Forward

When the Millennium Development Goals (MDGs) were declared in the year 2000 Jordan faced the challenge of reducing its Maternal Mortality Ratio (MMR) by a staggering seventy five per cent by the year 2015. Having conducted a study in 1995-1996 which showed Jordan's maternal mortality ratio at 41.4 per 100,000 live births, the task ahead was a difficult one and required a comprehensive national strategy and implementation program. It also needed an unprecedented commitment from the government of Jordan to the overall health and wellbeing of all Jordanians.

This study between our hands today shows that Jordan has exceeded all expectations and has already achieved the target it set for itself - seven years ahead of schedule. The maternal mortality ratio in Jordan has dropped to 19 per 100,000 live births setting a notable downward trend that not only highlights Jordan's success in implementing the MDG priorities successfully but also in providing tangible justification for the large investment the government and the other supportive sectors has made in the maternity arena over the past decade or so. Today Jordan's record indicates that is has come close to achieving the low maternal death rates of the developed countries of the world.

Not only is the achievement of this marked improvement in maternal mortality ratio commendable, but I also feel that I must also highlight the work that has gone into researching and documenting the current ratio as well as the in-depth identification of avoidable factors that could further contribute to reducing MMR in Jordan. The research team and the powerful National Steering Committee who worked on this study took seriously Jordan's commitment to the MDGs and therefore has developed a set of findings and recommendations that I believe will be indispensible to providers of maternal services who will now be able to audit their current provision of services and reassess their guidelines for the management of .the more common conditions based on sound scientific evidence and recommendations

I call upon policy makers, program managers and service providers to join the national effort to safeguard the downward trend on MMR and to share in the responsibility to achieving the set targets and to .work to minimize avoidable deaths in order to guarantee our continued success in Jordan

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Secretary General
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EXECUTIVE SUMMARY

This report describes the surveillance that was conducted to identify pregnancy-related deaths for the biennium 2007-2008. The aim and objectives were to review the factors that contributed to those deaths, to analyze and interpret the information gathered, with the ultimate goal of acting on the results to reduce such deaths in the future.

Worldwide, in 2005 there were over 500,000 maternal deaths. By the broad Millennium Development Goals, developing countries accounted for 99% of these deaths, at 450 maternal deaths per 100,000 live births, in contrast to developed countries at 9 per 100,000 live births. It is estimated that the adult lifetime risk of maternal death, i.e. the probability that a 15-year-old female will die from a maternal cause, is 1 in 26 in Africa, 1 in 120 in Asia, in contrast to 1 in 7300 in the developed world.

OBJECTIVES OF THE STUDY

The objectives of maternal mortality study in Jordan, 2007-2008, were as follows:

1. Estimate maternal mortality ratio among Jordanian women in the reproductive age.
2. Identify the direct and indirect causes of maternal mortality.
3. Determine the extent to which maternal deaths are preventable.
4. Determine the factors which if addressed, would prevent maternal deaths.
5. Assess hospital medical records and vital records in terms of appropriateness and completeness.

STUDY DESIGN

This study aimed to identify all maternal deaths for the years 2007-2008 in jordan. The reproductive-age mortality survey (RAMOS) approach was applied to study maternal deaths. Multiple approaches for data collection and validation were followed during the study. Civil registration systems, household surveys, sister hoods methods, reproductive-age mortality studies (RAMOS), community-based maternal death reviews (verbal autopsy) and facility-based maternal deaths review. RAMOS is the gold standard for identifying pregnancy-related approach.

RESULTS

A total of 76 maternal deaths were identified in the biennium 2007-2008 out of 397588 live births, a maternal mortality ratio of 19.1 deaths per 100,000 live births. Analysis of trends showed that young age, large family size, being from the Southern Region of the country, attending peripheral hospitals, lower education and lower monthly family income were associated with a higher risk of maternal death.

Of the total of 76 maternal deaths, 56.6% were attributable to haemorrhage, thrombosis and thromboembolism and sepsis. Avoidable factors were judged to be present in 53.9% of the total maternal deaths, and 52.6% had substandard care, Antenatal care was poor as 19.7% women did not attend any health facility for antenantel care 33.3% had less than 3 or less antenatal visits in total.

Of all 76 women maternal deaths, the details of family planning were not available for 32.9% of women. Of those with available information, only 29.4% had ever used any form of contraception, and 70.6% had never used any form of contraception. Of the total, 39 (51.3%) women were planning to conceive the index pregnancy.

RECOMMENDATIONS

1. Develop a national maternal health policy which prioritize the interventions needed to reach the population groups most in need and bring all elements of maternal health together in one policy document.

2. Adopt and scale up the implementation of the strategies and plans of action related to Making Pregnancy Safer, these having proved effective in supporting national efforts towards achieving the MDGs. In this respect, appropriate monitoring mechanisms to ensure effective implementation of national plans in accordance with their targets and objectives should be set up.

3. Upgrade recording and reporting systems to ensure data consistency and efficient input to the national health information systems, and further develop national surveillance systems to identify epidemiological patterns and maternal morbidity and mortality trends.

4. Extend efforts in implementing community-based interventions related to maternal health as an investment towards developing and empowering the community to play an active and effective role in caring for mothers and children. Particular focus should be placed both on early recognition of the danger signs of sickness and also on preventive measures to promote maternal health.

5. Introduce the adapted maternal health-related guidelines into the formal teaching curricula of medical and paramedical schools, both to improve the quality of teaching and to ensure sustainability of the effective interventions.

INTRODUCTION

Improving maternal mortality is one of the eight Millennium Development Goals (MDGs) adopted at the Millennium Summit in 2000. Within this framework, the international community is committed to reduce the Maternal Mortality Ratio (MMR) by three quarters between 1990 and 2015 [1].

The World Health Organization (WHO), the United Nations Children's Fund (UNICEF), and the United Nations Population Fund (UNFPA) have analyzed the trends to assess the likely change in MMR from 1990 to 2005 at the regional and global levels. Of the estimated total of 536000 maternal deaths in a total of 171 countries and territories worldwide in 2005, developing countries accounted for 99% (533000) of these deaths. Slightly more than half of the maternal deaths (270000) occurred in sub-Saharan Africa alone, followed by South Asia (188000). Thus, Sub-Saharan Africa and South Asia accounted for 86% of global maternal deaths [2].

By the broad MDG regions, MMR in 2005 was highest in developing regions (at 450 maternal deaths per 100,000 live births), in contrast to developed regions (at 9 maternal deaths per 100,000 live births). In addition, the adult lifetime risk of maternal death (the probability that a 15-year-old female will die from a maternal cause) is highest in Africa (at 1 in 26), followed by Oceania (1 in 62) and Asia (1 in 120), while the developed regions had the smallest lifetime risk (1 in 7300) [2].

By countries, of all 171 for which estimates were made, Niger had the highest estimated lifetime risk of 1 in 7, in stark contrast to Ireland, which had the lowest lifetime risk of 1 in 48000 [2]. These estimates strongly indicate a need for more action for maternal mortality reduction and more provision of future data on MMR.

At global level, maternal mortality had decreased at an average of less than 1% annually between 1990 and 2005 [2]. This is far below the 5.5% annual decline recommended by the fifth Millennium Development Goal. To achieve that goal, MMRs will need to decrease at a much faster rate in the future especially in developing countries.

Confidential enquires into maternal deaths assess the levels, causes of, and contributors to maternal mortality and learn lessons to address these. For this purpose, individual countries' in-depth reviews of maternal mortality are a necessity. Furthermore, those reviews, through audit of standards of maternity services, can determine new strategies needed for better resource allocation. Thus, confidential enquires are vital towards improved quality of medical care for women, with the ultimate goal of making pregnancy safer [3,4].

Jordan launched its first national maternal mortality study in 1995/1996. It reported a MMR of 41.4 per 100,000 live births. Prior to that there were only some hospital-based studies, but none were conducted on a national basis. The 1995/1996 study covered all hospital deaths and civil registry reported deaths. The study claimed accuracy rate of around 99%. During the study period, 91% of all deliveries had taken place in hospitals, 7% had taken place outside hospitals and were supervised by health centers and United Nations Relief and Works Agency (UNRWA) district nurses, and only 2% were supervised by trained midwives and traditional birth attendants. The study found that 76.5 % of maternal deaths took place in hospitals, 11.7% during transportation and 11.7% at home. The study found that 70% of maternal deaths occurred during or after delivery (8% and 62% respectively), and 30% during pregnancy. Hypertensive disorders in pregnancy were the leading cause for direct maternal mortality, followed by haemorrhage and pulmonary embolism. Cardiac diseases followed by malignancy and diabetes mellitus were the leading three indirect causes of maternal deaths [5].

SIGNIFICANCE OF THE STUDY

Maternal death has implications for the whole family and an impact that rebounds across generations. The complications that cause the deaths and disabilities of mothers also damage the infants they are carrying. Of nearly 8 million infant deaths each year, around two-thirds occur during the neonatal period, before the age of 1 month; 3.4 million of these neonatal deaths occur within the first week of life and are largely a consequence of inadequate or inappropriate care during pregnancy, delivery, or the first critical hours after birth. Moreover, for every neonate who dies at least one other infant is stillborn. Significant additional reductions in infant mortality can be achieved with interventions designed to improve the health of the mother and her access to care during labour, birth, and the critical hours immediately afterwards [2,4].

