Incidence and Correlates of Maternal Near Miss in Southeast Iran

Tayebeh Naderi,1 Shohreh Foroodnia, 2 Samaneh Omidi, 1 Faezeh Samadani, 2 and Nouzar Nakhaee 3

1Research Center for Health Services Management, Institute of Futures Studies in Health, Kerman University of Medical Sciences, Kerman 76175-113, Iran
2Research Center for Social Determinants of Health, Institute of Futures Studies in Health, Kerman University of Medical Sciences, Kerman 76175-113, Iran
3Neuroscience Research Center, Institute of Neuropharmacology, Kerman University of Medical Sciences, Kerman 76175-113, Iran

Correspondence should be addressed to Nouzar Nakhaee; nakhaeen@kmu.ac.ir

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This prospective study aimed to estimate the incidence and associated factors of severe maternal morbidity in southeast Iran. During a 9-month period in 2013, all women referring to eight hospitals for termination of pregnancy as well as women admitted during 42 days after the termination of pregnancy were enrolled into the study. Maternal near miss conditions were defined based on Say et al.’s recommendations. Five hundred and one cases of maternal near miss and 19,908 live births occurred in the study period, yielding a maternal near miss ratio of 25.2 per 1000 live births. This rate was 7.5 and 105 per 1000 in private and tertiary care settings, respectively. The rate of maternal death in near miss cases was 0.40% with a case:fatality ratio of 250:1. The most prevalent causes of near miss were severe preeclampsia (27.3%), ectopic pregnancy (18.4%), and abruptio placentae (16.2%). Higher age, higher education, and being primiparous were associated with a higher risk of near miss. Considering the high rate of maternal near miss in referral hospitals, maternal near miss surveillance system should be set up in these hospitals to identify cases of severe maternal morbidity as soon as possible.

1. Introduction

There are approximately 287,000 preventable maternal deaths annually, of which 99% occur in developing countries [1]. As a sentinel event, maternal death is also a prime indicator in evaluating the quality of a nation’s health care delivery systems [2, 3]. Mothers are pivotal to the social, economic, and cultural development of a community [2]; maintaining their health elevates the physical, psychological, and social well-being of their children and families and, by extension, society as a whole [4]. For this reason, improving maternal health has been proposed by the World Health Organization (WHO) as one of their eight Millennium Development Goals (MDG) [1].

Traditionally, maternal death evaluation has been viewed as key to maternal death prevention [5]. However, in countries with few maternal deaths, this approach fails to provide comprehensive information, leaving policy makers to react based on current rather than past statistics. To facilitate the development of precautionary measures and safer environments that minimize maternal deaths, it is essential that near miss data are recorded and analyzed [6]. The WHO defines an individual having experienced severe acute maternal morbidity (SAMM) (i.e., near miss) as “a woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy” [7].

In fact, maternal near miss includes those cases in which a woman nearly died but survived during pregnancy or during 42 days after the delivery [8]. Using near miss data in maternal death prevention planning has several advantages. First, because the number of near miss cases exceeds maternal death cases, near miss is a better predicate for preventive planning. Second, because the mother survives a near miss,
she can provide valuable details on what she experienced. Lastly, because near miss is one step removed from death, obtaining any information about the event could prove useful in preventing maternal death [8–10].

The prevalence of maternal near miss varies among different countries based on health care quality and availability. Nevertheless, in a systematic review using disease-specific criteria, near miss rates have been reported to be between 0.6% and 14.98% [11].

From a global perspective, Iran has been notably successful in reducing maternal mortality. Between 1990 and 2008, Iran has managed to decrease its maternal mortality rate by 80% [1], which, at present, translates to about 25 deaths in 100,000 [12]. The availability of emergency obstetrical care, improvements in women’s education [13], and the expansion of family planning services have all contributed to the decrease in maternal mortality [14]. In Iran, a national maternal mortality surveillance system examines maternal death cases by reviewing files and interviewing key parties to determine the cause of death [15]. Although some studies have been carried out in Iran and the Middle East regarding the causes of maternal death and risk factors of pregnancy [12–17], the authors know of no published study on severe maternal morbidities and near miss occurrences from Iran or other Middle Eastern countries. The present study aimed to establish a profile of severe maternal morbidities in Iran and their relationship with other underlying factors.

