Policy and Practice

National maternal mortality ratio in Egypt halved between 1992–93 and 2000

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Abstract Two surveys of maternal mortality conducted in Egypt, in 1992–93 and in 2000, collected data from a representative sample of health bureaus covering all of Egypt, except for five frontier governorates which were covered only by the later survey, using the vital registration forms. The numbers of maternal deaths were determined and interviews conducted. The medical causes of death and avoidable factors were determined. Results showed that the maternal mortality ratio (MMR) had dropped by 52% within that period (from 174 to 84/100 000 live births). The National Maternal Mortality Survey in 1992–93 (NMMS) revealed that the metropolitan areas and Upper Egypt had a higher MMR than Lower Egypt. In response to these results, the Egyptian Ministry of Health and Population (MOHP) intensified the efforts of its Safe Motherhood programmes in Upper Egypt with the result that the regional situation had reversed in 2000. Consideration of the intermediate and outcome indicators suggests that the greatest effect of maternal health interventions was on the death-related avoidable factors "substandard care by health providers" and "delays in recognizing problems or seeking medical care". The enormous improvements in these areas are certainly due in part to extensive training, revised curricula, the publication of medical protocols and services standards, the upgrading of facilities, and successful community outreach programmes and media campaigns. The impact on the utilization of antenatal care (ANC) has been less successful. Other areas that remain problematic are inadequate supplies of blood, drugs and equipment. Although the number of maternal deaths linked to haemorrhage has been drastically reduced, it remains the primary cause.

The drop in maternal mortality in the 1990s in response to Safe Motherhood programmes was impressive and the ability to tailor interventions based on the data from the NMMS of 1992–93 and 2000 was clearly demonstrated. To ensure the continuing availability of information to guide and evaluate programmes for reducing maternal mortality, an Egyptian national maternal mortality surveillance system is being developed.

Keywords Maternal mortality/trends; Cause of death; Risk factors; Prenatal care/standards; Maternal health services; Egypt (*source: MeSH, NLM*).

Mots clés Mortalité maternelle/orientations; Cause décès; Facteur risque; Soins prénataux/normes; Service santé maternelle; Egypte (*source: MeSH, INSERM*).

Palabras clave Mortalidad maternal/tendencies; Causa de muerte; Factores de riesgo; Atención prenatal/normas; Servicios de salud materna; Egipto (*fuente: DeCS, BIREME*).

Arabic

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Voir page 470 le résumé en français. En la página 470 figura un resumen en español.

Introduction

Maternal mortality is a major global concern that affects families and thus society. Surveys to determine the causes of maternal deaths (MD) are the primary tools on which interventions have been based. Two national maternal mortality surveys (NMMSs) were performed in 1992–93 and 2000 in Egypt. The results from these surveys indicated that the maternal mortality ratio (MMR) in Egypt had decreased by 52% from 174/100 000 live births in 1992–93 to 84/100 000 live births in 2000 (*1*, *2*).

Various interventions were implemented in Egypt by the Maternal and Child Health Directorate/Ministry of Health and Population (MCH/MOHP) with assistance from the Child Survival Project funded by the United States Agency for International Development (USAID), between 1985 and 1996. A primary goal of this nationwide effort was to reduce the 1989 maternal mortality rate (220/100 000 live births) by 15% by 1995 (3). Many of the interventions were later refocused based on the results of the NMMS of 1992–93.

The MotherCare Egypt Project took over from the Child Survival Project, focusing between 1996 and 1998 on pilot studies in three districts in Upper Egypt (4). Building upon these results, the Healthy Mother/Healthy Child Project (HM/HC) started work in Upper Egypt (in Aswan and Luxor) in June 1998, covering all districts (5). This paper reviews the shifts in causes and avoidable factors related to maternal deaths and analyses the impact of Safe Motherhood programmes in Egypt on the MMR through their effect on intermediate indicators.

Methods

Egypt can be divided into three distinct regions: metropolitan (Cairo, Alexandria, Port Said and Suez), the north (Lower Egypt) and the south (Upper Egypt). It is estimated that one-third of its population lives below the poverty line (6). Compared to other developing countries, Egypt belongs to the middle level on a scale of socioeconomic development. The poverty is most severe in Upper Egypt, which is home to 41% of all poor people in Egypt (6). Urban governorates had the lowest densities of poor people, followed by urban Lower Egypt and urban Upper Egypt, which is the poorest of urban locations. Regions with higher than average levels of relative poverty were rural Lower Egypt followed by rural Upper Egypt, which was the poorest region of the country (7). All regions were comparable in other relevant respects (e.g. religion and languages). Detailed socioeconomic and demographic data on all regions have been published elsewhere (8).

The MOHP conducted the surveys between 1 March 1992 and 28 February 1993 and 1 January to 31 December 2000, with the assistance of the Egyptian Central Agency for Public Mobilization and Statistics (CAPMAS). The methods for carrying out the two surveys were essentially identical and the results were comparable. Data for the 1992–93 survey were obtained from a selection of 122 health bureaus in 21 governorates. In 2000, five more frontier governorates were added, and Luxor City had become a governorate, bringing the total to 27 governorates, covering the whole of Egypt.

Guidance on survey design, strategy and dissemination was provided by a central advisory group and a reproductive age mortality study-based (RAMOS) methodology was used (9). Advantage was taken of Egypt's virtually complete registration of adult deaths, to obtain a population-based sample of deaths among women aged 15–49 years. In 18 governorates, one-third of health bureaus were randomly selected; all health bureaus in the remaining nine governorates were included as these were of particular interest to the MOHP for various reasons. The participation of 149 health bureaus in the 27 Egyptian governorates enabled an overall statistical estimation of MMR to be made with an accuracy of plus or minus 10%.

