

# Exploring maternal mortality in relation to socioeconomic factors in Iran

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**INTRODUCTION** Maternal mortality is a tragic death, and is perceived as a sensitive indicator of the socioeconomic status and healthcare services in a given country. In this study, the relationship between maternal deaths and factors such as socioeconomic development and the proportion of medical professionals in Iran was examined.

**METHODS** This was an ecological study, where three main groups of data based on different provinces were applied. Data included maternal mortality ratio, the proportion of medical professionals and socioeconomic variables, such as urban residency, unemployment and literacy. Data were obtained from various sources, including census returns, the Family Unit at the Ministry of Health and Medical Education, Tehran and the Iran Medical Council. Data were analysed using univariate and multivariate methodologies.

**RESULTS** Multivariate analysis showed a significant inverse relationship between maternal deaths and variables of male literacy ( $p < 0.001$ ) and unemployment ( $p = 0.04$ ). A marginally significant association was also found between maternal deaths and the proportion of midwives ( $p = 0.09$ ).

**CONCLUSION** Our findings underscore the role of literacy, particularly male literacy, in the prevention of maternal deaths. Iran, as a male-dominated society, could benefit from targeting men for training programmes to enhance the health of their families, and ultimately, that of the society. As economic status does play a role in maternal deaths, there is a need to strengthen the financial situation of families. The number of skilled medical personnel available in a population also plays a key role in reducing maternal deaths.

Keywords: literacy, maternal mortality, women's status  
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## INTRODUCTION

Maternal mortality is the tragic death of a woman due to complications during pregnancy, delivery or within 42 days of delivery.<sup>(1,2)</sup> A range of factors, including socioeconomic status and the quality and quantity of healthcare, have been implicated in maternal mortality.<sup>(3,4)</sup> As a majority of maternal deaths are caused by complications requiring prompt medical intervention that is unavailable, the role of skilled birth attendants is an important factor in the reduction of maternal deaths.<sup>(5)</sup>

A multitude of determinants influence the developmental status of a society. In recent years, maternal deaths have taken centre stage in international deliberations, drawing attention away from issues such as human rights and developmental issues. As the United Nations Millennium Development Goals aims to broadly increase development, human rights and democracy, maternal mortality has now become an indicator of whether these goals are being achieved by countries.<sup>(6)</sup> One of the variables that determines maternal mortality is urbanisation, which is defined as a population residing in an urban area. Urbanisation is not only a factor but also an indicator of development in general, as social and economic structural changes are triggered by the phenomenon.<sup>(7)</sup> These changes in turn simultaneously invoke a further strengthening of the society's infrastructure.<sup>(8)</sup> Economics plays an important role too, as the lifetime risk of maternal deaths

is much higher in poor countries (1 in 16) when compared to that in richer nations (1 in 2,800).<sup>(9)</sup> This may be due to poverty, which not only influences a woman's utilisation of health facilities but also has indirect effects on her general health by way of malnutrition, which is more common in families with low incomes.<sup>(4)</sup>

Another socioeconomic aspect determining women's health is the status accorded to women in society as a whole. Women's status can be described as the power of women in a community in comparison with that of men.<sup>(10)</sup> It should be noted that this definition does not account for absolute power but rather the proportion of women's power vis-à-vis men's power.<sup>(10)</sup> Decision making is an important indicator of women's status, and factors such as education and employment help to empower women.<sup>(10,11)</sup> However, these may not be the only factors that specify the power of women in decision making, as issues such as value systems and culture might also have important roles to play in enabling women to make decisions.<sup>(12)</sup> At least one study has shown a positive relationship between the level of education in men and their acceptance of a woman's right to make decisions.<sup>(13)</sup> Women with higher decision-making powers are likely to be more mobile and avail more of health services such as antenatal care, which in turn could influence the number of maternal mortalities in such societies.<sup>(14)</sup>

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Iran is a low- to middle-income country in the Middle East that lies to the southwest of Asia. There has been considerable improvement in the overall healthcare in Iran in recent years with regard to major health concerns. However, the speed of such progress has not been the same in all of its provinces.<sup>(15)</sup> From an economic point of view, the rates of economic growth and investment in the country have remained static, with an accompanying high unemployment rate, so that nearly 15% to 25% of its population are living in poverty.<sup>(16)</sup> Despite key policies to improve social equity, there is a considerable gap in income and wealth distribution between the poor and the affluent.<sup>(17)</sup> The poor economic situation in Iran has widely been attributed to its eight-year-long war with Iraq and the economic sanctions effected by the United States.<sup>(17)</sup>

As the effects of socioeconomic factors on health have been reported to vary in different countries and ethnic groups,<sup>(18)</sup> it is important for each country to assess this relationship within its own population. Although the literature on maternal deaths in Iran is limited, some studies have been conducted in the country's individual provinces, with reports examining the relationship between socioeconomic status, skilled birth attendance and maternal mortality in an Iranian population.<sup>(19–22)</sup> Our study aimed to explore the relationship between maternal deaths with respect to socioeconomic factors and the proportion of medical personnel available in the local population.