Finding as many pregnancy-related deaths as possible is important. Women die at home, in clinics, or in hospitals. They die during pregnancy, while giving birth, or after delivery; they die of complications from childbirth, abortion, or ectopic pregnancy. To have a representative picture of the determinants of maternal death, one needs to have a complete picture of the women who died as possible. Women who die at home may be different from women who die in referral hospitals. Women who die on labor or delivery wards may have different stories from women who die on gynecology wards or emergency rooms. At national and international levels, the demand for reliable maternal death estimates has grown significantly since the creation of the Millennium Development Goals [1].

The reduction of maternal deaths is a high priority for the international community, especially in view of the increased attention on the Millennium Development Goals. Maternal deaths arise from the risks attributable to pregnancy and childbirth as well as from the poor quality care from health services. Effective services to improve overall maternal health need targeted health and social policies that are informed by reliable and valid epidemiological data. A comprehensive summary of the magnitude and distribution of the causes of maternal deaths is critical to inform reproductive health policies and programmes. Identifying and reviewing pregnancy-related deaths, analyzing the findings, and taking action should decrease a woman's risk of mortality due to pregnancy as well as help the many women who suffer pregnancy-related morbidity without dying [2,4].

To improve maternal health and survival, decision-makers must make difficult choices about where to allocate scarce resources and how to set programme and policy priorities. To make such decisions, policymakers and programme planners need accurate data on the level of and trends in maternal death in their country or region. Equally valuable is information on differences in the risk of maternal death between, for example, remote and urban communities, or between the rich and the poor in a country. Unfortunately, reliable and comparable data are scarce. Too often policies or programmes are developed despite a lack of data that identifies which women are at highest risk of maternal death and inadequate knowledge of what actions are most likely to reduce the risk of such deaths [2,4].

Reliable data on the levels and causes of maternal death can be used for planning, monitoring, and evaluating programmes. Such data can also be used for priority setting and advocacy, which can help increase awareness about safe motherhood, encourage accountability, and raise funds [2,4].

Study Objectives

The objectives of maternal mortality study in Jordan, 2007-2008, were as follows:

1. Estimate maternal mortality ratio among Jordanian women in the reproductive age.
2. Identify the direct and indirect causes of maternal mortality.
3. Determine the extent to which maternal deaths are preventable.
4. Determine the factors which if addressed, would prevent maternal deaths.
5. Assess hospital medical records and vital records in terms of appropriateness and completeness.

METHODOLOGY

Target Population and Study Sample:

All reproductive age deaths in Jordan (institutional and non-institutional) during the years 2007 and 2008 were included. All deaths listed in the National Death Registry and/or Death Certificates of women aged 15–49 years and corresponding clinical records were reviewed based on the definitions of the International Classification of Disease (ICD-10) with the exclusion of late maternal deaths and pregnancy related deaths [6].

This study aimed to identify all maternal deaths for the years 2007-2008 in Jordan. The reproductive-age mortality survey (RAMOS) approach was applied to study maternal deaths. RAMOS is the gold standard for identifying pregnancy-related approach and involves:

1. Identifying and investigating the causes of all deaths of women of reproductive age in a defined area/ population by using multiple sources of data (e.g. interviews of family members, vital registrations, burial records, traditional birth attendants, reviewing the medical records of physicians, clinics, and hospitals) on all women who died from age 10 through 50.

2. Review of autopsy records of selected deaths with causes likely to be associated with pregnancy (e.g., deaths from haemorrhage, embolism, or sepsis).

3. Deaths from causes such as motor vehicle-related injuries and cancer would not be reviewed.

RAMOS has the following characteristics:

1. Judgment is made concerning the most recent and the best estimate (e.g. direct sisterhood would be selected over indirect sisterhood method and RAMOS over vital registration if both are available for the same year).

2. RAMOS fills the gap caused by poorly functioning vital registration systems.

3. Varied sources of information must be used; no single source identifies all the deaths.

4. Inadequate identification of all deaths of reproductive-aged women results in underestimation of MMR

5. Interviews with household members and health-care providers and reviews of facility records are used to classify the deaths as maternal or otherwise.

6. If properly conducted, this approach provides a robust estimation of maternal mortality (in the absence of reliable routine registration systems) and could provide national MMRs.

7. Can be complicated, time-consuming, and expensive.

8. The number of live births used in the computation may not be accurate where most women deliver at home.

An action plan was set for the entire 2007 and 2008 Jordan Maternal Mortality Study period (Appendix 1, 2).

Operational Definition

The International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, 1992 (ICD-10), of WHO includes the following concepts and definitions [6]:

Maternal Death

Defined as «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 but not from accidental or incidental causes».

This definition requires cause-of-death information so that accidental and incidental causes can be excluded and maternal deaths can be subdivided into two groups: direct obstetric deaths and indirect obstetric deaths.

Direct obstetric death

Defined as «death resulting from obstetric complications of the pregnant state (pregnancy, labour and the puerperium), from interventions, omissions, incorrect treatment, or from a chain of events resulting from any of the above».

Indirect obstetric death

Defined as «death resulting from previous existing disease or disease that developed during pregnancy and which was not due to direct obstetric causes, but was aggravated by physiologic effects of pregnancy».

Pregnancy-related death

Defined as «death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the cause of death». This concept of pregnancy-related death incorporates maternal deaths due to any cause. According to this concept, any death during pregnancy, childbirth, or the postpartum period is defined as a "pregnancy-related death" even if it is due to accidental or incidental causes. This alternative definition allows measurement of deaths in settings where accurate information about causes of deaths based on medical certificates are unavailable such as when the sisterhood method is used, without eliciting any information on cause of death, thus measuring pregnancy-related deaths rather than maternal deaths.

Measures of maternal mortality

It is important to measure maternal mortality to:

- Establish levels and trends of maternal mortality.
- Identify characteristics and determinants of maternal deaths.
- Monitor and evaluate effectiveness of activities designed to reduce maternal mortality.
- Monitor progress towards the Fifth Millennium Development Goal.

Maternal Mortality Ratio (MMR)

number of maternal deaths during a given time period per 100,000 live births during the same time period.

$$MMR = \frac{\text{Number of Maternal Deaths}}{\text{Number of live Births}} \times 100\,000$$

$$MMR = \frac{\text{MMRate}}{\text{General Fertility Rate}}$$

$$MMR = 1 - (1 - LTR)^{1/TFR}$$

(LTR: lifetime risk).

.(TFR: total fertility rate)

Maternal Mortality Rate

Number of maternal deaths in a given time period per 100,000 women of reproductive age, or woman-years of .risk exposure, in the same time period

$$MMRate = \frac{\text{Number of MaternalDeaths}}{\text{Number of Women Aged 15-49 years}} \times 100\,000$$

$$MMRate = MMRatio \times General\ Fertility\ Rate$$

$$MMRate = 1 - (1 - LTR)^{1/35}$$

Lifetime Risk of Maternal Death

.The probability of maternal death across a woman's reproductive life, usually expressed in terms of odds

$$LTR = 1 - (1 - MMRate)^{35}$$

(Proportion of Maternal Deaths Among Female Deaths (PMDF

Maternal deaths as a proportion of all female deaths of reproductive age, usually defined as 15–49, in a .given time period. It reflects contribution of maternal deaths to overall mortality among women of reproductive age

$$PMRDF = \frac{\text{Number of MaternalDeaths in a Period}}{\text{Number of Dead Women Aged 15-49 years in Same Period}}$$

Case Fatality Rate

Reflects the number of women who die from a specific complication among all pregnant or recently delivered women who experience that complication.

Study Desgin

Approaches for Measuring Maternal Mortality

In order to measure maternal mortality, number of approached in data collection and validation. Civil registration systems, houesold surverys, sister hoods methods, Reproductive-age mortality studies (RAMOS), Community-based maternal death reviews (verbal autopsy) and Facility-based maternal deaths review.

Civil registration systems

Maternal mortality, ideally, should be obtained through civil registration data, where there is routine registration of births and deaths. However, even where all deaths are identified based on standard medical certificates, maternal deaths may be missed or misclassified, and therefore active case-finding is necessary [7].

Household surveys

Household surveys provide an alternative where civil registration data are not available. However, they identify pregnancy-related deaths, rather than maternal deaths, and require large sample sizes to provide statistically reliable estimates as maternal deaths are rare events. Because of wide confidence intervals, even with large sample sizes, it is difficult to monitor trends [2].

Sisterhood methods

Sisterhood methods gather information by interviewing a representative sample of respondents about the survival of all their adult sisters. Data is obtained about number of ever-married sisters with details on whether they are alive or dead, and if death was related to pregnancy, delivery, or within six weeks of delivery. This approach reduces the sample size, but it identifies pregnancy-related deaths, not maternal deaths, with wide confidence intervals, thereby precluding trend analysis [8, 9].

Reproductive-age mortality studies (RAMOS)

This approach identifies and investigates all deaths of women of reproductive age in a defined population by using multiple sources of data (Civil Registry and Ministry of Health entries, health facility records, interviews of attending health care workers, forensic medicine records and family members) [10-12].

Community-based maternal death reviews (verbal autopsy)

This approach is based on interviews with family members, neighbors, and traditional birth attendants, where cause of death is not available. Misclassification of causes of reproductive-aged female deaths with this technique is not uncommon [13-15].