Deaths related to pregnancy were identified at the selected health bureaus using a one-page screening questionnaire

> Box 1. **Headings of the main sections of the 44-page household questionnaire**
>
> 1. Identification of the deceased woman
> 2. Relatives and health provider attending the death
> 3. Brief summary; overall description of the case
> 4. Details about the death and circumstances related to the death
> 5. Details relating to the antenatal care visit(s)
> 6. Delivery details
> 7. Outcome of the "current" delivery
> 8. Past medical history of the deceased
> 9. Personal history of the deceased and husband
> 10. Household details

filled in within 48 hours of the death. The selected health bureaus sent weekly reports to CAPMAS on all deaths of women aged 15–49 years during the period of the survey. MDs were confirmed by non-local, university-educated CAPMAS fieldworkers who conducted in-depth home interviews with relatives of the deceased, using a 44-page verbal autopsy (Box 1) based on the Basic Support for Institutionalizing Child Survival (BASICS) questionnaire and the WHO Verbal Autopsy for Infants (10–12). Inter-gender interviews were not prohibited. Health-care providers involved in caring for the mother were interviewed using an 11-page questionnaire administered by a designated local advisory group in the governorate, composed of the Undersecretary of the Health Directorate, the MCH Director, one obstetrician and one paediatrician. All questionnaires had been pre-tested in a pilot study conducted in Kalyubia Governorate, Lower Egypt. Interviews were not conducted in 54/772 cases in 1992–93 and 5/585 cases in 2000 because of failure to locate the home of the deceased.

Completed household questionnaires were checked by the CAPMAS field supervisors who also repeated 2–3 of the household interviews conducted by each field interviewer, thus double-checking the quality of data for 62 maternal deaths. Local advisory groups reviewed all cases, including medical records, to determine the cause of death, and made assessments of avoidable factors. Causes of maternal deaths were categorized as either direct or indirect in accordance with *WHO International Classification of Diseases, tenth revision* (13). More than one cause of death and more than one avoidable factor could be assigned, but a single main cause of death was decided upon by consensus by the local advisory group. The technical advisory group, composed of the 13 Chairs of Egyptian university departments of obstetrics and gynaecology, met monthly to review cases and finalize reports. An anaesthesia consultant reviewed all cases in which anaesthesia had been given.

All interviewers, doctors from the selected health bureaus and panel members received training. Interviewers received 10 days of continuous training, which included role-play, survey tools and 7 days of practical fieldwork. The training stressed the need for confidentiality. The 173 directors of the selected health bureaus had three half-day training sessions which emphasized the importance of accurate completion of questionnaires and recording of detailed addresses. The 112 members of the local advisory groups attended two 1-day training workshops. Refresher training was provided if a need was indicated by the results of quality control measures used in the data validation process.

Data were double-entered and validated using EPI-INFO, and analysed using Stata and Excel software.

To calculate the MMR in the 18 sampled governorates, the proportion of deaths in women (FD) that were classified as maternal deaths (MD) was multiplied by the total number of women who had died based on the most recently available data (1998, obtained through CAPMAS), and divided by the total number of live births (LB) in 2000. For the remaining nine governorates, the total number of confirmed MDs was divided by the total number of live births:

$$[(MD^{2000}/FD^{2000}) \times FD^{1998}]/LB^{2000} \times 100\ 000$$

Results

In 1992–93 and 2000, a total of 7487/8497 deaths (15–49 years) were reported among women. Of these, 825 (11%) and 639 (7.5%), respectively, were pregnancy-related; 772 (94%) and 585 (92%), respectively, were categorized as MDs and 53 (6%) and 54 (8%), respectively, were due to non-maternal causes. MDs comprised 10.3% and 6.9% of deaths among women of reproductive age in 1992–93 and 2000, respectively. The overall MMR was reduced from 174/100 000 to 84/100 000 live births (1, 2, 14, 15).

Table 1 shows the individual, direct and indirect causes of MD. The major cause of death in both survey periods was haemorrhage (30%); postpartum haemorrhage (PPH) caused 22% of MDs in 1992–93 and 27% in 2000. However, the absolute numbers of deaths caused by PPH remained approximately the same (161 MDs in 1992–93 and 157 deaths in 2000). Deaths caused by antepartum haemorrhage (APH) were substantially reduced from 50 (7%) deaths in 1992–93 to only 19 (3%) in 2000.

The number of MDs due to hypertensive disease dropped by 32 between 1992–93 and 2000, deaths due to sepsis by 22 and those due to abortion by 17. Pulmonary embolism and lack of anaesthesia had become more significant problems in 2000. However, the diagnosis of pulmonary embolism was based on case histories rather than on autopsies, which could result in misdiagnosis. The numbers of MDs due to ruptured uterus, complications of caesarean section, ectopic pregnancy, obstructed labour and active uterine inversion remained fairly stable.

The ranking of the individual major causes of death remained fairly stable. After haemorrhage, hypertensive disease caused most deaths (15% in 1992–93 and 13% in 2000), followed by sepsis (8%), ruptured uterus (6%) and abortion (5%) in 1992–93. In 2000, the figures were ruptured uterus (8%), rheumatic heart disease (7%), sepsis (6%) and pulmonary embolism (6%).

In both 1992–93 and 2000, the major avoidable factor contributing to MDs was substandard care by obstetricians (334 (47%) deaths and 247 (43%) deaths, respectively) (Table 2). Although it was still the single most important factor, it caused 87 fewer MDs in 2000 than in 1992–93. In the earlier survey, the delay in recognizing the problem and seeking medical care was the second most important contributory factor. Although still a major concern in 2000 when it caused 172 deaths (30%), this was 132 fewer deaths than in 1992–93, and ranked third in importance. Although the contribution of absence of, or poor quality of, antenatal care to the MMR was reduced, in terms of absolute numbers, by 39 MDs in 2000, it became the second most important avoidable factor.