## METHODS

This was an ecological study, where maternal death was treated as a multidimensional indicator. Relevant data on socioeconomic status and health services were obtained from various sources based in different provinces of the country, although data extraction proved to be a bottleneck and was time consuming. Data obtained were categorised into three main groups – maternal mortality, socioeconomic status and medical professionals based in the various provinces. As information on provincial maternal deaths and the number of medical personnel was not available on the Internet, the authors contacted and coordinated with the Family Unit at the Kerman University of Medical Sciences at the provincial level for information on maternal mortality. The unit, in turn, followed up on relevant statistics through contacts with the Family Unit at the Ministry of Health and Medical Education, Tehran, at the national level. Data on maternal deaths from the various provinces were obtained for the period 2001–2008. Data on medical professionals, including the number of midwives, general practitioners and specialists of all branches working in Iran, were obtained from the Iran Medical Council. Socioeconomic data were collated from the results of the 2006 census in Iran. The main socioeconomic variables were unemployment, urbanisation and literacy in the different provinces.

Data were then prepared for analysis. The proportion of medical personnel per 10,000 citizens was calculated for each province based on the population of Iran in 2006. The average number of maternal deaths was estimated for each province

**Table 1. Maternal deaths and its determinants in Iran.**

Determinant	Mean ± SD (range)
<b>Average maternal deaths per 100,000 live births</b>	25.80 ± 8.542 (11.99–53.67)
<b>Literacy</b>	
Total	0.83 ± 0.04 (0.68–0.91)
Female	0.78 ± 0.05 (0.61–0.89)
Male	0.87 ± 0.03 (0.74–0.94)
<b>Unemployment</b>	11.36 ± 2.83 (5.1–18)
<b>Urban residency (%)</b>	0.63 ± 0.12 (0.47–0.94)
<b>No. of midwives per 10,000 citizens</b>	3.31 ± 1.64 (1.008–7.65)
<b>No. of general practitioners per 10,000 citizens</b>	8.43 ± 3.65 (4.4–21.73)
<b>No. of specialists per 10,000 citizens</b>	2.53 ± 2.36 (0.64–13.64)

SD: standard deviation

from the number of provincial maternal deaths reported between 2001 and 2008. Data was also amended to account for changes to the provincial map of Iran. For instance, a province of 2001 was divided into three provinces in 2005. For uniformity of data, the provincial map of 2001, with 28 provinces in the country, was used in our study. Data were analysed using univariate, multivariate and partial correlation methodologies, and using Stata version 11 (StataCorp, College Station, TX, USA). The level of significance was fixed at  $\alpha = 0.05$ .

## RESULTS

The results of the study are presented under three main areas – descriptive, univariate and multivariate analyses. Table I shows the determinants of maternal deaths during the study period, while Table II details the maternal mortality ratios and rates of literacy and urban residency in different provinces of Iran. The mean number of maternal deaths in Iran was 25.80 for every 100,000 live births. Tehran had the least number of maternal deaths (11.98), while Sistan and Baluchestan were at the other end of the spectrum, with a maximum of 53.67 mortalities. Although the average rate of literacy in the total population was 83.00%, the literacy rate was higher in men (0.87) than in women (0.78). The difference in the literacy rates between the two genders was statistically significant ( $p \leq 0.001$ ). On average, 63.00% of the Iranian population lived in urban areas. However, considerable discrepancies were observed among the different provinces. The percentage of urban residency was the lowest in Hormozgan (47.00%) and highest in Qom (93.00%). The mean proportion of midwives per 10,000 citizens was 3.31. Tehran had the highest number of midwives per 10,000 citizens (10.64) in Iran, while the provinces of Kohgiluyeh and Boyer Ahmad showed the lowest numbers (1.21). Sistan and Baluchestan, which had the highest number of maternal deaths among the various provinces, had low urban residency (50%) and literacy (68%) rates. Meanwhile, Tehran, which showed the lowest maternal mortality rates, had among the highest urban residency (91%) and literacy (91%) rates in the country, but its employment rate was not so.

