Egypt

National Maternal Mortality Study 2000

MINISTRY OF HEALTH AND POPULATION

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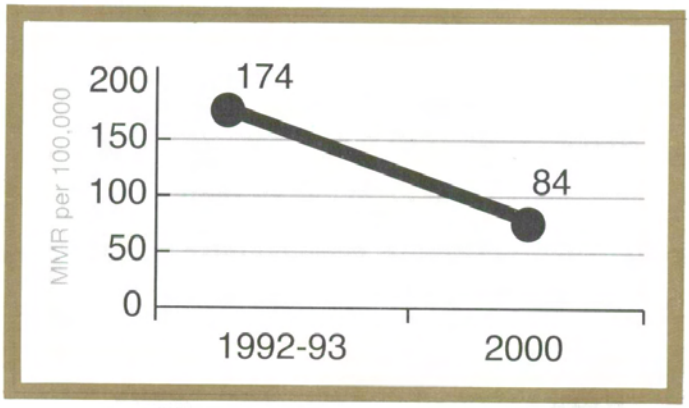
REPORT OF FINDINGS AND CONCLUSIONS



THE NATIONAL MATERNAL MORTALITY STUDY:
EGYPT 2000

REPORT OF
FINDINGS AND CONCLUSIONS

JUNE 2001

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Directorate of Maternal and Child Health Care
Ministry of Health and Population, Egypt

The National Maternal Mortality Study: Egypt 2000 was conducted by the Directorate of Maternal and Child Health Care, Ministry of Health and Population, under the Healthy Mother/Healthy Child Project in collaboration with the United States Agency for International Development and its technical assistance contractor, John Snow, Inc.

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Foreword

The National Maternal Mortality Study: Egypt, 2000 is the second national study of maternal mortality to take place in Egypt. I requested that this study be repeated to measure the degree of reduction in maternal mortality since the first study (1992/93), which was conducted eight years ago. Both studies were conducted by the Ministry of Health and Population, Directorate of Maternal and Child Health Care with help from the Central Agency for Public Mobilization and Statistics (CAPMAS). Support to fund this study was provided by the Ministry of Health and Population and the United States Agency for International Development (USAID), with technical support provided by USAID contractor John Snow, Inc.

It is with great pleasure that I congratulate all of my MOHP colleagues on their accomplishments and contributions to lowering the national maternal mortality ratio by over 50% (from 174 to 84 per 100,000 live births) in the past eight years. Such a tremendous achievement as this dramatic decline in the number of maternal deaths is indeed a great contribution to the welfare of the nation as well as to the Egyptian women whose lives have been saved and their families.

This report provides the major findings of the National Maternal Mortality Study: Egypt 2000. It summarizes the trends of maternal mortality and the major causes of maternal death in Egypt. More importantly, it also examines the avoidable factors which contributed to these deaths so that current preventive programs can be assessed, revised and continue to be implemented to further reduce maternal mortality. The huge effort put into designing this study, with the help of great national expertise, make it unique in its accuracy and usefulness.

The study is also unusual because over 284 Ministry of Health and Population doctors in 27 governorates conducted the research. We are grateful to all the research team, and the study contributors for their serious and sincere efforts. We look forward to implementing the practical recommendations and continuing our efforts to reduce maternal mortality in Egypt.

Professor Dr. Ismail Salam
Minister of Health and Population

Acknowledgements

The Ministry of Health and Population conducted the second National Maternal Mortality Study in response to His Excellency Prof. Dr. Ismail Salam's request and focus on improving maternal health care services and decreasing the level of maternal mortality. We are grateful to the Minister for initiating this study and all the MOHP colleagues who have contributed to its completion. We also acknowledge the tremendous achievement of lowering the national maternal mortality ratio by half since 1992. The Minister's emphasis and strong support for the Ministry's Maternal and Child Health Program has greatly contributed to this achievement.

A major study such as this is only possible through the help and collaboration of many people. We would like to express our thanks to all those whose great efforts and excellent work ensured the success and accuracy of the study. We would also like to thank the families of the deceased women who accepted to participate in our study and who gave us information so we can try to prevent future deaths.

The assistance given by the Central Agency for Public Mobilization and Statistics (CAPMAS) in collecting household data under the supervision of the President of CAPMAS, General Ehab Elwy, and Director of the Population Studies and Research Center of CAPMAS, Dr. Botheina El Deeb, is greatly appreciated. We thank all the CAPMAS team for their successful collaboration.

The study was made possible by the work of a Central Advisory Group, a Technical Advisory Group and 27 Local Advisory Groups, from each governorate, who supplied the detailed records and reports of the maternal deaths. Particular thanks are owed to the consultant obstetricians who determined the causes of maternal deaths. We are also grateful to the 149 Health Bureau Directors who formed the backbone of the study, and notified us of the female deaths. Members of the research team who collaborated in the study are shown in the last section of this report.

We would like to acknowledge with deep appreciation the hard work and invaluable contributions of all those named in this report and the support provided by United States Agency for International Development (USAID) and its technical assistance contractor, John Snow, Inc. Many thanks are also due Dr. Oona Campbell of the London School of Hygiene and Tropical Medicine for her technical assistance as principle investigator and for her assistance in the preparation of the report.

It is my sincere hope that the recommendations from this study will contribute to our efforts to continue to reduce the number of pregnant women who die from avoidable causes.

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Under Secretary of Primary Health Care
General Director
Directorate of Maternal and Child Health Care
Healthy Mother Healthy Child Project Executive Director

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Abbreviations

ANC	Antenatal care
APH	Antepartum hemorrhage
CAG	Central Advisory Group (*The Cairo-based steering committee that supervised the overall study design and implementation strategy*.)
CAPMAS	Central Agency for Public Mobilization and Statistics
CS	Cesarean section
Daya	Traditional birth attendant
EDHS	Egypt Demographic and Health Survey (*A national household survey conducted in 1988, 1992, 1995, 1997, 1998, and 2000*.)
EOC	Essential Obstetric Care
FD	Female deaths
FETP	Field Epidemiology Training Program (*A program in the Ministry of Health and Population with the US Centers for Disease Control*.)
FUSND	Follow-up Study of Stillbirths and Neonatal Deaths
FW	Field workers (*Trained interviewers from CAPMAS who interviewed families*.)
Health providers	Health providers include Obstetricians, General Practitioners, Midwives and Nurses
HM/HC	Healthy Mother/Healthy Child
ICD-10	International Statistical Classification of Diseases, Injuries and Causes of Death, Tenth Revision
JSI	John Snow, Incorporated

LAG	Local Advisory Group (*The governorate level committees, consisting of up to six doctors, which reviewed all maternal deaths, attributed cause of death, and listed sub-standard care*.)
MCH	Maternal and child health
MD	Maternal deaths
MMR	Maternal mortality ratio
MOHP	Ministry of Health and Population
MRCOG	Member of Royal College of Obstetrics and Gynecology
MS	Masters of Science
NGO	Non-governmental organization
NMMR	National maternal mortality ratio
NMMS	National Maternal Mortality Study
Obs/Gyn	Obstetrics and Gynecology
PPH	Postpartum hemorrhage
RAMOS	Reproductive Age Mortality Study
SHB	Selected health bureau
TAG	Technical Advisory Group (*The Cairo-based technical committee comprised of eminent obstetricians and pediatricians, which reviewed all problematic deaths, and assigned a final cause of death and sub-standard care (avoidable factors).*)
TBA	Traditional birth attendant or daya
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development

WHO	World Health Organization

THE NATIONAL MATERNAL MORTALITY STUDY:
EGYPT 2000

Executive Summary

The 2000 National Maternal Mortality Study

The 2000 National Maternal Mortality Study (NMMS) was the second national survey of maternal death to be carried out in Egypt. It was commissioned and conducted by the Ministry of Health and Population to estimate maternal mortality in Egypt overall, the regions, and in nine specific governorates (Aswan, Luxor, Qena, Beni Suef, Fayoum, Assuit, Kafr El Sheikh, Suez, and New Valley), and to assess changes in maternal death since the 1992-93 NMMS. The survey also identified the main medical causes of, and avoidable factors contributing to, maternal death and investigated what had happened to the infants of deceased women.

The NMMS was conducted by the Directorate of Maternal and Child Health Care, with assistance from the Central Agency for Public Mobilization and Statistics, funding from the United States Agency for International Development (USAID), and technical support from USAID's contractor John Snow, Inc.

Methods

Information about maternal deaths in women aged 15-49 years was collected from 149 health bureaus in all 27 governorates in Egypt. The bureaus identified 8,497 deaths in women of reproductive age between January 1 and December 31 2000, of which 585 (6.9%) were considered to be maternal deaths. All of these deaths were investigated by interviewing the families of deceased women and any health providers who had been involved in their care. In each governorate, a Local Advisory Group (LAG) comprising the Undersecretary for Health, Director of MCH, an obstetrician and a pediatrician, reviewed the cases of all women who had died and assigned medical causes and avoidable factors for all maternal deaths.

Key Findings

The NMMS found that maternal mortality has declined dramatically in Egypt, from 174/100,000 live births in 1992-93 to 84/100,000 in 2000. This remarkable achievement of more than 50% decrease is a vindication of Egypt's efforts to improve the quality of obstetric care, increase access to family planning, educate women and families about seeking prompt medical care for problems during pregnancy and labor, and train dayas to refer women with obstetric complications. However, there were significant regional differences in maternal mortality, with the highest levels of maternal death occurring in the frontier governorates and the lowest levels in Metropolitan Egypt.

The NMMS also found that mortality in infants of women who die from maternal causes has declined. In 50% of cases of maternal death in 2000, the fetus or infant also died, whereas the figure for 1992-1993 was 57%. When maternal death occurred during delivery or postpartum, 34% of infants died at birth or soon after, compared to 43% in 1992-1993, suggesting that there may have been improvements in care of newborns.

As in many other countries, the risk of maternal death was higher in mothers aged more than 40 years and in women who had already had five or more children. Most maternal deaths (49%) occurred during delivery and the 24 hours after delivery, or during the six weeks after delivery (27%). Women who died were more likely to have delivered in a health facility and less likely to have delivered at home than women in Egypt in general and 62% of maternal deaths took place in health facilities, 29% at home, and 9% during transportation. The majority (93%) of women who died sought medical help when they experienced problems. A disproportionate number of postpartum hemorrhage and cesarean section deaths occurred in private facilities, possibly due to lack of blood, poor back-up, or delays in transferring patients to hospital. The contribution of lack of transportation to the maternal mortality ratio is 4 per 100,000 live births in 2000, compared to 7 per 100,000 live births in 1992-93.

Main Medical Causes of Maternal Death

Medical causes of death were classified in two categories, direct causes and indirect causes. Based on the single main cause of death determined by Local Advisory Groups, direct obstetric causes were responsible for 77% of maternal deaths and indirect causes for 20% of maternal deaths. For 3% it was not possible to determine a cause of death.

Hemorrhage before and after delivery was the leading direct cause of maternal death (43%), with most hemorrhage deaths due to postpartum hemorrhage. Other important direct obstetric causes of maternal death were hypertensive diseases of pregnancy (22%), sepsis (8%), ruptured uterus (8%), cesarean section (7%), and obstructed labor (5%). The proportion of deaths from ruptured uterus had increased since 1992-93, possibly associated with increased use of drugs, such as oxytocin, to speed up labor. Cardiac disease was the leading indirect cause of maternal death (13%), and the most common cardiac problem was rheumatic heart fever. Anemia was the second most important indirect cause of maternal death (11%).

There were 32 maternal deaths with hemorrhage per 100,000 live births. The figures for hypertensive diseases were 18 per 100,000, for sepsis 7 per 100,000, for ruptured uterus 7 per 100,000, for cesarean section 6 per 100,000, for obstructed labor 4 per 100,000, for cardiac disease 11 per 100,000 and for anemia 9 per 100,000.

Main Avoidable Factors Contributing To Maternal Death

Avoidable factors contributing to maternal death were classified in three categories, health provider factors, health facility factors, and woman and family factors. Although the proportion of births attended by a skilled health provider has increased significantly since 1992-93, sub-standard care by health providers – in particular obstetricians and general practitioners – remains the most important avoidable factor, contributing to 54% of maternal deaths. Sub-standard care in the private sector is of particular concern, since deliveries in the private sector (26%) have overtaken

deliveries in the public sector (22%). General practitioners contributed disproportionately to maternal deaths, possibly due to delays in referral of women with obstetric complications and misuse of drugs used to speed up labor. In contrast, midwives and dayas made a positive contribution, with the exception of sepsis deaths, where the risk was higher for home deliveries attended by a daya.

Shortage of blood was the most frequent avoidable health facility factor, contributing to 16% of maternal deaths and playing an especially important role in deaths from hemorrhage, ruptured uterus, and complications of cesarean section. Lack of blood was associated with 13 deaths per 100,000 live births. Delay in seeking care, mainly because of failure to recognize danger signs during pregnancy or delivery, was the most frequent patient and family factor, contributing to 30% of maternal deaths. Delay in seeking care was associated with 25 deaths per 100,000 live births. Delay was also associated with initial care seeking from general practitioners and private practitioners who are unable to manage obstetric emergencies or delay referral to hospital. In addition, compared with women in Egypt in general, women who died were less likely to have been using modern contraception and more likely to have experienced contraceptive failure, and a higher proportion had unwanted pregnancies.

In most cases, deaths resulted from a combination of avoidable factors and medical causes. For example, sub-standard care by obstetricians, sub-standard care by dayas, and shortage of blood, were all important factors in postpartum hemorrhage deaths; and delays in seeking care, sub-standard care by obstetricians, and shortage of blood were all important factors in antepartum hemorrhage deaths.

Conclusions and Recommendations

Further reduction in maternal mortality is likely to be contingent on the continued strengthening of health systems and improving the knowledge and capacity of women to maintain their health. The 2000 NMMS makes a range of recommendations for improving antenatal care, referral linkages, hospital management, pre-service and in-service training of health

providers, and management of obstetric emergencies. It also recommends actions to ensure that women and their families are better informed about the importance of family planning and antenatal care, and to ensure that they recognize and act on complications during pregnancy and delivery.

The Ministry of Health and Population is committed to implementing the recommendations of the 2000 NMMS to continue to revise and review medical training, preventive programs, and maternal health services, as part of its continuing efforts to further reduce maternal mortality in Egypt.

Introduction

The National Maternal Mortality Study: Egypt, 2000 is the second national study of maternal mortality to take place in Egypt. The study covers a sample of the maternal deaths (see Appendix 1 for terms and definitions) that occurred in all governorates in Egypt between 1 January 2000 and 31 December 2000.

The objectives of the study were:

- To estimate the maternal mortality ratios for Egypt, the regions, and for the nine governorates of Aswan, Luxor, Qena, Beni Suef, Fayoum, Assiut, Kafr El-Sheikh, Suez, and New Valley.
- To determine the main medical causes of maternal death.
- To determine the avoidable factors contributing to maternal death.
- To provide data that can be used to assess changes in maternal mortality since the first national study was conducted in 1992-1993.

The study was conducted with the active participation of Ministry of Health and Population health providers, both to ensure their appreciation of the medical causes and avoidable factors that result in maternal death, and because they will play a critical role in the revised national maternal mortality surveillance system that the Ministry has started to introduce. Additionally, the study was completed with the assistance of the Central Agency for Public Mobilization and Statistics (CAPMAS), funding from the United States Agency for International Development (USAID), and technical support from USAID's contractor, John Snow, Inc. (see the List of Contributors).

This report presents the data collected by the National Maternal Mortality Study: Egypt, 2000, identifies the major direct and indirect causes of maternal death, highlights issues to be addressed, and makes recommendations for action to further reduce maternal mortality in Egypt.

It is also anticipated that the findings will be used:

- To strengthen preventive programs to reduce maternal deaths.
- To make recommendations for the revision of the national maternal mortality surveillance system.
- To improve understanding of the consequences of maternal death for the fetus or infant.
- To improve understanding of the risk factors for maternal death, through comparison with the findings from an Egypt DHS 2000 sub-sample of women who did not die in childbirth.

Background

Worldwide, around 515,000 women die each year from maternal causes (Hill et al, 2001). Many more experience serious problems during pregnancy and childbirth (Abou Zahr, 1998). In addition, 120 million women have unwanted pregnancies and 20 million have unsafe abortions (Ashford 1995). The World Bank estimates that 18% of the global disease burden of women aged 15-44 years is due to maternal mortality and morbidity. Maternal health problems are, therefore, the leading cause of ill health in women of reproductive age (World Bank, 1993; Abou Zahr, 1998). The majority of maternal health problems occur in low-income countries, where the risk is increased by high fertility, low literacy, poverty, lack of access to services and poor quality medical care (Mahler, 1987; Royston and Armstrong, 1989; WHO, 1996). Maternal health problems also occur in a context of gender-based economic, political and cultural discrimination and inequality.

Maternal death is a tragedy, affecting children, families and communities. Each year, millions of children are left motherless and an estimated one million young children die as a result of maternal death. Previous research in Egypt has demonstrated that once a mother dies, the health and nutrition of children suffers (Saleh, 1989). But maternal mortality is largely avoidable, through obstetric care interventions that have been shown to be effective (WHO, 1994a; Starrs, 1998). The challenge is to create an enabling environment for implementing these interventions (Koblinsky et al, 1999).

Maternal Mortality in Egypt

A summary of the findings of previous studies of maternal mortality in Egypt is shown in Table 1. The most comprehensive of these studies, the National Maternal Mortality Study in 1992-1993, estimated that the maternal mortality ratio was 174 per 100,000 live births.

Table 1: Population-based studies of maternal mortality in Egypt

	Year	No. of maternal deaths	MMR	Reference
Lower Egypt				
Giza study	1985-86	153	150	***El Kady et al, 1989a,b***
Menoufia (RAMOS)	1981-83	385	190	***Fortney et al, 1984***
Alexandria	1963-82	183	163	***El Ghamry et al, 1984***
Upper Egypt				
Assiut (Kausaih)	1984-85	16	178	***Abdullah et al, 1985***
Sohag	1984-85	23	471	***Abdullah et al, 1985***
Qena	1984-85	34	323	***Abdullah et al, 1985***
Qena	1989-90	185	207	***Saleh, 1991***
Assiut + 3 villages	1987-88	29	368	***Abdullah et al, 1992***
National				
National Sisterhood method estimate[1]	≈1976	150	170	***Stanton et al, 1997***
National Sisterhood method estimate[1]	≈1979	87	177	***CAPMAS, 1993***
Urban[1]	≈1979	NS[2]	150	***CAPMAS, 1993***
Rural[1]	≈1979	NS[2]	193	***CAPMAS, 1993***
National Maternal Mortality Study[1]	1992-3	772	174	***MOH, 1994a***
Rapid Assessment Survey	1997	896	96	***MOHP, 1997a***

[1] Excluding frontier governorates

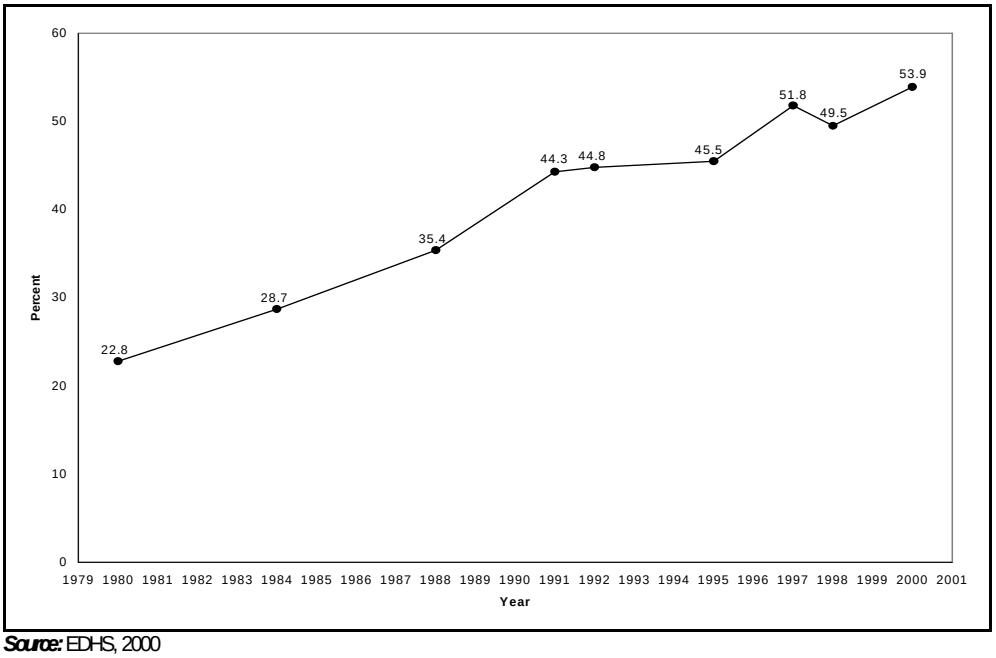
Egypt has made considerable progress in two areas that prevent maternal death: family planning and access to skilled delivery care.