The lack of blood and drugs, and lack of supplies and equipment are the only two avoidable factors that notably contributed to more deaths in 2000 (45 and 92 MDs, respectively) than in 1992–93 (15 and 33 MDs, respectively) (Table 2). The number of deaths due to unavoidable factors had also increased in 2000.

Discussion

The 52% reduction in the MMR between 1992–93 and 2000 in Egypt was a remarkable success worthy of detailed analysis. The relationship between observed decline in national figures and heightened community awareness as well as improved access to and quality of services should be examined closely.

Despite the overall decline in the MMR, the distribution of causes has not changed dramatically. Haemorrhage, both APH and PPH, continues to be the major cause of maternal deaths in Egypt as in many other countries. The changes in percentage contribution do not reflect the reduction of direct cause of death in real terms. Although haemorrhage contributed to 30% of MDs in both survey periods, in real terms there were 36 fewer deaths related to haemorrhage in 2000, i.e. 5% fewer than in 1992–93. Thus, in order to assess the areas in which there have been improvements from one year to another it is important to look at actual numbers. Comparative percentages are useful when determining which areas need more immediate attention when designing maternal care programmes. This area should be the focus of future interventions targeting further reduction.

It is encouraging that the contribution of delays in recognizing a problem or seeking medical care as a factor in maternal mortality decreased from 42% to 30%. This may indicate enhanced community awareness.

Deaths due to substandard care by health providers (including *dayas* (traditional birth attendants)) dropped from 505 (71%) to 386 (66%) reflecting a gradual improvement of health care services.

The increase in number of deaths related to a lack of blood or drugs and supplies is a cause for concern, but could indicate a greater proportion of deaths occurring in health-care facilities and consequently be linked to specific deficiencies within that system.

The reversal in the MMR between regions is shown in Table 3. Lower Egypt, a more urbanized and affluent area, had the higher MMR in 2000. As mentioned above, maternal health interventions were more extensive in Upper Egypt (1996–2000). This is not proof of the effectiveness of these interventions, but could be seen as circumstantial evidence for their success.

In order to analyse the possible reasons for improvement in certain areas, it is necessary to try to establish causal links between interventions, intermediate indicators and outcomes. Table 4 shows relevant intermediate indicators in Egypt. Table 5 summarizes the primary area of impact of each major programme component.

It is generally recognized that it takes from 3 to 5 years for programme activities to have a demonstrable impact on maternal mortality outputs or outcomes, ultimately leading to a change in the MMR. It is difficult to establish direct correlations between activities implemented in the field and proxy indicators and/or maternal mortality outcomes especially at the national level.

Table 1. **Direct and indirect causes of maternal deaths, Egyptian National Maternal Mortality Survey (ENMMS) 1992–93 and 2000**

Causes of death	No. of deaths, ENMMS 1992–93	(%)[a] ENMMS 1992–93	No. of deaths, ENMMS 2000	(%)[a] ENMMS 2000
Direct causes				
Haemorrhage	212	(30)	176	(30)
Postpartum haemorrhage	161	(22)	157	(27)
Antepartum haemorrhage	50	(7)	19	(3)
Hypertensive diseases of pregnancy	110	(15)	78	(13)
With convulsions	66	(9)	47	(8)
Without convulsions	44	(6)	29	(5)
Chronic hypertension			2	(0)
Sepsis	59	(8)	37	(6)
Puerperal sepsis			36	(6)
Obstetric sepsis			1	(0)
Abortion	32	(5)	15	(3)
Spontaneous	19	(3)	9	(2)
Induced	13	(2)	6	(1)
Other	86	(12)	141	(24)
Ruptured uterus	41	(6)	47	(8)
Pulmonary embolism	7	(1)	33	(6)
Anaesthesia	13	(2)	30	(5)
Caesarean section	17	(2)	24	(4)
Ectopic pregnancy	4	(1)	4	(1)
Active uterine inversion			2	(0)
Obstructed labour	3	(0)	1	(0)
Total direct causes	*499*		*448*	*(77)*
Indirect causes				
Cardiovascular disorders	92	(13)	58	(10)
Rheumatic heart disease			40	(7)
Myocardial infarction/stroke			13	(2)
Congenital heart disease			5	(1)
Infectious and parasitic diseases	26	(4)	16	(3)
Encephalitis			6	(1)
Bacterial meningitis			4	(1)
Tuberculosis			3	(1)
Septicaemia			3	(0)
Digestive disorders	9	(1)	16	(3)
Liver failure			14	(2)
Other digestive disorders			2	(0)
Neoplasms	12	(2)	9	(2)
Other neoplasms			6	(1)
Acute leukaemia			3	(0)
Respiratory disorders			6	(1)
Anaemia	4	(1)	3	(1)
Acute renal failure			3	(0)
Neurological disorders	17	(2)	1	(0)
Other	33	(4)		
Total indirect causes	*193*	*(27)*	*116*	*(20)*
Unknown causes	26	(4)	16	(3)
Total maternal deaths	**718**	**(100)**	**580**[b]	**(100)**

[a] Percentages do not add up to 100 due to rounding.

[b] Interviews could not be completed for 54 of 772 cases in 1992–93 and five of the 585 cases in 2000. The cause of death was confirmed to be unknown if the data were still insufficient after review by the technical advisory group.