**Table II. Maternal mortality ratios, and literacy and urban residency rates in different provinces of Iran.**

Province	Urban residency	Literacy	Maternal mortality ratio*
Ardebil	0.58	0.80	20.51
Boosher	0.65	0.86	31.50
Chahar Mahal & Bakhtiari	0.51	0.82	18.13
East Azarbayjan	0.66	0.81	18.40
Fars	0.61	0.86	22.22
Gilan	0.53	0.83	20.14
Hamedan	0.57	0.82	22.76
Hormozgan	0.47	0.82	35.84
Kordestan	0.59	0.77	26.13
Lorestan	0.59	0.81	28.85
Markazi	0.68	0.83	24.95
Qom	0.93	0.86	26.57
Semnan	0.74	0.88	24.61
Sistan & Baluchestan	0.49	0.68	53.67
Tehran	0.91	0.91	11.98
West Azarbayjan	0.60	0.77	30.38
Yazd	0.79	0.88	22.80
Zanjan	0.57	0.81	18.92
Ilam	0.60	0.82	29.56
Isfahan	0.83	0.87	17.60
Kerman	0.58	0.82	33.90
Kermanshah	0.66	0.82	26.35
Khozestan	0.67	0.83	26.88
Khorasan	0.55	0.82	23.23
Kohgiluyeh & Boyer Ahmad	0.47	0.81	42.44
Mazandaran	0.53	0.85	15.67

\*Per 100,000 live births

The results of univariate regression analysis revealed that at  $\alpha = 0.05$ , all independent variables, including total literacy ( $p < 0.001$ ), male literacy ( $p = 0.001$ ), female literacy ( $p < 0.001$ ), urban residency ( $p = 0.02$ ), proportion of midwives ( $p = 0.002$ ), proportion of general practitioners ( $p = 0.003$ ) and proportion of specialists ( $p = 0.007$ ), were statistically significant, with the exception of unemployment rate (Table III). In general, the male and female literacy rates, urban residency and proportion of all groups of medical personnel had a negative linear relationship with maternal deaths, indicating an adverse association. On the other hand, the association of maternal mortality and unemployment was positive. The model used checked for residual assumption and no violations from the assumptions were found.

Two models were initially tested for multivariate analysis in our study. In model 1, the main effects of male literacy, urbanisation, unemployment and the proportion of midwives per 10,000 citizens were included. In model 2, the interaction between unemployment and male literacy was added. However, as the difference in the  $R^2$  (model 1: 0.65 vs. model 2: 0.65) and

sum of squares error (SSE; model 1: 682.3 vs. model 2: 683.3) values from these two models was not statistically significant ( $p = 0.86$ ), the interaction between unemployment and male literacy was excluded from the model. There was high correlation among the medical personnel, including the proportion of general practitioners and specialists ( $R = 82\%$ ); midwives and specialists ( $R = 67\%$ ); and midwives and general practitioners ( $R = 62\%$ ). As midwives are directly concerned with maternal health from among these three groups of medical personnel (general practitioners, specialists and midwives), the proportion of midwives per 10,000 citizens was included in the model for multivariate analysis in our study. Similarly, total literacy was excluded from our multivariate model as a high correlation was found between male literacy, total literacy and female literacy ( $R > 90\%$  for each pair).

Based on these findings, the two models for multivariate analysis were amended. The proportion of midwives per 10,000 citizens, urban residency and unemployment were included as variables in both models. Male literacy was only offered to model 1 and female literacy added to only model 2. The results indicated that male literacy ( $p < 0.001$ ) and unemployment ( $p = 0.04$ ) were significant in model 1, while the proportion of midwives per 10,000 citizens was marginally significant ( $p = 0.09$ ). The  $R^2$  of model 1 was 0.65. Female literacy ( $p = 0.02$ ) was significant in model 2, while unemployment ( $p = 0.07$ ) and the proportion of midwives ( $p = 0.09$ ) were marginally significant. The results of the final model used for multivariate analysis is presented in Table IV. As the possibility of a small sample size (28 provinces) limiting the robustness of the findings of multivariate analysis in our study could not be disregarded, the results of multivariate analysis were confirmed using a partial correlation analysis.