Census

Because all women are covered in a national census, sampling errors are eliminated. Extra information need to be obtained by trained enumerators in maternal death enquiries [16].

Facility-based maternal deaths review

This is a qualitative, in-depth investigation of the contributing causes, and circumstances surrounding, maternal deaths which occur in health care facilities. It is particularly concerned with tracing the path of the women who died, through the health care system and within the facility, to identify any avoidable or remediable factors which could be changed to improve future maternal care [17].

Data Collection

Prior to beginning the survey, conformity with the Higher Population Council implementation protocol of the study was achieved. The Higher Population Council issued the necessary credential letters addressed to all governmental and non-governmental parties involved in the study. The study team initiated visits to the Civil Registry Department and the Department of Information at the Ministry of Health. A comprehensive list of deaths of women aged 15–49 years was obtained from the Jordanian Ministry of Health and the Jordanian Civil Registry (these governmental institutions were the primary source for death certificate collection of reproductive age women). By amalgamating the two lists and omitting duplications, one master list was created with the names of all dead women of reproductive age. The list included dead women's names (first, father, grand-father and surnames), birth date, death date, place of death, address, and national number. This was the first step toward composing a master list.

The study team met on a regular basis to

1. Finalize the survey questionnaire. The questionnaire (Appendix 3) was developed and comprised three sections: hospital and household based information (sections 1 and 2) had questions to fill in from hospital records, doctors, households and family members. The third section was for verbal autopsy of cases with no ascertained cause of death by the previous sections in the questionnaire. The final workable version was divided into subdivisions that included demographic profiles, admission information, death event information, history (family, medical, and obstetric), reference pregnancy, hospital file information, household information including socioeconomic status, delays in taking action, quality of health care services and verbal autopsy questions.

2. Agree on the data collection protocol. It was decided to contact the relatives of the dead women with an available telephone number. If the result indicated that the death was not during pregnancy, childbirth, or during the 42 days after termination of pregnancy, the name was categorized as "NO" in the master list, and no further action was taken to investigate her hospital records. The hospital records of all the remaining names were reviewed.

3. Decide to investigate deaths of all reproductive age women at United Nations Relief and Works Agency, all forensic departments and all hospitals in Jordan.

4. Explore the best way to identify place of death for those women in the master list with no details on place of death. The team decided to look for those details by initially finding the telephone numbers of their next of kin from the telephone directory. Local health care professionals (doctors, midwives and nurses) helped in identifying some addresses and telephone numbers.

5. Contact specialists from other areas for consultation in cases where the cause of death was not clear or controversial. Examples included consultation with gynaecologists, histopathologists, radiologists, anaesthetists and forensic experts.

Implementation

A pilot survey started in January 2008 at Princess Basma hospital in the city of Irbid, Northern Region. The study team appointed a member from the study team to be in charge of identification and collection of information on all maternal mortality cases. The protocol encompassed identification of all hospitals in Jordan, contacting their administrative offices, visiting all hospitals to locate the records of all women named in the master list, cross checking with the hospital's own death registry to identify any possible names not included in the master list.

From the Civil Registry, a list with 1164 names was obtained for dead women between 15 and 49 years of age with full name, residence, national number, dates of birth and death, place of death. From the Ministry of Health (MOH), 848 names were obtained with full name, residence, national number, date of birth, date of death, place of death, name of attending doctor, marital status, and telephone number if available.

The two lists were pooled and contained details on 1177 married women in the age group 15-49 years. Those 1177 names included in this list were grouped according to the region in which they died: Northern (272 names), Middle (802 names), and Southern regions (103 names).

Of this list, 518 women had no hospital details. Those with telephone numbers were contacted, and for those without telephone numbers, extensive attempts were made to obtain their numbers from the Telephone Directory. The relatives were contacted regarding hospital details, department, doctors> name, details regarding the time of death in relation to the pregnancy or puerperium, age of youngest child. Hospitals were visited to search for women whose households were not contacted. Women with no death location and no contact number shrank to 322. Further investigation into telephone numbers of relatives and death informants brought this number down to 82. Of the 240 leads that were contacted, only one was a maternal related death, which was cross identified during the visit to Princess Iman hospital at Maadi. From visits to hospitals, 229 names of dead women in the reproductive age were obtained directly.

Visits to the Police Units in charge of «Dead on Arrival» cases were conducted to identify any possible cases. Available Forensic Medicine Departments were visited to identify any cases with unknown cause of death.

The hospital records for 1406 names identified from the master list and hospital registry (1177 and 229 names, respectively) were the final number of reproductive age dead women (Fig 1). The next visit was to the dead women households after making telephone call contact, thus all possible sources of information were approached to identify maternal deaths. The questionnaires were filled-in with information about all identified maternal mortality cases, and were checked for any missing information from physicians, obstetric wards and family members as necessary.

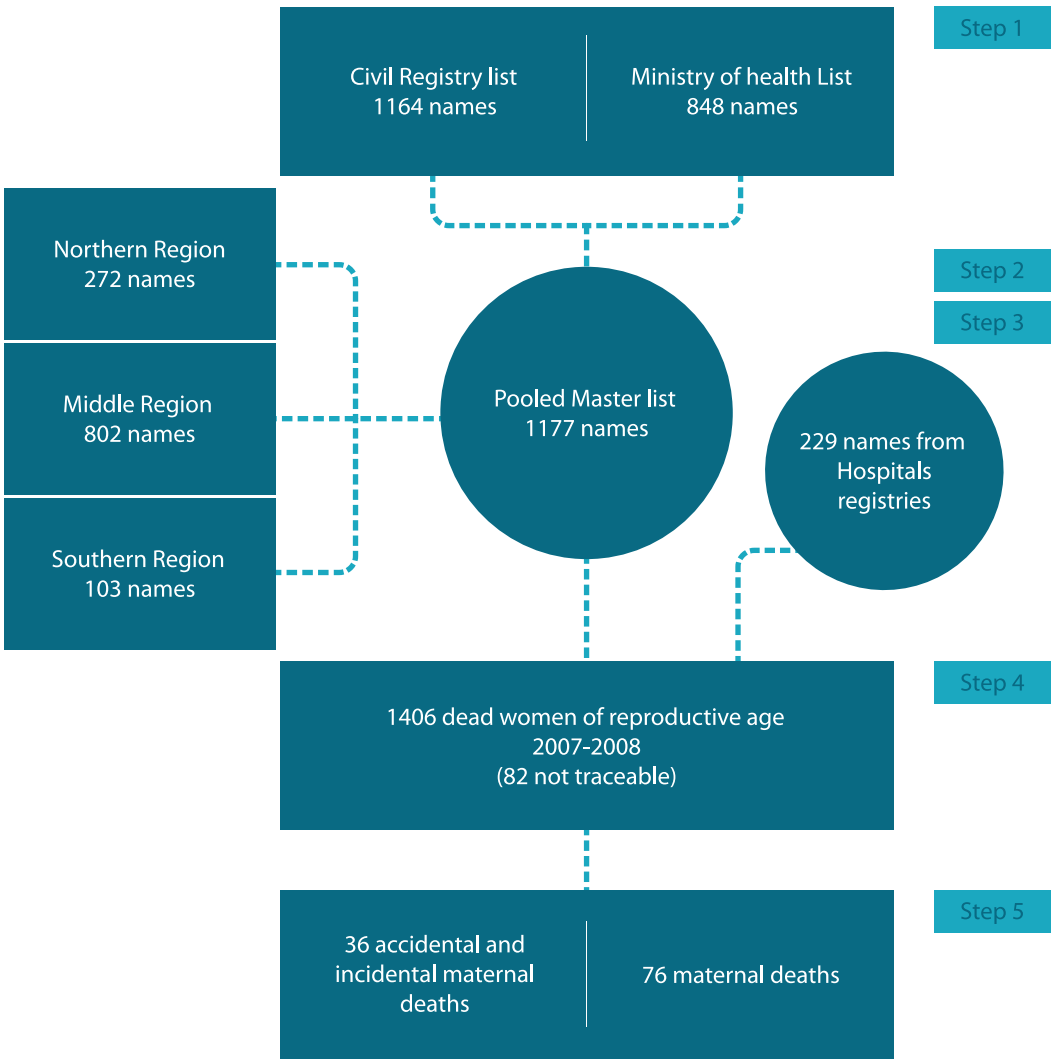
Caesarean Section classification

The types of Caesarean Section were classified as follows:

Emergency: Immediate threat to life of woman or fetus.
Urgent: Maternal or fetal compromise which is not immediately life threatening.
Elective: At a time to suit the patient and the maternity team.
Perimortem: Carried out in extremes while the mother is undergoing active resuscitation.
Postmortem: Carried out after the death of the mother in order to try to save the fetus.

The definition of major substandard care used in this report refers to those which contributed significantly to the death of the mother, where different management would reasonably have been expected to alter the outcome, and minor where it was a relevant contributory factor, and a different management was unlikely to alter outcome.

Figure 1. *Steps of identifying maternal mortality cases during the years 2007- 2008*



Maternal mortality ratio

To calculate maternal mortality ratio two variables are required:

1. The number of maternal deaths according to the definition in the years 2007-2008.
2. The number of total live births in Jordan for the years 2007- 2008.