Family Planning and Delivery Care

The use of modern contraception increased from 23% in 1980 to 54% in 2000 (Figure 1 shows national estimates of contraceptive prevalence rate) and the total fertility rate decreased from 5.3 in 1980 to 3.5 in 2000 (EDHS, 2000). Together, these factors (Campbell and Graham, 1990; Fortney, 1987; Winikoff and Sullivan, 1987):

- Reduce the number of pregnancies, which decreases the number of times women face the risk of maternal death.
- Avoid high risk pregnancies at higher parities.
- Prevent unwanted pregnancies, which may result in unsafe induced abortion or in poorer care-seeking behavior.

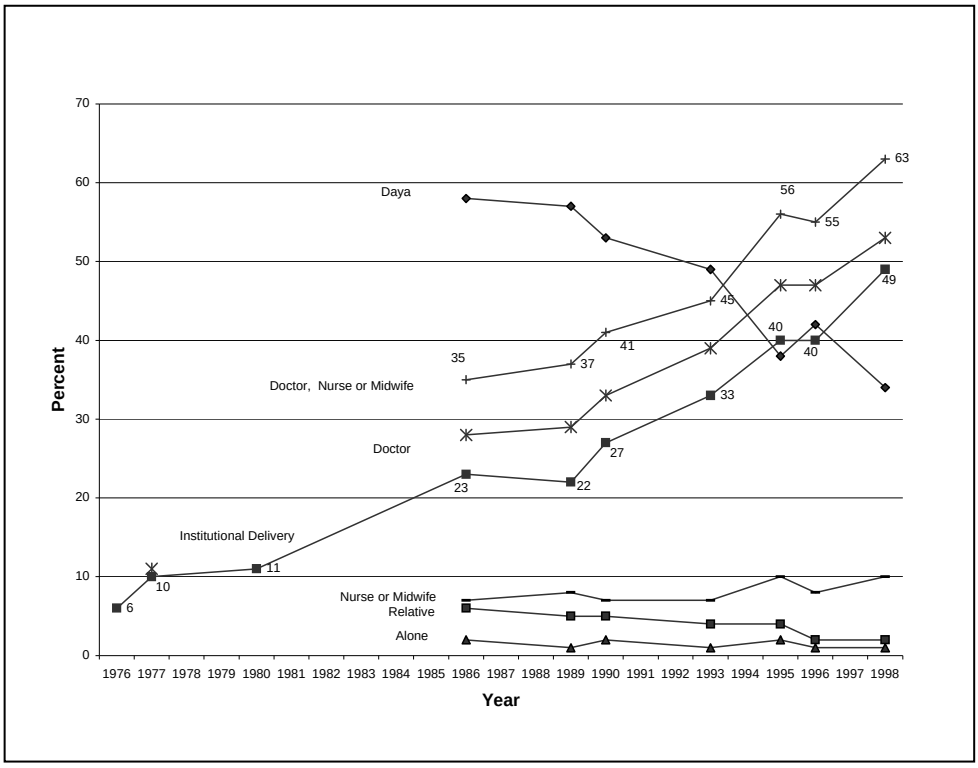
Figure 1. Percent using modern contraception, Egypt



Source: EDHS, 2000

Reducing maternal mortality requires more than family planning, as women will continue to have families with children. Maternal mortality is highly sensitive to the availability of modern medical services and the standard of obstetric care (Loudon, 1992; Maine, 1991). Egypt has a large number of medical doctors and an extensive health service infrastructure (Sayed, 1991). Most women live within reach of medical facilities that can provide maternity care, including emergency obstetric care. The proportion of births that take place in health facilities increased from 6% in 1976 to 49% in 1998, and the proportion attended by a doctor or nurse increased from 35% in 1986 to 63% in 1998 (see Figure 2).

Figure 2. Percent births by facility delivery by type of attendant, Egypt



The Government of Egypt has demonstrated continued political commitment to improving maternal and child health. Egypt was one of the six countries that supported the 1990 Summit Conference for the Protection and Development of Children, which strongly endorsed safe motherhood programs and strategies. In 1994, as host nation of the International Conference on Population and Development, the Government of Egypt endorsed a comprehensive approach to women's health, with a focus on reducing maternal mortality. Reducing maternal mortality was also a key goal of the National Five-Year Plan (1998-2002) of the Ministry of Health and Population (MOHP). The current goal for 2010 is to reduce maternal mortality to no more than 50 per 100,000 live births (MOHP 1997a).

The national program to reduce maternal mortality is overseen and implemented by the Directorate of Maternal and Child Health Care (MCH), under the Division of Primary Health Care of the MOHP (the development and implementation process for the maternal care program is included in Appendix 1). The MOHP used the conclusions and recommendations of the 1992-1993 NMMS to design and implement interventions during the past eight years (see Appendix 2). Particular attention has been paid to improving the quality of delivery care as well as to encourage appropriate care-seeking behavior.

Specific projects and interventions have been implemented through the MOHP MCH Directorate with support from USAID, UNICEF, UNFPA, the Population Council and other international donors. The MOHP National Child Survival Project (1985-1996), funded by USAID, implemented interventions to improve quality and use of antenatal, delivery and postpartum health services throughout Egypt. Similar MOHP interventions have been implemented through the MotherCare Project (1996-1998) and the Healthy Mother/Healthy Child Project (1996-2005), both funded by USAID, focusing on Upper Egypt where maternal and neonatal mortality were highest.

At the national level, the MCH Directorate has defined a package of MCH services that includes basic and comprehensive essential obstetric care for normal delivery and management of obstetric complications. Clinical protocols and service standards for Essential Obstetric Care (EOC) and competency-based training curricula and materials have been developed and officially approved for national use. Quality of care issues were also addressed through a series of administrative decrees covering issues such as the presence of senior obstetricians during deliveries, midwife training and licensing, improvement in blood services, and use of facility-generated revenue for local service improvement. More than 170 maternity centers have been upgraded in under-served urban and rural areas to provide safe and clean normal delivery services and to be able to refer pregnant women with complications (MOHP, 2001).

To address the problem of delay in seeking medical care by women and families, two national mass media campaigns have been carried out to improve

knowledge and awareness of birth preparedness (HM/HC RP, 2000), and of danger signs in pregnancy, delivery and postpartum (MotherCare Project, Egypt 1998). Most recently, the MOHP has issued an administrative decree to establish Safe Motherhood Committees in all governorates, to co-ordinate local activities and to play a key role in the future maternal mortality surveillance system (MOHP, 2001).

At the regional level, the EOC component of the package of MCH services is being implemented in five governorates in Upper Egypt in an area covering 25 administrative districts and reaching over eight million Egyptians. Obstetric services in 25 governorate and district hospitals have been upgraded to ensure access to quality care for obstetric complications (HM/HC RP, 2001). A total of 75 rural hospitals and primary health care units have also been upgraded to offer normal delivery care and to improve linkages with referral centers. Over 1,300 medical and nursing personnel have completed competency-based training in the EOC protocols and clinical supervision has been improved in each of the target facilities (HM/HC RP, 2001a). Management tools and 65 information centers have also been implemented at governorate, district and facility levels to monitor compliance with service standards and to track service use against planned targets (HM/HC RP, 2001a). Finally, partnerships have been established between community-based private and public representatives to address district health constraints and promote health activities.

UNICEF has been working with the MOHP in 18 districts of Upper Egypt to upgrade their emergency obstetric care services (EMOC).

Study Design Summary

A population-based sample of female deaths in the reproductive age group 15-49 years over a 12 month period between 1 January and 31 December 2000 was obtained using vital registration data from a selection of 149 health bureaus in all 27 governorates in Egypt, including the frontier governorates (see Figure 3). In 1992-1993 Egypt had a total of 26 governorates, and the first national study of maternal mortality did not include the five frontier governorates.

The selected health bureaus (SHB) were asked to report weekly all notified deaths of women aged 15-49 years. Pregnancy-related deaths were initially identified by a screening questionnaire at the health bureaus. All pregnancy-related deaths were investigated by interviewing the family of the deceased woman and any medical providers involved. Information about pregnancy-related deaths was obtained from medical records, drug prescription and x-ray forms from MCH units, hospitals, private clinics, and health bureaus. The status of the infants of deceased women was also assessed. A Local Advisory Group (LAG) in each governorate reviewed the questionnaires and records, and assigned medical causes of death and avoidable factors for all maternal deaths by consensus.

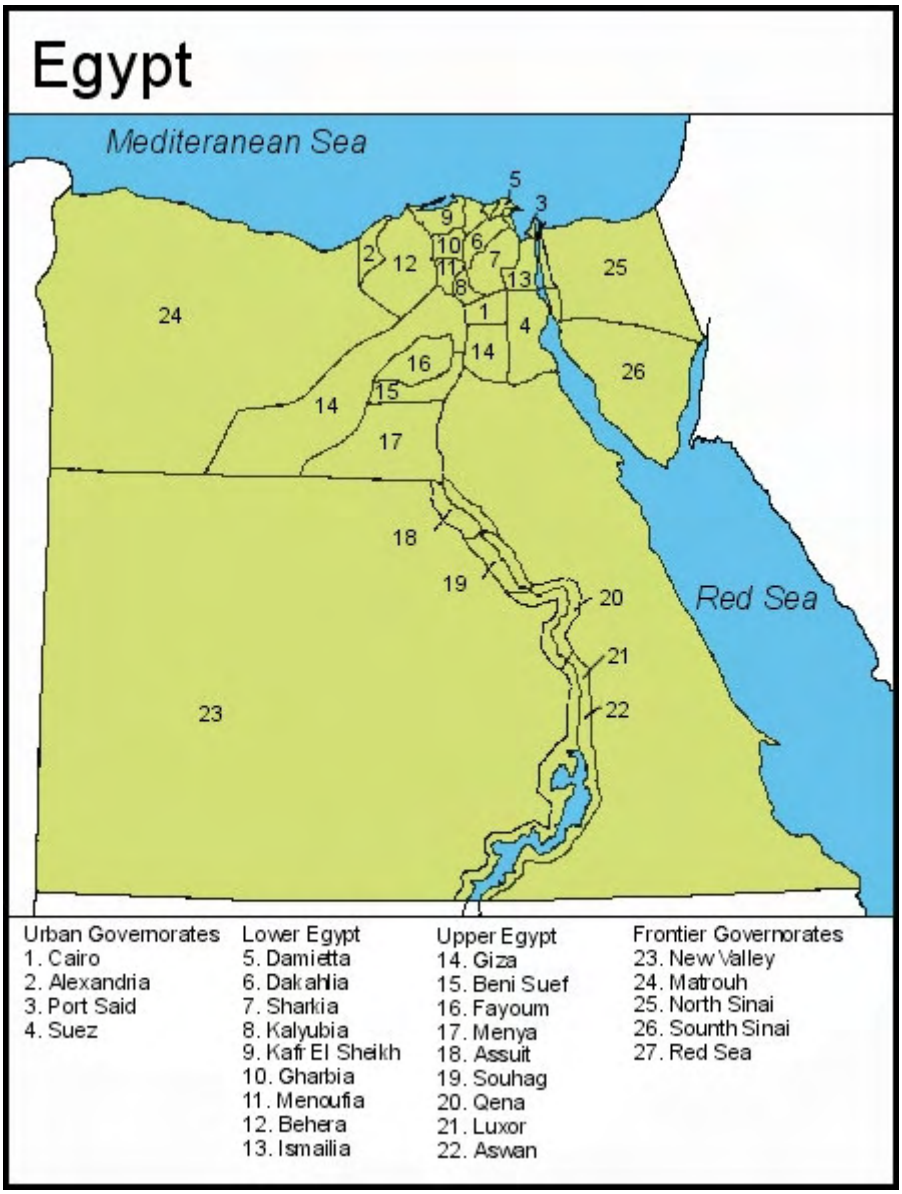
Vital registration data for the 12-month period 1 January to 31 December 2000 reported to CAPMAS were used to obtain information about live births, in order to calculate the maternal mortality ratio. Comparisons to women who did not die in childbirth were made using a sample of women from the Egypt Demographic and Health Survey (EDHS) 2000, and supplementary data were obtained by interviewing a sub-sample of these women through the Follow-up Study of National Perinatal/Neonatal Mortality Study (NPNMS). Results are reported in a separate report.

Overall guidance on study design, strategy and dissemination was provided by a Central Advisory Group (CAG), which acted as the steering committee for the National Maternal Mortality Study. Confidentiality and a no-blame policy were strictly enforced. Confidentiality ensured that no legal or

political proceedings would result from the findings, and the absence of recrimination or censure of individuals allowed for fuller reporting.

Details of the sample design, tools and training, data collection and review, classification of causes of maternal death and avoidable factors, quality control, data quality and data processing and analysis are in Appendix 3.

Figure 3. Map of Egypt



Overall Results

The sample selected for the National Maternal Mortality Study: Egypt 2000 included 8,497 deaths of women of reproductive age between 1 January and 31 December 2000. Of these 8,497 female deaths, 639 (7.5%) were among women who died during pregnancy, delivery, or within 42 days of the end of pregnancy. Of these 639 pregnancy-related deaths, 585 (92%) were maternal deaths and 54 (8%) were due to incidental causes. Maternal deaths, therefore, represent 6.9% of female deaths. Questionnaires were missing for five (0.8%) of the 585 maternal deaths, because the addresses of these women could not be traced. These five deaths are included in estimates of the maternal mortality ratio, but are excluded from tables providing details on causes of death or avoidable factors.

Table 2 shows the percentage of female deaths in the reproductive age group that are maternal deaths, and the maternal mortality ratios (MMR), with 95% confidence intervals. It also shows the number of female and maternal deaths by region (Metropolitan/Urban, Upper Egypt, Lower Egypt, Frontier governorates), and by governorate (for the nine governorates with a 100% sample).

Number of Female Deaths and Proportion of Maternal Deaths

The numbers of female deaths in women of reproductive age identified in each governorate were considerably less than the numbers expected based on the sampling frame.

The proportion of female deaths represented by maternal deaths (6.9%) is lower than the 10.3% expected based on the 1992-1993 NMMS, and considerably lower than the figures reported by earlier studies using a similar methodology in Menoufia (22.8%) (Fortney et al, 1984; Fortney et al, 1986; Grubb et al, 1988; Kane et al, 1992; Saleh et al, 1987) and Giza (18.5%) (El Kady et al 1989a). The lower than expected figure in the 2000 NMMS has three possible explanations:

- Firstly, fertility has continued to decrease in Egypt (EDHS, 2000), reducing the number of pregnancies. This reduces the number of maternal deaths and the percentage of female deaths that are maternal, although it may not necessarily reduce the maternal mortality ratio.
- Secondly, the expected proportion was based on the 1992-1993 NMMS, and maternal mortality could have declined in the intervening eight years.
- Thirdly, the study methodology may not have captured all female and maternal deaths.

Maternal mortality ratio estimates using slightly different procedures which adjust for the shortfall in expected female and maternal deaths are presented in Appendix 3.

Table 2. Female deaths, maternal deaths, and maternal mortality ratios by region and governorate, 2000

Region, Governorate	Live births	Female Deaths (FD) sample	Pregnancy related Deaths	Maternal Deaths (MD)	%MD/ FD	MMR	Confidence Limits LCL	UCL
Total	1,752,562	8497	639	585	6.9	84	80	89
Metropolitan	282,196	1,844	71	59	3.2	48	40	56
Lower Egypt	725,936	2,845	225	208	7.3	93	86	100
Upper Egypt	717,773	3,713	328	303	8.2	89	82	96
Frontier	26,657	95	15	15	15.8	120	78	161
Suez	11,460	78	11	10	12.8	87	33	141
Kafr El Sheikh	57,879	494	37	35	7.1	60	40	80
Beni Suef	61,468	379	43	41	10.8	67	46	87
Fayoum	66,851	418	36	34	8.1	51	34	68
Qena	80,965	647	49	49	7.6	61	44	77
Assiut	101,768	1,024	67	61	6.0	60	45	75
Luxor	10,798	90	9	9	10.0	83	29	138
Aswan	23,305	203	18	17	8.4	73	38	108
New Valley	4,283	15	1	1	6.7	23	0	69

To calculate the maternal mortality ratio for the nine governorates with a 100% sample of female deaths, the maternal deaths were used without

correction and divided by the total number of live births in these governorates. For the 18 sampled governorates, the proportion of female deaths that were maternal was applied to the expected number of female deaths based on the most recently available data (1998), and the total live births in 2000 were used as the denominator.

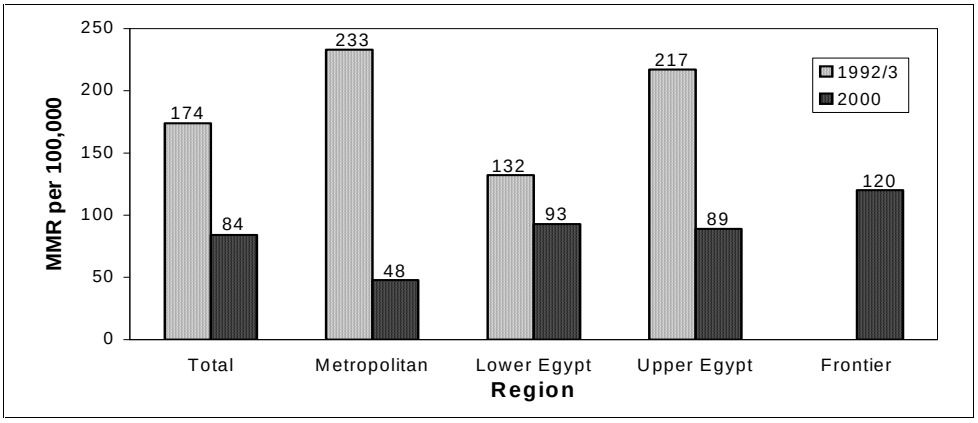
Maternal Mortality by Region and Governorate

Metropolitan Egypt has the lowest proportion of maternal deaths (3.2%), followed by Lower Egypt, Upper Egypt, and Frontier (7.3%, 8.2%, and 15.8% respectively). This conforms to what would be expected given the level of development of these regions.

Figure 4 presents the national and regional maternal mortality ratios for 1992-93 and 2000. The national maternal mortality ratio is 84 maternal deaths per 100,000 live births. This figure assumes that 100% of all female deaths were identified in the nine governorates of Aswan, Luxor, Qena, Beni Suef, Fayoum, Assiut, Kafr El-Sheikh, Suez, and New Valley. Missing female and maternal deaths would have the effect of underestimating the maternal mortality ratio.

There has been a substantial decline in MMR since 1992-93, and compared to the earlier studies summarized in Table 1. Declines of similar magnitude have been reported in the 1960s in industrialized countries, and more recently in Honduras, where mortality declined from 182 in 1990 to 108 in 1997 (Danel, 2001).

Figure 4. Maternal mortality ratios by region in Egypt (1992-93 and 2000)



Maternal Mortality by Age and Parity

Figures 5 and 6 show maternal mortality ratios by age and parity. As might be expected, they indicate that the oldest mothers are at the highest risk of death, as are women having a high order birth. The risk for first births is also higher than the risk for women with one or two previous births. However, as Table 3 shows, preventive approaches that focus only on women defined as high risk based on age will not solve the problem of maternal mortality, since only 5% of deaths occur among women aged less than 20 and only 12% in women aged 40 and over. This is because women in these age groups are the least likely to be pregnant even though they have a high risk of maternal death (Graham and Airey, 1987).

