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Research Article

## Maternal mortality: a tertiary care hospital experience in Upper Egypt

Ahmed M. Abbas\*, Mariam T. Amin, Shymaa S. Ali, Neima Z. Salem

<sup>1</sup>Department of Obstetrics and Gynaecology, Assiut University, Egypt

<sup>2</sup>Department of Public Health, Assiut University, Egypt

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**\*Correspondence:**

Dr. Ahmed M. Abbas,

E-mail: bmr90@hotmail.com

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### ABSTRACT

**Background:** Maternal mortality is one of the major challenges which face the developing countries throughout the world. The aim of the study is to assess the causes of maternal mortality at Women Health Hospital, Assiut University, Egypt, and to identify the avoidable ones.

**Methods:** Data were collected from records of patients who presented to and/or delivered at Women Health Hospital between 2009 and 2014. Only cases of maternal mortality were included in this study. In our study, we found 213 maternal deaths at our hospital between 2009 and 2014.

**Results:** The maternal mortality ratio decreased progressively from 2009 to 2014 (228 and 89 per 100000 live birth respectively). Moreover, we found that the indirect causes of maternal mortality accounted for 24.9 % of all mortalities. As regards the direct causes of maternal mortality, preeclampsia remained the primary cause and represented 27.7 % of the avoidable causes. The second most frequent cause of direct maternal mortality was postpartum hemorrhage (PPH), which represented 26.8 %.

**Conclusions:** Preeclampsia and PPH, as well as their complications are the leading causes of death in one of the biggest tertiary care university hospitals in Egypt. However, there are other important avoidable predisposing factors that should be dealt with including lack of patient education, delayed transfer from other hospitals, and substandard practice.

**Keywords:** Developing countries, Health facilities, Preeclampsia, Postpartum hemorrhage, Maternal mortality

### INTRODUCTION

Maternal mortality is one of the major challenges which face the developing countries throughout the world. According to the tenth revision of the international classification of diseases (ICD-10) it is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and to the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes.<sup>1</sup> The 42-day limit is somewhat arbitrary, and in recognizing the fact that modern life-sustaining procedures and technologies can delay death, ICD-10 introduced a new category, namely

the late maternal death, which is defined as the death of a woman out of direct or indirect obstetric causes more than 42 days but less than one year after the termination of pregnancy.<sup>2</sup> Maternal mortality ratio is defined as the number of women who died while pregnant or within 42 days of termination of pregnancy per 100,000 live births.<sup>3</sup>

Maternal deaths are divided into two groups. The first group is the direct obstetric deaths which result from obstetric complications during pregnancy, labour and the puerperium, or resulted from interventions, and any incorrect treatment received. The second group is the indirect deaths which are the result from previous existing disease or disease that developed during

pregnancy and which were not due to direct obstetric causes, but was aggravated by physiologic effects of pregnancy.<sup>4</sup> Deaths from “accidental or incidental” causes have historically been excluded from maternal mortality statistics.

According to the WHO, 80% of maternal deaths in developing countries are due to direct maternal causes such as haemorrhage, sepsis and hypertensive disorders. Additionally, indirect causes such as HIV/AIDS, cardiac diseases, hepatic diseases and anemia account for the remaining 20% of maternal deaths.<sup>5</sup> Of the 287,000 deaths due to pregnancy or childbirth complications that occur each year worldwide, 85 % are in Africa and Asia alone.<sup>4</sup>

The difference in maternal mortality between developed countries (lifetime risk of maternal death is 1 in 3800) and developing countries (life time risk of maternal death is 1 in 150) is one of the highest differentials in public health. In Egypt the overall maternal mortality ratio is 32.6/100.000.<sup>6</sup>

As 90% of maternal deaths are preventable, access to good quality essential obstetrical care can prevent 48% of maternal deaths at time of delivery.<sup>7</sup> It is cost effective to invest in policy makers that reduce maternal mortality in the most efficient manner possible.<sup>8</sup>

Regarding the most riskiest time for maternal death, it seems that the most maternal deaths occur between third trimester and the first week after delivery. This risk is extremely high on the first and second days after delivery.<sup>3,9</sup> These findings provide strong support for prioritization of strategies that focus on professional intrapartum care.

There are three types of delay in emergency care for the pregnant women according to the framework presented by Thaddeus and Maine.<sup>10</sup> The first delay is that delay caused by family and woman to recognize the need for medical help. The second delay is caused because of the late referral, so the woman arrives at the hospital too late to get a benefit from emergency care. The third delay is that due to the delay in receiving effective interventions after arriving at the hospital.<sup>11</sup> Avoidable causes of maternal deaths are referred to as departure from the standard of satisfactorily accepted care by the woman, practitioner or institution/expected at a particular level of care, which may have contributed to the death.<sup>12</sup>

In this study, we estimated the maternal mortality burden in the largest tertiary care university hospital in Upper Egypt. Our aim was to search for the causes of maternal deaths, calculate the maternal mortality ratio and identify the avoidable causes and demographic factors for maternal mortality.

## METHODS

This is a retrospective observational study conducted at Assiut women health hospital, which is the largest maternal tertiary care center in upper Egypt providing health services for seven governorates from January 2009 till December 2014.