Maternal mortality ratio (MMR): number of maternal deaths during a given time period per 100,000 live births during the same time period.

$$\text{MMR} = \frac{\text{Number of Maternal Deaths}}{\text{Number of live Births}} \times 100\,000$$

Data Analysis

All data were coded and entered in an Excel file and then transferred to the Statistical Package for Social Sciences (SPSS, version 15). Data were organized and summarized using frequencies (frequency distribution was used for categorical variables and means and standard deviation were used for continuous variables), means and proportions. Graph Pad Software was used to analyze confidence intervals [18].

RESULTS

Characteristics of maternal deaths

A total of 76 maternal deaths were identified in 2007-2008 out of 397588 live births, a maternal mortality ratio of 19.1 deaths per 100,000 live births. Of those maternal deaths, 40.8% were in the age group of 15-29 years, 29.3% had a family size of 7 members or more, and 15.8% of deaths occurred in the Southern Region of the country, where the population there constitutes only 9.3% of the total population of Jordan [19]. Only 38.1% of women had finished some college education, 19% had high school certification, 14.3% had middle school education, 19% had elementary education, and 9.6% were illiterates. The majority (80.4%) had a monthly family income of <350 Jordanian Dinars. Of all maternal deaths, 46.1% took place at peripheral hospitals, and 17.1% did not make it to a hospital. The distribution of maternal deaths according to socio-demographic, maternal and relevant characteristics is shown in Table 1.

Table 1. Distribution of maternal deaths according to certain characteristics.

Variable	n	%
Age		
15-29	31	40.8
30-39	27	35.5
≥40	18	23.7
Region		
Middle (62.3% of population)	45	59.2
Northern (28.1% of population)	19	25
Southern (9.3% of population)	12	15.8
Family size		
2-3	17	29.3
4-6	24	41.4
≥7	17	29.3
Income in Jordanian Dinar		
≤350	41	80.4
>350	10	19.6
Gravidity		
1-3	28	43.1
4-6	21	32.3
≥7	16	24.6
Parity		
0-1	23	34.8
2-4	26	39.4
≥5	17	25.8
Gestational age		
≤27	18	24
28-36	17	22.7
≥37	40	53.3
Nationality		
Jordanian	70	92.1
Egyptian	3	3.9
Syrian	1	1.3
Chinese	1	1.3
Bangal	1	1.3

Measures of maternal mortality

The measures of maternal mortality and the necessary data for Jordan for the years 2007-2008 are shown in Table 2. The maternal mortality ratio was 19.1 per 100,000 live births (95% confidence interval: 14.3 to 26.5). The adult lifetime risk of maternal death (the probability that a 15-year-old female will die from a maternal cause) was 1 in 1428.

Table 2. Number of maternal deaths, number of live births, total fertility rate, and measures of maternal mortality for 2007-2008.

Number of maternal deaths (95% CI)	76 (60 to 95)
Number of live births in 2007	192058
Number of live births in 2008	205530
Number of live births in 2007-2008	397588
Total fertility rate (TFR)	3.6
Maternal Mortality Ratio (per 100,000 live births) (95% CI)	19.1 (14.3 to 26.5)
Maternal Mortality Rate (per 100,000 women of reproductive age)	2
Lifetime risk of maternal death (The probability that a 15-year-old female will die from a maternal cause)	0.0007 (1 in 1428)

Causes of maternal deaths

Of the total of 76 maternal deaths (35 deaths in 2007, and 41 deaths in 2008), 56 (73.7%) were due to direct causes. Of the total, 19 (25.0%) were due to haemorrhage. This was the most common direct cause of maternal deaths and the most frequent cause-specific maternal mortality factor. The most common cause of indirect deaths was cardiac disease (10.5%). Overall, more than half (56.6%) of maternal deaths were attributable to hemorrhage, thrombosis and thromboembolism and sepsis. The distribution of causes for maternal deaths is shown in Table 3.

Table 3. Direct and indirect causes of maternal deaths among Jordanian women in 2007- 2008 (N=76).

Causes of maternal deaths	n	%
Direct Causes	*56*	*73.7*
Haemorrhage	19	25
Uterine rupture (n=5)		
Uterine atony (n=5)		
Placental abruption (n=3)		
Disseminated intravascular coagulation (n=4)		
Ruptured ectopic pregnancy (n=2)		
Thrombosis and thromboembolism	18	23.7
Sepsis	6	7.9
Hypertensive disorders of pregnancy	5	6.6
Amniotic fluid embolism	4	5.3
Anesthesia	3	3.9
Hyperemesis gravidarum	1	1.3
Indirect Causes	*20*	*26.3*
Cardiac disease	8	10.5
Diseases of the central nervous system	6	7.9
Cerebro-vascular accident (n=4)		
Epilepsy (n=2)		
Infectious diseases	4	5.2
Hepatobiliary peritonitis (n=2)		
Pancreatic perotonitis (n=1)		
Pulmonary purulent infection (n=1)		
Chronic anemia	1	1.3
Renal failure	1	1.3

Maternal deaths as being avoidable or non-avoidable

Avoidable factors were judged to be present in 41 (53.9%) of the total maternal deaths. Forty women (52.6%) had substandard care. Seventy-five percent of cardiac deaths were associated with some degree of substandard care. Of the total, 9 (16.7%) women did not attend any health facility for antenatal care and 15 (33.3%) had, in total, 3 or less antenatal visits all through their pregnancy. Responsibility for these factors was allocated to patients alone, referring medical practitioner, hospital medical staff, or combinations of those. The majority of those maternal deaths could have been prevented where certain factors, whether on part of the family or on the part of the health care personnel not taken place (Table 4).

Table 4. Factors associated with maternal mortality among Jordanian women in 2007-2008.

Type	*n*	*%*
Transport delay	3	4.0
Delay in seeking care	42	55.3
Delay in providing prompt care	37	48.7
Substandard Management	40	52.6
Suboptimal facilities	4	5.3

Distribution of maternal deaths according to important variables

The distribution of maternal deaths among Jordanian women in 2007-2008 by period of pregnancy, type of hospital and autopsy status is shown in Table 5. The place of death for the majority of cases was hospital-based. Of the total maternal deaths, 17.1% of women arrived dead, 2.6% of women died at maternity hospitals, 46.1% died at general peripheral hospitals, and 34.2% at general referral hospitals. More than half (56.6%) of women died after delivery, 36.8% died during pregnancy, and 6.6% died during labour. A total of 22 women (28.9%) had undergone autopsy (Table 5).

Table 5: Frequency distribution of maternal deaths among Jordanian women in 2007-2008 by period of pregnancy, type of hospital and autopsy status (N=76).		
Period of pregnancy	*n*	*%*
During pregnancy	28	36.8
Intrapartum	5	6.6
Postpartum	43	56.6
Type of hospital		
Death on Arrival	13	17.1
Maternity	2	2.6
Peripheral	35	46.1
Referral	26	34.2
Autopsy status		
Dead on arrival-Autopsy	13	17.1
Hospital death-Autopsy	9	11.8
Arrived dead-No Autopsy	3	3.9
Hospital death-No Autopsy	51	67.1

The type of delivery for all maternal deaths occurring after 24 weeks of completed gestation is shown in Table 6. A total of 27 women were delivered by Caesarean Section.

Table 6. Frequency distribution of maternal deaths by mode and status of delivery N=76		
Type of delivery	*n*	*%*
No delivery	24	31.5
Abortion	5	6.5
Spontaneous vaginal	15	19.7
Induced vaginal	1	1.3
Ventouse	1	1.3
Forceps	3	3.9
Vaginal breech	0	0.0
Caesarean Section	27	35.5
Emergency	20	26.3
Elective	5	6.5
Perimortem	1	1.3
Postmortem	1	1.3

Furthermore, of all 76 women maternal deaths, the details of family planning were not available for 25 (32.9%) women. Of those with available information, only 15 (29.4%) had ever used any form of contraception, 36 (70.6%) had never used any form of contraception. Of the total, 39 (51.3%) women were planning to conceive the index pregnancy.

Thirty-Eight (50%) of the next of kin were satisfied with the health care provided to their dead relatives. Among the reasons for reported dissatisfaction were "long waiting time" (28%), "lack of respect" (39%), "delay of care" (53%) and "lack of competent staff" (63%).

Characteristics and determinants of maternal deaths

Access to care

Health insurance status: 24.6% of women had no medical insurance, 20% had military insurance, 38.5% had MOH insurance, 7.7% had UNRWA insurance which did not cover delivery procedure, and 9.2% had private company insurance cover.

Transport: 97% of women had no problem in relation to physical accessibility to health facilities, 20% of women were within 15 minutes car journey to the nearest hospital.

Delays: there was no problem in relation to physical accessibility to health facilities; however there were certain factors that contributed to maternal deaths, such as:

a. Family delays: In 42 (55.3%) cases there was a delay in seeking care.

b. Home hospital delays: 13 women were initially admitted to a hospital, but were subsequently transferred to another hospital. One of them had delivered in one referral hospital, developed post-partum haemorrhage, and while in critical condition was transferred to a peripheral hospital due to lack of beds. Another 3 women were admitted to a hospital, referred to another hospital, and followed by a further referral to a tertiary referral hospital. Two women reported to hospitals and were reassured and sent home at a time when they were in bad need for admission to the hospital.

c. Patient behavioral delays: 4 patients signed their own discharge against medical advice, and were later readmitted in a very critical condition and subsequently died. One woman had refused to terminate her pregnancy against medical advice shortly before her death.