Figure 5. Maternal mortality ratio by age group of the woman

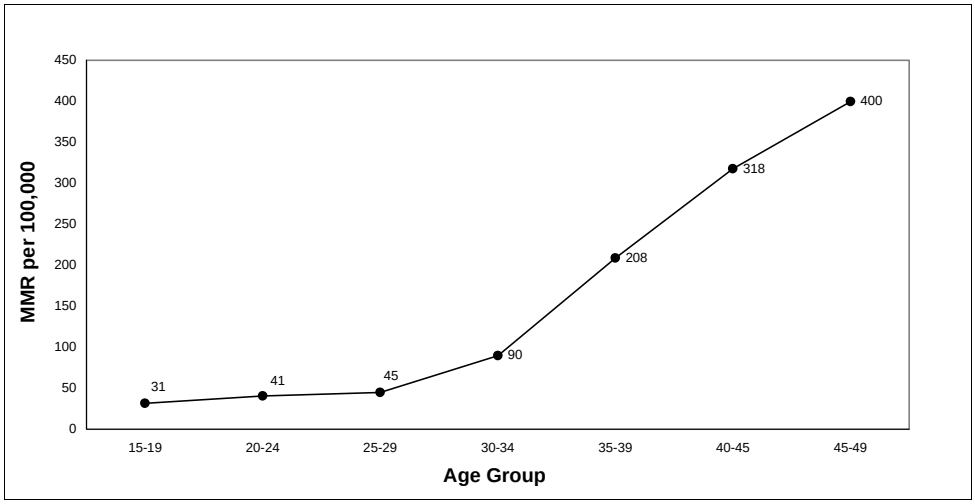


Figure 6. Maternal mortality ratio by parity group of the woman

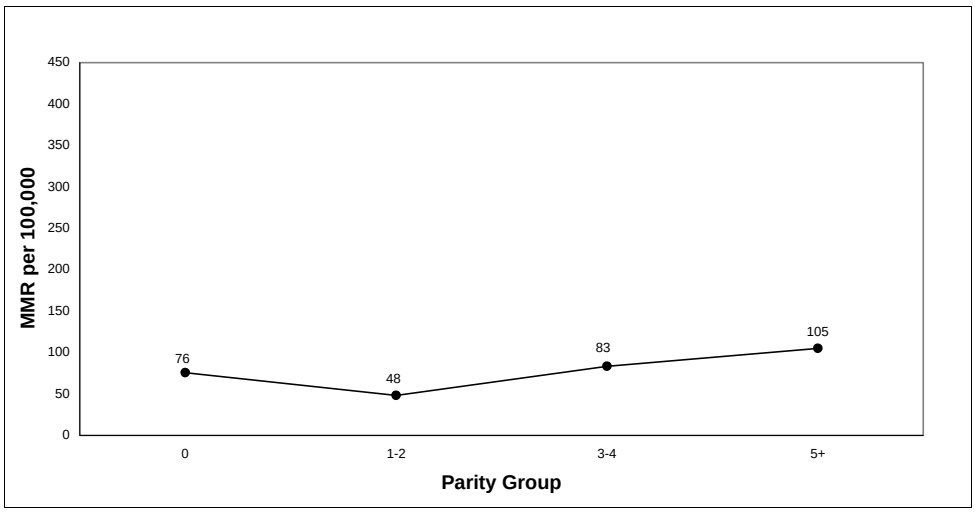


Table 3: Percentage of maternal mortality and percentage of births by age group

Age group	Number	%	% of births by mother's age in EDHS 2000*
15-19	29	5	11
20-24	108	19	32
25-29	105	18	28
30-34	134	23	18
35-39	135	23	8
40-45	62	11	2
45-49	8	1	0
Total	**580**	**100**	**100**

* Source: EDHS, 2000

Time of Maternal Death

The 2000 NMMS found that most maternal deaths took place during delivery or postpartum:

- 9% of deaths occurred in early pregnancy (before 6 months).
- 16% of deaths occurred in late pregnancy (between 6 and 9 months).
- 49% occurred during delivery and the 24 hours after delivery.
- 26% occurred in the postpartum period (11% in week one, 7% in week two, and 8% in weeks three to six postpartum).

Compared to the first NMMS, deaths in 2000 were more likely to occur during delivery (49% compared to 39% in 1992-93) and less likely to occur during the postpartum period (27% compared to 35% in 1992-93).

Outcome for the Fetus or Infant

Table 4 shows the outcome for the fetus or infant related to the time of maternal death.

Table 4. Outcome for the fetus or infant by time of death of the mother

Outcome	No. of maternal deaths	% of maternal deaths
Mother and fetus died in early pregnancy	52	9
Mother and fetus died undelivered	90	16
Mother died in delivery		
- infant alive	185	32
- infant dead	97	16
Mother died postpartum		
- infant alive	104	18
- infant dead	52	9
Total	**580**	**100**

In 50% of cases of maternal death, the fetus or infant also died (compared to 57% in the 1992-93 NMMS). When maternal death occurred during delivery or the postpartum period, 34% of infants died at birth or soon after (compared to 43% in the 1992-1993 NMMS), and this decline may be attributable to better postpartum care of newborns.

Place of Maternal Death

Table 5 shows that 62% of maternal deaths occurred in health facilities, 29% occurred at home, and 9% occurred during transportation. In 1992-93 women who died in the postpartum period were more likely to have delivered at home (42%), but this was not the case in 2000 (20%). Compared to the 1992-93 NMMS, a greater proportion of maternal deaths in 2000 occurred during transportation. Of particular concern is the fact that 27% of women delivering in private facilities and 23% of those delivering in public facilities subsequently die at home or during transportation, suggesting possible problems with referrals or premature discharge. Previous work has shown that the length of hospital stay for delivery is short (1.6 days) (MOH, 1994b).

Table 5. Place of maternal death

Place of delivery	Place of death			
	Home	During transportation	Health facilities	**Total (Place of delivery)**
Home	55 (48%)	17 (15%)	42 (37%)	**114 (20%)**
During transportation	0 (33%)	1 (67%)	0 (0%)	**1 (0%)**
Private health facility	23 (16%)	16 (11%)	107 (73%)	**146 (25%)**
Public health facility	35 (20%)	5 (3%)	135 (77%)	**176 (30%)**
Undelivered	55 (39%)	12 (8%)	76 (53%)	**143 (25%)**
Total (Place of death)	**169 (29%)**	**51 (9%)**	**360 (62%)**	**580 (100%)**

Table 6 compares the place of delivery of women who died with the place of delivery for previous births and for women in Egypt in general. Among the 437 women who delivered, 26% delivered at home, whereas data from the EDHS 2000 suggest that 52% of women in Egypt deliver at home (EDHS, 2000) and 55% of families, when asked where the deceased women had had their previous deliveries, reported that they usually delivered at home. The lower proportion of home deliveries among women who died suggests that women seek medical care when they experience problems, and this is confirmed by the 2000 NMMS which found that 93% of women who died had sought medical help at some point during the events leading to their deaths.

Table 6. Place of delivery

Place of delivery	Index delivery[1]	Previous delivery[2]	EDHS 2000*
Home	114 (26%)	231 (55%)	52%
During transportation	1 (0%)		0%
Private Health Facility	146 (33%)	81 (19%)	26%
Public Health Facility	176 (40%)	108 (26%)	22%
Total	**437 (100%)**	**421 (100%)**	**100%**

Source: EDHS 2000
Notes:
[1] Excludes 143 women who died undelivered.
[2]. Excludes 159 women delivering for the first time.

Direct and Indirect Causes of Maternal Death

Using data related to the single main cause of death for 580 maternal deaths, Figure 7 presents the major categories of causes of death. Direct obstetric causes were responsible for 448 maternal deaths (77%), and indirect obstetric causes were responsible for 116 maternal deaths (20%). For 16 women (3%), it was not possible to arrive at a cause of death, either because insufficient information was obtained from the family or health providers involved, or because the story was confused, or because diagnosis was not possible without an autopsy. The findings for the main categories of causes of death are comparable to results obtained from studies in other developing countries (Abou Zahr, 1998), and are not much different to the results obtained by the 1992-1993 NMMS (69% and 27% respectively). When multiple causes of death are considered, direct obstetric causes alone were responsible for 349 maternal deaths (60%), indirect obstetric causes alone were responsible for 99 maternal deaths (17%), and both direct and indirect causes for 117 (20%).

Figure 7. Categories of causes of maternal death

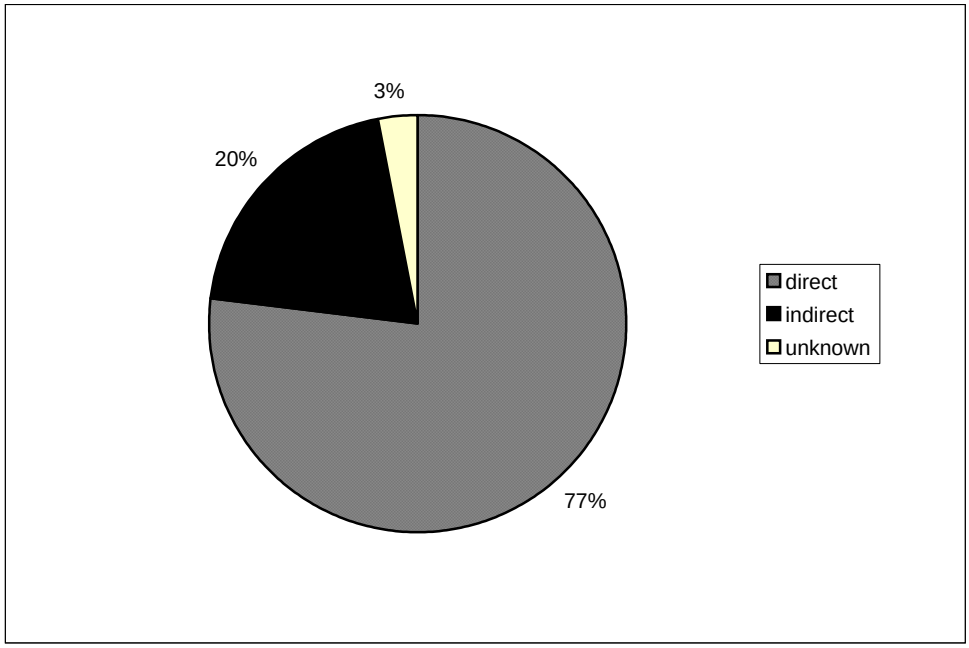


Table 7 shows the single main cause of death, determined by the LAG. However, as discussed in the previous section, it is possible for women to have more than one cause of death. Using data related to the multiple causes of death for 580 maternal deaths, direct obstetric causes contributed to 80% and indirect obstetric causes to 37% of maternal deaths respectively. Table 8 and Figures 8 and 9 show the direct and indirect causes of death, allowing for multiple causes. For example, Cesarean section was the single main cause in 4% of deaths but contributed to 7% of deaths. Table 8 shows that as in the NMMS 1992-1993 hemorrhage, especially postpartum hemorrhage, is the leading cause of death followed by hypertensive diseases of pregnancy and cardiovascular diseases. In the NMMS 1992-1993 sepsis was the fourth cause whereas in the NMMS 2000 ruptured uterus and sepsis are in equal fourth place. Anemia also emerges as an important cause of death when multiple causes are allowed but is rarely the single main cause of death.

Table 7. Single main causes of maternal death

Cause	Number	% of total*
Direct Obstetric Causes of Death	**448**	**77**
Hemorrhage	**176**	**30**
Antepartum	19	3
Postpartum	157	27
Hypertensive diseases of pregnancy	**78**	**13**
Without convulsion	29	5
With convulsion	47	8
Chronic hypertension	2	0
Sepsis	**37**	**6**
Puerperal Sepsis	36	6
Obstetric tetanus	1	0
Abortion	**15**	**3**
Spontaneous	9	2
Induced	6	1
Other	**141**	**24**
Ectopic	4	1
Acute uterine inversion	2	0
Ruptured uterus	47	8
Obstructed labor	1	0
Cesarean section	24	4
Anesthesia	30	5
Pulmonary embolism	33	6
Indirect Obstetric Causes of Death	**116**	**20**
Anemia	**3**	**1**
Cardiovascular	**58**	**10**
Rheumatic heart	40	7
Congenital heart	5	1
Myocardial infarction/stroke	13	2
Neurological disorders	**1**	**0**
Infectious and parasitic diseases	**16**	**3**
TB	3	1
Bacterial meningitis	4	1
Encephalitis	6	1
Septicemia	3	0
Digestive	**16**	**3**
Liver failure	14	2
Other digestive	2	0
Acute renal failure	**3**	**0**
Neoplasms	**9**	**2**
Acute leukemia	3	0
Other neoplasms	6	1
Respiratory	**6**	**1**
Unknown Causes	**16**	**3**
Accidental Causes of Death	**54**	
Road traffic and other accidents	13	
Burns	29	
Suicides	2	
Homicides	4	
Poisonings	6	

*Percentages do not add up to 100 because of rounding.

Table 8. Direct and indirect causes of maternal death

Cause	Number	Percent	% of total
Direct Obstetric Causes of Death	**465**		**80**
Hemorrhage	222	48	38
Antepartum hemorrhage	50	11	9
Postpartum hemorrhage	197	42	34
Hypertensive diseases of pregnancy	126	27	22
Without convulsion	84	18	14
With convulsion	50	11	9
Sepsis	45	10	8
Abortion	20	4	4
Spontaneous	11	2	2
Induced	9	2	2
Other	160	34	28
Ectopic	4	1	1
Other early pregnancy deaths	3	1	0
Ruptured uterus	45	10	8
Obstructed labor	30	6	5
Cesarean section	38	8	7
Anesthesia	30	6	5
Pulmonary embolism	20	4	4
Other direct causes	25	5	4
Indirect Obstetric Causes of Death	**216**		**37**
Anemia	61	28	11
Cardiovascular	76	35	13
Neurological disorders	12	6	2
Infectious and parasitic diseases	23	11	4
Hepatitis	15	7	3
Digestive	11	5	2
Diabetes	12	5	2
Urogenital	20	9	4
Neoplasms	9	4	2
Other indirect	43	20	7
Unknown Causes	**16**		**3**
Total Maternal Deaths	**580**		**100**

Notes:

1. Percentages are calculated for direct causes (N = 465), for indirect causes (N = 216), and for unknown (N = 15) as relevant.
2. Percentages do not add up to 100 as there can be more than one cause.

Figure 8. Direct causes of maternal death*

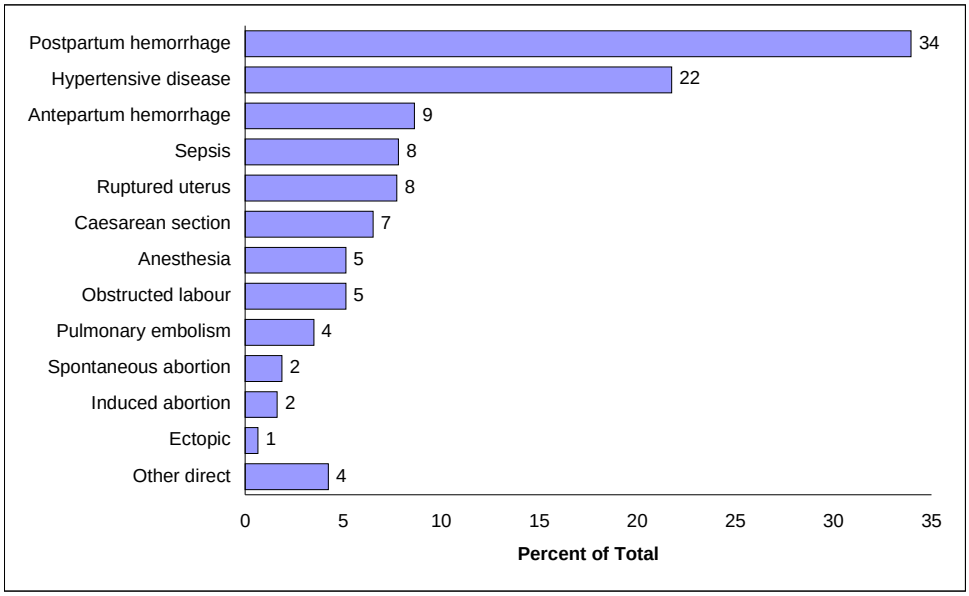
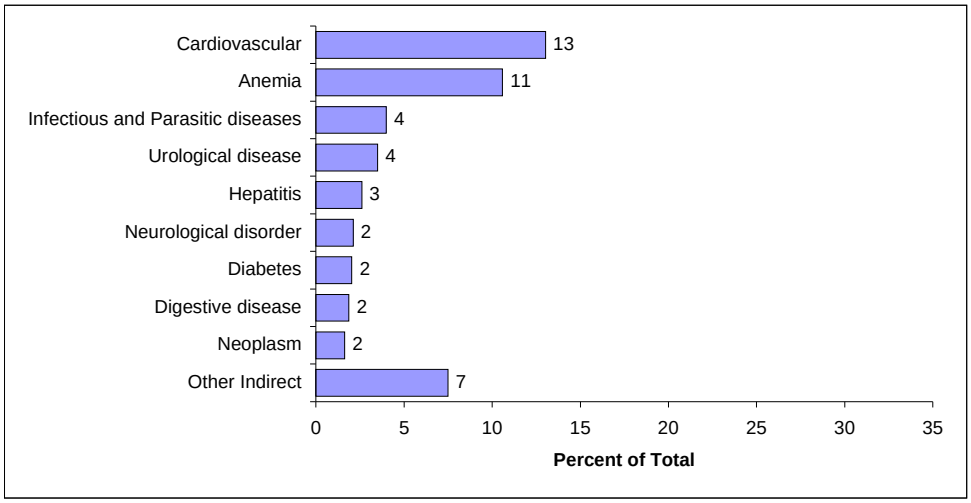


Figure 9. Indirect causes of maternal death*



*Percents do not add to 100 as there can be more than one cause

Avoidable Factors Contributing To Maternal Death

Table 9 shows the avoidable factors contributing to maternal deaths. As discussed earlier, women could have more than one factor contributing to death. It also shows the maternal deaths per 100,000 live births where the avoidable factor contributed.

Table 9. Avoidable factors contributing to maternal death and maternal mortality ratio per 100,000 live births

Factor	Direct N (%)	Indirect N (%)	Unknown n (%)	Total n (%)	MMR Ratio
Total number of deaths	**465**	**216**	**16**	**580**	
No ANC	93 (20%)	43 (20%)	2 (15%)	110 (19%)	16
Delay in recognizing problem/seeking medical care	141 (30%)	79 (37%)	3 (18%)	172 (30%)	25
Unwanted pregnancy	12 (3%)	9 (4%)	0 (0%)	14 (2%)	2
Poor quality ANC	66 (14%)	42 (19%)	3 (21%)	90 (15%)	13
Substandard care from					
General practitioner	56 (12%)	21 (10%)	0 (0%)	66 (11%)	9
Midwife	23 (5%)	3 (1%)	1 (9%)	26 (4%)	3
Obstetrician	222 (48%)	76 (35%)	1 (9%)	247 (43%)	36
Daya	43 (9%)	10 (5%)	0 (3%)	47 (8%)	7
Lack of drugs, supplies and equipment in health facilities	25 (5%)	14 (6%)	0 (3%)	33 (6%)	5
Lack of anesthetist/anesthesia facilities	24 (5%)	7 (3%)	0 (0%)	24 (4%)	3
Lack of blood	86 (18%)	30 (14%)	0 (3%)	92 (16%)	13
Lack of transportation	28 (6%)	5 (2%)	0 (3%)	30 (5%)	4
Long distance to hospital	22 (5%)	6 (3%)	0 (3%)	23 (4%)	3
No avoidable factors	66 (14%)	59 (27%)	7 (42%)	113 (19%)	16

Notes:
1. Percentages do not add up to 100% as each death can have more than one avoidable factor.
2. Maternal mortality ratios add up to more than the total national maternal mortality ratio because more than one avoidable factor can contribute to each death.

In the 2000 NMMS, one or more avoidable factors contributed to 467 of 580 (81%) of maternal deaths, compared to 92% in the 1992-1993 NMMS. Maternal death was considered to be unavoidable in 113 cases (19%),

compared to 8% with no avoidable factors in the 1992-1993 NMMS. This means that in 2000 there were 16 maternal deaths per 100,000 live births that were considered unavoidable compared to 14 maternal deaths per 100,000 live births in 1992-1993.