Provider level

Skilled attendants at birth

The accepted paradigm is that "risk of maternal deaths can be reduced by skilled attendance at delivery" (*16*). "Skilled attendant" refers here to providers with midwifery and obstetric skills, thus excluding trained birth attendants. Attendance at delivery (from onset of labour to the immediate puerperium) can affect four direct causes of MD: obstructed labour, eclampsia, puerperal sepsis

and obstetric haemorrhage. Assuming access to and utilization of skilled attendants, Graham et al. have suggested that 16–33% of all MDs could potentially be avoided although this estimate has not been supported by any randomized trials (*17*).

According to the findings of Koblinsky et al. (*18*), among others, in countries where the majority of births take place at home without the presence of skilled attendants, it is apparently impossible to reduce maternal mortality to below 100/100 000

Table 2. **Avoidable factors contributing to maternal deaths from the 1992–93 and 2000 Egyptian National Maternal Mortality Surveys (ENMMS)**

Avoidable factors	Total (ENMMS 1992–93) No. (%)[a]	Total (ENMMS 2000) No. (%)[a]
Substandard care from		
Obstetrician	334 (47)	247 (43)
General practitioner	87 (12)	66 (11)
Daya	84 (12)	47 (8)
Midwife	–	26 (4)
Delay in recognizing problem or seeking medical care	304 (42)	172 (30)
No antenatal care	–	110 (19)
Poor quality antenatal care	239 (33)[b]	90 (15)
Lack of blood	45 (6)	92 (16)
Lack of drugs, supplies and equipment in health facilities	15 (2)	33 (6)
Lack of transportation	28 (4)	30 (5)
Long distance to hospital (> 30 km)	–	23 (4)
Lack of anaesthetist/anaesthesia facilities	–	24 (4)
Unwanted pregnancy	36 (5)	14 (2)
No avoidable factors	54 (8)	113 (19)
Total	**718**	**580[c]**

[a] Percentages do not add up to 100% as each death can be due to more than one avoidable factor.
[b] The ENMMS 1992–93 grouped "no antenatal care" and "poor quality antenatal care" into one category.
[c] Interviews could not be completed for 54 of 772 cases in 1992–93 and five of the 585 cases in 2000.

live births. Graham et al. (*17*) have found that disaggregating the data for 50 developing countries revealed a definite negative correlation between the MMR and the number of births attended by doctors. The correlation between MMR and attendance by midwives is also negative but much weaker. It is important to note that although these stand-alone statistics indicate a link, further work is required to confirm its existence. In Egypt, both the number of deliveries that took place in health-care facilities and assistance by skilled birth attendants increased by about 50% between 1992–93 and 2000 (27% and 40.7% and 49% and 60.9%, respectively (Table 4). The number of deaths caused by pregnancy-related hypertensive diseases, obstructed labour and sepsis decreased significantly between the two surveys (Table 1). A reasonable inference is that presence of skilled birth attendants at birth has contributed to reducing MMR in Egypt. The data available do not allow an assessment of the coverage of problematic births, but as 61% of all pregnant women (general population) are assisted during the birth by skilled attendants, at least two-thirds of those with serious conditions should be covered. However, only certain complications such as sepsis and pre-eclampsia can be avoided or treated in most environments, others such as obstructed labour and haemorrhage can be dealt with only if the necessary blood, supplies and equipment, and referral and transportation are available.

Substandard care

Substandard care was a major avoidable factor that caused maternal mortality in 1992–93 and it remained the second key factor in 2000. Access to ANC, recognizing danger signs and seeking professional care can be effective only if quality professional services are available.

Trained professionals. Although comparatively more deaths are linked to substandard care by obstetricians than to other professional categories, this is probably in part due to complicated cases being attended by an obstetrician.

Table 3. **Female deaths, maternal deaths and maternal mortality ratios by region and governorate in the Egyptian National Maternal Mortality Survey (NMMS) 1992–93 and in 2000**

Region or governorate[a]	Maternal mortality ratio 1992–93	(Lower–upper confidence limits) 1992–93	Maternal mortality ratio 2000[b]	(Lower–upper confidence limits) 2000
Metropolitan[c]	233	(197–276)	48	(40–56)
Lower Egypt[d]	132	(118–148)	93	(86–100)
Upper Egypt[e]	217	(195–244)	89	(82–96)
Frontier[f]			120	(78–161)
Total/National	**174**	**(162–187)**	**84**	**(80–89)**

[a] The ENMMSs of 1992–93 and 2000 did not report on all 27 Governorates individually. The frontier regions were not included in the ENMMS 1992–93. The New Valley Governorate is a new settlement area with a big population influx.
[b] The national MMR values are statistically significantly different between 1992–93 and 2000 (*P*-value < 0.0001).
[c] Metropolitan: urban areas of Cairo, Alexandria, Port Said and Suez.
[d] Lower Egypt: more developed parts of northern Egypt.
[e] Upper Egypt: less developed rural parts of southern Egypt.
[f] Frontier: sparsely populated areas bordering Israel, Libyan Arab Jamahiriya and Sudan.

Table 4. **Changes in the main intermediate indicators in Egypt between 1992–93 and 2000**

Indicator	EDHS 1992[a]	EDHS 2000[a]	% change
Contraceptive prevalence (%)	47.1	56.1	19% increase
Total fertility rate	3.9	3.5	decrease
Neonatal mortality rate (per 1000 live births)	33	24	27% decrease
Infant mortality rate (per 1000 live births)	62	44	29% decrease
Mortality rate for children under 5 years (per 1000 live births)	85	54	36% decrease
Women receiving any ANC[b] (%)	52.9	52.9	35% increase
No of ANC[b] visits: 1 ANC visit	12.3	3.2	
2–3 ANC visits	17.4	9.1	
≥4 ANC visits	22.5	36.7	
Don't know/missing	0.7	3.9	
Presence at delivery of skilled attendant (%)	40.7	60.9	50% increase
No. of institutional deliveries	27	49	82% increase
No. of health units per 100 000 population	12	13	increased
No. of hospital beds per 100 000 population	196	211	increased
No. of primary health care facilities	3329	3575	increased
No. of maternity units	–	170	increased
Women's education: Completed secondary/higher education	13	22	increased
Completed primary/some secondary	19	22	increased

[a] The Egyptian Demographic and Health Surveys (EDHS) results span a period of 5 years preceding the date of publication. The study group comprised all pregnant women in Egypt.
[b] Antenatal care.

