregnancies according to the mother and child friendly country protocols.

SPSS version 21 (Armonk, NY: IBM Corp.) was used for statistical analysis. P values less than 0.05 were considered significant.

Results

Table 1 shows the demographic findings of maternal mortality cases in Iran from March 2014 until March 2015. In total, 250 cases of maternal mortality with the mean age of 31±3 were evaluated. As observed in table one, a majority of cases (187 cases, 74.8) were in 18-35 year old age category. Also, the majority of cases were in 2-4 gravid group. A high rate of mortality happened after cesarean section (109 cases, 43.6%) and the most common past history of disease recorded was pulmonary distress observed in 101 cases (40.4%). One hundred and forty five (59.6%) cases were high risk pregnancy cases, and the most common cause of maternal mortality was hemorrhage observed in 87 cases (34.8%) followed by hypertension- preeclampsia in 60 cases (24%), heart diseases in 47 cases (19%), infection in 28 cases (11.2%), and thromboembolism in 28 cases (11.2%).

Table 2 shows the maternal MMR in Iran in the present study (From March 2014 till March 2015) in total and divided by provinces. We categorized the provinces into three groups based on their MMR: the first group or low risk provinces had a MMR of below 10 per 100,000 live births, the second group or medium risk provinces had a MMR of between 10 and 20 and the third group of high risk provinces had an MMR of more than 20 per 100,000 live births. Figure 1 show these provinces with the color red indicating high risk provinces, the color yellow indicating provinces with the moderate risk, and the color green indicating provinces with the low risk of maternal mortality.

Based on this map, provinces of West Azerbaijan, Qazvin, Markazi, Kohgiluyeh and Boyer-Ahmad, Bushehr, Hormozgan and Sistan and Baluchestan were high risk provinces with the MMR of above 20.

Table 1. Demographic data of maternal mortality cases in Iran 2014-2015

Demographic Data	Category	Number (Percent)
Age (Mean±SD)		31±3
Age	<18	2(0.8)
	18-35	187(74.8)
	>35	61(24.4)
Parity	First Pregnancy	29(11.6)
	Gravid 2-4	180(72)
	Gravid 5 or more	41(16.4)
Time of MMR*	Before Delivery	60(24)
	After Cesarean	109 (43.6)
	After Normal Vaginal Delivery	69 (27.6)
	After Curettage	6 (2.4)
	After Ectopic Pregnancy	6 (2.4)
Gestational age (Mean ±SD)		26.9±3.1
Past History of Disease	Preeclampsia	5 (2.0)
	Addiction	10(4.0)
	History of chronic hypertension	7(2.7)
	Drug Usage	43(17.2)
	Bleeding	59 (23.6)
	Pulmonary disease	8 (3.2)
	Diabetes	5 (2.0)
	Hypothyroidism	10 (4.0)
	Anemia	43 (17.2)
	Pulmonary Distress	101 (40.4)
	Heart Disease	19 (7.6)
	Palpitation	25 (10.0)
	Convulsion	55 (22.0)
Category of pregnancy	High risk Pregnancy	149 (59.6)
	Low risk Pregnancy	101 (40.4)
Cause of Dead	Hemorrhage	87 (34.8)
	Hypertension-Preeclampsia	60 (24.0)
	Suspected preeclampsia	19 (7.6)
	Infection	28 (11.2)
	Heart Disease	47 (19.0)
	Thromboembolism	28 (11.2)

*MMR: Maternal Mortality rate

Table 2. Maternal mortality ratio (MMR) in total and divided by provinces

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Province	Maternal death	Total Birth	MMR*
Tehran	26	196957	13.2
Khorasan Razavi	20	149235	13.4
Esfahan	16	93104	19.2
Fars	8	87264	9.1
Khozestan	17	112610	15
East Azerbaijan	14	72489	19.3
West Azerbaijan	14	69491	20.1
Mazandaran	6	46294	12.9
Kerman	9	63688	13.2
Sistan & Baluchestan	35	100183	34.9
Gilan	2	32456	6.2
Alborz	6	39744	15.1
Kermanshah	6	36112	16.6
Golestan	5	42499	11.7
Hamadan	4	33638	11.9
Lorestan	3	39388	7.6
Hormozgan	12	39644	30
Kordestan	4	30997	12.9
Markazi	5	22705	22
Ardabil	2	25568	7.8
Ghazvin	7	22718	31
Qom	3	25229	11.9
Yazd	3	24415	12.3
Bushehr	5	21465	23.3
Zanjan	1	20623	4.8
Chaharmahal and Bakhtiari	3	20874	14.4
North Khhorasan	3	19538	15.3
South Khorasan	2	18212	11
Kohgiluyeh & Boyer-Ahmad	4	15867	25.2
Semnan	1	10502	9.5
Ilam	1	10853	9.2
Unknown	3	-	-
Total	250	1534362	16.3

West Azer: West Azerbaijan; Ham: Hamadan; Alb: Alborz; Chah: Chaharmahal and Bakhtiari; Kohg: Kohgiluyeh and Boyer-Ahmad; Bush: Bushehr

Figure 1. The Maternal mortality risk in Iran provinces with color red indicating high risk provinces, color yellow indicating provinces with moderate risk and color green indicating provinces with low risk of maternal mortality

Table 3. Estimated Maternal mortality ratio (MMR) in twenty countries in 2015 by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division (10).