## DISCUSSION

Socioeconomic factors play an important role in ensuring safe motherhood. There is considerable literature emphasising the role of female education in achieving maternal safety.<sup>(23)</sup> Educated women are more likely to have better knowledge about the possible problems that may arise during pregnancy and thus more likely to seek immediate professional medical help in case of complication. Another related reason could be that educated women are more likely to live in cities than in villages, and that timely healthcare might be more readily available to women residing in urban areas due to a higher concentration of health facilities in cities than in the rural areas.<sup>(24)</sup> These deductions were highlighted in a study by Hong et al, who found that women in Rwanda who received little education were poor, lived in rural areas and were more likely to give birth at home in the presence of an unskilled attendant.<sup>(25)</sup> Our findings also highlight the roles of literacy in both genders and employment in the prevention of maternal deaths.

Evaluation of maternal mortality from the context of women's status adds another dimension to this discussion. Education and employment of women are important factors in terms of women's status,<sup>(10,11)</sup> as women with the power to choose are more likely

**Table III. Univariate regression analysis of average maternal mortality ratio.**

Determinant	Coefficient	Standardised coefficient	R <sup>2</sup>	Standard error	p-value	Confidence interval
<b>Literacy</b>						
Total	-129.21	-0.65	0.42	-4.36	< 0.001	-190.06 to -8.36
Female	-182.94	-0.71	0.51	34.89	< 0.001	-254.67 to -111.21
Male	-94.66	-0.6	0.36	24.63	0.001	-145.29 to -44.03
<b>Unemployment</b>	0.68	0.21	0.04	0.60	0.27*	-0.56 to 1.958
<b>Urban residency</b>	-29.71	-0.42	0.18	12.36	0.02	-55.11 to -4.31
<b>No. of midwives<sup>†</sup></b>	-2.97	-0.57	0.32	0.83	0.002	-4.69 to -1.24
<b>No. of general practitioners<sup>†</sup></b>	-1.27	-0.54	0.29	0.38	0.003	-2.06 to -0.48
<b>No. of specialists<sup>†</sup></b>	-1.78	-0.49	0.24	0.61	0.007	-3.05 to -0.52

\*p > 0.05 was not statistically significant. †Per 10,000 citizens.

to make decisions on issues relating to their own health as well as that of their families. For instance, Smith et al found a relationship between a child's nutrition and the status of women in families from developing countries.<sup>(10)</sup> In another study from Afghanistan, Sorosh indicated that the low status of women was a key factor affecting maternal deaths.<sup>(26)</sup> Determinants found to be affecting the status of women in the study were education, culture, and economic and policy concerns.<sup>(26)</sup> Likewise, using the dimensions of women's autonomy, Bloom et al found that women who had more freedom in terms of movement and higher education tended to use health facilities more than women with less freedom and education.<sup>(27)</sup>

However, it should be noted that as the social context forms the basis of the equilibrium between the power shared by women and men,<sup>(14)</sup> education and employment are not the only determinants of women's status, or in other words, that although decision making is a manifestation of power and an aspect of women's status in families,<sup>(14)</sup> it may not solely be defined by women-related factors such as education. There may be occasions where decision making regarding health-related issues is vital, but such decisions are made by relatives instead and remain beyond the personal preference of the person directly concerned.<sup>(12)</sup> The varying emphasis placed on cultural issues and value systems when it comes to decision making in different societies might be a reason here.<sup>(12)</sup>

It is highly likely that the status of women in the family is influenced by their status in the society.<sup>(10)</sup> The United Nations, in a report, has discussed the role of men in improving gender equality in societies by suggesting that equality could be achieved through the direct and indirect efforts of men to involve women in decision-making processes.<sup>(28)</sup> When it comes to a family, it has even been controversially suggested that a woman's status is often determined by the men related to her in the family. Our results support male literacy as a factor determining maternal deaths, as Iran is known to be a male-dominated society<sup>(29)</sup> where men generally control decision making in families. Societies with a higher male literacy rate would have more educated men as key decision-makers in households, which could in turn influence the usage of health facilities, antenatal care and family planning by women.<sup>(28)</sup> Furthermore, as education is equally likely to be

**Table IV. Prediction of maternal mortality ratios based on literacy, unemployment and urban residency.**

Variable	Model 1		Model 2	
	β	p-value	β	p-value
<b>Literacy</b>				
Female	.*	.*	-82.77	0.02
Male	-256.68	< 0.001	.*	.*
<b>Unemployment</b>	0.84	0.04	0.90	0.07
<b>Urban residency</b>	6.21	0.57	0.95	0.94
<b>No. of midwives<sup>†</sup></b>	-1.3	0.09	-1.5	0.09

\*Variable was not included. †Per 10,000 citizens.  
Model 1: male literacy model; Model 2: female literacy model

a criteria during mate selection,<sup>(30)</sup> where a literate man is likely to prefer a literate woman and vice versa, there is the possibility that a literate couple would have a positive role to play in family health.