The number of deaths caused by substandard care by obstetricians had diminished by about one-third in 2000. Table 1 shows that the numbers of MDs due to APH, sepsis and pregnancy-related hypertensive diseases had dropped. Because abortion is illegal in Egypt it is most likely under-reported. However, if this was the case in both 1992–93 and 2000, the results remain comparable.

Diagnosis and treatment of (pre-)eclampsia with magnesium sulfate has been strongly promoted in Egypt and detailed medical protocols have been developed. Infection control measures have been a major concern at all levels of the medical profession and the various MCH/MOHP programmes have increased their focus in this area. Although MDs due to sepsis have diminished since 1992–93 (Table 1), it is still the third main, single cause of death.

Establishing competency-based field training and introducing updated, detailed medical protocols are key components of the Safe Motherhood HM/HC programme in Egypt.

The health facility level

The MCH programmes in Egypt have included components focused on strengthening facilities at the essential obstetric care and primary health care levels (e.g. provision of equipment, drugs and supplies and structural upgrades) as shown in Table 6 (web version only, available from: http://www.int/bulletin). The number of health units and the number of hospital beds per 100 000 inhabitants as well as the number of primary health care and maternity facilities had all increased between 1992 and 2000 (Table 4).

The number of deaths caused by lack of available blood had increased between 1992–93 and 2000. An Egyptian-Swiss project has recently restructured the Egyptian Blood Transfusion Service, but the various programmes that have attempted to correct the situation have only been running since 1998. State-of-the-art blood banks operating independently from hospitals have been established; blood drives (in which vans drive around to collect blood donations) have been conducted; and detailed protocols have been put into place. Improvements to the system are continuing but are unlikely to show an impact for several more years (unpublished report, 2003).

The community level
Antenatal care

ANC comprises a variety of services, including providing patients with information, treating existing conditions and screening for risk factors (19). ANC is also seen as a proxy indicator for the socioeconomic status of women, thus obscuring the direct impact it may have on MMRs. A rise in utilization of ANC has been associated with better community awareness, but may also be linked to better access to care. The mass-media messages and campaigns as well as community outreach programmes in Egypt have stressed the importance of ANC and the recognition of danger signs that indicate the need for professional help.

According to the Egyptian Demographic and Health Surveys (EDHS), in both 1992 and 2000, 47.1% of pregnant women in Egypt received no ANC. However, the frequency of visits had increased; in 2000, 36.7% pregnant women made four or more visits to ANC facilities compared to 22.5% in 1992 (Table 4). The EDHS further reported that ANC was most likely to have been received by women of lower parity and/or by women in urban areas. More attendances for ANC increase the chances of detecting pregnancy-related problems. It also offers the medical staff a chance to educate women regarding the danger signs and measures to be taken. However, it is the subgroups most at risk (i.e. women in rural areas who have further to travel to hospitals and those of lower socioeconomic status and/or of high parity) that are least likely to receive ANC. Campaigns and programmes aimed at improving ANC coverage have apparently not reached their goal although it is difficult to assess their exact impact on the reduction of the MMR

Table 5. **Major maternal health interventions by the Egyptian Ministry of Health and Population 1985–2005 and their area of impact[a]**

Intervention	Programme[b]	Avoidable factor — category
Establishment of a daya training programme	CSPE	Providers
Introduction of a revised curriculum and pre-service training in nursing and medical schools	CSPE	Providers
In-service training to upgrade skills of health providers in MCH[c] service delivery. A competency-based training method was pilot-tested in selected governorates	CSPE	Providers
Introduction of service standards for improved clinical management	CSPE	Providers
Providing equipment to strengthen health and laboratory facilities	CSPE	Health facilities
Training laboratory technicians in the proper use of upgraded MCH[c] laboratories	CSPE	Providers
Initiation of the development of an improved, computerized health information system	CSPE	Health facilities
Implementation of systems for improved and decentralized planning, management and supervision	CSPE	Health facilities
Organization of mass media campaigns	CSPE	Communities
Development of standards of care	MCEP	Providers
Strengthening of institutional capacity to improve maternal health	MCEP	Health facilities
Increasing community awareness and participation	MCEP	Communities
Enhancement of national policy environment for maternal health	MCEP	Providers, health facilities and communities

[a] The Healthy Mother/Healthy Child (HM/HC) result package (later the HM/HC Project) (1998–2005) essentially undertakes the same tasks as the previous project, but on a larger scale. Further details and results of the activities described above can be found in the final reports of the respective projects (*1, 2, 3*).
[b] CSPE, Child Survival Project Egypt (1985–96); MCEP, MotherCare Egypt Project (1996–98).
[c] Maternal and child health.

in Egypt. Possibly more importantly, antenatal care has had an indirect influence by helping to raise the awareness of women of how to recognize danger signs and the necessity for seeking professional help. This would be reflected by the increased number of deliveries in health-care facilities (82% increase between 1992–93 and 2000), births attended by skilled attendants (Table 4) and 142 fewer deaths in 2000 than in 1992–93 caused by a delay in recognizing a problem or in seeking medical care (Table 2).