Data were collected from the files of pregnant women admitted to the hospital. Inclusion criteria were death of a pregnant woman while she was pregnant or within 42 days from giving birth, including late maternal deaths which occurred more than 42 days but less than one year after termination of pregnancy, whether she was delivered inside or outside our hospital. The number of live births in the same period was obtained from the hospital logbooks. The ethical review board of Assiut faculty of medicine approved the study.

Data analysis was carried out, and the maternal mortality ratio was measured by dividing the number of maternal deaths by the number of live births during the period of the study multiplied by 100,000. The data obtained were compared and analyzed using SPSS Inc., (Statistical program for social science Inc.,) Chicago, IL, USA, version.<sup>16</sup> Variables were expressed as frequency and percentage. Chi-square test and binomial test were used to compare variables. Level of significance "P" value was evaluated, where P value <0.05 was considered statistically significant.

## RESULTS

During the period of the study, a total of 125 349 pregnant women were admitted to Assiut Women Health Hospital. The total number of live births was 94,196. Two-hundred and thirteen cases of maternal deaths were identified during study period. It was evident that the maternal mortality ratio, had decreased progressively from 228 in 2009 to 89 in 2014 (P-value <0.001) (Table 1). The leading cause of death in the 6 years was preeclampsia with its complications (27.7%). The second cause was the uncontrollable postpartum haemorrhage (26.8%), and the rest of the causes; direct and indirect accounted for 45.5 %. Direct maternal deaths accounted for 75.1 % of all maternal deaths while 24.9 % of maternal deaths were due to indirect causes (Figure 1).

When we analyzed the demographic characteristics of maternal deaths we found that the mean age of maternal deaths were 28.9±6.58 years with significant differences between age groups (P-value<0.0001). The mean of women's age who gave birth in our hospital was 27.3±6.98 with no statistically significant difference with the mean age of maternal deaths (P-value=0.23). The mean parity of maternal deaths was 3.12±1.56, and deaths among women parity ≤4 were significantly higher than grand multiparous women with parity >5 (P-value <0.0001) (Table2).

**Table 1: Total live birth in each year with maternal mortality ratio at Women Health Hospital in the study period.**

Year	Total live births	Mortality			Total	MMR** per 100,000 live birth***
		Inside the hospital*	Outside the hospital	Late maternal deaths		
2009 <sup>1</sup>	11858	27	3	0	30	228
2010	13398	28	5	2	35	209
2011	15569	34	4	2	40	218
2012	16220	33	8	1	42	203
2013	18091	31	6	2	49	171
2014 <sup>1</sup>	19060	17	7	3	27	89
<b>Total</b>	<b>94196</b>	<b>170</b>	<b>33</b>	<b>10</b>	<b>213</b>	<b>180</b>

\* Either delivered or not; \*\* MMR: Maternal Mortality Ratio; \*\*\*  $MMR = \frac{\text{Material deaths inside the hospital}}{\text{Total live births inside the hospital}} \times 100,000$ ; 1\* P-value calculated to detect the difference between MMR in 2009 and 2014; it is < 0.0001.

**Table 2: Demographic characteristics for maternal deaths in the study period.**

	Frequency (%)	P-value*
<b>Age groups (years)</b>		
< 20	11 (5.2%)	< 0.0001
20-29	108 (50.7%)	
30-39	72 (33.8%)	
> 40	22 (10.3%)	
<b>Gravidity and parity</b>		
≤ G4	171 (80.3%)	< 0.0001
> G5	42 (19.7%)	
<b>Residence</b>		
Urban	59 (27.7%)	< 0.0001
Rural	154 (72.3%)	
<b>Education</b>		
No education	172 (80.8%)	< 0.0001
Primary	41 (19.2%)	

\*P-value by Chi-square test and binomial test.

**Table 3: Distribution of maternal deaths regarding place, time and pregnancy outcome in the study period.**

	Frequency	%	
<b>Place of death</b>			
Women Health Hospital	200	93.9	
Outside the hospital	13	6.1	
<b>Time of death</b>			
During pregnancy			
Day of delivery			
	During labor	22	10.3
	After labor	29	13.6
Postpartum (within 42 days)			
	1-7 days after delivery	77	36.1
	8-42 days after delivery	45	21.1
Late maternal deaths	10	4.7	
<b>Pregnancy outcome</b>			
Not delivered	30	14.1	
Abortion / stillbirth	31	14.6	
Living	152	71.4	

**Table 4: Place and mode of delivery for cases of maternal deaths in the study period.**

Place of delivery	Inside the hospital	Outside the hospital	P- value*
Number	144 (78.7%)	39 (21.3%)	< 0.0001
<b>Delivered by health professional</b>			
Yes	142 (77.6%)	0 (0%)	< 0.0001
No	2 (1.1%)	39 (21.3%)	
<b>Mode of delivery</b>			
Vaginal	71 (38.8%)	25 (13.7%)	0.101
Cesarean section	73 (39.9%)	14 (7.6%)	

\*P-value by Chi-square test.