Accidental and incidental maternal deaths

A total of 36 women were found to have died of accidental or incidental causes as detailed in Table 7.

Table 7. Frequency distribution of accidental and incidental deaths by cause.	
Cause of death	n
Road traffic accident	11
CO poisoning	4
Lymphoma or Leukemia	3
Homicide	2
Burn	1
Electric shock	2
Meningitis	1
Pancreatic cancer	1
Breast cancer	1
Ruptured aneurism	1
Colon cancer	1
Bowel obstruction	2
Cardio-vascular accident	3
Dog bite	1
Fall	1
Drowning	1
Total	36

OPERATIONAL DIFFICULTIES

Many of the names included in the master list of reproductive age dead women were not found in the hospital records or anywhere else. Death certificates were insignificant in identifying maternal deaths.

Hurdles were encountered which hindered the course of this study. Three institutions declined access to their medical records, for 6 to 13 months, due to delays in correspondence, obtaining higher authority approval, taking a final decision and arranging contact personnel.

Many maternal deaths identified in Forensic Medicine Departments were with no hospital identifying details, names or address of a family member. Similarly, many hospital death files contained no records of addresses or phone numbers. Only the city or the village of residence were documented, and not for all of them.

Out of 76 files on maternal deaths, only 12 were well structured and had complete details about events in their respective hospitals. Substandard quality was evident in all other medical case notes that were reviewed. Key data were missing, such as the address or telephone number of relatives and details about the current and previous pregnancy, medical and family history.

Similarly, during the search through the files of dead women of reproductive age to identify those that were maternal deaths, the vast majority lacked details on the marital status, and if the dead women were married, files lacked any details about their reproductive history, current address and telephone number, medical and family history. In addition, non-standardized physical exam notes were used, with very little effort to report observed abnormalities. In a large percentage of cases it was impossible to completely assess all required information, in the form of ineligible writing or the use of unfamiliar abbreviations. Most of those notes were not signed, dated or stamped.

In addition, many files were deficient and improperly indexed, with pages that were not numbered, not organized in order of date of entry or event, and with missing laboratory results.

Furthermore, 4 files could not be located. The data for those cases had to be retrieved through an interview with the doctor in charge, the head of the department, and members of the family.

DISCUSSION

This report should reassure the public that maternal deaths in Jordan are rare and declining. Overall, 76 women had a maternal death out of the 397588 mothers who gave live birth during the years 2007-2008. The maternal mortality ratio for both direct and indirect causes of death showed a remarkable decrease as compared with the last Report of 1995/1996. A reduction of 53.9% achieved in 12 years (4.5% annual reduction) goes well with the 75% reduction as recommended by the Millennium Development Goal 5. At global level, maternal mortality had decreased at an average of less than 1 % annually between 1990 and 2005 [3]. This is far below the 5.5% annual decline recommended by the fifth Millennium Development Goal.

Country estimates of maternal mortality over time are crucial to inform planning of reproductive health programmes and to guide advocacy efforts and research at the national level. These estimates are also needed at the international level, to inform decision-making concerning resource allocation by development partners and donors [1,2].

Globally, women die from a wide range of complications in pregnancy, childbirth or the postpartum period. The five major killers are: severe bleeding (mostly bleeding postpartum), infections (also mostly soon after delivery), hypertensive disorders in pregnancy (eclampsia), obstructed labour [2,20], and complications after unsafe abortion that causes 13% of maternal deaths. About 80% of maternal deaths are due to these five causes. Among the indirect causes (20%) of maternal deaths are diseases that complicate pregnancy or are aggravated by pregnancy, such as malaria and anaemia. Women also die because of poor health at conception and lack of appropriate care needed for the healthy outcome of the pregnancy for themselves and their babies [2].

The main causes of maternal mortality differ between developed and developing countries. The order of leading causes of direct and indirect deaths as reported by the Confidential Enquiry into Maternal Death in the United Kingdom 2000–2002 are different from that of the global scale (Table 8-10) [2,21,22].

Table 8. Mortality rates per million maternities of leading causes of direct deaths as reported by the Confidential Enquiry into Maternal Death in the United Kingdom; 2000–2002.

Thrombosis and thromboembolism	15
Haemorrhage	8
Deaths in early pregnancy including ectopics	7
Hypertensive disease of pregnancy	5
Sepsis	6
Other Direct	4
Anaesthesia	3
Amniotic fluid embolism	2

Table 9. Mortality rates per million maternities of leading causes of indirect deaths as reported by the Confidential Enquiry into Maternal Death in the United Kingdom; 2000–2002.	
Cardiac	22
Suicide	18
CNS haemorrhage	12
Epilepsy	7
Infections	7
Respiratory	5
Gastrointestinal	3
Other Indirect	6

Table 10. The World Health Report on causes of maternal deaths, 2005.	
Causes of maternal death	%
Haemorrhage	25
Infection	15
Eclampsia	12
Obstructed labour	8
Unsafe abortion	13
Other direct causes	8
Indirect causes	20

Factors underlying the medical causes

The low social and economic status of women is a fundamental determinant of maternal mortality in many countries. Low status limits the access of girls and women to education and adequate nutrition as well as to the economic resources needed to pay for health care or family planning services. The factors underlying the direct causes of maternal deaths operate at several levels. The low social status of women in developing countries limits their access to economic resources and basic education and thus their ability to make decisions related to their health and nutrition. Some women are denied access to care when it is needed either because of cultural practices of seclusion or because decision-making is the responsibility of other family members [23-26].

Lack of access to and use of, essential obstetric services is a crucial factor that contributes to high maternal mortality. Lack of decision-making power and of alternative opportunities consigns many women to a life of repeated childbearing. Excessive physical work coupled with inadequate diet also contributes to poor maternal outcomes [23-26].

In developing countries, many women are assisted at delivery by traditional birth attendants or relatives, and many deliver alone. World-wide, 61.5% of births were attended by a skilled health worker. Although virtually all births were attended by skilled health personnel in more developed countries, this proportion is 57.4% in less developed countries and only 33.7% in the least developed countries. Skilled birth attendants are defined by the World Health Organization as "trained midwives, nurses, nurse-midwives or doctors who have completed a set course of study and are registered or legally licensed to practice". Only 40% of pregnant women give birth in a hospital or health centre. An estimated 15% of pregnant women will experience life-threatening complications that require emergency care, yet there are almost no data on the proportion with access to such care. In as many as 40% of pregnancies it is likely that there will be a need for some form of special care. Providing skilled attendants able to detect and manage major obstetric complications, together with the necessary equipment and drugs are most important in preventing maternal deaths [27].

Inadequate nutrition contributes to poor maternal health and underlies poor pregnancy outcomes. Inadequate nutrition before and during pregnancy contributes in a variety of ways to poor maternal health, obstetric problems, and poor pregnancy outcomes. Stunting during childhood as a result of severe malnutrition exposes women to the risk of obstructed labour due to cephalopelvic disproportion. Anaemia may be due to several causes, which may interact. These include inadequate intake, and losses due to parasitic infestations and malaria, of iron, folic acid, and vitamin A [28-38].

Approximately 50% of all pregnant women worldwide are anaemic. Women with severe anaemia are more vulnerable to infection during pregnancy and childbirth, are at increased risk of death due to obstetric haemorrhage, and are poor operative risks in the event that Caesarean delivery is needed [28-38].

Severe vitamin A deficiency may make women more vulnerable to obstetric complications and to associated maternal mortality. Further research is needed on the impact of vitamin A deficiency on pregnancy outcome and on the feasibility of introducing vitamin A supplementation into maternal health care programmes. Iodine deficiency increases the risk of stillbirths and spontaneous abortion and, in severely deficient areas, may contribute to maternal death through severe hypo-thyroidism [28-38].

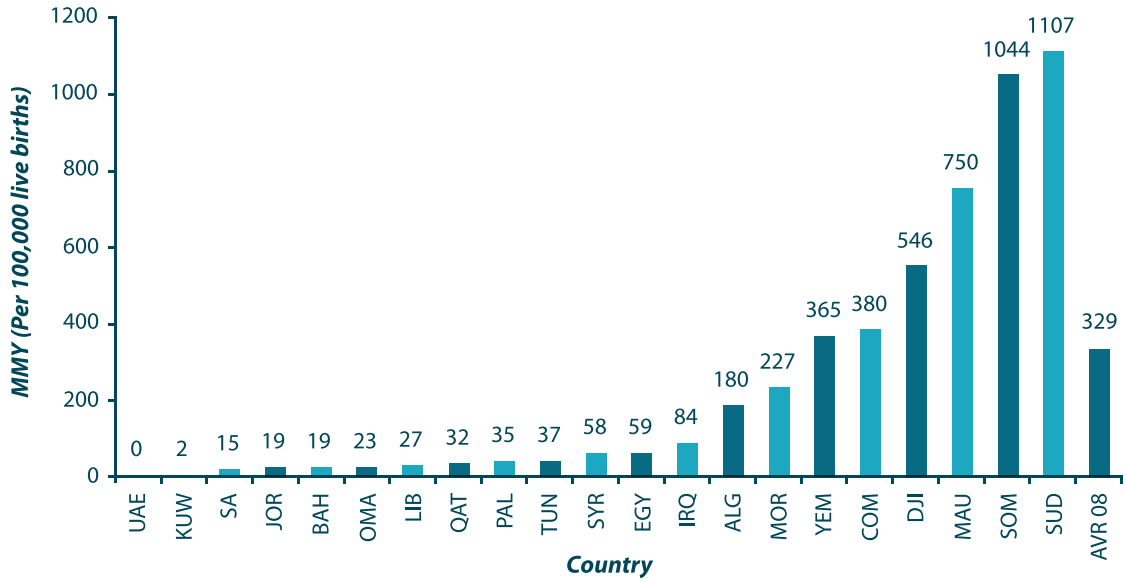
Lack of dietary calcium appears to increase the risk of a woman developing pre-eclampsia and eclampsia during pregnancy. Calcium supplementation seemingly has little impact in preventing pre-eclampsia in areas where dietary intake is sufficient but may be an important option where diets are deficient in calcium. Other micronutrient deficiencies probably contribute to poor health and adverse pregnancy outcomes in some parts of the world, although evidence on the benefits of supplementation during pregnancy is not yet available [28-38].