Poor diagnosis and management by obstetricians was the most frequent avoidable factor (43%), contributing to 36 maternal deaths per 100,000 live births. Woman and family factors, in particular delay in recognizing problems and in seeking medical care, and absence of antenatal care, were also significant contributors to maternal death (30% and 19% respectively), contributing to 25 and 16 maternal deaths per 100,000 live births respectively. However, many maternal deaths are the result of multiple avoidable factors. For example, in 24% of the 247 cases where poor medical management contributed to maternal death, delay in seeking care was also a factor. Doctors often report that women arrive at hospitals for obstetric management after much delay and in complicated conditions associated with high mortality even with the best medical care. Women sometimes seek care from several health providers, including private practitioners, before coming to the hospital, which contributes to delays in obtaining appropriate obstetric management. Obstetric teams attending moribund cases were not judged by the LAG to have contributed to sub-standard care.

Three categories of avoidable factors, medical team factors, health facility factors, and woman and family factors, are discussed in the following section. Ten maternal deaths among the 580 were also selected to provide typical case studies, and some of these cases are cited below to illustrate specific points.

Health provider factors

Poor quality antenatal care was found to contribute to 19% of maternal deaths, and to 16 maternal deaths per 100,000 live births. There appears to be a widely held perception that all women have to do is attend the required number of antenatal visits, and little attention is paid to ensuring that antenatal care is effective. Even when women attend antenatal clinics, they do not necessarily receive preventive care, screening or treatment for

problems identified (EDHS, 2000; FUSND). These studies found that only 12% of women who attended antenatal care had care of a minimally acceptable standard (defined as comprising one or more tetanus toxoid immunizations, two or more weight measurements, two or more blood pressure measurements, one or more urine and blood tests, a general examination and an abdominal examination). The NMMS 2000 also found inadequate care and a failure to act on problems identified during antenatal care. This is illustrated by the following case study, where the health provider failed to intervene to deliver the woman despite correctly diagnosing hypertension.

> *The woman was 35 years old when she died. She had given birth to five children, three of whom were alive at the time of the household interview. The woman made a total of five antenatal visits to an obstetrician at a private clinic. At an antenatal visit in her seventh month of pregnancy, she complained of edema in her lower limbs. The obstetrician diagnosed hypertension and she took the treatment prescribed. At her last antenatal visit in the ninth month of pregnancy, she felt unwell but the obstetrician told her it would be ten more days before she delivered. After the visit she continued to feel unwell. She lost consciousness and her family took her to the obstetrician, who transferred her to the Intensive Care Unit at the district hospital. The district hospital in turn referred her to the governorate hospital. There a Cesarean Section was done while she was in a coma and a dead infant was delivered. She remained unconscious and died in the hospital five days later.*

It is imperative that women receive prompt and competent medical care once they arrive at a health facility, and that facilities which cannot provide emergency obstetric services are able to stabilize women and offer emergency first aid. However, the 2000 NMMS found that failure of early diagnosis and inadequate management by obstetricians (see Terms and Definitions for definition of an obstetrician in Egypt) were significant avoidable factors, contributing to 19% and 42% of maternal deaths

respectively. Overall, sub-standard care by obstetricians contributed to 43% of maternal deaths. Sub-standard care by general practitioners contributed to 11% of maternal deaths, while midwives contributed to 4% of deaths. Together, all trained health providers (obstetricians, general practitioners, midwives and nurses) contributed to 54% of all maternal deaths. Maternal mortality ratios associated with these avoidable factors are 16 per 100,000 live births for failure of early diagnosis by obstetricians, 35 per 100,000 for inadequate management by obstetricians, 36 per 100,000 for sub-standard care by obstetricians overall, 9 per 100,000 for sub-standard care by general practitioners, 3 per 100,000 for sub-standard care by midwives, and 45 per 100,000 for all trained health providers. Specific medical team factors, illustrated by case studies, are discussed in more detail in the next section on cause-specific results.

Failure of diagnosis and management by obstetricians can occur during antenatal care, delivery or postpartum care. The following case studies illustrate poor obstetric management by public hospitals and private providers and, more specifically, the harmful inappropriate use of oxytocin.

> *A 40 year old woman with 11 previous births became pregnant while using injectable contraceptives. She had mild vaginal bleeding at 20 weeks and had a consultation with a private obstetrician, who concluded that everything was normal after carrying out an ultrasound and a clinical examination. The bleeding continued for 40 days and, at 34 weeks, the woman developed severe antepartum hemorrhage with lower abdominal pain, which persisted for seven days. The private obstetricians diagnosed placenta previa by ultrasound, but told the woman she did not need a blood transfusion. After another severe episode of vaginal bleeding, she saw another private obstetrician who did not do anything to manage her condition. She died undelivered.*
>
> *The woman was 18 years old when she died. This was her first pregnancy, and she had been trying to get pregnant for three years. She attended ten antenatal care visits with an*

obstetrician at a private clinic and no problems were detected. At nine months gestation, the obstetrician started induction of labor because she was 'post-date'. She was given half a tablet of misoprostol and then another half tablet, but still did not have labor pains. In addition, she received two ampoules of oxytocin. After two hours, when she was bleeding and unconscious, the obstetrician transferred her to the governorate hospital. She was pronounced dead on arrival.

Although general practitioners contributed to only 11% of maternal deaths, it is estimated that only about 1% of women seek care from a general practitioner (FUNSD), suggesting that these health providers make a disproportionate contribution to maternal death. This could either be because they are providing sub-standard care or because they are the first point of contact for women with life-threatening complications and are not trained to provide emergency first aid and referral. In contrast, midwives contribute to only 4% of maternal deaths, even though they provide delivery care to 7% of women (EDHS 2000).

Dayas contributed to 8% of all maternal deaths overall and, more specifically, to 6% of deaths by failing to refer and to 6% by using harmful practices. Dayas contributed to 7 maternal deaths per 100,000 live births. Since an estimated 36% of Egyptian women use traditional birth attendants (EDHS 2000), this suggests that training programs conducted by the Ministry of Health and Population in collaboration with UNICEF and USAID (MOHP, 2001; Richter, 1992; UNICEF, 1985), have been relatively successful in encouraging dayas to refer promptly women with complications and to reduce the use of harmful practices.

Poor referral practices, in terms of when and where to refer cases, were also an important avoidable factor in maternal deaths. Studies have shown that women are more likely to seek private care for obstetric morbidities (EFCS, 1995b; EFCS, 1996). Failure by the first health provider to refer correctly was associated with 13% of deaths and, in a disproportionately large number of cases, women who died had been to see private practitioners who

delayed referring women to hospital facilities. The NMMS noted that this is due in part to the lack of a referral system, including protocols for dealing with obstetric emergencies, within the health care system. El Mouelhy (1987), who reviewed all maternal mortality studies in Egypt, makes similar observations. The Ministry of Health and Population recently introduced standards and protocols in Upper Egypt (MOHP, 2000), but coverage has yet to be extended to the rest of the country.

Health facility factors

The lack of functioning health facilities, particularly first referral level hospitals, is one of major factors contributing to maternal deaths worldwide (Maine, 1991). A review of three public sector hospitals in Alexandria, Suez and Beni Suef revealed that Obstetrics/Gynecology wards have spare capacity, with bed occupancy rates of less than 60% (MOH, 1994b). Moreover, most women in Egypt have access to health facilities, and data from a 1989 survey suggests that, even in rural areas, 99% of women live within 30 kilometers of at least one government hospital (Sayed, 1991). This is confirmed by the 2000 NMMS, which showed that the majority of deceased women sought hospital care at some point in the events leading to their death.

Other health facility factors played a relatively minor role in contributing to maternal deaths. Of these, lack of blood was the most important factor (16%), followed by distance (4%) and lack of transportation (5%), or both together (7%). Lack of drugs (2%), supplies (2%) and equipment (5%) in health facilities contributed to 6% of maternal deaths. Lack of available operating theatre, anesthetist/anesthesia facilities, and other back-up facilities contributed to 2%, 4% and 2% of maternal deaths respectively. The contribution of these factors to the maternal mortality ratio are as follows: lack of blood contributed to 13 maternal deaths per 100,000 live births, distance to 3 per 100,000, lack of transportation to 4 per 100,000, both together to 6 per 100,000, lack of drugs to 2 per 100,000, lack of supplies to 2 per 100,000, lack of equipment to 4 per 100,000, lack of drugs, supplies and equipment together to 5 per 100,000, lack of operating theatre to 2 per 100,000, lack of anesthetist/anesthesia facilities to 3 per 100,000,

and lack of other back-up facilities to 2 per 100,000. The following case illustrates the role of the medical team and health facility factors – poor management including inappropriate use of syntocinon by the general practitioner, and poor management, including lack of blood, at the hospital – in contributing to maternal death.

> *The woman was 26 years of age when she died and had given birth to one child who was alive at the time of the household interview. She had no medical problems during her first pregnancy or the pregnancy that led to her death, and she did not go for antenatal care in either pregnancy. At nine months gestation, the woman developed labor pains and went to a general practitioner in a rural health unit. After a failed trial of labor using a syntocinon intravenous drip, the general practitioner referred her to the district hospital for a CS. At the hospital she was diagnosed as having a ruptured uterus and was admitted in shock. A CS was performed and delivered a dead infant. After the CS, the woman had uncontrollable bleeding and a sub-total hysterectomy was carried out to stop the bleeding. However, the woman was given only one unit (500cc) of blood. She went into irreversible shock and died three hours after admission to hospital.*

Woman and family factors

Failure by the woman or her family to recognize problems and delay in seeking medical care were significant avoidable factors, contributing to 27% and 21% of maternal deaths respectively. These were associated with 23 maternal deaths per 100,000 live births and 18 maternal deaths per 100,000 live births respectively. Failure to recognize danger signs usually contributed to delay in seeking care – in only 3% of cases were danger signs recognized and care seeking delayed for other reasons – and together these factors contributed to 30% of all maternal deaths, and 25 maternal deaths per 100,000 live births. Similar results were found by other studies in Egypt

(Khattab and Kamal, 1988; EFCS, 1995b; EFCS, 1996). For example, a population-based study of women in Menoufia (EFCS 1995b) asked about serious morbidities in the last pregnancy (malaria, severe hemorrhage, fits and convulsions, edema of the face and hands, hypertension, fever>3 days, severe vomiting, jaundice, pulmonary TB, labor >18 hours, perineal, vaginal or cervical tear, postpartum shock, and foul discharge). They found that 44%, 8%, and 34% of women reported having one or more of the morbidities in the antepartum, intrapartum and postpartum periods respectively. However depending on the morbidity, 61% to 100% perceived these as serious, and the subset of these who sought care for the problem ranged from 48% to 100% (EFCS 1995b).

In addition to failure to recognize danger signs and complications in pregnancy, delay in care seeking is also likely to be associated with lack of confidence in the quality of health facilities and inability to afford the costs of medical care. A previous KAP study, conducted through focus group discussions with women in Upper Egypt, suggested that perceptions about poor quality services and financial cost are barriers to use of antenatal and delivery services respectively (Loza, 1994).

Other important woman and family factors identified by the study were failure to adopt preventive measures, in particular use of contraception to prevent unwanted pregnancy and use of antenatal care, which contributed to 2% and 19% of maternal deaths respectively.

Table 10 shows some of the key variables with respect to contraception and unwanted pregnancy related to maternal deaths. Among women who died, 36% of women had previously used modern contraception, and 6% of women experienced contraceptive failure resulting in the pregnancy that led to their death. In contrast, the EDHS 2000 showed 54% use of modern contraception and 1% contraceptive failure among ever-married woman in the general population (EDHS, 2000). Among women who died, families reported that 22% of pregnancies were unwanted, compared to the EDHS 2000 figure of 13% unwanted and 5% wanted later. However, it appears that LAG rarely recognized unwanted pregnancy as an avoidable factor,

concluding that it contributed to only 2% of maternal deaths, and was associated with 2 maternal deaths per 100,000 live births.

Table 10. Use of contraception and wanted pregnancy among maternal deaths

	No. of maternal deaths	% of maternal deaths	EDHS 2000*
Current use of modern contraception	212	36%	54%
Method failed with index pregnancy	33	6%	1%
Wanted pregnancy later	30	5%	5%
Did not want pregnancy at all	128	22%	13%
Pregnancy was a big problem	58	10%	NA
Pregnancy was a small problem	42	7%	NA

Source: EDHS, 2000

Table 11 shows the number of antenatal care visits related to maternal deaths. Since the 1992-1993 NMMS, the proportion of deceased women who received no antenatal care declined from 35% to 32%, and the proportion that made ten or more visits increased from 13% to 24%.

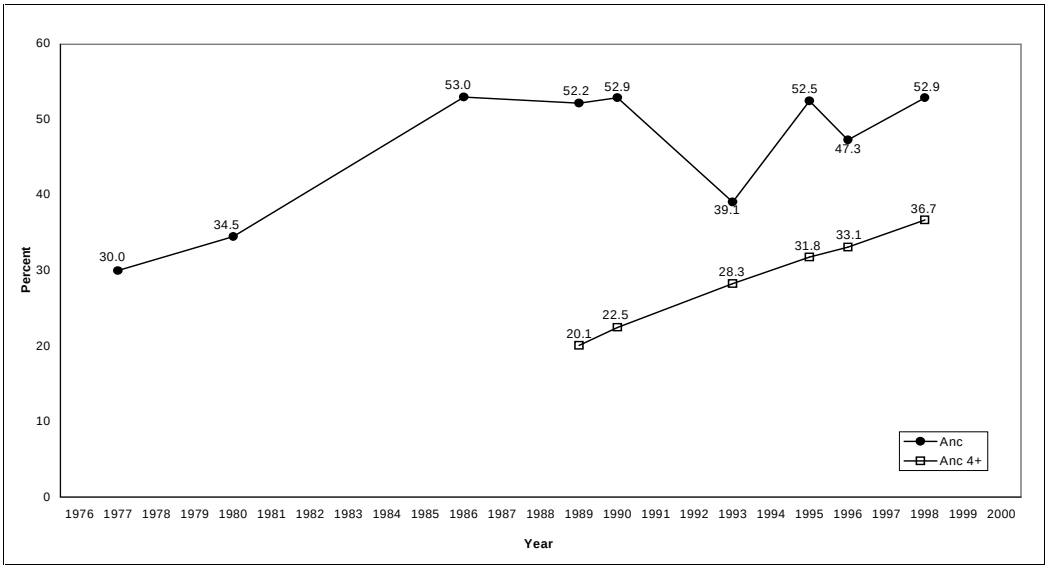
The 2000 NMMS found that 68% of women who had died had received antenatal care, and 53% had made four or more antenatal visits. This is a higher proportion than the 53% of women who reported receiving antenatal care in the EDHS 2000 and the 37% with four or more visits. Taken at face value, this suggests that there is an association between attending for antenatal care and maternal death. However, a more likely explanation is that women who died sought antenatal care because they experienced problems during pregnancy. In addition, it is possible that families reported antenatal visits that did not take place because of fears of being blamed for the death.

Table 11. Number of antenatal care visits among maternal deaths

No. of ANC visits	No. of maternal deaths	% of maternal deaths	EDHS 2000
None	185	32	47
One	20	3	3
2-3	56	10	9
4-9	166	29	37
10+	138	24	
Not known	15	3	4
Total	**580**	**100**	**100**

It is difficult to draw conclusions about the extent to which lack of antenatal care contributes to maternal death. This is because it is not possible to prevent, detect or treat all the causes of maternal death during antenatal care (Rooney, 1992; Carroli et al 2001). Some interventions in pregnancy have been shown to be effective related mainly to chronic conditions—anemia, hypertensive disorders in pregnancy, and infections in pregnancy. For example, antenatal care can prevent deaths from hypertensive causes by detecting the proteinuria indicative of pre-eclampsia and treating the hypertension, but it can do little to prevent deaths from postpartum hemorrhage, pulmonary embolism, or induced abortion. Despite this, and the fact that maternal mortality in Egypt has been reduced by around 50% without a substantial increase in the proportion of women receiving antenatal care (see Figure 10), LAG appear to have over-estimated the contribution of lack of antenatal care to maternal deaths.

Figure 10. Percent with any antenatal care, and with 4+ antenatal visits, Egypt



The following case study illustrates the contribution to maternal death of woman and family factors, including failure to adopt measures to prevent pregnancy, lack of antenatal care, non-adherence to medical treatment, failure to recognize and seek care for danger signs, and the decision to deliver at home with a daya. It also shows clearly the contribution of medical team factors, most notably poor management by the obstetrician in a private clinic.

> *The woman was 37 years old when she died. She had previously given birth to six children, of whom all were alive at the time of the household interview. The woman had a history of pre-eclampsia with two pregnancies, and had been hospitalized for one of these. She had used injectable contraceptives for three years and then switched to oral contraceptive pills, but stopped using them after three days because they gave her a headache. The pregnancy that led to her death was unwanted. She first sought antenatal care at*

five months gestation, when she had vomiting and vaginal itching. She was diagnosed with severe pre-eclampsia but did not take the medication prescribed to control her blood pressure, because she could not afford it. At six months gestation she developed swelling of the hands and legs, at eight months she had swelling of the face, and at nine months she had blurred vision, but she did not seek care for any of these danger signs. At 40 weeks, she developed labor pains and was seen at home by a daya, who advised her to go to a private Obs/Gyn clinic. At the clinic, she was confirmed to have severe pre-eclampsia with a transverse lie. Labor was augmented with syntocinon but there was no progress. After four hours, the woman was transferred to a governorate hospital. During the transfer she complained that the fetus had stopped moving and she started to bleed. At the governorate hospital she was taken immediately to the operating theatre for a CS, during which it was discovered that she had a ruptured uterus and that the fetus was dead. Permission for a hysterectomy was obtained from the husband, but the woman died on the operating table.

This case study also highlights other issues, including patient-provider communication, family decision-making, and the relevance of advice given by health providers, which play an important role in the behavior of the woman and her family.

Firstly, the case study illustrates the importance of providing women with clear advice about alternative contraceptive methods and managing side effects. This is confirmed by the EDHS 2000 (EDHS, 2000), which found that only 30% of contraceptive users were told what to do about side effects. It also shows that women need easily understandable information about management of problems during pregnancy, since it was not clear how health providers who diagnosed this woman's previous pre-eclampsia or who recommended treatment during the index pregnancy communicated with her or whether this was adequate to inform her of the potential seriousness of her condition.

A qualitative study in Upper Egypt also identified patient-provider communication as a problem (SPAAC, 1998), with the following typical example of misunderstanding resulting from poor communication between an obstetrician and his patient. A woman who consulted an obstetrician at a private clinic in Aswan after her second miscarriage was told that her problem was RH negative blood, but she did not understand what this meant. The doctor said *'You have zafarra fil damm, and that's why you miscarry*'. When the interviewer asked her what *zafarra fil damm* means, the woman said she did not know. The obstetrician advised her to have antenatal care in the future. She did this for her next two pregnancies, but after that she stopped because she could not afford it. She also reported that the doctor said she should not be afraid *'because a percentage of the shots was still in me'*.

Secondly, the case study illustrates the important role of other family members in making decisions about women's health care. Other studies have shown that many women in Egypt are unable to take autonomous decisions about their own health (Khattab, 1992; Lane and Meleis, 1991). The EDHS 2000 indicated that 36% of women take their own decisions about their health, 24% take decisions together with their husband or with someone else, but for 38% of women the decision is taken by the husband alone and for 2% the decision is taken by someone else alone (EDHS, 2000). The EDHS 2000 also found that disapproval on the part of the husband prevents 5% of women who wish to use modern contraception methods from accessing family planning services (EDHS, 2000).

Finally, the case study illustrates the importance of providing women with advice that is relevant to their situation. In this case, non-adherence was related to the cost of treatment. Khattab (1992) also identified health providers' lack of knowledge about the social conditions of women's lives as a reason for non-adherence. For example, women may be told to take complete bed rest without the provider checking that this is feasible.

Cause Specific Results

The 2000 National Maternal Mortality Study also analyzed the specific direct and indirect causes of death. This section presents the findings, for specific causes contributing to more than 30 deaths. Hemorrhage, hypertensive diseases of pregnancy, sepsis, ruptured uterus, Cesarean section (CS) and abortion were the most important direct causes, and cardiac disease the most important indirect cause, of maternal death.

Table 12 shows the characteristics of cause-specific deaths, including the use of antenatal care, reasons for the last antenatal care visit, place of delivery, place of death, and Table 13 shows avoidable factors related to cause-specific deaths. By comparing the percentages for specific causes in the tables with the percentages for all maternal deaths, it is possible to see if a particular avoidable factor plays a role in contributing to mortality from a specific cause. For example, Table 13 shows that lack of blood contributed to 16% of maternal deaths overall. However, shortage of blood played a more important role in some specific causes of death than in others, contributing to 23% of antepartum hemorrhage deaths, 31% of postpartum hemorrhage deaths, 25% of ruptured uterus deaths, and 39% of Cesarean deaths, but only contributing to 7% of sepsis deaths and 6% of cardiac deaths.