A WHO worldwide ranking of causes of death by actual number showed that haemorrhage was the predominant cause, followed by sepsis, unsafe abortion, (pre-)eclampsia, obstructed labour and other direct causes (*20*). As stated by Bergsjo (*21*), the causes of haemorrhage differ and are mostly unpredictable. Sometimes, for example, in the early detection of placenta praevia, referral for sonographic investigation and management can prevent death. In Egypt, the number of deaths caused by PPH, but not the number caused by APH, was greater in 2000 than in 1992–93. The problem of dealing with haemorrhage was compounded by the increasing lack of available blood in emergency situations. It is possible that increased ANC attendance has led to a better recognition of the problem of APH whereas PPH, especially in the first 48 hours after delivery, may not yet be recognized by women or family members as a sign of danger. Furthermore, the traditional belief, still held in many rural areas, that a woman should not leave her home in the first 40 days postpartum needs to be addressed (at present, social workers are encouraged to make home visits).

Egyptian mothers who had been educated at least to secondary level made more ANC visits (EDHS 1992 and 2000). Education may also induce women to seek medical care for

bleeding. Sepsis is not predictable and ANC can only assist by educating women on the dangers of giving birth in an unclean environment. Early detection of (pre)-eclampsia is possible and those at high risk should be followed more closely. But the number of women at low risk who might still develop the condition is extremely high and not all can be followed closely. Obstructed labour is unpredictable. Given that the estimated average interval from onset of major obstetric complications to death ranges from 2 hours (postpartum haemorrhage) to 6 days (sepsis) (*22*), and because most complications cannot be predicted, the usefulness of ANC seems to be more restricted than has often been implied.
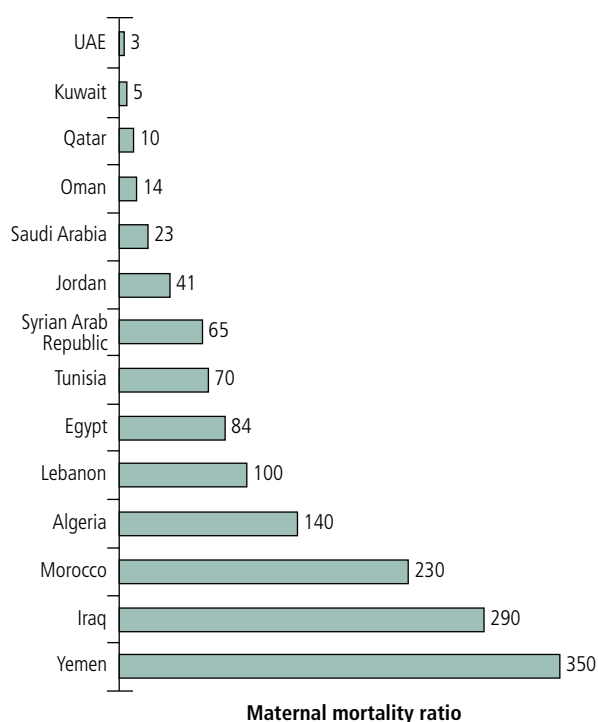
Education and socioeconomic status

Women's general education improved during the 1990s, especially in terms of the numbers who received higher education, and this has no doubt improved their socioeconomic status. This in turn, should lead to better medical coverage, better health conditions and an improved knowledge and use of contraceptive measures (Table 4). The lowest and highest age groups (15–19 and 40–50 years) as well as women who have had a large number of deliveries are most at risk. Longer and better education should reduce the number of early pregnancies and improved contraceptive measures should reduce the number of unwanted, late pregnancies.

Conclusion

A documented, reduction in MMR over a relatively short time demonstrates the collective effect of an integrated national Safe Motherhood programme aimed at making improvements at
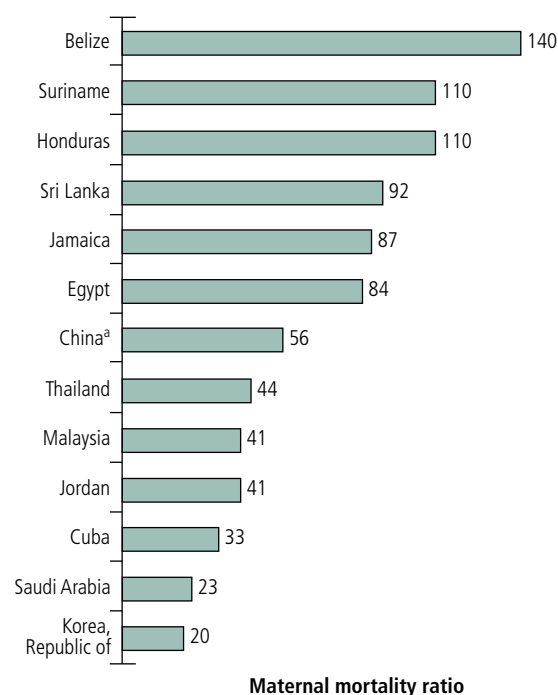
Fig. 1. **Maternal mortality in selected countries**

Country	Maternal mortality ratio
UAE	3
Kuwait	5
Qatar	10
Oman	14
Saudi Arabia	23
Jordan	41
Syrian Arab Republic	65
Tunisia	70
Egypt	84
Lebanon	100
Algeria	140
Morocco	230
Iraq	290
Yemen	350

Maternal mortality ratio

UAE = United Arab Emirates
Source: ref. *23*. Reproduced with permission of the copyright holder.
WHO 05.19

Fig. 2. **Maternal mortality based on the Reproductive Age Mortality Study-based (RAMOS) method**

Country	Maternal mortality ratio
Belize	140
Suriname	110
Honduras	110
Sri Lanka	92
Jamaica	87
Egypt	84
China[a]	56
Thailand	44
Malaysia	41
Jordan	41
Cuba	33
Saudi Arabia	23
Korea, Republic of	20

Maternal mortality ratio

[a]Including Macao and Hong Kong Special Administrative Regions.
Data collected between 1993 and 2000.
WHO 05.20

the community, health-care delivery site and health-care professional levels. The intensive training received by the medical personnel apparently had a positive effect on reducing the MMR in the 1990s in Egypt. It is more difficult to quantify what direct impact infrastructural improvements, increased utilization of ANC and the presence of skilled attendants at birth have had.