We also found that maternal deaths were higher in provinces with higher unemployment rates. Indeed, most maternal deaths have been reported in low-income countries, with less than 1% of such deaths reported in richer countries.<sup>(31)</sup> Some studies that attempted to establish direct links between maternal deaths and macroeconomic markers (such as gross domestic product) have found a weak direct relationship between economic markers and maternal mortality ratios.<sup>(32,33)</sup> Graham et al too reported higher rates of maternal deaths in poorer populations.<sup>(4)</sup> These authors found that the availability and usage of health facilities were factors that differed among the poor and the rich, which could in turn affect maternal health.<sup>(4)</sup> Factors such as socioeconomic status, level of education and place of residence might also influence the availability and usage of health facilities. For instance, as indicated by McCarthy and Maine, poor citizens living in a comparatively deprived area with no health facilities would need to pay for transportation to avail such facilities elsewhere,<sup>(24)</sup> in addition to shouldering the costs of treatment and other associated expenditures (such as accommodation), which might dissuade them from using health services altogether. Also, the poor who are less educated might use health facilities less often. Poverty might also determine maternal deaths by way of resonating in the form of social security and malnutrition,<sup>(26)</sup> as the income levels of a family would surely affect decisions on seeking



professional help during delivery or illness. For instance, being able to afford medical insurance, so that one would need to pay less for treatment, was identified as a factor that could encourage women to give birth at health facilities by Hong et al.<sup>(25)</sup>

The availability of medical personnel is one more factor that could promote safe motherhood. The percentage of skilled attendants was shown to be a proxy for maternal mortality, with the two having an inverse relationship.<sup>(5)</sup> However, we only observed a marginal relationship between the proportions of midwives available and the provincial maternal death rates noted. It should be kept in mind that the proportion of medical personnel available does not entirely reflect the reality of maternal deaths, as the usage of skilled attendants by women in need is not solely determined by the level of skilled attendance.<sup>(5)</sup> Using such figures on their own, as a proxy for maternal deaths, might thus be an inaccurate and even misleading statistic. Apart from the number of skilled attendants, the role of health professionals in reducing maternal deaths has been discussed by Chamberlain et al.<sup>(34)</sup> The authors, who examined the role of health professionals from a political standpoint, proposed that as stakeholders, they could be very influential in ensuring the provision of basic rights to women in their countries. A likely outcome of such participation could even be the setting in motion of a process at the national level that would enhance women's status, including education and employment, and thereby ensure safe motherhood for most women.<sup>(34)</sup>

The present study was not without limitations. Although our study highlighted some issues related to maternal deaths, the authors acknowledge that maternal mortality is a multidimensional issue that is affected by various factors, such as healthcare quality, and access to and usage of medical healthcare, etc. Determinants such as maternal age and comorbidities (e.g. high blood pressure), which may have affected maternal death rates, were not included. These were some of the variables that were not considered in our study, mainly due to the unavailability of pertinent data. In addition, as results were garnered from aggregated data, the findings are likely to be limited and generalised at the individual level. It is recommended that future studies also analyse data at the individual level to overcome such shortcomings. Sample size was another limitation of this study. Future studies that include larger study populations in order to ensure a robust statistical model for analysis are required. However, it should be noted that sample size may not be ideal for complex statistical models due to the nature of the populations in such studies, which may be provincial, as in Iran.

The number of studies that focus on the role of men in relation to women's health is limited. Most literature regarding maternal health focuses on factors related to women, although in a social context, there may be other factors affecting women's health. In spite of these limitations, our findings may provide the impetus to evaluate the role of men in the provision of healthcare for the family and society as a whole, especially in a male-dominated society such as Iran. There is a need for policymakers to target

men for training and intervention with regard to women's health. Also, as unemployment was associated with maternal deaths, efforts to improve the economic status of the population may help to prevent maternal deaths in Iran. Ensuring an adequate number of medical personnel, as well as easy access to medical facilities across the country for people from all walks of life, will also be critical.

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