

## Determinants of Maternal Mortality in Eritrea.

Mismay Ghebrehwet, MD, MPH, PhD<sup>1</sup> and Richard H. Morrow MD<sup>2</sup>.

Institutional affiliation:

<sup>1</sup>Advisor to the Minister of Health State of Eritrea.

<sup>2</sup>Professor of International Health, Bloomberg School of Public Health, Johns Hopkins University

Corresponding author: Dr Mismay Ghebrehwet, email address: gmismay@yahoo.com

### Abstract

**Objective:** This study was undertaken with a general objective of determining the determinants of maternal mortality in Eritrea.

**Methods:** The study was a case control study which compared 50 women whose pregnancies led to death with 50 individually matched women that survived a severe life threatening obstetric complication in the same community.

**Findings:** From the comparison of maternal deaths (cases) and survivors of severe life threatening obstetric complications (controls), seeking medical care on the part of the survivors was significantly more frequent in both bivariate and multivariate analysis than was the case in those who died and was probably protective.

**Conclusion:** The study concluded that seeking medical care was negatively associated with maternal death and was probably protective.

**Keywords:** maternal deaths, near misses, determinants, antenatal care, delivery, seeking medical care, warning signs.

### Introduction

Eritrea is a country located in the horn of Africa, which lies north of the equator. The 2002 EDHS data revealed that delivery usually (73 percent) takes place at home and is performed by a non professional, who may be a trained or untrained traditional birth attendant (43 percent), relatives or friends (27 percent). Such persons are not trained to manage obstetric complications. Only the remaining 26 percent take place in health facilities and are assisted by health professionals (1).

The 2002 EDHS did not determine the level of maternal mortality in Eritrea, the 1995 EDHS however, revealed an extremely high level of maternal mortality ratio, at 998 per 100,000 live births (2).

The 2003 study undertaken by the authors revealed a maternal mortality ratio of 752 per 100,000 live births, while the WHO, UNFPA, UNICEF and World Bank Maternal Mortality Estimates for 2005 published in 2007 estimates the maternal mortality ratio for Eritrea at 450 per 100,000 live births, which is 55 percent lower than the 1995 EDHS finding.

### Materials and Methods

The study was a matched pair case control analytic study that compared women who died due to an obstetric complication (cases) with those who survived a severe life threatening obstetric complication in the same community, also referred as near misses (controls). The study involved conducting maternal death or a survived life threatening condition review through interview with close families of maternal deaths (cases) and families of the near misses from the same community (individually matched controls).

25 of the cases were selected from 42 randomly selected communities from each of the six zones, while 17 cases were selected from the hospitals. All deaths that were selected occurred within one year prior to the study, May to October 2003. The cases

were identified using RAMOS (Reproductive Age Mortality Study), which identify all deaths of women of reproductive age as a source of maternal deaths.

The data collection for the study was conducted in the following four steps:

1. Identify all female deaths within reproductive age group (15-49)
2. Identify cases (maternal deaths), among the female deaths.
3. Identify and select near misses (controls) from the same community.
4. Identify source of data (interviewees and written records) for each case and control.

A checklist was prepared to assist the interviewers, to identify maternal deaths among all female deaths within the reproductive age group, during the verbal autopsy. The interviewers were trained on use and interpretation of the checklist, which was field-tested and accordingly amended during the training.

Once the cases were identified, then the same number of controls were selected from the same community. To do so first, all the TBAs working in the study communities were identified. The TBAs were first asked to identify the women according to their subjective judgment and experience, using local terms 'moyta neyra or kab mot wetsiaa' which mean 'this woman nearly dead or escaped from death' and describe to the professional interviewers what exactly happened. The near miss who survived the most severe life threatening obstetric complication among all of the near misses identified was then selected. The criteria for selection was severity, the most severe among the near misses identified in the same communities with the cases.

A total of 50 cases and 50 individually matched controls were successfully matched and included for the quantitative matched pairs analysis and the McNemar's test.