In recent years, the Egyptian MOHP has focused its efforts and resources through the Safe Motherhood programme-HM/HC Project on a regional basis, starting in Upper Egypt and moving towards the north of the country. By addressing all aspects of the maternal health system within a defined area, the MOHP has demonstrated the collective effectiveness of implementing a multidisciplinary approach to MMR. Such a model of intervention may have global applications.

The majority of the above-mentioned intermediate indicators related to maternal deaths improved in Egypt between 1992–93 and 2000 with an associated reduction of the MMR. The network of adequate essential obstetric care and primary health care facilities has been improved, and long distance to a hospital and lack of transportation are now less of a barrier to care. However, the recognition of the value of preventive ANC services, and the recognition of emergency situations by pregnant women and family members, and seeking and receiving appropriate medical care remain problematic. This may be linked to the perceptions in the community of the quality of ANC and emergency services available. Vast improvements in nearly all areas have been made and the reduction of the MMR between 1992–93 and 2000 of 52% is a clear indication that the measures taken have had a great impact. Reducing the MMR below 84/100 000 live births may necessitate a larger effort for a smaller result. But it is clear that to further reduce the

MMR in Egypt, sustained training and monitoring of medical and administrative staff, an improved referral system, further community outreach programmes and awareness campaigns would be key measures.

In the countries shown in Fig. 1, the rates of maternal mortality seem to correlate with the per capita income (see World Bank ranking, *24*), and Kuwait and the United Arab Emirates have low MMRs by international standards. In this context, Egypt's maternal mortality is lower than its per capita income would predict.

If the MMR in developing countries is assessed using a RAMOS-based method (Fig. 2), Egypt ranks in the middle. Clearly, the measures taken in the form of the Safe Motherhood programmes have yielded satisfactory results, placing Egypt on a level with socioeconomically comparable, successful countries. However, it may also be inferred that further improving the MMR will be tightly linked to the improvement of Egypt's overall economic situation.

The two surveys probably underreported deaths among women as well as maternal deaths, to some extent, for reasons such as the illegality of abortion and the sampling effect in 18 governorates (partially corrected through weighting). Also, when compared to the expected number of deaths among women, there was an unexpected deficit in the reported numbers of deaths in women in the nine governorates in which all health bureaus were sampled. After correcting for this shortfall, the national MMR was calculated to be 94/100 000 live births. By and large, the surveys were comparable and clearly indicate the trend towards reduced maternal mortality in Egypt. These surveys were expensive and did not produce data in a timely fashion. A maternal mortality surveillance system is therefore being put into place in Egypt. The maternal mortality surveillance

Résumé

La mortalité maternelle en Egypte a baissé de moitié entre 1992-93 et 2000

Dans le cadre de deux enquêtes sur la mortalité maternelle réalisées en Egypte en 1992-93 et en 2000, des données ont été recueillies auprès d'un échantillon représentatif de bureaux de santé couvrant toute l'Egypte, à l'exception de cinq gouvernorats frontaliers couverts uniquement par l'enquête ultérieure, au moyen des formulaires sur les données d'état civil. Le nombre des décès maternel a été déterminé et des entretiens ont été organisés. Les causes médicales des décès et les facteurs évitables ont été déterminés. Les résultats ont fait apparaître une baisse de 52% du taux de mortalité maternelle au cours de cette période (de 174 à 84/100 000 naissances vivantes). L'enquête nationale sur la mortalité maternelle de 1992-1993 a montré que le taux était plus élevé dans les zones métropolitaines et en Haute Egypte qu'en Basse Egypte. Face à ces résultats, le Ministère égyptien de la santé et de la population a intensifié les activités de ses programmes pour une maternité sans risque en Haute Egypte et la situation dans cette région s'était inversée en 2000. Les indicateurs intermédiaires et de résultat indiquent que les interventions de santé maternelle ont surtout influé sur les facteurs de mortalité évitables « mauvaise qualité des soins dispensés » et « reconnaissance tardive des problèmes ou recours tardif aux soins ». Les améliorations considérables dans ces domaines sont certainement dues en partie à la formation dispensée sur une grande échelle, à la révision des programmes d'études, à la publication de protocoles médicaux et de normes applicables aux services, à l'amélioration des installations et au succès des programmes de vulgarisation communautaires et aux campagnes médiatiques. Des effets moindres ont été obtenus sur l'utilisation des soins prénatals. Les autres domaines qui restent problématiques sont l'insuffisance des stocks de sang, de médicaments et de matériel. Si le nombre des décès maternels liés à des hémorragies a considérablement baissé, celles-ci restent la cause principale de mortalité.

Le recul de la mortalité maternelle dans les années 90 sous l'effet des programmes Pour une maternité sans risque a été impressionnant, signe de la capacité d'adapter les interventions en fonction des données de l'enquête nationale sur la mortalité maternelle de 1992-1993 et de 2000. Le système national de surveillance de la mortalité maternelle en cours de mise en place en Egypte aidera à assurer la disponibilité continue d'informations pour orienter et évaluer les programmes destinés à réduire la mortalité maternelle.