Hemorrhage

Hemorrhage was the leading contributor to maternal mortality in Egypt in 2000, as it was in 1992-1993. It was associated with 48% of direct obstetric deaths and 38% of all maternal deaths (Table 8). Hemorrhage was the specific cause in 222 deaths, and the maternal mortality ratio for hemorrhage deaths was 32/100,000. Of these 222 deaths, 197 were associated with postpartum hemorrhage and 50 with antepartum hemorrhage. The majority of antepartum hemorrhage deaths were associated with placental abruption, with the remainder due to placenta previa. The maternal mortality ratios for postpartum hemorrhage and antepartum hemorrhage were 29/100,000 and 8/100,000, respectively.

Twenty five women had both antepartum and postpartum hemorrhage, and the following describes the case of one of these women.

> *The woman was 35 years old when she died. She had previously had three CS and one vaginal delivery, and all four children were alive at the time of the household interview. The woman had a history of hypertension. During the pregnancy in which she died she had continual spotting, which increased during the fifth and sixth months. She made 20 antenatal care visits, to general practitioners and obstetricians in private and public facilities. An obstetrician diagnosed placenta previa and told her this was dangerous and that she should rest completely. At the beginning of the eight month, she developed severe bleeding and no longer felt fetal movement. She had an ultrasound at a private clinic, which showed that the fetus was dead, and the obstetrician referred her to the university hospital. At the hospital a CS was performed and the woman received blood. She developed postpartum hemorrhage and died in the operating room.*

The most important avoidable factors in deaths associated with postpartum hemorrhage were sub-standard care by obstetricians (50%), lack of blood (31%), and sub-standard care by dayas (14%). The comparable figures for all causes of maternal death were 43%, 16% and 8% respectively, indicating that all of these avoidable factors were more likely to contribute to deaths from postpartum hemorrhage (Table 13).

Among women who had postpartum hemorrhage, 29% had no antenatal care during pregnancy, and lack of antenatal care and poor quality antenatal care were avoidable factors in 22% and 11% of postpartum hemorrhage deaths. The comparable figures for all causes of death are 32%, 19% and 19% (Table 13). The contribution of lack of antenatal care and poor quality antenatal care to postpartum hemorrhage deaths may be over-estimated, however, since antenatal care can do little to predict or prevent postpartum hemorrhage. Of the 197 women with postpartum hemorrhage, only 5% were

not seen by a physician at some point around the time of death, and 66% delivered in a health facility (29% in a government hospital and 37% in a private facility), and 32% delivered at home. Reasons for the disproportionate number of postpartum hemorrhage deaths in private facilities may include poor management of the third stage of labor, lack of blood supplies, and reluctance to lose face by transferring a patient.

The most important avoidable factors in deaths associated with antepartum hemorrhage were delay in recognizing the problem or seeking medical care (27%), sub-standard care by obstetricians once women reached a health facility (61%), and lack of blood (23%). Sub-standard care by obstetricians and lack of blood were avoidable factors in 43% and 16% of all maternal deaths, which suggests that these factors were more likely to contribute to deaths from antepartum hemorrhage.

Among women who had antepartum hemorrhage, 35% had no antenatal care during pregnancy, and lack of antenatal care contributed to 20% of these maternal deaths. The comparable figures for all causes of maternal death are 32% and 19%, indicating that lack of antenatal care played a similar role in deaths from antepartum hemorrhage as in deaths from other causes. All 50 women with antepartum hemorrhage sought medical help at some point around the time of death and, of the women who delivered, 94% delivered in a hospital.

Hypertensive Diseases of Pregnancy

Hypertensive diseases of pregnancy are also a major cause of maternal death in Egypt, associated with 27% of direct obstetric deaths and 22% of all maternal deaths (Table 8). Hypertensive disease was the specific cause in 126 maternal deaths. Of these 126 cases, there were 50 with convulsions and 84 without convulsions, and these were associated with 11% and 18% of all direct obstetric deaths and 9% and 14% of all maternal deaths, respectively. The maternal mortality ratio for all deaths with hypertensive diseases of pregnancy was 18/100,000 (the ratio for deaths with convulsions was 8/100,000 and the ratio for those without convulsions was 12/100,000).

The most important avoidable factors in deaths associated with hypertensive diseases of pregnancy were sub-standard care by obstetricians (47%), delay in recognizing the problem or seeking medical care (40%), poor quality antenatal care (34%), and lack of antenatal care (24%). The comparable figures for all causes of maternal death were 43%, 30%, 19% and 19% respectively, indicating that all of these factors were more likely to play a role in deaths from hypertensive diseases of pregnancy.

Among women who had hypertensive diseases of pregnancy, 31% had no antenatal care during pregnancy, and lack of antenatal care and poor quality antenatal care were avoidable factors in 24% and 34% of deaths associated with hypertensive diseases. The comparable figures for all causes of death are 19% and 19%, indicating that lack of antenatal care and poor quality antenatal care played a more important role in deaths caused by hypertensive diseases of pregnancy. This is because effective antenatal care should be able to detect and treat pre-eclampsia. Almost a third (30%) of women died before delivering. Of the remainder, 58% delivered in a government hospital, 30% in a private facility, and 12% at home. Only 3% were not seen by a physician at some point around the time of death.

Sepsis

Sepsis was associated with 45 maternal deaths, contributing to 10% of direct obstetric deaths and 8% of all maternal deaths (Table 8). The maternal mortality ratio for sepsis deaths was 7/100,000. The following two case studies illustrate some of the important avoidable factors in sepsis deaths.

> *The woman had three previous births. During the pregnancy that led to her death, she made three antenatal care visits to an obstetrician at a government health facility, where she was immunized with tetanus toxoid. The woman had no health problems during pregnancy and at nine months delivered a live birth at home with the assistance of her mother-in-law. Fifteen days postpartum, she was pale, had fever and an offensive vaginal discharge. She also had abdominal pains radiating to her left thigh. At a private*

clinic she was diagnosed as having puerperal sepsis. Her family refused to transfer her, so she was given treatment and advised to return the next day for follow-up. She died 17 days postpartum on the second day of treatment.

The woman had two previous births. During the pregnancy that led to her death, she made five antenatal care visits to the MCH unit. She had anemia and was treated with iron and a blood transfusion. At nine months, she delivered a live birth at a private obstetric clinic. She had postpartum hemorrhage but this was controlled by medical treatment at the clinic. Fifteen days postpartum, she developed fever and lost her appetite. She was diagnosed as having puerperal sepsis, and was transferred first to a fever hospital and then to a private hospital. She lost consciousness and did not improve. The woman was then transferred to another private hospital in Cairo, where she died four days after admission, 28 days postpartum.

The majority (93%) of women with sepsis were seen by a health provider at some point around the time of death. Sub-standard care by obstetricians was an important avoidable factor, contributing to 38% of sepsis deaths. The comparable figure for all causes of maternal death is 43%, indicating that sub-standard care by obstetricians is slightly less likely to contribute to sepsis deaths. However, 32% of sepsis deaths had also been attended by a daya at some point, compared to 11% of all maternal deaths, which suggests that sub-standard care by dayas is more likely to contribute to sepsis deaths.

Fifteen percent of the women died undelivered, often following an abortion. Of the remainder, 39% delivered at home, 34% in a government hospital, and 27% in a private facility. The 1992-1993 NMMS found that 65% of sepsis deaths occurred in women who delivered at home, suggesting that the risk of death associated with sepsis is increased by home delivery and attendance by a daya. Although the 2000 NMMS found that the risk of sepsis death associated with home delivery was lower than in 1992-1993, sub-standard care by dayas was still a significant avoidable factor,

contributing to 17% of sepsis deaths compared to 8% of all maternal deaths. Qualitative and quantitative studies of daya practices and maternal mortality in Egypt have shown that some dayas carry out excessive numbers of vaginal examinations and may attempt to dilate the vagina with their fingers (El Kady et al, 1989a).

Of the women with sepsis, 43% had no antenatal care, and lack of antenatal care and poor quality antenatal care were considered to be avoidable factors in 18% and 17% of deaths associated with sepsis. The comparable figures for all causes of maternal death were 32%, 19% and 19% respectively. The contribution of lack of antenatal care and poor quality antenatal care to sepsis deaths may be over-estimated, however, since antenatal care can do little to predict or prevent sepsis, which usually occurs in the postpartum period.

Abortion

Abortion policy in Egypt is usually classified as "rather restrictive", in that abortion is permitted only to preserve the health of the woman (Rahman et al, 1998). However, even when pregnancy is terminated within the prescribed 120-day period and for health reasons, abortion is an extremely delicate and sensitive issue. Because of these restrictions, the availability of safe abortion services in Egypt is limited, particularly for poorer women (Huntington et al, 1998).

Women in the EDHS 2000 report that 10.5% of all their pregnancies end in spontaneous abortion. This is within the 8-12% range for clinically recognized (i.e. after missing one period) pregnancies reported from prospective and cohort studies (Kline et al 1989), but it is considerably lower than the 31% spontaneous abortion rate observed by prospective studies recording clinical markers of pregnancy (Wilcox et al, 1988). Nearly 3% of women in the EDHS 1995 reported ever having an induced abortion (El-Zanaty et al 1996). Similarly, a survey in Menoufia found 2.3% of women reported ever having an induced abortion, of whom less than 10% sought hospital treatment for complications (EFCS, 1995b). However, these are likely to be underestimates; a recent study estimated the

induced abortion rate in Egypt to be 14.8 per 100 pregnancies, and the case fatality rate to be 0.43 deaths per 100 abortion-related admissions (Huntington et al, 1998).

Abortion in the NMMS 2000 was associated with 20 deaths, contributing to 4% of direct obstetric deaths and 4% of all maternal deaths (Table 8). Of these, 11 cases were judged to be spontaneous abortion (55%) and nine to be induced abortion (45%). The maternal mortality ratio was 2/100,000 for spontaneous abortion and 2/100,000 for induced abortion. The study findings suggest that induced abortion is a less significant problem in Egypt than in some other countries where it has been found to contribute to over 50% of all maternal deaths (Royston and Armstrong, 1989).

However, identifying deaths due to abortion, and classifying them correctly as spontaneous or induced, is extremely difficult (Barreto et al, 1992). This is because deaths in early pregnancy may be missed, and because families will be reluctant to report deaths due to induced abortion in settings where abortion is illegal. It is, therefore, likely that the NMMS 2000, like other studies, missed and misclassified abortion deaths, so the NMMS findings were compared with those of other studies in Egypt.

An overview of these studies (El Mouelhy, 1987), including hospital admission case series, found that the proportion of induced or septic abortions ranged from 1.7% to 60%. (The studies include the following proportions: 60% (Alexandria), 50-25% (Kamal, Cairo University, 1969), 37.6% (El Kashlan and Al Galaa, 1974), 25% (Al-Galaa, 1977), 22% (Kamal, UAR, 1975), 13.6% (El-Kholi and Tanta, 1971-81), 9.8% (Foda, UAR, 1977), 5.6% (Toppozada, Alexandria, 1974-77), 3.9% (El Kabariti, Ain Shams, 1984), and 1.7% (El Katsha, Ahmed Maher Hospital, 1983).) More recently, 7% of hospital abortion admissions in 86 public-sector hospitals in Egypt were found to be certainly or probably induced compared to 58% possibly induced and 35% spontaneous (Huntington et al, 1998). Since abortion deaths are likely to result disproportionately from induced abortion deaths, the NMMS 2000 finding that 45% of abortion deaths were associated with induced abortion is not implausible. However, Huntington and colleagues' (1998) finding of 18 abortion-related deaths among a 15%

sample of public sector hospitals over a 30-day period confirms that abortion deaths were probably missed by the NMMS 2000.

Studies of postpartum care indicate that there is considerable scope to improve management of early pregnancy complications (EFCS, 1995a; Huntington and Piet-Pelon, 1999; Huntington et al, 1995), as the following case study of an induced abortion death illustrates.

> *An unmarried woman aged 20 years induced an abortion at two months gestation in her home. The method she used was not mentioned. She developed septic shock and was taken to a district hospital. She was given blood but died the next day.*

Ruptured Uterus

Ruptured uterus was associated with 45 deaths, contributing to 10% of direct obstetric deaths and 8% of all maternal deaths. The maternal mortality ratio was 7/100,000. Ruptured uterus deaths were associated with other causes of death, most often postpartum hemorrhage and obstructed labor.

Among women with ruptured uterus, 27% had received no antenatal care. Lack of antenatal care and poor quality antenatal care were considered to have been avoidable factors in 14% and 17% of these deaths, compared to 19% and 19% of maternal deaths from all causes. Only 4% of the women were not seen by a physician at some point around the time of death. The 45 women were equally likely to have delivered in a public or a private health facility, but a high proportion of deaths (69%) occurred in hospitals.

The most important avoidable factor was sub-standard care by obstetricians, contributing to 64% of ruptured uterus deaths. The comparable figure for all causes of maternal death is 43%, indicating that sub-standard care by obstetricians plays a significant role in deaths associated with ruptured uterus. It might be expected that this finding would be associated with delay in care seeking by women and families. However, delay in seeking care played a less important role in contributing to ruptured uterus deaths (23%) than to deaths from all causes (30%). Sub-standard care by general

practitioners was also an important avoidable factor, contributing to 21% of ruptured uterus deaths compared to 11% of all maternal deaths. Lack of blood also played an important role, contributing to 25% of ruptured uterus deaths compared to 16% of deaths from all causes. Qualitative research to assess delivery practices, including the use of oxytocin, is underway (Khalil, 2001) and this is likely to inform efforts to improve delivery care.

The following case study illustrates the avoidable factors, including inappropriate use of syntocinon, in the death of a woman with a ruptured uterus.

> *The woman was 32 years old when she died. She had given birth to three children, all of whom were alive at the time of the household interview, and her previous pregnancies and deliveries had been normal. The woman had been using an IUD for eight years, but removed it at her husband's request. During the pregnancy that led to her death, she had one antenatal care visit with an obstetrician in a private clinic. She had recurrent vomiting before her labor pains started. During labor she was seen at home by a midwife who gave her an injection of syntocinon. Eight hours later she was taken to the district hospital where a ruptured uterus was diagnosed. The hospital had no blood and within 15 minutes she was transferred to the governorate hospital for a hysterectomy. She died on the way.*

Cesarean Section

Cesarean section (CS) was associated with 38 maternal deaths, contributing to 8% of direct causes and 7% of all maternal deaths (Table 8). The maternal mortality ratio from CS was 6/100,000. CS was associated with other causes of death, most often postpartum hemorrhage, antepartum hemorrhage, anesthesia, and hypertensive diseases.

Most of the women who died after a CS (70%) had received antenatal care. Lack of antenatal care and poor quality antenatal care were considered to be

avoidable factors in 23% and 13% of CS deaths. The comparable figures for all causes of death are 19% and 19% respectively, indicating that lack of, but not poor quality, antenatal care plays a more important role in CS deaths. All 38 women who had a CS were attended by an obstetrician and delivered in a health facility: 53% in a government hospital and 48% in a private facility. However, among all maternal deaths, 45% of the women who delivered did so in a private facility. Reasons for the slight excess of CS deaths in private facilities may include lack of blood, supplies and equipment, poor anesthesia back-up, and reluctance to transfer patients.

The most significant avoidable factors were sub-standard care by obstetricians and general practitioners, contributing to 68% and 18% of CS deaths. The figures for all maternal deaths were 43% and 11% respectively, indicating that sub-standard care by obstetricians and general practitioners play a more important role in CS deaths. Lack of blood was also an important avoidable factor, contributing to 39% of CS deaths, compared to 16% of maternal deaths from all causes.

Cardiac Diseases

Cardiovascular diseases of pregnancy were the most frequent indirect cause of maternal death. The NMMS identified 76 cases with cardiac disease, representing 35% of all indirect obstetric causes and contributing to 13% of all maternal deaths (Table 8). Rheumatic heart disease with valvular lesion of the heart was the most common type of cardiac disease. The maternal mortality ratio for cardiac disease deaths was 11/100,000.

Among women with cardiac diseases, the most important avoidable factor was delay in recognizing the problem or seeking care by the woman or her family, which contributed to 29% of deaths. Of the 76 women, 28% had no antenatal care. Lack of antenatal care and poor quality antenatal care were considered to be an avoidable factor in 19% and 28% of cardiac disease deaths, compared to 19% and 19% of maternal deaths from all causes. This is because effective antenatal care should be able to detect rheumatic heart disease.

Only 14% of the 76 women were not seen by a physician at some point around the time of death. Over half (52%) of women died before delivering, 29% delivered in a government hospital, 9% delivered in a private clinic, and 10% delivered at home. Deaths from cardiac disease were more likely to occur at home than deaths from other causes, suggesting sudden onset of death.

Table 12. Summary characteristics of cause specific deaths

	Total		Antepartum Hemorrhage		Postpartum Hemorrhage		Sepsis		Hypertensive Disease		Spontaneous Abortion		Induced Abortion		Ruptured Uterus		Cesarean Section		Cardiac Disease	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Total	580		50		197		45		126		11		9		45		38		76	
ANC																				
0	185	32	17	35	58	29	19	43	39	31	8	70	7	75	12	27	11	30	21	28
1-3	76	13	6	12	20	10	9	20	13	10	1	13	0	5	5	12	1	3	10	14
4+	304	52	25	50	112	57	15	33	69	55	2	17	2	20	27	60	26	68	43	58
Unknown	15	3	1	3	7	3	2	4	4	3	0	0	0	0	0	1	0	0	1	1
Place of delivery																				
Home	114	20	2	5	64	32	15	33	10	8	0	0	0	0	12	27	0	0	8	10
Private	146	25	15	29	73	37	10	23	26	21	0	0	0	0	15	33	18	48	7	9
Public	176	30	24	47	56	29	13	29	51	40	0	0	0	5	15	33	20	53	22	29
Taxi	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	1
Undelivered	143	25	9	19	4	2	7	15	38	30	11	100	9	95	2	5	0	0	39	52
Place of death																				
Home	169	29	13	26	46	23	18	41	32	25	5	43	3	35	9	20	7	19	35	46
Hospital	360	62	34	67	127	65	21	46	87	69	6	52	6	60	31	69	30	80	36	48
On road	51	9	3	7	24	12	6	14	8	6	0	4	0	5	5	11	0	1	4	6
Contact with medical care	541	93	50	100	187	95	42	93	123	97	11	100	9	100	43	96	38	100	65	86

Note: Percents do not add up to 100 as there can be more than one cause.

Table 13. Summary avoidable factors for the cause specific deaths

	Total		Antepartum Hemorrhage		Postpartum Hemorrhage		Sepsis		Hypertensive Disease		Spontaneous Abortion		Induced Abortion		Ruptured Uterus		Cesarean Section		Cardiac Disease	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Total	580		50		197		45		126		11		9		45		38		76	
No antenatal care	110	19	10	20	43	22	8	18	31	24	2	17	1	10	6	14	9	23	14	19
Delay recognizing problem/seeking care	172	30	14	27	57	29	17	38	51	40	5	43	1	15	10	23	11	30	22	29
Unwanted pregnancy	14	2	1	3	3	2	1	3	5	4	0	0	0	5	2	4	0	1	2	3
Poor quality ANC	111	19	11	23	21	11	8	17	43	34	1	13	0	0	8	17	5	13	21	28
Substandard care from:																				
General Practitioner	66	11	3	7	28	14	5	10	10	8	0	0	0	0	9	21	7	18	7	9
Midwife	26	4	0	1	18	9	0	1	6	5	0	0	0	0	5	11	0	1	1	2
Obstetrician	247	43	31	61	98	50	17	38	60	47	6	57	6	60	29	64	26	68	24	31
Daya	47	8	1	3	27	14	8	17	8	6	0	0	0	0	6	14	1	4	4	6
Lack drugs, supplies and equipment	33	6	2	5	14	7	1	3	5	4	1	13	1	15	0	1	3	8	7	9
Lack of anesthetist/ anesthetic facilities	24	4	0	0	9	5	1	3	1	1	1	13	0	0	0	1	2	5	2	3
Lack of blood	92	16	11	23	61	31	3	7	15	12	2	17	1	10	11	25	15	39	5	6
Lack of transportation	30	5	3	7	20	10	0	1	9	7	0	0	0	0	2	4	0	1	0	1
Long distance to hospital	23	4	3	6	9	5	2	4	8	6	1	13	0	0	1	2	1	3	2	3
No avoidable causes	113	19	7	14	17	9	9	19	18	14	1	9	2	20	3	6	5	13	23	30

Note: Percents do not add up to 100 as there can be more than one cause.