According to The World Health Organization (WHO), the United Nations Children's Fund (UNICEF), and the United Nations Population Fund (UNFPA), of the estimated total of 536 000 maternal deaths worldwide in 2005, developing countries accounted for 99% (533 000) of these deaths. Slightly more than half of the maternal deaths (270 000) occurred in the sub-Saharan Africa region alone, followed by South Asia (188 000). Thus, Sub-Saharan Africa and South Asia accounted for 86% of global maternal deaths [2].

By the broad Millennium Development Goals regions, MMR in 2005 was highest in developing regions (450 maternal deaths per 100 000 live births), in stark contrast to developed regions (9) and countries of the commonwealth of independent states (51). Among the developing regions, sub-Saharan Africa had the highest MMR (900), followed by South Asia (490), Oceania (430), South-Eastern Asia (300), Western Asia (160), Northern Africa (160), Latin America and the Caribbean (130), and Eastern Asia (50) [2].

By countries, in 2005, a total of 14 had MMRs of at least 1000, of which 13 (excluding Afghanistan) were in the sub-Saharan African region. These countries are (listed in descending order): Sierra Leone (2100), Niger (1800), Afghanistan (1800), Chad (1500), Somalia (1400), Angola (1400), Rwanda (1300), Liberia (1200), Guinea Bissau (1100), Burundi (1100), the Democratic Republic of the Congo (1100), Nigeria (1100), Malawi (1100), and Cameroon (1000). By contrast, Ireland had an MMR of 1 [2].

Compared with the most recent available MMRs from Arab countries in 2008, MMR in Jordan was lower than all Arab States except the United Arab Emirates and Kuwait as shown in figure 2.



Regarding the accuracy of this study's findings, although standardized definitions of maternal mortality exist, accurate measurement of maternal mortality was challenging as it was difficult to identify maternal deaths as routine recording of deaths was not complete within civil registration systems. The vast majority of National Statistics death certificates lacked any information on the maternity related items, and the death of a woman of reproductive age was not recorded in all cases. Even when such a death was recorded, the woman's pregnancy status was not necessarily known and the death would therefore not have been reported as a maternal death. Moreover, in its strive to collect all maternal deaths, the team investigated deaths of all women of reproductive age at UNRWA, all forensic departments and all hospitals in Jordan. This approach identified 229 extra names on top of those from the civil registry and Ministry of Health lists. Of these 229 names, 14 maternal deaths were identified and investigated.

Maternal deaths may be underreported even in developed countries, and identification of the true numbers of maternal deaths may require additional special investigations into the causes of deaths. A specific example of such an investigation is the Confidential Enquiry into Maternal Deaths, which was established in the United Kingdom in 1928. The most recent report for 2000-2002 identified 44% more maternal deaths than was reported in the routine civil registration system [22].

Accurate identification of the causes of maternal deaths by differentiating the extent to which they are due to direct or indirect obstetric causes, or due to accidental or incidental events, was not always possible particularly because correct attribution of causes of death were not always adequate in the various sources of information used in this study, particularly the hospital records. This was compounded by the fact that most cases did not undergo post-mortem examination, which is consistent with the findings of other confidential enquires into maternal deaths [29-39].

The methodology adopted for the purposes of this study was reproductive-age mortality study (RAMOS). This approach involves identifying and investigating the causes of all deaths of women of reproductive age in a defined area or population by using multiple sources, and if properly conducted, this approach provides a fairly complete estimation of maternal mortality in the absence of reliable routine registration systems.

The D group of the WHO 2005 report on maternal mortality compromised Brazil, Egypt, Jordan, and Turkey, have conducted national RAMOS studies (or have conducted RAMOS studies in selected regions of a country that have been nationally adjusted). The reported MMR was accepted as the lower limit of uncertainty, while the upper limit of uncertainty was the RAMOS estimate multiplied by two. The midpoint of the uncertainty limits was taken as the point estimate of MMR [2].

Our data clearly indicated that maternal mortality was predominantly amongst the less privileged, less educated and the uninsured, and, per capita, it was highest in the Southern Region, at 15.8% of all deaths, with a 9.3% of the total population of Jordan. In addition, the vast majority of deaths occurred among those women that utilized family planning services to a lesser degree, for want of having more children. Addressing those areas will further contribute to a targeted further reduction in MMR in Jordan.

Avoidable factors and substandard care was difficult to evaluate in the majority of cases in this report, due to deficiencies in key data in case notes. This was consistent with other reports [40-44]. On one hand it was clear that many of the cases received less than optimum care, on the other it was not always possible to quantify these deficiencies with certainty. Despite the limitations, over 50% of deaths in this report were classified as having some form of substandard care, and avoidable factors were judged to be present in 53.9% of maternal deaths. This contrasts with the 60% and 67% figures of the last 2 Confidential Enquiries into Maternal Death in the United Kingdom, 1997-1999 and 2000–2002. The concerns about the care of such cases were failure of health care workers to pass on relevant medical information in referral letters or by telephone to the booking clinics or to hospitals on admission, failure of accident and emergency staff to recognize the illness and to ask for obstetric assessment, failure of some obstetric staff to recognize and act on medical conditions, appreciate the severity of the illness or make the right diagnoses, lack of communication and multidisciplinary team work, the continuing lack of a clear policy for the prevention or treatment of conditions such as massive haemorrhage, pulmonary embolism or sepsis, lack of immediate access to intensive care or high dependency beds or to blood supplies, lack of active follow-up of women who were known not to attend for antenatal care, particularly for those women with known high risk conditions. This was consistent with other reports [28-38].

The leading cause of maternal deaths in this study was haemorrhage, followed by thrombosis and thromboembolism, and sepsis. Those 3 causes accounted for 43 (56.6%) of all 76 cases. The results of this study indicated that 53.9% of deaths were avoidable. Haemorrhage accounted for 19 (25%) out of 76 cases. Of those, 3 cases were due to uterine rupture that were not clinically diagnosed, and had to await a post-mortem examination to reach the diagnosis. Death due to haemorrhage lends it self for improvement by reducing delays on the part of families in reporting to health services in a timely manner, by making the correct diagnosis and by cutting on delays in making prompt diagnosis. This highlights the fact that there is a good room for a further reduction in the maternal mortality ratio.

Deaths from thrombosis and thromboembolism accounted for 18 (23.7%) maternal deaths, and were the second commonest cause of maternal mortality in this report. Some occurred without warning in patients with no risk factors and would have been difficult to prevent. However, other women reported symptoms of breathlessness or chest pain, treated as respiratory infections, before embolism occurred. The risk of thromboembolic disease rises five-fold during pregnancy and the puerperium [5]. The majorities of deaths occur in the puerperium and are more common after Caesarean Section [5]. In this study, almost 57% of deaths were postpartum and 36% of deaths occurred in women who had been delivered by Caesarean section. If deep vein thrombosis or pulmonary embolism is suspected, full anticoagulant therapy should be commenced and full investigation should be carried out. Obstetric health care professionals should be familiar with the recommendations of working parties on the prophylaxis against thromboembolism in pregnancy and the puerperium.

Data collected on deaths are almost complete counts of these events and are not subject to sampling error. However, when the number of pregnancy-related deaths is small, the MMR is not an adequate indicator of changes in maternal health, and often fluctuate from year to year, which causes variation in the MMR. When the number of deaths is small, the ratios are not reliable as the 95% confidence intervals overlap, and the difference would not be statistically significant. In general, it is recommended that MMR should be reported only when there are at least 20 deaths (relative standard error <23%). To get more reliable estimates of MMR the aggregation of several years would be more reliable. However, by aggregating several years, the ability to detect trends and changes over time is lost [2].

RECOMMENDATIONS

Based on the findings of this report on maternal mortality, the following are made:

General Recommendations

1. Develop a national maternal health policy which prioritize the interventions needed to reach the population groups most in need and bring all elements of maternal health together in one policy document.

2. Adopt and scale up the implementation of the strategies and plans of action related to Making Pregnancy Safer, these having proved effective in supporting national efforts towards achieving the MDGs. In this respect, appropriate monitoring mechanisms to ensure effective implementation of national plans in accordance with their targets and objectives should be set up.

3. Upgrade recording and reporting systems to ensure data consistency and efficient input to the national health information systems, and further develop national surveillance systems to identify epidemiological patterns and maternal morbidity and mortality trends.

4. Extend efforts in implementing community-based interventions related to maternal health as an investment towards developing and empowering the community to play an active and effective role in caring for mothers and children. Particular focus should be placed both on early recognition of the danger signs of sickness and also on preventive measures to promote maternal health.