2. Method

This prospective study encompassed eight hospitals with maternity facilities located in the two large cities of Kerman and Jiroft in southeast Iran. The study was performed in 2013 for a period of nine months. The study protocol was approved by the Ethical Committee of Kerman University of Medical Sciences (E.C./90/518). After explaining the study’s nature and aims, oral consent was obtained from the participants who all were assured that their information would remain confidential. First, a list of maternal near miss conditions was prepared based on Say et al.’s recommendations for prospective surveillance of maternal near miss cases [8]. This list included four major groups of haemorrhagic disorders, hypertensive disorders, severe management indicators, and other systemic disorders. Moreover, a category including other conditions was also considered so as not to miss any other life-threatening illness [8]. All women admitted during the nine-month study period for delivery or completion of pregnancy as well as women admitted within 42 days after the termination of pregnancy were enrolled into the study. After the participating hospitals’ maternity, labour, general ICU, emergency, and admission departments were fully coordinated, our case survey was implemented. A check list was completed for cases with potentially life-threatening conditions. Next, a

| Hospital type | Number of near miss cases | Number of live births | Ratio (CI 95%) |
|---------------|--------------------------|-----------------------|---------------|
| Referral      | 345                      | 3293                  | 104.8 (94.8–115.7) |
| Public        | 128                      | 2877                  | 9.9 (8.3–11.8)   |
| Private       | 28                       | 3738                  | 7.5 (5.2–10.8)   |
| Total         | 501                      | 9908                  | 25.2 (23.1–27.5) |

3. Results

During the study period, there were 501 cases of near miss in 19,908 live births (a near miss ratio of 25.2 per 1000 live births). The highest near miss ratio (104.8 in 1000) was observed in the referral (educational) hospital (Table 1). The mean age of near miss cases was 28.3 ± 6.1 years versus the control group’s 26.0 ± 5.8 years (P < 0.001). University degrees were seen more among near miss women (Table 2). In the near miss group, 208 women (41.5%) were primiparous, whereas, in the control group, the number was 225 (45.2%; P = 0.243). The frequency of abortion in the near miss and control groups was 18.6% and 1.6%, respectively (P < 0.001). The frequency of caesarean section in the near miss and control groups was 24.7% and 54.2%, respectively (P < 0.001).

In our study group, there were two cases of maternal death. One was a 19-year-old woman diagnosed with intracerebral haemorrhage (ICH); the other was a 28-year-old woman who had undergone curettage due to a failed abortion and died from sepsis because of perforations in the uterus and intestine.

The rate of maternal death in near miss cases was 0.40% with a case: fatality ratio of 250:1.

As shown in Table 3, the most prevalent causes of near miss were severe preeclampsia (27.3%), ectopic pregnancy (18.4%), and abruptio placenta (16.2%). In all, 15.2% had at least one systemic disease, and 43 women in the near miss group were hospitalised in the ICU (Table 3). The majority of the near miss cases were observed in the haemorrhagic disorders group (Table 3). Logistic regression analysis showed that four variables had significant relationship with near miss.
Table 2: Baseline and clinical characteristics in near miss and control groups.