Conclusions

Maternal mortality in Egypt has declined from 174/100,000 to 84/100,000 between 1992-1993 and 2000. This dramatic reduction in maternal deaths is a major achievement, and a vindication of Egypt's sustained efforts to improve the quality of obstetric care and to reduce the fertility rate and unwanted births. (A summary of the results of the 1992-93 NMMS and the 2000 NMMS and recommendations is included in Appendix 4, and a comparison of the national and regional maternal mortality ratios in 1992-93 and 2000 is included in Appendix 5).

The 1992-93 NMMS played an important role in drawing attention to the magnitude of maternal death in Egypt, and many of the recommendations made in the 1992-93 report were adopted (see Appendix 2). Conducting a second national study of maternal mortality in Egypt is also a major achievement. However, in future, Egypt needs to continue implementing its national surveillance system for monitoring maternal deaths. Plans for expanding such a system have been approved by the Minister of Health and Population.

Further reduction in maternal mortality is likely to be contingent on continuing efforts to strengthen health systems (Koblinsky et al, 1999, Goodburn and Campbell, 2001) and, in the longer term, on improvements in the socio-economic and educational status of women, which increase both their knowledge and capacity to maintain their health.

Characteristics of Maternal Death

Women who died were more likely to have delivered in a health facility (73%) than women in Egypt in general (48%). This is not surprising since the study found that 93% of women seek medical care when they experience problems. Almost half of maternal deaths (49%) occurred during delivery (compared to 39% in 1992-93) and 27% occurred postpartum (compared to 35% in 1992-93). The proportion of deaths that occurred during transportation increased between 1992-93 and 2000, but the Maternal

Mortlaity Ratio (MMR) declined, suggesting possible problems with referrals or premature discharge. In 50% of cases of maternal death, the fetus or infant also died. However, the percentage of infants dying at or soon after birth has declined from 43% in 1992-93 to 34%, suggesting that postpartum care of newborns has improved.

There has been little change since 1992-93 in the main medical causes and avoidable factors contributing to maternal death. Direct obstetric causes were responsible for 77% of maternal deaths and indirect obstetric causes for 20% of maternal deaths, based on the single main cause of death determined by Local Advisory Groups. For 3% it was not possible to determine a cause of death. Many maternal deaths are the result of multiple medical causes and, when this is allowed for, direct obstetric causes contributed to 80% and indirect obstetric causes to 37% of maternal deaths, respectively. Hemorrhage (especially postpartum hemorrhage), hypertensive diseases of pregnancy, sepsis, ruptured uterus, Cesarean section and abortion were the most important direct causes, and cardiac disease was the most important indirect cause, of maternal death. Anemia was also an important indirect contributor to death but was rarely the single main cause.

One or more avoidable factors contributed to 81% of maternal deaths, compared to 92% in 1992-93, indicating that the contribution of avoidable factors has declined. Avoidable factors were categorized as medical team factors, health facility factors, and woman and family factors. The most frequent factors were poor management by obstetricians and delays in seeking care by women and families, but the study noted that many maternal deaths were the result of multiple avoidable factors rather than one single factor.

Sub-Standard Care by Health Providers

Although the percentage of births attended by a skilled attendant has increased dramatically since 1992-93, sub-standard care by health providers remains the most significant avoidable factor, contributing to 54% of maternal deaths.

Sub-standard care by obstetricians contributed to 43% of maternal deaths from all causes, but was more likely to contribute to deaths associated with hemorrhage, hypertensive diseases, ruptured uterus, Cesarean section and abortion. Many maternal deaths are managed by junior obstetricians and trainee doctors with limited experience, where senior obstetricians are not available to assist with complicated procedures. Sub-standard care by general practitioners contributes to 11% of maternal deaths, even though they only carry out 1% of deliveries, suggesting that they are either engaged in harmful practices or failing to stabilize or refer effectively emergency cases. The proportion of deaths where providers administer harmful treatments, in particular inappropriate use of oxytocic drugs, has increased since 1992-93, and the 2000 NMMS identified more deaths associated with ruptured uterus. In addition, national rates of Cesarean section are rising (from 4.1% in 1989 to 10.3% in 1998 (CAPMAS,1993; EDHS, 2000), with the potential for a commensurate increase in iatrogenic deaths.

Midwives and dayas, responsible for 7% and 36% of deliveries respectively, were the exception, contributing to 4% and 8% of maternal deaths. The contribution of sub-standard care by dayas to maternal deaths decreased from 12% in 1992-93 (MOH, 1994a), and this is likely to be due in part to the decline in the proportion of deliveries carried out by dayas from 70% in 1992-93, and in part to the success of programs to train dayas to refer promptly women with complications. However, sub-standard care by dayas appeared to play a disproportionate role in sepsis deaths, contributing to 17% of these deaths compared to 8% of all maternal deaths.

Sub-standard care in the private sector is of particular concern. Women with obstetric morbidities usually seek care with the private sector (EFCS, 1995b; EFCS, 1996). The EDHS 2000 shows that deliveries in the private sector (26%) have overtaken deliveries in the public sector (22%), yet many women mismanaged by the private sector die in public facilities or at home. The 2000 NMMS found that private practitioners who were unable to manage the obstetric emergency and who delayed transfer to higher-level facilities contributed to 13% of maternal deaths, and also identified an excess of cesarean section deaths in private facilities.

Health Facilities

The NMMS focused on individual deaths, so it was less able to identify institutional factors contributing to maternal death. Yet these factors are often the major reason behind deaths. Before blaming individual health providers for poor diagnosis and management, it is important to recognize that the most effective way to change individual practices is to change the system within which doctors and midwives work.

In our study, 93% of women attended a health facility at some point in the events leading to their death, so it is appropriate to start improvements at the level of health services. Priority should continue to be given to tackling problems at hospital facilities (Maine, 1991), since many of the causes of maternal death cannot be addressed at community level and require obstetric care that can only be provided at district or tertiary level hospitals. In addition, health facilities and providers must be able to cope with the existing situation before efforts are made to increase demand for services.

Lack of blood was the most significant health facility factor identified by the NMMS, contributing to 16% of all maternal deaths but, more significantly, contributing to 31% of hemorrhage deaths, 25% of ruptured uterus deaths, and 39% of cesarean section deaths. The Ministry of Health and Population is currently working to address the issue of blood supply with a special focus on the availability of blood for emergency obstetric and neonatal cases (HMHC, 2001). Lack of drugs, supplies and equipment were not major factors, contributing to 6% of maternal deaths. Nonetheless, the Ministry of Health and Population has been upgrading delivery facilities, and has defined Basic Essential Obstetric Care service standards.

Delay in Seeking Care

Failure to recognize danger signs and, consequently, delay in seeking care, was the second most important avoidable factor, contributing to 30% of all maternal deaths but, more significantly contributing to 40% of deaths associated with hypertensive diseases.

Distance and lack of transport were rarely reasons for delay in care seeking or non-compliance with referral, since even in rural Egypt, 99% of women live within 30 kilometers of a government hospital, and 48% live in villages with a private physician who conducts deliveries (Sayed, 1991). Other possible reasons for delay in seeking care, in addition to failure to recognize danger signs and complications in pregnancy, may include lack of confidence in the quality of health facilities, and inability to afford the costs of medical care.

Antenatal Care

Although the effectiveness of antenatal care in preventing maternal death from some causes has been questioned (Maine, 1991; Rooney, 1992; Carroli et al, 2001), effective antenatal care can detect and treat anemia, hypertensive disease, and existing conditions and diseases that cause complications in pregnancy. The NMMS found that poor quality antenatal care contributed to 19% of maternal deaths from all causes, but played a more important role in deaths associated with hypertensive diseases (34%). In addition, failure to use antenatal care was estimated to contribute to 19% of maternal deaths.

Family Planning

In Egypt as a whole, great progress has been made in family planning programs, and this has undoubtedly made a significant contribution to the reduction in maternal mortality. However, the NMMS identified significant differences with respect to contraception and unwanted pregnancy, between women who had died and women in Egypt in general. Household interviews with the families of deceased women revealed that 36% had ever used modern contraception and 6% had experienced contraceptive failure leading to the pregnancy that caused their death. In contrast the EDHS 2000 (EDHS, 2000) showed 54% use of modern contraception and 1% contraceptive failure among ever-married women in the general population. Among women who died, 22% of pregnancies were unwanted, compared to 13% in the general population.

Recommendations

1. Future efforts should continue to focus on improving linkages between antenatal, delivery and immediate postpartum care; strengthening referral systems; ensuring better oversight and regulation of the private sector; tackling deficiencies in hospital management and systems; improving pre-service and in-service training; and increasing accountability.
2. The maternal mortality surveillance system should be reviewed to ensure it is as simple as possible, in order to provide governorate level estimates and time trends. Specific mechanisms should be developed to investigate medical causes and sub-standard care on a sample and periodic basis, and these should be piloted before being adopted more widely.
3. Further reduction of maternal mortality will be contingent on tackling poor diagnosis and management by health providers. This represents a significant challenge to expand efforts to introduce standard protocols, strengthen training and supervision, and promote appropriate practices in the private sector.
4. Protocols developed for the management of common obstetric complications and emergencies, core care protocols for normal pregnancy and delivery, and for antenatal and postnatal care (MOHP, 2000; MotherCare, 1998, HM/HC RP, 2000) should be implemented more widely and their use supervised. Strategies are also required to ensure that private providers adopt these protocols. The development of new protocols and manuals on emergency services (including treatment for shock), post abortion care, interpersonal communications and counseling, anesthesia, operating room and blood transfusions/banking should be continued and completed.
5. Senior obstetricians should be more involved in obstetric care, particularly in taking early decisions for operative procedures. MOHP administrative policies on availability of senior staff (MOHP, 2001)

should be reviewed to improve compliance. There is also a need for better medical supervision and a more effective and structured approach to residency training.

6. Obstetricians should continue to receive more practical supervised in-service training. This training should be based on the competency-based training modules, clinical protocols and standards, and training programs for master and physician trainers (MOHP, 2000; HM/HC RP, 2000).
7. The Ministry of Health and Population and the Medical Schools should conduct a comprehensive review of postgraduate training programs. The Egyptian board degree for obstetrics and gynecology is a step in the right direction. The Egyptian Medical Syndicate and Ministry of Higher Education should link continuing medical education with the competency-based training program for re-licensing.
8. Efforts to revise the obstetric and nurse training curricula in medical and nursing schools should be continued in collaboration with the MOHP, Medical Schools, Ministry of Higher Education, and Medical Syndicate.
9. Strategies for working with private providers, clinics and hospitals, and efforts to collaborate with the Egyptian Medical Syndicate need to be strengthened. Efforts to accredit clinics and hospitals against service standards may be a useful way forward.
10. Further research is required to establish the reasons for the disproportionate contribution of general practitioners to maternal deaths, in order to develop appropriate policy and training.
11. Families, women and dayas need to be able to recognize danger signs to ensure that care is sought promptly and from an appropriate facility. Further research is required to improve understanding of the factors that determine care-seeking and to develop community-based interventions. The national information, education, communication (IEC) program on ‘birth preparedness’, where women and families are asked to prepare for what they would do in emergencies, should be followed with supportive activities throughout Egypt.

12. Greater efforts should be made to increase awareness of danger signs in pregnancy, delivery and postpartum. The EDHS 2000 shows that only 18% of women attending antenatal care were told about danger signs in pregnancy and only 14% were told where to go if they had a complication. Communication about these issues should be an integral part of antenatal care. Such information should be given at all possible opportunities, including through dayas and through the mass media. Consideration should be given to continuing Egypt's successful television campaigns on a six-monthly basis. Communication strategies should focus on behavior change and should provide clear and specific action-orientated information.

13. Messages should be linked to health facility protocols, so that women who seek care are not turned away. Efforts to educate women and their families should be complemented by efforts to increase the awareness of health providers of the social conditions of women's lives, to tackle negative or patronizing attitudes, and to educate private providers about the importance of prompt referral of medical emergencies. Doctors should be encouraged to do operational research on factors involving delay in provision of care as part of their research training.

14. The Ministry of Health and Population should develop an inventory of hospitals able to provide all the emergency obstetric functions recommended by the World Health Organization (WHO, 1991), and ensure that budgets are sufficient to maintain equipment and drugs.

15. Particular efforts should be made to establish and maintain adequate blood supplies and blood products. The system must include district hospitals.

16. Maternal death audits should be instituted in all teaching hospitals and a proportion of governorate hospitals. Results from pilot hospitals should be reviewed, with a view to adoption in additional hospitals. As maternal deaths may be comparatively rare in any given facility, severe maternal morbidity (near-misses) could be investigated (Stones et al, 1991, Filippi et al, 2000).

17. Tools developed to identify hospital administrative and management problems in obstetric care should be used more widely (MOHP, 2000; HM/HC RP, 2000). These include hospital audits and time motion studies.

18. The Ministry of Health and Population should conduct policy analyses to plan the future of delivery care, in particular which health providers should attend normal deliveries and where these deliveries should take place. Policy analyses should address the following questions. Should the trend towards obstetrician deliveries be encouraged? Why is the contribution of midwives and dayas to maternal death disproportionately less than that of other health providers? What should be the future role of midwives? Should the pilot training program for licensed midwives be extended? Where would women prefer to deliver? Should women deliver in public or private facilities? Which public sector facilities should provide delivery services? What are the costs associated with delivery care in facilities at different levels? How can good evidence-based care (e.g. that avoids the over use of augmentation, supine position and lack of companionship) (Enkin et al 1996)) be promoted?

19. More analysis is required to identify which women are and are not using antenatal care and the factors that influence uptake of services. This would help to inform efforts to increase the attractiveness of antenatal care, for example by extending service hours. Women should be told what to expect from antenatal care, perhaps using the rights approach adopted by family planning services. Aspects of antenatal care that are most likely to prevent maternal death should be strengthened, as should the antenatal record system. WHO has recently concluded a multi-country trial of a reduced regimen of antenatal care that carefully reviewed effective and desirable antenatal care elements. Women-held antenatal record cards are being used and have been successful in some settings. These should be evaluated in Egypt and expanded if they are shown to be successful. Health providers also need training in interpersonal communication skills, to enable them to better advise and counsel women.

20. Finally, greater efforts must also be made to reach women who do not want any more children, but who are not contracepting, with family planning services. This must be complemented by efforts to educate husbands and mothers-in-law, who often play an important role in decisions about family planning.

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Appendix 1: Terms and Definitions

Terms and Definitions

1.0 Female death

In this study, female deaths are deaths of women of reproductive age. Women of reproductive age are defined as those aged 15 to 49 years.

2.0 Maternal death

2.1 Maternal mortality is 'the 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' (ICD-10, WHO, 1994b). Maternal deaths are sub-divided into:

2.2 Direct obstetric causes – 'those resulting from obstetric complications of the pregnant state (pregnancy, labor, and puerperium) from interventions, omissions, incorrect treatment or from a chain of events resulting from any of the above'.

2.3 Indirect obstetric causes – 'those resulting from previous existing disease or diseases that developed during pregnancy and which were not due to direct obstetric causes, but which were aggravated by physiological effects of pregnancy'.

2.4 Incidental deaths are deaths among women who die in pregnancy, delivery, or the postpartum period, which are not due to direct or indirect obstetric causes. In this study, some deaths are attributed to an unknown cause, as it was not possible to arrive at a definitive cause of death with the available data.

2.5 Maternal mortality ratio - maternal mortality is usually reported as the ratio of the number of maternal deaths per 100,000 live births. The maternal mortality ratio is calculated as follows (Campbell and Graham, 1990):

$$\frac{\textit{Number of maternal deaths in 12 months}}{\textit{Number of live births in the same 12 months}} x100{,}000$$

2.6 Maternal mortality rate - the maternal mortality rate is the number of maternal deaths per 100,000 women of reproductive age. It is calculated as follows (Campbell and Graham, 1990):

$$\frac{\textit{Number of maternal deaths in 12 months}}{\textit{Average number of women of reproductive age in the same 12 months}} x100{,}000$$

3.0 Pregnancy-related death

Pregnancy-related death is 'the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the cause of death (ICD-10, WHO, 1994b).

4.0 Stillbirth

Stillbirths are defined as fetal deaths after 22, 24, or 28 weeks of gestation. The most commonly used definition is 28 weeks, but the ICD-10 uses 22 weeks. In this study, stillbirths are defined as births after six months gestation, which corresponds most closely to the 28-week definition.

5.0 Neonatal death

Neonatal deaths are defined as live births that die in the first 28 days of life. Neonatal deaths are sub-divided into:

5.1 Early neonatal deaths – live births that die in the first week of life (death after 0-6 completed days).

5.2 Late neonatal deaths – live births that die in the neonatal period but after the first week of life (death after 7-27 completed days).

5.3 Perinatal death

Perinatal deaths are stillbirths and early neonatal deaths.

6. 0 Obstetrician

In Egypt, an obstetrician can hold one of several degrees (Issa and Samy, 2001; Fahmy 1988):

6.1 Diploma – which consists primarily of a one-year theoretical course and exam.

6.2 Master of science (MS) – which consists of a minimum of two years, the first part on basic sciences, and theses or essays on Obs/Gyn-related problems, followed by an exam.

6.3 Medical Doctorate (MD) – which consists of a minimum of two more years of academic research after the MS, followed by an exam.

6.4 Member of Royal College of Obstetrics and Gynecology (MRCOG) – which consists of three years of practical training in the United Kingdom and an exam.

6.5 Egyptian Board degree for Obs/Gyn – which is a two to four-year, practical, on-the-job degree for MOHP employees. This is a new program with no graduates yet.

7.0 Avoidable factors

The terms avoidable factors and sub-standard care are used to describe failures in clinical care and, also, some of the underlying factors that may have produced a low standard of care for the woman (Turnbull et al, 1989). The term sub-standard care is generally preferred over the term avoidable factors, since not all sub-standard care is avoidable within health system constraints. However, it seems inappropriate to use the term substandard care to refer to woman or family factors so the term avoidable factors is used to encompass health facility, medical team and woman or family factors, while sub-standard care includes health facility and medical team factors, classified as shown in Figure 12. This study takes account of the possibility that more than one avoidable factor or aspect of sub-standard care can contribute to death.

8.0 Parity

Parity was recorded in this study as the number of previous pregnancies (prior to the pregnancy which led to the woman's death) of 28 weeks gestation or more, regardless of the outcome of pregnancy. In the study, parity does not include the pregnancy that led to the woman's death, irrespective of gestation. For example, a woman with one previous live birth would have been considered parity 1, even if she died in pregnancy at 20 weeks or died postpartum having delivered a second live birth.