5. Introduce the adapted maternal health-related guidelines into the formal teaching curricula of medical and paramedical schools, both to improve the quality of teaching and to ensure sustainability of the effective interventions.

Specific Recommendations

- Attention should be paid to all avoidable maternal deaths, specifically to haemorrhage. A forum of experts at a national level addressing maternal mortality due to haemorrhage is recommended to develop a multidisciplinary massive haemorrhage protocol that should be updated and rehearsed regularly in conjunction with blood banks. Women at high risk of bleeding should be delivered in centres with facilities for blood transfusion and intensive care.

- All pregnant women should undergo an assessment of their thromboembolic risk profile. A thrombophilic risk profile protocol should be developed and implemented as necessary in all maternity hospitals and departments.

- Hospitals should have an antibiotic policy for cases of sepsis to control infection and prevent the development of disseminated intravascular coagulation and organ failure. Advice from a microbiologist must be sought early to ensure appropriate antibiotic therapy.

- Women with known cardiac disease should receive pre-pregnancy counseling. All medical and nursing staff should be trained in basic, intermediate and advanced life support as appropriate.

- A planned multidisciplinary care for women with cancer is paramount. Obstetricians, general practitioners, oncologists, surgeons and palliative care services should be involved. Women planning pregnancies after treatment for cancer should be counseled. If preterm delivery is planned to allow more radical therapy for the mother, a paediatrician should be involved antenatally.

- A sudden development of a state of confusion may be an early feature of the onset of hypoxia and warning symptoms of amniotic fluid embolism. The early involvement of senior staff, anaesthetists and intensivists is important. If the diagnosis of amniotic fluid embolism is suspected clinically in any pregnant who dies following sudden collapse, all attempts should be made to confirm this by autopsy. Fetal elements should be searched for in the pulmonary vasculature at autopsy in any pregnant who dies following sudden collapse.

- Immediate access to intensive care or high dependency beds or to blood supplies. When transfer is required, consideration should be given to improved stabilization and elective intubation prior to transfer. Intensive care consultants should be part of the team planning care for patients with serious co-morbidity.

- Accident and emergency staff should be in a better position to recognize the severity of illness in pregnant women and to ask for obstetric assessment. Better diagnoses and treatment by junior staff with timely referral of cases to senior colleagues who should attend without inappropriate delegation of responsibility.

- The importance of seeking antenatal care early in pregnancy should be part of health education and promotion materials prepared for all groups in society to emphasize the need for early first visit to the antenatal clinic during the first trimester.

- Health education programs need to be developed and implemented at community level, primary health care and hospital levels to counsel pregnant women about life threatening risks of certain medical conditions and to offer them pregnancy termination as necessary.

- Patient satisfaction: The level of patient satisfaction should be taken as a valid measure of quality of care of the health care system.

- The provision of multidisciplinary support for women with particular medical, social or psychiatric needs and for those from the more vulnerable groups of our society.

- Continuous medical education and professional development, and recertification are required for all health workers in general, and to obstetricians and gynaecologists in particular, where maternal mortality is concerned.

- Proper documentation of Patient Medical Records to enable greater degree of accuracy in the assessment diagnosis and treatment of patients. All clinical departments and hospitals should carry out detailed audits regularly into the contents of their medical notes and suggest changes.

- The MOH should take the necessary action to ensure the completeness of death certificates regarding items pertaining to the obstetric status of deceased mothers, and to emphasize the importance of improved data quality for maternal mortality documentation at all levels.

- Hospitals must make provision for the prompt offer of support and counseling for all staff that have cared for a woman who has died.

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Appendix 1. Maternal mortality study questionnaire.

THE HASHEMITE KINGDOM OF JORDAN
MATERNAL MORTALITY STUDY 2007-2008

SECTION 1: Dead Woman Information:

1.1. I. D. #			
1.2. Region:			
1.3. Governorate:			
1.4. Residence:	City:	Village:	
1.5. Name			
1.5. National Number			
1.6. Birth Date	Day/Month/Year:		
1.7. Address			
1.8. Phone Number	1.	2.	3.

SECTION 2: Woman's Death Information:

2.1. Death Date	Day: Month: Year:
2.2. Age at death	
2.3. The woman died:	1. While pregnant (what month of pregnancy?.....)
	2. During delivery / before childbirth.
	3. During delivery / after childbirth.
	4. Postpartum during the 42 days after delivery
	5. Postpartum after 42 days after delivery up to one year: how many days or months (.....)
2.4. Place of death:	1. House.
	2. Hospital.
	3. Other.
2.5. Description of her death event:	1. She died in hospital: Please describe how she died .....
2.5. Continue	1. She died in house (or outside hospital): Please describe how she died .....

SECTION 3: Respondent's Information:

3.1. Name
3.2. Age
3.3. Relationship to dead woman
3.4. Address and phone number

SECTION 4: Dead Woman's Reproductive History:

4.1. How many pregnancies she had ?	
4.2 How many children she Had?	
4.3. How many abortions she Had?	
4.4. How many dead children she had?	
4.5. The age of youngest child:	
4.5. Did she ever use any contraception or birth spacing?	1. Yes 2. No
4.6. If yes, what contraceptive method was ever used?	1. IUCD
	2. Pills
	3. Injections
	4. Male condoms
	5. Tubal ligation
	6. Other
4.7. Before the current pregnancy, did she use any contraceptive method?	1. Yes 2. No
4.8. If yes, what contraceptive method she used?	1. IUCD
	2. Pills
	3. Injections
	4. Male condoms
	5. Tubal ligation
	6. Other
4.9. Was the contraceptive method used regularly?	1. Yes 2. No
4.10. If she did not practice birth spacing, why?	

SECTION 5: Dead Woman's Socio-Demographic Data:

5.1. Marital status	1. Married.
	2. Divorced.
	3. Widow.
	4. Separated.
	5. Other……..
5.2. Education:	1. Illiterate.
	2. Can read only.
	3. Less than high school.
	4. Finished high school.
	5. College or higher education.
5.3. Was she working?	1. Yes 2. No
5.4. If yes, what was she working?	
5.5. What the husband work?	
5.6. Husband's education?	1. Illiterate.
	2. Can read only.
	3. Less than high school.
	4. Finished high school.
	5. College or higher education.
5.7. Monthly income of the household?	1. <JD 100
	2. JD 101 – 200
	3. JD 201 – 300
	4. JD 301 – 400
	5. JD 401 – 500
	6. JD 501 – 700
	7. JD 701 – 900
	8. > JD 900
5.8. House ownership:	1. Own
	2. Rent
	3. Husband's family
	4. Woman's family
	5. Other….
5.9. Number of rooms:	1. One room plus kitchen and bath.
	2. Two rooms plus kitchen and bath.
	3. Three rooms plus kitchen and bath.
	4. Four rooms plus kitchen and bath.
	5. One room and bath.
	6. Other……..

5.10. How many people live in the household including the dead woman?	
5.11. Drinking water source:	1. Pipe water.
	2. Bottled water.
	3. Well.
	4. Other……..
5.12. Bathroom available:	1. Yes 2. No
5.13. Was the dead woman smoking?	1. Yes 2. No
5.14. Was any one smoking in the household?	1. Yes 2. No
5.15. Did she or her husband own a car?	1. Yes 2. No
5.16. Was it easy for her to get transportation?	1. Yes 2. No

SECTION 6: Health Care Services Data:

6.1. Was it easy for her to get to the nearest hospital?	1. Yes 2. No
6.2. How far is / was the nearest hospital to you?	1. 10 to 20 min walking.
	2. < 10 min by car.
	3. 10 - 20 min by car
	4. > 20 min by car
	5. Other……..
6.3. Was she satisfied with the health care provided for her in the nearest hospital to you?	1. Yes 2. No
6.4. Were you satisfied with the health care provided for her in the nearest hospital to you?	1. Yes 2. No
6.5. If no, Why?	1. Long waiting time.
	2. No respect.
	3. Delay of care or No on time care.
	4. No competent or experienced staff
	5. Other……..

SECTION 7: Past Obstetric And Medical History:

7.1. Before the beginning of this pregnancy, did she has:	1. Pregnancy complications or pregnancy related problems.
	2. Hospital admission.
	3. Surgery (not Caesarean).
	4. Medical or infectious diseases.
	5. Other……..
7.2. Was she taking care of her health during previous pregnancy:	1. Yes 2. No 3. Don't Know
7.3. Was she visiting doctor or health center for prenatal care?	1. Yes 2. No 3. Don't Know
7.4. Did she have Caesarean section?	1. Yes 2. No 3. Don't Know
7.5. Did she know any life threatening danger sings during pregnancy or after delivery?	1. Yes 2. No 3. Don't Know

SECTION 8: Current Pregnancy:

8.1. Did she get prenatal care?	1. Yes 2. No 3. Don't know
8.2. If yes, Where?	1. Private clinic or hospital
	2. MOH health center
	3. MOH hospital.
	4. Army clinic or hospital
	5. University clinic or hospital.
	6. Other….
8.3. How many time she got prenatal care?	1. ……. 2. Don't Know
8.4. When she started her prenatal care? (what month)	1. ……. 2. Don't Know
8.5. Was she getting help or support during pregnancy?	1. Yes 2. No 3. Don't know
8.6. Was this pregnancy wanted or planned for?	1. Yes 2. No 3. Don't know
8.7. Were was the delivery?	1. Hospital.
	2. Clinic.
	3. Home.
8.8. Who supervised the delivery?	1. Physician
	2. Midwife.
	3. Other…….
8.9. Her delivery was:	1. Normal.
	2. Complicated. (breech or malpresentation, prolonged or obstructed labor)
	3. By forceps of vacuum.
	4. Caesarean.
	5. Other……..
	6. Don't know.