The majority of the sample 84 percent (41 cases and 41 matched controls) were from rural area, while

the remaining 16 percent were from urban or semi urban areas. The 6 percent (3 cases and 3 controls) were from Asmara, the capital and 10 percent (5 cases and 5 matched controls) were from other towns.

The following data collection techniques were utilized for the case control component of the study: -

- Interview with close relatives (or other knowledgeable persons about the death or the life threatening condition) of maternal deaths (cases) and near misses (Controls).
- Interview with Health Providers who provided care to the cases or controls who reached a health facility.
- Record Review of cards for the cases or controls who reached a health facility.

Once the cases (maternal deaths) and their matched controls (near misses) were identified, source of data (interviewees and records) were then identified for structured interview. For those cases or controls who had not reached a health facility, the data were collected only at the community level, while for those cases or controls that were taken to the health facilities, data were collected from both the community and the health facility levels.

Once the data collection was completed, the data were entered in to an excel computer program and were copied to STATA version 8 statistical package. Matched paired bivariate data analysis was used, using STATA Version 8. The appropriate significance test, which is McNemer's Chi Square test (X<sup>2</sup>), for the comparison of paired proportions was applied, which among other things produced, the Odds Ratio (OR) for matched pairs as the ratio of the discordant pairs, i.e. the ratio of the number of pairs in which the case was exposed and the control was not, to the number of pairs in which the control was exposed and the case was not. A 95 percent confidence interval for the Odds ratio was obtained, using the statistical package.

Once the bivariate data analysis was completed, a multivariate data analysis was undertaken using a special form of logistic regression called conditional logistic regression for analysis of several risk factors, or the need to adjust for confounding variables additional to those matched for in the design.

The following variables were entered in to the model: parity, antenatal care attendance at least once, antenatal care attendance during the last month of the pregnancy and seeking medical among those pairs where the cases were identified from the communities (i.e. after dropping the matched pairs in which the case was identified from the hospital). The conditional logistic regression model used is presented below:

$$\ln \left[ \frac{Y}{1-Y} \right] = b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + \dots b_nX_n$$

Where:

- Y = probability of maternal death
- X<sub>1</sub> = parity level (1 = primi, 0 = parity greater than one)
- X<sub>2</sub> = At least one antenatal care attendance (1 = attended, 0 = did not attend)
- X<sub>3</sub> = Antenatal care attendance during the last

month of the pregnancy (1 = attended, 0 = did not attend)

X<sub>4</sub> = Seeking medical care (1 = went to health facility, 2 = did not go to health facility)

X<sub>4</sub> ... X<sub>n</sub> = other independent variables

b<sub>1</sub> ... b<sub>n</sub> = the respective coefficients of each of the independent variables.

## Results

As can be seen from table 1, no significant difference was revealed between the cases and the controls, in age, educational status, parity, at least one attendance of antenatal care, whether they decided themselves where to deliver or somebody else decided for them, and in the knowledge of danger signs of families or status of circumcision.

Although there was no significant difference between the cases and the controls in the attendance of at least one antenatal care during the whole pregnancy, as depicted in table 1, in the bivariate analysis, there was significant difference between the cases and the controls in the attendance of antenatal care during the last month of the pregnancy. Among those who attended at least one antenatal care, the controls were more likely to attend during the last month (93 percent) than the case (68 percent), which was significant difference (P=0.021). The odds ratio for this was 0.111 with a 95 percent confidence interval of 0.003 to 0.801.

Only 56 percent of the cases as compared with 74 percent of the controls sought medical care. Hence, 22 (44 percent) of the cases and 13 (26 percent) of the controls did not seek medical care despite the life threatening complication. Although the difference between the cases and the controls in the over all seeking of medical care was not significant, it is important to bear in mind that 17 of the cases were already selected from health facilities. When a further analysis was done, by excluding these 17 cases, i.e an analysis only in the cases that were identified from the 42 selected communities and their matched controls, the difference became significant as presented in table 1.