Maternal deaths among illiterate women and those who live in rural areas were also significantly higher than those who received at least a primary education or lived in urban areas (P-value < 0.0001) (Table 2).

Regarding the place and time of death, there were 13 cases of maternal deaths died on their way to the hospital and reached the hospital dead with failed trials of cardiopulmonary resuscitation. Two-hundred cases died inside the hospital; 30 cases during pregnancy most of them were in their third trimester, but the majority of the cases died postpartum (75.6 %), only 10 cases of them stayed more than 42 days on mechanical ventilator and considered as a late maternal deaths. Fifty-one women died on the day of the delivery, while 77 stayed for 1 week before death (Table 3).

When we analyzed the place of delivery, we found that only 39 cases of maternal deaths delivered outside our hospital either at home, private clinics or secondary health care hospitals. Most of the cases were delivered at our hospital with significant statistical difference (P-value < 0.0001). About 86.3 % of the cases were delivered by health professional while the rest of the cases were delivered spontaneously without assistance or by a traditional birth attendant. No statistically significant difference in mortality between those who delivered vaginally or by caesarean section (P-value= 0.101) (Table 4).



Maternal mortality studies showing differences between urban and rural areas especially in the poor countries. In Egypt, the maternal mortality ratio was high in the nomadic Frontier region than in the Metropolitan region (125 versus 54).<sup>15</sup> In our study there were significant difference in maternal mortality among rural areas; 154 cases versus 59 cases only in urban areas (P- value <0.0001). This can be attributed to poverty and lack of transfer facilities from far villages, besides the higher rates of illiteracy among people than those living in urban areas.

Woman's education also is an important factor; as educated woman can determine the risks and complications early and usually aware about health services more than the illiterate woman.<sup>16</sup> In our study we found this maternal death were significantly higher among illiterate women (P- value <0.0001).

Most maternal deaths seem to occur between the third trimester and the first week after the end of pregnancy.<sup>3,9</sup> Mortality is extremely high on the first and second days after birth. The results obtained from our study coincided with the published data. Nineteen cases out of 30 cases died during pregnancy were at their third trimester, 51 cases died on their first day after birth. These findings provide strong support for prioritization of strategies that focus on professional intrapartum care.

The risk of maternal death remains for some time after delivery. Maternal deaths defined as those occurring up to 42 days postpartum, although recently the late maternal death category has been introduced to include deaths up to 1 year postpartum. This change in definition is important since there is evidence that risk of death is increased for up to 6 months postpartum.<sup>2</sup> In our study there were 10 cases of late maternal deaths, the longest case died 116 days after delivery due to brain stem hemorrhage resulted from eclamptic fits.

The maternal mortality ratio shows significant decrease in Assiut Women Health Hospital, Egypt over the period of the study reaching its lowest level in 2014 (P-value <0.001). This can be attributed to increasing in workforce to include three running operative rooms with eight obstetricians working daily the supervision of a senior staff and equipped with an ultrasound machine. An intensive care unit was established with twelve beds equipped with all facilities with intensive monitoring and highly skilled nurses and residents available twenty-four hours per day. The hospital own blood bank which was established in 2013 to facilitate the supply of blood and blood products to all obstetric cases. This helped significantly in decreasing maternal mortality ratio from 2013.

Moreover, regulations were established in our hospital to guarantee the availability of a senior staff twenty-four hours per day all over the week in the obstetric emergency unit to save time when emergency cases are

brought to the hospital. Improvements have been made in the full reporting of maternal deaths and maternal mortality surveillance systems have been installed. In addition, a review committee was established in 2013 for analysis and discussion of any maternal mortality in addition to developing strategies for prevention of avoidable factors of maternal mortality.

Although, the above factors have led to a significant decrease in the maternal mortality ratio they are still not enough as this only decreases the third delay which is the delay in the receiving effective intervention. The first delay, which is the delay caused by family and woman to recognize the need for medical help can be avoided by increasing the community awareness, by informing the pregnant woman about risks of her pregnancy and encouraging her to receive antenatal care. This will help in decreasing most of the indirect causes of maternal deaths. The second delay because of late referral, can be prevented by improving health system especially primary care centers, ambulance services and infrastructure which is some sort difficult and need long-term national plan.<sup>11,17</sup>

One of the limitations of our study that it only reflects the cases that were brought to our hospital and thus may be a biased sample of the general population making our data not completely generalizable.

Saving maternal lives is a matter of human right and equality and as Professor Mahmoud Fathalla, past president of the international federation of obstetricians and gynecologists and former chair of the WHO advisory committee on health research, said: "women are not dying because of untreatable diseases. They are dying because societies have yet to make the decision that their lives are worth saving."<sup>18</sup>

## CONCLUSIONS

The maternal mortality ratio in Assiut, Egypt women health hospital has been significantly decreased from 2009 to 2014. Preeclampsia and postpartum haemorrhage are still the most two leading causes of death in developing countries. Moreover, there were two major contributing factors in these deaths: the substandard care and delayed transfer of cases; both are avoidable. Efforts should be made to ensure that all deliveries occur with the help of skilled personnel.

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*Ethical approval: The study was approved by the Institutional Ethics Committee*

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