Appendix 2: Maternal Care Program Development and Implementation Process

MOHP

Maternal Care Program Development and Implementation Process

	Problems	Pathway to Survival Steps	Objectives	Activities and Interventions
Household and Community	**Problems: Maternal** • 1992 NMMR was 174/100,000 • 92% deaths avoidable • 42% deaths due to delay • 71% sought care • Major causes of death: Hemorrhage, Pre/Eclampsia, Sepsis • Antepartum & postpartum hemorrhage 31.9% • Pre&/eclampsia 15.9% • Genital sepsis 8.4% • Ruptured uterus 6.7% • Cesarean Section 6.1% • Abortion 4.5% • Obstructed labor 3.1% • Anesthesia 2.6% • Existing diseases 26.9% (cardiovascular, infections diabetes, etc.)	**Step 1. Recognition of Problem** • Knowledge • Awareness • Effect/vulnerability	Increase knowledge and improve health behavior of households	• Support better antenatal care especially for high risk pregnancies • Support early postpartum home visits • Community education on danger signs • Daya training on danger signs • NGO activities • Research on health knowledge • Research on nutrition knowledge
		Step 2. Decision to Seek Care • Behavior • Motivation to seek care • Barriers	Increase women's use of antenatal, intrapartum, and postpartum service through a community based strategy.	• Daya and health provider links improved • Research on care seeking and barriers • Community groups and NGO activities to reduce local barriers • Sensitize health providers to community needs
	• 4% due to lack of transportation	**Step 3. Access to Care** (Logistics to reach) • Transportation • Cost	Increase accessibility of transportation (ambulance), and referral system.	• Community resources mobilized for transport and other support
				• Improve quality and access to nutrition education, iron supplements and TT immunization in schools

MOHP

Maternal Care Program Development and Implementation Process

	Problems	Pathway to Survival Steps	Objectives	Activities and Interventions
Providers	**Problems: Providers and Facilities** • 47% of maternal deaths due to substandard obstetric care • 12% due to GPs and 12% to dayas	**Step 4. Quality Care** • Knowledge, skills, attitudes, behaviors • Technical competency: training & experience, effectiveness, safety • Ability to provide supplies, equipment, drugs • Continuity of care	Improve quality of essential maternal, perinatal and child health services Strengthen district capability to provide essential MPC health services Sustain established child survival programs	• Upgrade selected anchor facilities • Establish national service standards for obstetric and neonatal care • Improve planning and management systems to ensure staff and resources available and in compliance to standards • Provide competency-based training for clinical trainers, doctors, nurses, midwives • Revise medical and nursing school curricula and improve training skills on include CBT methods and service standards • Develop and test maternal and neonatal referral system • Assist MOHP to improve ANC, PP, ARI, CDD, EPI services in target governorate • Train private providers in essential obstetric and neonatal care topics • Conduct research on mortality patterns and OR to improve services effectiveness • Improve nutrition education curricula and health educator skills
Facilities	• 6% to lack of blood, 2% drugs/supplies • Limited services available in MOHP facilities • No referral system • Lack of management systems to maintain quality of service • Low demand for services			

Appendix 3: NMMS 1992-93 Recommendations and Subsequent MOHP Interventions

Table 14. NMMS 1992-93 Recommendations and Subsequent MOHP Interventions

NMMS 1992-93 Recommendation	MOHP Intervention
1. We recommend repeating the study on a regular basis (every three years) to monitor progress in improving maternal health and to increase awareness of the problem. This should be considered part of the continuous medical education process.	• It was determined that three years was too short a period to detect significant changes in mortality. The studies are also a very expensive activity. The study was therefore repeated as advised in the year 2000. The maternal mortality problem in Egypt was publicly designated as a top priority for the MOHP.
2. Avoidable factors such as delays in seeking medical care…need to be tackled.	• Community research has been carried out to understand these problems, and MCH program activities designed to address them. Birth preparedness and recognition of danger signs were the focus of the first national mass media campaign under the HM/HC Project. Health educators and NGO outreach workers were trained to conduct home visits and give talks in local communities on danger signs and actions to take.
3. Substandard care should be addressed through the following means: • Protocols for the management of common obstetric emergencies should be developed and used.	• Clinical protocols and service standards were developed and introduced in target districts to improve care (HM/HCRP, 2001a). The Essential Obstetric Care (EOC) protocols address: maternal mortality; ethics and obstetric practices; infection control; interpersonal communications and counseling; antenatal care; bleeding in pregnancy; pre-eclampsia/ eclampsia; pre-existing problems in pregnancy; premature labor; postpartum hemorrhage; puerperal sepsis; and, septic shock. These official MOHP clinical guidelines and standards were published and distributed by the Directorate of Maternal and Child Health Care.

NMMS 1992-93 Recommendation	MOHP Intervention
• In-service training for obstetricians and general practitioners should be provided.	• Competency-based programs have been developed to upgrade skills of health providers. The program has been implemented in five Upper Egypt governorates under the HM/HC Project. Post-classroom on-the-job training and clinical supervision is provided in the practitioners' own public facilities. Certification logs are used to monitor the "development of basic competency" and "mastery" of basic EOC skills.
• Senior obstetricians should be more involved in obstetric care, particularly in making early decisions for operative procedures	• The Minister of Health and Population issued a decree in 1998 where specialists have to be present in the hospitals in evenings and nights. Also, all surgical interventions have to be planned and carried out in the presence of senior obstetrician. This is also in accordance with the official protocols for managing EOC.
• Confidential inquiries should be instituted in all teaching hospitals and in at least some government hospitals. Hospital audits and time motion studies can be used to identify administrative and management problems.	• Confidential inquiries have been established in many general and district hospitals of the MOHP. Facility management tools have been developed and tested to monitor service standard compliance and identify problems.
• The Ministry of Health, with the Medical Schools, should review and re-evaluate the postgraduate training programs, particularly the Obstetric Diploma, which lacks practical training. Teaching Hospitals of the Ministry of Health should play a role in such training and qualification.	• MOHP introduced a new curriculum to develop physician skills in different fields. After four years of practice, the physician will be entitled to get the Egyptian Board Certificate. The obstetrician and neonatology board members agreed to use the clinical protocols and training modules. Under the HM/HC Project, the Obs/Gyn curricula in 13 medical and 13 nursing schools (university-level and secondary nursing schools) is being revised and implemented using the competency-based training (CBT) approach and materials.

NMMS 1992-93 Recommendation	MOHP Intervention
• Avenues for working with private doctors, private clinics, and private hospitals, perhaps through the medical syndicate, need to be sought. Private clinics should not conduct operative deliveries per the current legislation and the law shall be enforced.	• The training for some private sector physicians has been initiated and implemented in the five HM/HC target governorates through collaboration with the Medical Syndicate.
• Training curricula for the Traditional Birth Attendants (dayas) should be reviewed. The daya training programs should be continued and strengthened.	• A Daya Refresher Training Manual and curriculum was developed by the MOHP in conjunction with UNICEF. These refresher courses are being implemented nationwide.
• As an alternative to deliveries by traditional birth attendants (dayas), the midwifery pilot licensing program should be evaluated, and if successful, extended to other governorates.	• A decision been reached by the MOHP not to train new dayas. A renewed emphasis has therefore been placed on the training and licensing of midwives nationwide. Several training courses have been conducted.
4. More investigation needs to be done to identify the precise reasons for delay in seeking care.	• Several studies have been conducted including a comprehensive situation analysis and community diagnosis to identify the precise reasons for delay in seeking care (USAID's contractor MotherCare 1996-1998 & HM/HCRP 1998-2001). Based on the results of the studies, many interventions have been developed and implemented especially in Upper Egypt.
• Campaigns should be launched to tackle issues of women's awareness and health professionals' attitudes. Television campaigns should be considered for maternal health. The communication strategies used should focus on behavior change and be precise.	• A national mass media campaign (television, radio, and print) on birth preparedness was implemented. Survey results assessing the impact of the campaign showed that over 50% of women in the HM/HC target governorates knew about danger signs and to act promptly to seek care (El-Zanaty, 2001). Significant improvements in the awareness level of husbands were also noted.

5. Greater effort must be made to reach women with family planning.	• Use of modern contraceptives increased from 45% in 1992 to 54% in 2000 with decrease in total fertility rate from 3.9 in 1992 to 3.5 in 2000 (EDHS, 2000). These changes reflect the effort to decrease the number of pregnancies, including those with high risk factors such as high parity and to avoid unwanted pregnancy, which may end in an illegal induced abortion.
6. It would be ideal if the Ministry of Health could inventory hospitals capable of providing all the emergency obstetric functions recommended by the World Health Organization (WHO, 1991), and ensure that these are maintained with sufficient funding in the routine budget to provide for equipment and drugs. • Further investigation of the issue of blood supply and ways of maintaining it is needed.	• Over the last few years, thousands of hospitals, and health units have been re-built, renovated, and upgraded all over Egypt. These hospitals have been equipped with the necessary commodities and supplies. For the maintenance of the running costs the Minister issued Decree 239 of 1997 giving hospital administrators flexibility to generate and use resources to support the services provided. • In 1997, the Minister of Health and Population established a program for Blood Transfusion Services. In mid-1997 the MOHP signed by an agreement with the Swiss Government to implement a project for restructuring and upgrading this priority and vital health services. The project is underway to establish a National Blood Transfusion Center, 8 regional and 30 District Blood Banks in order to gradually replace the old fragmented system and to develop a successful blood program.
7. Attempts should be made to strengthen those aspects of antenatal care (detection and treatment of anemia, hypertensive disease, infections, and other existing conditions and diseases leading to dangerous pregnancy) which are most likely to have an effect on reducing maternal mortality.	• The MOHP MCH Directorate has trained primary health care providers in antenatal care, upgraded lab capabilities and provided simple diagnostic tests to MCH clinics throughout the country to improve detection of antenatal problems. A pilot program in anemia reduction among pregnant women is being carried out with UNICEF.

8. General improvements in the health and socio-economic status of women, including improving female education and combating illiteracy, are also likely to have a major impact on maternal mortality. The "Facts For Life" program initiated by UNICEF (UNICEF et al., 1993) may be an appropriate model of how to include maternal health education in preparatory school curricula.	• The EDHS 2000 shows there have been general improvements in the health and socio-economic status of women. Female education has increased and illiteracy has decreased. Under the HM/HC Project an integrated health and literacy activity, which incorporates maternal and child health messages with literacy curricula, has been pilot tested in Luxor governorate. Materials have also been produced related to female genital cutting and widely distributed by the MOHP and NGOs.

Source: HM/HCRP 2001

Appendix 4: Study Design and Implementation Details for the NMMS 2000

The study design aimed to obtain a nationally representative sample of maternal deaths.

Sample Design

Previous studies of the completeness of adult female death-registration data reported high levels of completeness (Committee on Population and Demography, 1982). Prior to starting the NMMS 2000, a review was conducted of the completeness of adult female death-registration data using demographic techniques (e.g. growth-balance techniques). This was limited by gaps in the data on female deaths aged less than 15, but suggested data quality was fairly complete; we have assumed the data quality remain satisfactory.

A listing of all health bureaus reporting deaths was obtained for 1997 from CAPMAS. In 18 governorates, health bureaus were randomized within governorate using Excel's random number generator, and 81 were selected using a systematic sample of every third bureau. All 68 health bureaus were selected in Aswan, Luxor, Qena, Beni Suef, Fayoum, Assiut, Kafr El-Sheikh, Suez and New Valley, since one of the study objectives was to estimate governorate-level maternal mortality ratios in these nine governorates.

The study expected to generate information on 11,231 female deaths, based on a sampling fraction of 6,172 (33%) of the total 18,516 expected adult female deaths in 18 governorates and 5,059 (100%) of the total 5,059 expected adult female deaths in nine governorates. From these female deaths, the study expected to identify a total of 1,118 maternal deaths (597 maternal deaths in the 18 governorates and 521 maternal deaths in the nine governorates).

Tools and Training

The study used the following tools: a screening questionnaire recording all female deaths and maternal deaths in the age group 15-49 years, which was completed by health bureau directors; a family questionnaire administered for each case of maternal death by a CAPMAS field worker to the family of

the deceased woman; a health provider questionnaire administered by the LAG committee to any health provider involved in a case of maternal death or in care of the infant of a deceased woman; and a form summarizing the causes of death and substandard care and avoidable factors, which was completed by the LAG committee.

Questionnaires used in the 1992-1993 National Maternal Mortality Study were modified for the study as follows: the unstructured component was elaborated (Campbell and Ronsmans 1995); the signs and symptoms used for verbal autopsy were reduced; the measurement of care-seeking processes were improved; and additional details on outcome in the fetus or infant were obtained. The daya questionnaire was eliminated, as it had produced incomplete data that was not used in the 1992-1993 report. Questions relating to the fetus or infant were based on the Jamaica Perinatal Mortality Study (Ashley et al, 1994; Greenwood et al, 1994; Golding et al, 1994); verbal autopsy questions were based on the BASICS questionnaire (BASICS, 1996) and the WHO Verbal Autopsy for Infants (Anker et al, 1999). Questionnaires were pre-tested through a pilot study of 25 maternal deaths and modified accordingly.

As far as possible, the study ensured that questions were asked in the same way as in the EDHS 2000 and the FUSND to ensure comparability, and that data collection methods and procedures complemented the planned national maternal mortality surveillance system. With regard to the latter, this included ensuring compatibility of definitions, length and content of forms, training methods, and incentives, and co-ordination to avoid potential duplication.

All those participating in the study, including health bureau directors, interviewers and LAG members, were trained to use the study tools. Interviewers received 10 days training conducted by CAPMAS and JSI, which included role play, use of study tools, and seven days practical field work. JSI and FETP also conducted three half-day training sessions for 173 SHB directors, emphasizing the importance of completing questionnaires accurately and of providing a detailed address. They also conducted two one-day regional training workshops for 112 LAG members. Refresher

training, based on needs identified by quality control measures, was provided by FETP team members.

Data Collection and Review

SHB directors were asked to record weekly all female deaths in the age group 15-49 years, based on notification from health facilities in their area. They were also requested to identify pregnancy-related deaths, defined as deaths during pregnancy, abortion, labor or the postpartum period (up to 42 days after delivery or abortion), and to obtain the addresses of deceased women. SHB directors recorded information about female death, pregnancy-related death, and addresses on a screening questionnaire, which was provided by CAPMAS.

Incentives were paid for each female death and each confirmed pregnancy-related death. Pregnancy-related deaths were excluded if they occurred after 42 days postpartum.

CAPMAS field supervisors collected SHB reports of female deaths and pregnancy-related deaths on a weekly basis, and returned them to JSI after taking note of any pregnancy-related deaths. CAPMAS field workers followed-up pregnancy-related deaths with home visits, to confirm that the death was of a pregnant or recently delivered woman, and to interview the relatives of deceased women. Field workers asked for the family's consent to a home interview. The household questionnaire was administered to the most knowledgeable person who had witnessed the death, usually the husband, mother, sister or mother-in-law. If several eligible respondents were present, the interviewer attempted to arrive at a consensus opinion.

A Local Advisory Group (LAG) was established in each governorate, comprising the Undersecretary for Health, MCH Director, an obstetrician and a pediatrician. This committee was responsible for co-ordinating the study at governorate level and, specifically, for reviewing data and assigning cause of death. The obstetrician reviewed medical records and conducted interviews with health providers in cases where a woman was taken to a public or private health facility. The pediatrician reviewed medical records

and conducted interviews with health providers in cases where perinatal death occurred in hospital or where an infant was taken to a public or private health facility. The LAGs met monthly to review household and health provider interviews and to prepare fill in the form identifying the direct and indirect causes of each maternal death, and the avoidable factors. In cases where cause of death was unclear, the LAG made further inquiries through the CAPMAS field interviewers. Occasionally, clinical supervisors – senior obstetricians involved in hospital training – took part in LAG meetings in five target governorates (Aswan, Luxor, Beni Suef, Fayoum and Qena), to support the decision-making process.

Household and health provider questionnaires and LAG reports were returned by CAPMAS. Completeness, duplicates and protocol violations were assessed by JSI and FETP and reports were referred back to the field if necessary. The Technical Advisory Group (TAG) met monthly to review cases and finalize maternal death reports. In addition, an anesthesia consultant was asked to review all cases where women had received an anesthetic.

Classification of Cause of Maternal Death

The LAG and/or the TAG assigned a single main cause of death to women who had died. However, in many cases there were multiple causes of death, and these were also recorded. For example, a woman could have obstructed labor, Cesarean section and anesthesia as direct obstetric causes, and obstructed labor as the single main cause of death. The classification used for the causes of maternal death is shown in Figure 11.

Figure 11. Classification of the causes of maternal death

DIRECT OBSTETRIC CAUSES

Hemorrhage

a. Antepartum hemorrhage (e.g. placental abruption or placenta previa)
b. Postpartum hemorrhage
c. Other hemorrhage

Hypertensive diseases of pregnancy

a. Pre-eclampsia
b. Eclampsia

Sepsis

a. Acute chorio amnionitis
b. Puerperal sepsis
c. Other obstetric related sepsis (tetanus, septicaemia)

Early pregnancy death

a. Spontaneous abortion
b. Induced abortion
c. Ectopic pregnancy

Other direct obstetric causes

a. Obstructed labor
b. Obstetric tract trauma (ruptured uterus and acute uterine inversion)
c. Cesarean section complications
e. Anesthesia complications
f. Pulmonary embolism
g. Other

INDIRECT OBSTETRIC CAUSES

Anemia
Cardiovascular disorders
Neurological disorders (e.g. epilepsy)
Infections (e.g. hepatitis)
Metabolic disorders
Gastrointestinal tract disorders
Urogenital disorders
Respiratory system disorders
Neoplasms
Other (e.g. diseases of the endocrine system)

UNKNOWN CAUSES

INCIDENTAL CAUSES

Burns
Road traffic accidents
Other accidental causes
Suicide

Classification of Sub-Standard Care

In the study, more than one aspect of sub-standard care or avoidable factor could contribute to maternal death. The classification used for avoidable factors is shown in Figure 12. The classification includes woman and family factors, although deceased women and families are not usually deemed to be responsible for the standard of care in the medical sense.

Figure 12. Classification of avoidable factors

MEDICAL TEAM FACTORS
Poor quality antenatal care
General practitioner factors
Midwife factors
Obstetrician factors
a. Failure of diagnosis
b. Failure of management
TBA (daya) factors
HEALTH FACILITY FACTORS
Blood bank
Drugs, equipment, supplies
Operating theatre
Anesthetic facilities
Back-up facilities (e.g. pathology, ultrasound, and radiological services)
Transportation
Distance to nearest hospital

WOMAN AND FAMILY FACTORS
Unwanted pregnancy
No antenatal care
Delay in recognizing problem
Delay in seeking medical care

Quality Control

Quality control was assured at every stage of the study. At health bureau level, a copy of the official register of notification of deaths was obtained monthly from each of the SHB and checked against the questionnaires received from SHB directors. CAPMAS checked 10% of the total of 7,858 female deaths, focusing on women aged 20-35 years with unexpected causes

of death, such as acute heart failure, and found 14 maternal deaths that had not been detected among 785 female deaths. Applying this rate to female deaths that were not checked would means as many as 126 maternal deaths were possibly missed. All questionnaires completed by SHB directors were also checked by the LAG, and incomplete or unsatisfactory questionnaires were returned for amendment.

Completed household questionnaires were checked by the field supervisors. CAPMAS field supervisors also repeated 2-3 household interviews for each field interviewer, checking the quality of data for 62 maternal deaths. The FETP team conducted checks of LAG health provider questionnaires. The TAG and JSI rechecked all questionnaires and LAG reports before data entry. Unsatisfactory reports were returned to the LAG and discussed with the committee concerned.

As a result of the decision taken by the CAG, at the request of the MOHP and USAID, to start the study in January 2000 rather than April 2000 as originally envisaged, SHB directors had to provide addresses retrospectively for deceased women who had already been registered. Obtaining this information was problematic in urban governorates, especially in Cairo and Alexandria. Further difficulties were caused by the inaccuracies in the original MOHP lists of sub-health offices that report to the SHBs. The first three months of data from Cairo and Alexandria were excluded to correct for these problems in Table 14 but not in Table2.

Data Processing

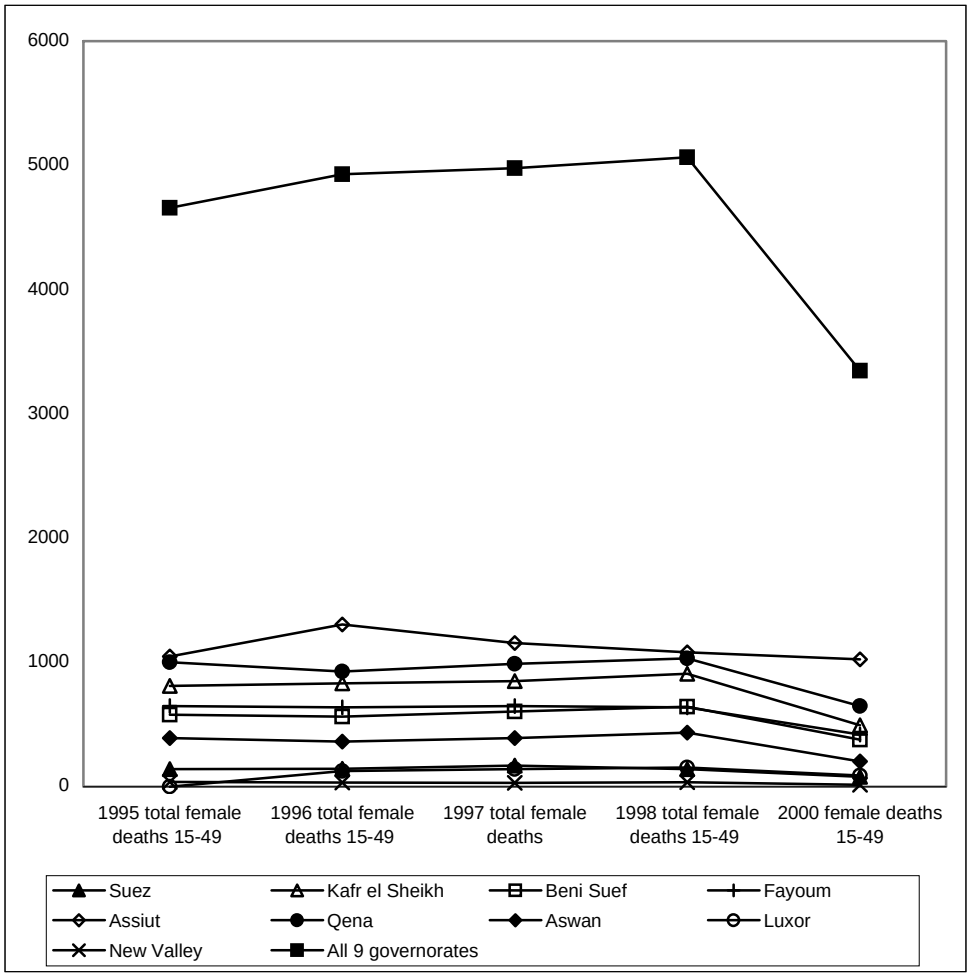
Data collection was completed four months after the end of 2000. Completed forms and questionnaires for each maternal death were kept in a separate folder, with a specific identification number indicating the name of deceased woman, the governorate, and the selected health bureau. As far as possible, data forms were pre-coded. JSI coded open questions, and double-entered and validated data using EPI Info in parallel with field work. Data analysis was carried out at JSI using EPI Info, and at the London School of Hygiene and Tropical Medicine using Stata and Excel.