Thirty one percent of the cases and 69 percent of the controls that were identified from the selected communities, visited health facilities. The difference is statistically significant, with p= 0.02. The odds ratio is 0.27, with a confidence interval of 0.06 to 0.84. Further study with a bigger sample size is required to determine more precise odds ratio with narrow 95 percent confidence interval.

The knowledge of signs of complications of both the families of the cases and the controls were similarly poor. Only 10 percent of the families of the cases and 8 percent of the families of the controls were able to mention four or more signs of the maternal complications of pregnancy and childbirth.

Virtually all cases (98 percent) and controls (98 percent) were circumcised; hence no difference between the cases the controls. Sixty seven percent of the cases and 60 percent of the controls were circumcised with the most severe form of circumcision, suturing of the opening of the genitalia. While the

remaining 33 percent of the cases and 40 percent of the controls involved cutting of the clitoris with or without excision of some flesh but no suturing of the opening of the genitalia.

Table 1: Bivariate Analysis (McNemar's test)

Variable	OR	95% Confidence Interval
Age (18-34 Vs <18 or > 34)	0.7	0.1 – 2.8
Education (Illiterate Vs Literate)	1.4	0.4 - 5.6
Parity (2-4 Vs <2 or >4)	0.8	0.3 - 1.9
ANC, at Least Once (Did not attend Vs Attended)	1.1	0.4 – 3.7
ANC, During Last Month 1 (Attended Vs Did not attend)	0.1	0.0 – 0.8
Place of Delivery <sup>2</sup> (Home Vs Health facility)	2.1	0.9 - 5.7
Decision to Seek Care (Herself Vs Not herself)	0.7	0.2 – 2.0
Approval Before Seeking Care (Doesn't need Vs Needs)	0.6	0.1 – 2.2
Seeking Medical Care, All participants (Seek Vs Did not seek)	0.5	0.2 – 1.2
Seeking Medical Care, 3 Sample Communities (Seek Vs Did not seek)	0.3	0.1 – 0.8
Knowledge of Families (Score <4 Vs >4)	1.3	0.2 – 9.1
Female Circumcision (Circumcised Vs Not Circumcised)	1	0.0 – 78.5
Female Circumcision 4 (Infibulated Vs Not Infibulated)	1.8	0.4 – 8.2

1 Chi-Sq = 6.40 p=0.01

2 Chi-Sq. = 3.2 P= 0.07

3 Chi-Sq. = 6.37 P= 0.01

4 Highly correlated with the matching variable

Once the bivariate data analysis was completed, a multivariate data analysis was undertaken using a conditional logistic regression model. The following variables were entered in to the model: parity, antenatal care attendance at least once, antenatal care attendance during the last month of the pregnancy and seeking medical among those pairs where the cases were identified from the communities (i.e. after dropping the matched pairs in which the case was identified from the hospital).

As depicted in table 2, seeking medical among those identified from the communities, which was significant in the bivariate analysis, was also significant in the multivariate analysis. However, antenatal care during the last month, which was significant in the bivariate analysis, became insignificant in the multivariate analysis, indicating that it was confounded.

Table 2: Multivariate Analysis (Conditional Logistic Regression Model)

Variable	OR	95% Confidence Interval
Parity (primi)	1.2	0.5 - 2.6
Place of delivery (home)	2.4	0.5 – 10.7
ANC (attended at least once)	1.3	0.4 – 3.8
ANC (attended during last month)	0.7	0.2 – 3.2
Seeking Medical Care, among those identified from the Communities.		
0.4		
0.1 – 0.8		

### Discussion

All deaths that were selected were identified using RAMOS (Reproductive Age Mortality Study), which identify all deaths of women of reproductive age as a source of maternal deaths. RAMOS has been used successfully in countries as different as Egypt, Honduras and Jamaica (5). How the deaths were identified in the studies differ according to the records and/or the types of knowledgeable informants available. RAMOS approaches can, when competently handled, provide valuable insights into the circumstances leading to maternal deaths.