| Variable                                     | Total (n = 1009) | Near miss (n = 501) | Control (n = 508) | P value |
|----------------------------------------------|------------------|---------------------|-------------------|---------|
| **Age group**                                |                  |                     |                   |         |
| <18                                          |                  | 4 (18.2)            | 18 (35.7)         | <0.001  |
| 18–35                                       | 978              | 432 (49.1)          | 447 (49.0)        |         |
| >35                                          | 98               | 65 (66.3)           | 33 (33.7)         |         |
| **Education**                                |                  |                     |                   |         |
| ≤ Primary                                    | 251              | 127 (50.6)          | 124 (49.4)        | <0.001  |
| Secondary                                    | 576              | 260 (45.1)          | 316 (54.9)        | <0.001  |
| College                                      | 172              | 114 (66.3)          | 58 (33.7)         |         |
| **Residence**                                |                  |                     |                   |         |
| Urban                                        | 789              | 402 (51.0)          | 387 (49.0)        | 0.327   |
| Rural                                        | 210              | 99 (47.1)           | 111 (52.9)        |         |
| **Type of delivery**                         |                  |                     |                   |         |
| Normal vaginal delivery                      | 501              | 134 (26.7)          | 367 (73.3)        | <0.001  |
| First cesarean delivery                      | 254              | 189 (74.4)          | 65 (25.6)         |         |
| Repeat cesarean delivery                     | 142              | 84 (59.2)           | 58 (40.8)         |         |
| Vaginal birth after cesarean delivery        | 1                | 1 (100)             | 0 (0)             |         |
| **Type of abortion**                         |                  |                     |                   |         |
| Medical                                      | 54               | 51 (94.4)           | 3 (5.6)           | 0.545   |
| Surgical                                     | 45               | 40 (88.9)           | 5 (11.1)          |         |
| Criminal                                     | 2                | 2 (100)             | 0 (0)             |         |
| Gravidity (mean ± SE)                        | —                | 2.3 (0.06)          | 2.1 (0.06)        | 0.012   |
| Parity (mean ± SE)                           | —                | 1.1 (0.06)          | 1.0 (0.06)        | 0.048   |
| Abortion (mean ± SE)                         | —                | 1.2 (0.08)          | 1.2 (0.07)        | 0.460   |
| Living (mean ± SE)                           | —                | 2.3 (0.3)           | 1.7 (0.09)        | 0.058   |
| Birth interval (mean ± SE)                   | —                | 5.3 (0.2)           | 4.7 (0.2)         | 0.055   |
| Gestational age (mean ± SE)                  | —                | 27.7 (0.6)          | 34.8 (0.4)        | <0.001  |
| Number of prenatal care (mean ± SE)          | —                | 6.4 (0.2)           | 6.9 (0.2)         | 0.028   |

*Numbers in parentheses are percents.

occurrence (Table 4). Of the 377 near miss cases (75.2%), the major problem was discerned at or during the first six hours of admission.

4. Discussion

In the present study, the near miss ratio was 25.2 per 1000 live births. In the private setting, this rate was 7.5 per 1000, and, in the tertiary care hospital, it was approximately 105 per 1000. The main advantages of this study were its prospective nature and its use of standard criteria for determining near miss cases. Because more than 97% of deliveries in Iran occur in hospitals [16], the present report may be considered as a population-based study. Because of the differences among patients and health care delivery systems, generalizing the results of this study on a countrywide basis should be done with caution.

The literature shows that maternal near miss ratios vary greatly depending on the population studied, how near miss is defined, and how the study is conducted (prospective versus retrospective) [11, 19]. Near miss ratios have been reported as 44.3 per 1000 in Brazil [9], 33 per 1000 in India [20], 3.83 per 1000 in Scotland [21], and 34 per 1000 in a WHO survey [10]. A recent systematic review using a unique definition for near miss showed SAMM rates in high-income countries to be significantly lower compared with those of low- and middle-income countries [11].

In this study, like some other studies [19, 20], the rate of near miss was significantly higher in the tertiary care setting (Table 1). The reason might be that, because of the limited facilities at private hospitals, women with complicated pregnancies are not usually referred to these centres.