To meet the survey objectives, which included providing governorate level estimates for nine governorates, different sampling fractions were applied to different governorates. In order to provide nationally representative estimates, the sample has been weighted, and all the results presented in this report are weighted. For example, if 25% of all female deaths in Lower Egypt were sampled, then the number of maternal deaths could be multiplied by four. For the 18 governorates with a 33% sample of female deaths, the deaths were multiplied by three before adding them to the deaths from the nine governorates with a 100% sample.

Data Analysis

To calculate the maternal mortality ratio in the 18 sampled governorates, the proportion of female deaths that were maternal was applied to the expected number of female deaths based on the most recently available year (1998), and the total live births in 2000 were used as the denominator. For the nine governorates with a 100% sample of female deaths, one of two approaches could be taken: the deaths could be used without correction and divided by the total number of live births in these governorates (as in the main body of the report), or the procedure used for the 18 sampled governorates could be adopted. The reason for the latter approach is an unexpected deficit in the numbers of female deaths in the nine governorates compared to previous years (see Figure 14). CAPMAS figures show adult female deaths to be declining at a rate of 0.512% per year, which would lead to a shortfall of 1.53% between 1997 when the sampling frame was obtained and 2000 when the study was conducted (El Deeb, 2001), but this is less than the shortfall in numbers in the study.

Figure 13. Female deaths for the nine governorates with a 100% sample, from vital registration and from the NMMS 2000.



The maternal mortality ratios using the second approach for all 27 governorates (applying the proportion of female deaths that were maternal observed in 2000 to the female deaths in 1998 to get an estimate of the total maternal deaths in 2000) are shown in Table 14. Review of the results needs to take account of under-reporting of live births, which could have the effect of over-estimating the maternal mortality ratio.

Table 15. Female deaths, maternal deaths, and maternal mortality ratios by region and governorate, adjusted for possible missed female deaths in 9 governorates and excluding 3 months of retrospectively reported data in urban governorates of Cairo and Alexandria.

Region, Governorate	Live births, 2000	Female Deaths 1998	Female Deaths, 2000 sample	%MD/FD, 2000, *adjusted	MMR	Confidence Limits LCL	Confidence Limits UCL
Total	1,752,562	22,316	8497	6.9	93	89	98
Metropolitan	282,196	4,852	1,844	3.3	54	45	62
Lower Egypt	725,936	9,118	2,845	7.3	97	90	104
Upper Egypt	717,773	8,142	3,713	8.2	104	96	111
Frontier	26,657	204	95	15.8	125	82	167
Suez	11,460	140	78	12.8	157	84	229
Kafr El Sheikh	57,879	909	494	7.1	111	84	138
Beni Suef	61,468	642	379	10.8	113	86	140
Fayoum	66,851	638	418	8.1	78	57	99
Qena	80,965	1031	647	7.6	96	75	118
Assiut	101,768	1081	1,024	6.0	63	48	79
Luxor	10,798	154	90	10.0	143	71	214
Aswan	23,305	434	203	8.4	156	105	207
New Valley	4,283	36	15	6.7	56	0	127

When a whole population rather than a sample is studied, there is some debate as to whether it is appropriate to calculate confidence intervals. In the case of the nine governorates in the NMMS 2000 with a 100% sample, it could be argued that the maternal mortality ratios observed are the actual ones, with no uncertainty. On the other hand it is also possible to argue that for a rare event in a small population, the observed maternal mortality ratio in a given year is just one realization of an underlying maternal mortality ratio with a binomial distribution that needs to have some measure of uncertainty put around it. We have erred on the side of caution and calculated confidence intervals for all the governorates and summed these to obtain the national confidence intervals.

Comparison Group

A nationally representative sample of women who did not die in childbirth was obtained from the EDHS 2000, in order to provide a comparison group.

Additional information was obtained from this sample by the FUSND. The EDHS 2000 sample was drawn from all 27 governorates in Egypt. It covered 17,521 households and interviewed 15,572 ever-married women aged 15-49 between February and May 2000, including obtaining in-depth histories for 11,467 live births in the 0-59 months preceding the survey.

The NMMS 2000 requested that the EDHS 2000 also ascertain whether women had had stillbirths, miscarriages or abortions in this period and, if so, the gestational age of pregnancy at which they occurred. A sample of stillbirths, neonatal deaths and live births that had not died during the neonatal period was identified from the EHDS 2000. The FUSND then followed up all cases of stillbirth or neonatal death in the two years preceding the EDHS 2000, and a sample of live births that had not died during the neonatal period (as controls). Three live births that had not died during the neonatal period were followed up for each case of stillbirth or neonatal death. Details of the EDHS 2000 and the FUSND are described in separate reports.

Steps in Conducting the Study

1. Every week selected health bureau (SHB) directors received notification of death from different health bureaus in their area.
2. Health bureau directors filled in the SHB form for all female deaths (15-49). Deaths during pregnancy, abortion, labor or postpartum (up to 42 days after delivery or abortion) were identified. The addresses of the deaths were obtained.
3. The CAPMAS field supervisors visited the selected health bureaus on a weekly basis to collect all SHB forms for both female deaths and maternal deaths. CAPMAS field workers transferred all SHB forms to JSI on a regular basis.
4. The CAPMAS field interviewers visited the homes of the women who died in pregnancy, delivery or the postpartum to fill in the household form. The interview was with the relatives (husband, mother, sister or

relatives most closely involved) of the deceased women. They also ensured that it was a maternal death.

5. The CAPMAS field interviewers transferred the completed household forms to the Local Advisory Group (LAG).
6. The LAG committee members (Undersecretary, MCH director, pediatrician and obstetrician) at the governorate level met every 3rd week to review all household forms and fill in the physician form through interviewing the physician(s) who attended the dead woman and her baby (if death occurred in a health facility). If the causes or avoidable factors were unclear, further enquiry was made through the CAPMAS interviewers. Direct and indirect causes of the mother's death would be determined in addition to the avoidable causes. The LAG committee completed the Local Advisory Group Report.
7. The CAPMAS field researchers transferred all LAG forms and completed household forms to the Technical Advisory Group (TAG) at the JSI office.
8. The TAG met on the 3rd week of each month to review the household, physician and LAG forms and finalize the maternal death reports.
9. All questionnaires (including those from the CAPMAS fieldworkers, LAGs and SHBs) were rechecked by JSI. In particular, all reports from the LAGs were revised by JSI staff and the TAG before data entry. Unsatisfactory LAG reports were returned and discussed with the concerned group.
10. Payment was made in accordance with the completed accepted study forms received by JSI.
11. CAPMAS and the FETP group at JSI carried out quality control measures.
12. At JSI, every maternal death has its own folder with a specific identification number which indicated the name of deceased woman, the governorate and the selected health bureau. The folder contains all study forms related to the woman.
13. Finalized questionnaires were coded and double entered.

14. Analysis and dissemination of the results was the responsibility of JSI and the CAG.

Appendix 5: Summary of Results of the 1992-93 NMMS and 2000 NMMS and Future Recommendations

Table 16. Pathway to Survival and Summary of Results NMMS 1992-93 and NMMS 2000 and Recommendations

Pathway to Survival Steps	NMMS 1992-93 Findings	NMMS 2000 Findings	Recommendations
Problem: Level of mortality Major causes of death Regional levels	MMR 174 Major causes: Hemorrhage Hypertensive disease Sepsis MMR: Upper (217) Lower (132) Metropolitan (233) 92% avoidable causes	MMR 84 Major causes: Hemorrhage Hypertensive disease Ruptured uterus MMR in Upper (89) Lower (93) Metropolitan (48) 81% avoidable causes	Mortality dramatically reduced. Continue MOHP activities to establish routine surveillance system to monitor deaths and to obtain governorate estimates and trends.
Step 1. Recognition of Problem: Knowledge Awareness Effect/vulnerability	Deaths during: pregnancy (25%) delivery+24hrs (39%) postpartum (36%) 42% of deaths delay in seeking care or non-adherence to medical advice 42% postpartum deaths and 65% sepsis deaths delivered at home 17% contraceptive failure among deaths	Deaths during: pregnancy (24%) delivery+24hrs (49%) postpartum (27%) 30% of deaths delay in seeking care or non-adherence to medical advice 20% postpartum deaths and 33% sepsis deaths delivered at home 6% contraceptive failure among deaths	More information on danger signs and the risks of home delivery should be given at all contacts and tied to facility protocols.
Step 2. Decision to seek Care Behavior Motivation Barriers	71% sought care 36% died at home	93% sought care 29% died at home	Research on why home deaths high for sepsis, hemorrhage and cardiac disease.
Step 3. Logistics to Reach Quality Care Transport Stabilization Referral	64% died in health facility 4% due to lack of transport	62% died in health facility 5% due to lack of transport 9% died during transport 13% 1st provider failed to manage and refer	Emergency referral procedures must be clear and known. Providers should receive specific training in stabilization, e.g. PPH.
Step 4. Quality Care Providers Technical competence Effectiveness of treatment Efficiency Safety	Substandard care by obstetric team contributed to 47% deaths GPs to 12% deaths 32% of CS deaths occurred in private clinic 15% of ruptured uterus delivered in private clinic Dayas contributed to 12% deaths, 37% of sepsis deaths 33% had poor quality ANC 57% fetus/infants died; 43% of those whose mother died in delivery or postpartum.	Substandard care by Obstetric team contributed to 43% deaths GPs to 11% deaths 47% of CS deaths occurred in private clinic 31% of ruptured uterus delivered in private clinic Dayas contributed to 8% deaths, 17% of sepsis deaths 19% had poor quality ANC 50% fetus/infants died; 34% of those whose mother died in delivery or postpartum.	Protocols for managing obstetric emergencies should be implemented nation wide and their use supervised. Competency-based training modules should be used for in-service, pre-service training, promotion and licensing system. Regulation of private clinics, especially surgery, to improve safety. Education for providers and community on misuse of oxytocins and risk of ruptured uterus. Dayas still need more effective training on infection prevention.
Facility Continuity of care Availability of supplies, equipment, drugs, blood Anesthetist	6% lack of blood (14% for APH, 20% PPH, C-S 11%) 2% lack of equipment, supplies, drugs	16% lack of blood (22% for APH, 31% PPH, C-S 38%) 6% lack of equipment, supplies, drugs 4% lack of anesthetist	Identify and correct problems in blood supply. Recruit, train, and retain more anesthetists in district hospitals.

Table 17. Maternal mortality per 100,000 live births attributed to various avoidable factors: comparison between 1992-1993 and 2000

Avoidable factor	Maternal deaths per 100,000 live births	
	1992-1993	2000
Delay in recognizing problem/ seeking medical care	73	25
Substandard care from general practitioner	21	9
Substandard care from obstetrician	82	36
Substandard care from daya	21	7
Lack of drugs, supplies, and equipment in health facilities	3	5
Lack of blood	10	13
Lack of transportation	7	4
No avoidable factors	14	16

Note: maternal mortality ratios add up to more than the total national maternal mortality ratio because more than one avoidable factor can contribute to each death.

Appendix 6: Comparison of National and Regional Maternal Mortality Ratios in 1992-93 and 2000

Table 18. Percent Change in the Maternal Mortality Ratio in 1992-93 Study Compared to 2000 Study

	2000	1992-1993	% Reduction
National MM Ratio	84	174	52%
Metropolitan MM Ratio	48	233	79%
Lower Egypt MM Ratio	93	132	29%
Upper Egypt MM Ratio	89	217	59%
Frontier MM Ratio	120	*	*

* Frontier Governorates was not included in 1992-1993 study

Table 17 shows the estimated MMRs from NMMS 1992-93 and 2000 for the three of the four regions in Egypt. Comparing the two studies, the Metropolitan region had the largest percent decrease in MMR (79%), followed by Upper Egypt (59%) and Lower Egypt (29%).

In 1992-93, Upper Egypt had an estimated 85 more maternal deaths per 100,000 births than did Lower Egypt. In 2000, this gap narrowed, and was even reversed, with Upper Egypt now having 4 fewer deaths per 100,000 births than Lower Egypt. The MOHP suggests that efforts in the last few years to improve the supply and quality of obstetric care in Upper Egypt may account for some of the decrease in Upper Egypt.

Table 19. Percent Change in Gap between Upper Egypt and Lower Egypt, 1992-93 and 2000

1992-93 NMMS	39% higher in Upper Egypt than Lower Egypt
2000 NMMS	4% lower in Upper Egypt than Lower Egypt

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	Dr. Mohamed Galal	*Markaz Housh Essa*
	Dr. Abdel Monem El Sayed	*Markaz Rasheed*
Ismailia	Dr. Walid Ibrahim	*Markaz Fayed*
	Dr. Ibrahim Ragab	*Kism Awal Ismailia*
	Dr. El Sayed Mahmoud	*Kism Thany Ismailia*
Giza	Dr. Ahmed Abo Baker	*Markaz El-Badrasheen*
	Dr. Emely Zaky Khalil	*Kism El-Giza*
	Dr. Mahmoud Abdel Kader	*Kism El-Wahat El-Baharia*
	Dr. Taha Mohamed Taha	*Markaz Imbaba*
	Dr. Yousef Faraweza	*Kism El-Agouza*
	Dr. Fayza Ibrahim	*Kism Madenet 6 October*
Beni Suef	Dr. Moner Mohamed	*Kism Beni Suef*
	Dr. Mohamed Abdel Fatah	*Markaz Beni Suef*
	Dr. Amro Sayed Ahmed	*Madenet Beni Suef El-Gedida*
	Dr. Abdel Azim Nazef	*Markaz El-Fashn*
	Dr. Zaynab Mohamed	*Markaz El-Wasta*
	Dr. Nabil Momtaz	*Markaz Ehnasia*
	Dr. Safwat Gergess	*Markaz Beba*
	Dr. Kamal Faress Ismail	*Markaz Somosta*
	Dr. Ahmed Mohamed	
	Dr. Meshel Gerogy Basta	*Markaz Naser*
Fayoum	Dr. Mahmoud Henafy Hassan	*Kism El-Fayoum*
	Dr. Magdy Zaher Awad	*Markaz El-Fayoum*
	Dr. Eid Gebaly Gad	*Markaz Ebshway*
	Dr. Ahmed Mohamed Hassan	
	Dr. Meshel Fahmy Armanus	*Markaz Etsa*
	Dr. Amgad Abdel Zaher	*Markaz Sennoris*

	Dr. Adel Salah Morsy	*Markaz Tamia*
	Dr. Mona Fouad	
Menya	Dr. Roshdy Ragy Rizk	*Markaz Bany Mazar*
	Dr. Gamil Ibrahim Gergess	*Markaz Matay*
	Dr. Noshy Abdel Malak	
	Dr. Ayman Welyam Tawfek	*Markaz El-Menya*
	Dr. Mohamed Safwat Mohamed	*Kism Malawy*
Assiut	Dr. Rafat Moner Tadoress	*Kism Awal Assiut*
	Dr. Moner Fam Beshay	*Kism Thany Assiut*
	Dr. Gamil Tawfek Sood	*Markaz Assiut*
	Dr. Hosen El Sayed	*Markaz Abnoub*
	Dr. Alfy Saber Zakary	*Markaz Abo-Teeg*
	Dr. Hamdy Saad Ahmed	*Markaz El-Badary*
	Dr. Yehya Baher Kalil	*Markaz Sahel Seleem*
	Dr. Mohamed Thabet Ahmed	*Markaz El-Ghanaym*
	Dr. Abdel Roof Abdel Monem	*Markaz El-Kosia*
	Dr. Nasr El Din Mohamed	*Markaz Dayrout*
	Dr. Safwat Sobhy Metry	*Markaz Sedfa*
	Dr. Fayez Abdel Meseh	*Markaz Manfalout*
	Dr. Ragy Fekry Tofeless	*Markaz El-Fath*
Souhag	Dr. Hassan El Bana	*Markaz El-Maragha*
	Dr. Mohamed Abdel Naby	*Kism Shortet Madenet Gerga*
	Dr. Ali Hassan Mohamed	*Markaz Tema*
	Dr. Khayri Mohamed	
	Dr. Abdel Wahed Ahmed	*Markaz Dar El-Salam*
	Dr. Mohamed Abdel Halem	*Markaz Sakolta*
Qena	Dr. Osama Kalad Ebed	*Kism Qena, Markaz Qena*
	Dr. Khalil Fouad	*Markaz Abou Tesht*
	Dr. Sayed Ahmed Ali	*Markaz Armant*
	Dr. Nasr Ali Hassan	
	Dr. Abdel Hakam Mohamed	*Markaz Isna*
	Dr. Abdel Rahman Mohamed	*Markaz Deshna*
	Dr. Ahmed Ahmed Mohamed	*Markaz Kous*
	Dr. Mostafa Galal	
	Dr. Gadalla Soliman	*Markaz Naga Hamadi*
	Dr. Ahmed Marzok	*Markaz Naqada*
	Dr. Ali El Samkory	*Markaz Farshoot*
	Dr. Ahmed Shawky Hosen	*Markaz Kift*
	Dr. Mowallen Goher Boktor	*Markaz Elwakf*

Aswan	Dr. Maher Loka	*Kism Aswan*
	Dr. Mostafa Hamza	*Markaz Aswan*
	Dr. Mohamed Ahmed	*Markaz Idfu*
	Dr. Bahgat Mohamed	*Markaz Komombo*
	Dr. Waell Nabyh	*Markaz Naaser*
	Dr. Sef El Nasr	*Markaz Draw*
Luxor	Dr. Ahmed Mohamed Taha	*Kism Luxor*
	Dr. Nahed Abdel Monem	
	Dr. Abdel Rehem Amin	*Markaz Luxor*
Red Sea	Dr. Abdel Kader Mostafa	*Kism Ghardaka*
	Dr. Salah Hisham	*Kism Ras Ghareb*
	Dr. Hosam El Din Fahmy	
New Valley	Dr. Mohamed Abdel Naby	*Markaz Elwahat ElKharga*
	Dr. Magdy Galy	*Markaz Elwahat Eldakhla*
	Dr. Mamdouh Sobhy	*Markaz lfarafra*
Matrouh	Dr. Esam Ahmed Ismail	*Markaz Siwa*
	Dr. Salah El Din Mohamed	*Markaz Elhammam*
	Dr. Ahmed Atef	*Markaz El Negila*
	Dr. Fathy Mahmoud	
North Sinai	Dr. Reda El Sayed	*Kism Thaleth El-Arish*
	Dr. Hatem Ahmed	
	Dr. Hassan Mohamed	*Markaz El-Sheekh Zowyed*
	Dr. Nabil Nagy Beltagy	*Kism El-Kasima*
South Sinai	Dr. Magdy Wasfy	*Kism Saint Cathrin*
	Dr. Mohamed Ali	*Kism Abo Redees*
	Dr. Ahmed Shawky	*Kism El-Tour*