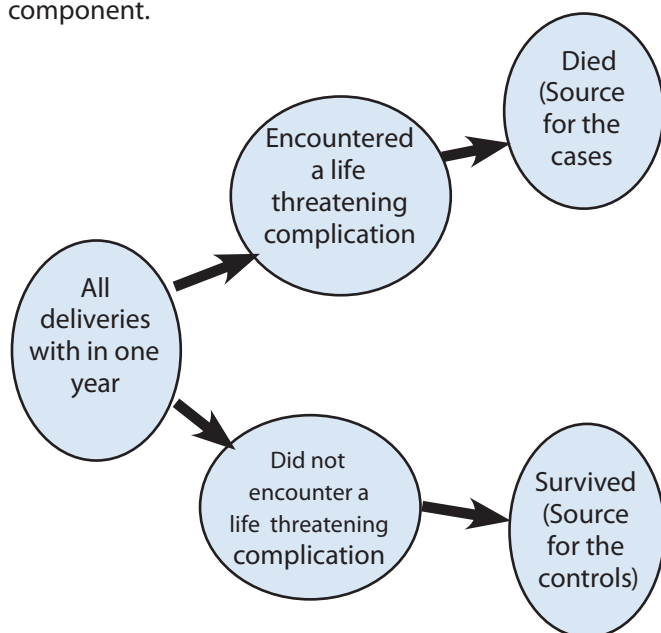
The bivariate and multivariate analysis revealed no significant difference between the cases and the controls in most of the determinants studied including, age, parity, education, attendance of antenatal care etc. The only significant difference revealed between the cases and the controls after controlling the effect of the other variables was seeking medical care, which is found to be negatively associated with maternal mortality in both the bivariate and multivariate analysis, and is probably protective.

A health worker with midwifery skills present at childbirth, supported by transport in case emergency referral is required, is perhaps the most critical intervention for making motherhood safer (5,6,7). However, besides adequate competence, to be highly effective, the skilled attendant needs to have an enabling environment that includes drugs, medical supplies, and a referral system with doctors providing emergency obstetric care (5, 6, 9 and 10).

In interpreting the findings it is important to note two methodological issues of this study. The first pertains to the selection of the cases and the controls. As depicted in fig 1, in principle among all deliveries that occurred with in one year prior to the study, some encountered complication while the majority did not. Among those who encountered a severe life threatening complication some died due the complication (which were the source for the cases in this study), while others survived the complication (which were the source for the controls in this study). It

is however, important to note that, at the initial phase (as depicted in fig. 1) the source for both the cases (who died due the complication) and the controls (who survived a severe life threatening complication) was the same, those who encountered a life threatening complication. Therefore this study included only those who encountered a severe life threatening complication and not those who did not. Which means, if there were any predicator variable that determined who develops a severe life threatening complication and who does not among all deliveries, was not included in this study. In effect, the above mentioned findings should be interpreted as: Once a mother encountered a severe life threatening obstetric complication the only variable that showed a significant difference was seeking medical care.

Fig. 1 Schematic presentation depicting the sources for the cases and the controls in the case control study component.



The second important methodological issue to note in interpreting the findings in this study is that by using community as a matching variable, we have artificially created similarity between the cases and the controls on residence and factors that are highly correlated with residence (community) including distance from the health facility, social, economic and cultural practices e.g. infibulation. Hence, we could not expect to find difference or to study the effect of such factors in this study. Data was however collected in some of these factors in order to find how prevalent a factor is and determine whether it is an important area for action regardless of the difference between the cases and the controls.

## Conclusions

From the findings of the comparison of maternal deaths (cases) and survivors of severe life threatening obstetric complications (controls, it can be concluded that, once mothers encountered a severe life threatening obstetric complication the only variable that showed a significant difference between those who died (cases) and those who survived (controls) was seeking medical care. Seeking medical care was negatively associated with maternal death and was probably protective.

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