In the present study, we found a higher rate of near miss and consequently a lower fatality rate (0.4%). These findings may be derived from our broader definition for near miss events, which combined disease-specific criteria with management-based criteria [8]. In Netherland, with a near miss ratio of 7.1 per 1000, the rate was 1.9% [22]. In Brazil, with a near miss ratio of 42 per 1000, the rate was 1.6% [19]. It should be mentioned that the maternal death rate shows a decreasing trend in Iran [12].

In our study, haemorrhagic disorders (46.1%) and hypertensive disorders (31.9%) were the most common causes of near miss (Table 3). These rates are similar to those reported
Table 3: Frequency of near miss criteria in 501 cases of severe maternal morbidity.

| Type of near miss                  | Frequency (%) |
|-----------------------------------|---------------|
| Hemorrhagic disorders             |               |
| Abruptio placenta                 | 81 (16.2)     |
| Accreta/increta/percreta placenta | 12 (2.4)      |
| Ectopic pregnancy                 | 92 (18.4)     |
| Postpartum haemorrhage             | 50 (10)       |
| Ruptured uterus                   | 3 (0.6)       |
| At least one type                  | 231 (46.1)    |
| Hypertensive disorders            |               |
| Severe preeclampsia               | 137 (27.3)    |
| Eclampsia                         | 11 (2.2)      |
| Severe hypertension (>170/110)     | 35 (7.0)      |
| Hypertensive encephalopathy       | 0 (0)         |
| HELLP syndrome                    | 10 (2.0)      |
| At least one type                  | 160 (31.9)    |
| Other systemic disorders          |               |
| Endometritis                      | 12 (2.4)      |
| Pulmonary edema                   | 0 (0)         |
| Respiratory failure               | 7 (1.4)       |
| Seizures                          | 12 (2.4)      |
| Sepsis                            | 4 (0.8)       |
| Shock                             | 5 (1.0)       |
| Thrombocytopenia < 100000         | 39 (7.8)      |
| Thyroid crisis                    | 0 (0)         |
| At least one type                  | 76 (15.2)     |
| Severe management indicators      |               |
| Blood transfusion ≥ 5 units       | 17 (3.4)      |
| Central venous access             | 2 (0.4)       |
| Hysterectomy                      | 10 (2.0)      |
| ICU admission                     | 43 (8.6)      |
| Prolonged hospital stay (>7 postpartum days) | 28 (5.6) |
| Nonanesthetic intubation          | 5 (1.0)       |
| Return to operating room          | 7 (1.4)       |
| Surgical intervention             |               |
| (other than cesarean section & hysterectomy) | 10 (2.0) |
| Dialysis for acute renal failure  | 1 (0.2)       |
| Cardiopulmonary resuscitation (CPR)| 2 (0.4)    |
| Others (please specify)           | 12 (2.4)      |
| At least one type                  | 91 (18.2)     |

According to our logistic regression model, four variables had a relationship with near miss (Table 4). In older women with university degrees, the near miss ratio was higher. In fact, most studies demonstrate a proportional relationship between higher near miss ratio and advancing age (particularly over 35 years) [22, 23]. In the WHO's global survey, the near miss ratio was significantly associated with higher educational levels. This finding has been attributed to the tendency among women with higher educational levels to undergo caesarean section, which increases the probability of near miss events [22]. The present study, as in previous studies, shows that being a primipara increases the probability of near miss ratio by 1.2%–1.4% [22, 23].

Although pregnancy complications are to a great extent unpredictable and unpreventable, early awareness of near miss cases can prevent the progress of disease and maternal death [19]. In this study, the feasibility of using WHO-recommended near miss criteria was recognized. However, because of inadequate health care services, it is necessary that the auditing of near miss cases be considered as important as the implementation of near miss surveillance systems [15, 23].

The present study showed that using data related to near miss cases can provide more comprehensive information when reviewing maternal death cases; therefore, establishing near miss surveillance systems in Iranian hospitals is highly recommended.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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