Country	MMR	Country	MMR
South Sudan	1110	Turkey	19
Somalia	855	Russia	18
Afghanistan	701	USA*	18
India	158	**Iran**	**17**
Pakistan	154	Saudi Arabia	17
Iraq	83	Canada	11
Libya	70	France	8
Egypt	39	German	5
China	30	Japan	5
Azerbaijan	27	Sweden	4

* USA:United States of America

Discussion

In the present study, the maternal mortality rate in Iran in 2014 (from March 10, 2014 until March 10,

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2015) was studied to achieve a better understanding of its epidemiology in different parts of the country and its etiologic characteristics.

Our results indicated that the MMR in this time period for the whole country was 16.3 in 100,000 live births, but the distribution of maternal mortality in different provinces indicated a wide range, with the least maternal mortality rate of 4.8 in Zanjan Province and the highest MMR of 34.9 in Sistan and Baluchestan. Based on our findings, provinces of West Azerbaijan, Qazvin, Markazi, Kohgiluyeh and Boyer-Ahmad, Bushehr, Hormozgan and Sistan and Baluchestan were high risk provinces with a MMR of above 20 deaths per 100,00 live births. This indicates that several provinces are still facing a relatively high MMR compared to the national average and the average in developed countries. These provinces are still regarded as high-risk areas. This high difference in MMR in different provinces might be explained by several factors including the socioeconomic, educational and the state of health care system in different provinces in Iran. In a study by Tajik et al., the relationship between socioeconomic factors, inequity and MMR was investigated between 2004 and 2006 among provinces in Iran. [14] Similar to our findings, they reported a much higher MMR in some provinces including the highest rate in Sistan and Baluchestan (14). They also reported that the association between income inequality and MMR in different provinces was not significant, but the adults' level of education and MMR were significantly associated (14). Similarly, Zalvand et al., in a systematic review of MMR rate in Iran, found that the socio-economic status of mothers can play a major role in the rate of MMR. [8] Moradi et al. studied the MMR in Hormozgan Province from 2007 until 2011 and reported that the MMR was higher than the national average (15). They suggested that increasing coverage of prenatal, pregnancy, postnatal care, and improvement of the quality of the family planning can be effective in reducing the high rate of maternal mortality rate in this province. Gholampoor et al. investigated the effect of socioeconomic factors like the total fertility, number of hospital beds, number of midwifes, number of physicians and urbanization on MMR over the period between 2008 and 2012 (16). They reported a relation between per capita income, access to health resources and urbanization and MMR (16).

Our results indicated that the most common cause of maternal mortality was hemorrhage observed in 87 cases (34.8%) followed by hypertension (preeclampsia and eclampsia) in 60 cases (24%), heart diseases in 47 cases (19%), infection in 28 cases (11.2%), and thromboembolism in 28 cases (11.2%). Similar to our findings, Zalvand et al., in their systemic review published in 2019, identified the hemorrhage (30.7%) and hypertensive disorders (17.1%) and circulatory system diseases (8.1%) as the most common causes of maternal mortality. In another systematic review conducted by Dadipoor et al. in 2017, bleeding, eclampsia, and sepsis were reported as the most common causes of MMR (13). In a study by Maharlouei et al. in Fars province, bleeding accounted for 35.6% of recorded causes of death, followed by postpartum sepsis (14.9%), eclampsia (10.9%) and pulmonary emboli (6.9%) (17). In another study by Karimzaei et al. in Iranshahr (Southeast of Iran), the most common causes of MMR among the study individuals were hemorrhage (38.2%), and eclampsia and preeclampsia (26.5%) (18).

Eftekhar-Vaghefi et al., in their study of MMR in Kerman province, reported preeclampsia/eclampsia in 15.6% of cases, postpartum hemorrhage in 12.5% of cases, and deep phlebothrombosis in 10.9% of cases (19). Farzianpour et al., in their study of MMR in Tehran province, reported that the most common causes of death were preeclampsia and eclampsia (23%), bleeding (20.4%), and Illegal abortion (1.8%) (20).

The results of the present study show a wide disparity between provinces in Iran with regard to MMR. Although Iran has had a successful track in reducing its MMR in the past several decades, this disparity and the high rate of MMR in some provinces show the need for more emphasis on reducing the MMR in those provinces with a higher rate of MMR. We think that a centralized and concentrated effort should be devised to further study the causes of this disparity and achieve the goal of reducing the MMR in these highly affected provinces. Also, our results show that preventable conditions like bleeding and hypertension can still lead to the highest number of maternal mortalities in Iran. By reducing these

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preventable conditions, Iran might achieve its goal of reducing the MMR to level of developed countries in a shorter period of time.

Conclusion

Despite the fact that Iran has had a successful track in reducing its maternal mortality rate, there is still a noticeable disparity in MMR between provinces, which should be meticulously addressed. Also, preventable conditions like bleeding and hypertension may still play a significant role in causing maternal mortality in Iran, which need more heed.

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Conflicts of Interest

The authors have no conflict of interest with the subject matter of the present study.

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