SECTION 9: Death Cause – Symptoms And Condictions:

9.1. Do you know what cause her death?	1. Yes 2. No 3. Don't Know
9.2. If yes, please tell us what was the cause of her death	
9.3. Was she in good health before death?	1. Yes 2. No 3. Don't Know
9.4. Did she die suddenly or else?	1. Sudden 2. Got sick 3. Don't Know
9.5. If she got sick, for how long she was sick before death?	1. …….. 2. Don't Know
9.6. During her sickness, was she able to perform her usual chores?	1. Yes 2. No 3. Don't Know
9.7. Did she visit a doctor for her sickness?	1. Yes 2. No 3. Don't Know
9.8. How her pregnancy resulted and terminated?	1. Delivery of normal live baby.
	2. Delivery of preterm live baby.
	3. Delivery of low birth weight live baby.
	4. Delivery of congenital malformed live baby.
	5. Delivery of dead baby.
	6. Post-delivery complication
	7. Abortion with medical indication.
	8. Abortion with no medical indication.
	9. Post-abortion complication.
	10. Ectopic pregnancy surgery.
	11. Ruptured uterus.
	12. Other……..
9.9. If she had pre-delivery complications, what were they?	1. Haemorrhage.
	2. Pre-eclampsia / eclampsia
	3. Other……..
9.10. If she had vaginal bleeding during pregnancy, when it started?	1. …… month 2. Don't Know
9.11. Did it last until death?	1. Yes 2. No 3. Don't Know
9.12. Did she has vaginal bleeding:	1. During delivery or abortion.
	2. After delivery or abortion.
9.13. If she had non-vaginal bleeding during pregnancy, when it started?	1. …… 2. Don't Know
9.14. Did it last until death?	1. Yes 2. No 3. Don't Know
9.15. If she had cough during pregnancy, when it started?	1. ……month 2. Don't Know
9.16. Did it last until death?	1. Yes 2. No. (How long…….) 3. Don't Know
9.17. Was she having sputum with cough?	1. Yes 2. No 3. Don't Know
9.18. Was she having blood in the sputum?	1. Yes 2. No 3. Don't Know

9.19. If she had dyspnoea during pregnancy, when it started?	1. During pregnancy ……month.
	2. Before pregnancy.
	3. After delivery.
	4. Don't Know
9.20. Did it last until death?	1. Yes 2. No. (How long……) 3. Don't Know
9.21. Did she have asthma?	1. Yes 2. No 3. Don't Know
9.22. If she had fever, when it started?	1. During pregnancy ……month.
	2. After delivery.
	3. Don't Know
9.23. Did it last until death?	1. Yes 2. No. (How long……) 3. Don't Know
9.24. Did she have chills?	1. Yes 2. No 3. Don't Know
9.25. If she had her face color changed, when it started?	1. During pregnancy ……month.
	2. After delivery.
	3. Don't Know
9.26. Was her face then:	1. Pale.
	2. Bluish.
	3. Don't Know
9.27. Did it last until death?	1. Yes 2. No. (How long……) 3. Don't Know
9.28. If she had pain, when it started?	1. During pregnancy ……month.
	2. After delivery.
	3. Don't Know
9.29. Where was the pain?	1. In the head.
	2. In her abdomen.
	3. In her chest.
	4. In her breast.
	5. In her legs
	6. All over her body
	7. Other……..
	8. Don't Know
9.30. Did it last until death?	1. Yes 2. No. (How long……) 3. Don't Know
9.31. If she had vomiting, when it started?	1. During pregnancy ……month.
	2. After delivery.
	3. Don't Know
9.32. How was the vomiting?	1. Sever.
	2. Vomiting everything.
	3. Vomiting blood
	4. Mild.
9.33. Did it last until death?	1. Yes 2. No. (How long……) 3. Don't Know

9.34. If she had diarrhea, when it started?	1. During pregnancy ……month.
	2. After delivery.
	3. Don't Know
9.35. Did she have the following with diarrhea	1. Bloody stools.
	2. Mucus.
	3. Pus.
	4. Other……..
9.36. Did it last until death?	1. Yes 2. No. (How long…….) 3. Don't Know
9.37. If she had dark stools, when it started?	1. During pregnancy ……month.
	2. After delivery.
	3. Don't Know
9.38. Did it last until death?	1. Yes 2. No. (How long…….) 3. Don't Know
9.39. If she had dysuria, or other urination difficulties, when it started?	1. During pregnancy ……month.
	2. After delivery.
	3. Don't Know
9.40. Did it last until death?	1. Yes 2. No. (How long…….) 3. Don't Know
9.41. If she had hematuria, when it started?	1. During pregnancy ……month.
	2. After delivery.
	3. Don't Know
9.42. Did it last until death?	1. Yes 2. No. (How long…….) 3. Don't Know
9.43. If she had frequency urination, when it started?	1. During pregnancy ……month.
	2. After delivery.
	3. Don't Know
9.44. Did it last until death?	1. Yes 2. No. (How long…….) 3. Don't Know
9.45. If she was getting tired easily, when it started?	1. During pregnancy ……month.
	2. After delivery.
	3. Don't Know
9.46. Did it last until death?	1. Yes 2. No. (How long…….) 3. Don't Know
9.47. If she was notably loosing weight, when it started?	1. During pregnancy ……month.
	2. After delivery.
	3. Don't Know
9.48. Did it last until death?	1. Yes 2. No. (How long…….) 3. Don't Know
9.49. If she was notably gaining weight, when it started?	1. During pregnancy ……month.
	2. After delivery.
	3. Don't Know
9.50. Was the weight gaining:	1. Sudden?
	2. Gradual?
	3. Don't Know

9.51. Did it last until death?	1. Yes 2. No. (How long…….) 3. Don't Know
9.52. If she had any part of her body swelled, when it started?	1. During pregnancy ……month.
	2. After delivery.
	3. Don't Know
9.53. Which part of her body was swelled?	1. The face
	2. The abdomen.
	3. Legs or feet.
	4. The face, legs and feet
	5. Don't Know
9.54. Did it last until death?	1. Yes 2. No. (How long…….) 3. Don't Know
9.55. If she had weakness or paralysis in her extremities, when it started?	1. During pregnancy ……month.
	2. After delivery.
	3. Don't Know
9.56. How it happened?	
9.57. Did it last until death?	1. Yes 2. No. (How long…….) 3. Don't Know
9.58. If she had collapsed or got unconscious, when it started?	1. During pregnancy ……month.
	2. After delivery.
	3. Don't Know
9.59. Did it last until death?	1. Yes 2. No. (How long…….) 3. Don't Know
9.60. If she had seizure or spasm, when it started?	1. During pregnancy ……month.
	2. After delivery.
	3. Don't Know
9.61. Did it last until death?	1. Yes 2. No. (How long…….) 3. Don't Know
9.62. If she was diagnosed as hypertensive, when it started?	1. During pregnancy ……month.
	2. After delivery.
	3. Don't Know
9.63. Did it last until death?	1. Yes 2. No. (How long…….) 3. Don't Know
9.64. Was she diagnosed as having any of these diseases?	1. Diabetes.
	2. Cardiac disease.
	3. Kidney disease.
	4. Liver Disease.
	5. Thyroid diseases.
	6. Tuberculosis.
	7. Other….
	8. Don't Know
9.65. If she had any of these diseases, did it last until death?	1. Yes 2. No. (How long…….) 3. Don't Know

9.66. If she had any surgery, when happened?	1. During pregnancy .....month.
	2. After delivery.
	3. Don't Know
9.67. What surgery?	1.....
	2. Don't Know
9.68. Where was the surgery done?	1.....
	2. Don't Know
9.69. If she had complications after the surgery, what were they?	1.....
	2. Don't Know
9.70. If she was taking any drug, when?	1. During pregnancy .....month.
	2. After delivery.
	3. Don't Know
9.71. What drug?	1..... do you have it?
	2. Don't Know
9.72. Where did she obtain the drug?	1. Prescription.
	2. Pharmacy.
	3. Don't Know.
9.73. Did she continue taking the drug until death	1. Yes 2. No. (How long.....) 3. Don't Know
9.74. If she had allergy, what was it from?	1. Food.
	2. Drug.
	3. Other.
	4. Don't Know.
9.75. Do you wish to add anything	
9.76. Interviewer evaluation about the quality of this information	1. Good.
	2. Middle.
	3. Weak.

SECTION 10: Panel Evaluation:

10.1. Data quality	1. Good.
	2. Middle.
	3. Weak.
10.2. Notes by the members	1. .....
	2. .....
	3. .....
	4. .....
	5. .....
10.3. Maternal death	1. Yes 2. No 3. Uncertain
10.3. Maternal death cause	*Direct:*
	1. .....
	2. .....
	3. .....
	4. .....
	Indirect:
	1. .....
	2. .....
	3. .....
	4. .....
10.4. Maternal death final diagnosis	

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