Resumen

La razón de mortalidad materna en Egipto, reducida a la mitad entre 1992–1993 y 2000

En dos encuestas sobre la mortalidad materna realizadas en Egipto en 1992–1993 y en 2000, se emplearon los formularios del registro civil para reunir datos de una muestra representativa de oficinas sanitarias que abarcaban todo Egipto, salvo cinco prefecturas fronterizas incluidas sólo en la última encuesta. Se determinó el número de defunciones maternas y se realizaron entrevistas. Se determinaron asimismo las causas médicas de defunción y los factores evitables. Los resultados indican que la razón de mortalidad materna (RMM) disminuyó un 52% en ese periodo (de 174 a 84/100 000 nacidos vivos). La Encuesta Nacional de Mortalidad Materna correspondiente a 1992–1993 reveló que las zonas metropolitanas y el Alto Egipto tenían una RMM mayor que el Bajo Egipto. En respuesta a esos resultados, el Ministerio de Salud y Población redobló los esfuerzos de sus programas de Maternidad sin Riesgo en el Alto Egipto, como consecuencia de lo cual en el año 2000 la situación regional se había invertido. El análisis de los indicadores intermedios y de resultados lleva a pensar que el mayor efecto de las intervenciones de salud materna fue el que acusaron los factores de defunción evitables descritos como «atención inferior a la norma por los proveedores de salud» y «demoras en el reconocimiento de los problemas o la búsqueda de atención médica». Las enormes mejoras registradas en estas áreas se deben en parte sin duda a las amplias actividades de formación emprendidas, la revisión de los programas de estudios, la publicación de protocolos médicos y de estándares para los servicios, la mejora de las instalaciones, y el éxito de los programas de extensión comunitaria y las campañas en los medios de comunicación. El impacto en el recurso a la atención prenatal ha sido menos satisfactorio. Otro aspecto aún problemático es el suministro insuficiente de sangre, medicamentos y equipo. Aunque el número de muertes maternas relacionadas con hemorragias se ha reducido drásticamente, este factor sigue siendo la causa principal de defunción.

La disminución de la mortalidad materna registrada en los años noventa en respuesta a los programas de Maternidad sin Riesgo fue muy notable, y demuestra claramente que es posible adaptar las intervenciones en función de los datos de las encuestas nacionales de mortalidad materna de 1992–1993 y 2000. A fin de garantizar la continua disponibilidad de información de utilidad para orientar y evaluar los programas de reducción de la mortalidad materna, se está desarrollando en el país un sistema de vigilancia nacional de dicha mortalidad.

Policy and Practice

Oona Campbell et al.   Maternal mortality rates in Egypt

Arabic

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Table 6. **"Pathway to survival"**, summary of results of Egyptian National Maternal Mortality Survey (ENMMS) 1992–93 and 2000 and recommendations

Steps in pathway to survival	Findings of ENMMS, 1992–93	Findings of ENMMS, 2000	Recommendations 2000
Problem: Level of mortality Major cause of death Regional levels	• MMR[a]:174 Major causes: haemorrhage hypertensive disease sepsis • MMR[a]: Upper Egypt (217) Lower Egypt (132) Metropolitan (233) 92% avoidable causes	• MMR: 84 Major causes: haemorrhage hypertensive disease ruptured uterus • MMR[a]: Upper Egypt (89) Lower Egypt (93) Metropolitan (48) 81% avoidable causes	• Mortality dramatically reduced; continue MOHP[b] 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 + 24 hrs (39%) postpartum (36%) • 42% of deaths due to delay in seeking care or nonadherence to medical advice • 42% postpartum deaths and 65% sepsis deaths after delivery at home • 17% of women who died had contraceptive failure	• Death during: pregnancy (24%) delivery + 24 hrs (49%) postpartum (27%) • 30% of deaths due to delay in seeking care or non-adherence to medical advice • 20% postpartum deaths and 33% sepsis deaths after delivery at home • 6% of women who died had contraceptive failure	• 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: Behaviour Motivation Barriers	• 71% sought health care • 36% died at home	• 93% sought care • 29% died at home	• Research on why home deliveries at high risk for sepsis, haemorrhage and cardiac disease
Step 3: Logistics to provide quality care: Transport Stabilization Referral	• 64% died in health facility • 4% died due to lack of transportation	• 62% died in health facility • 5% died due to lack of transportation; 9% died during transportation • 13% died because first provider failed to manage and refer	• Emergency referral procedures must be clear and known; providers should receive specific training in stabilization, e.g. PPH[c]
Step 4: Quality care providers Technical competence Effectiveness of treatment Efficiency Safety	• Substandard care by obstetric team contributed to 47% of deaths • GPs[d] to 12% deaths • 32% of CS[e] deaths occurred in private clinics • 15% of deaths from ruptured uterus occurred in private clinics • Dayas contributed to 12% of deaths overall and 37% of deaths due to sepsis • 33% had poor quality ANC[f] • 5.7% fetuses/infants died; 43% of those whose mother died in delivery or postpartum	• Substandard care by obstetric team contributed to 43% of deaths • GPs[d] to 11% of deaths • 47% of CS[e] deaths occurred in private clinics • 31% of deaths from ruptured uterus occurred in private clinics • Dayas contributed to 8% of deaths overall and 17% of deaths due to sepsis • 19% had poor quality ANC[f] • 5.0% fetuses/infants died; 34% of those whose mother died in delivery or postpartum	• Protocols for managing obstetric emergencies should be implemented nationwide and their use supervised; competency-based training modules should be used for in-service and pre-service training • Promotion and licensing; 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, anaesthetists**	• 6% died from lack of blood (14% APH,[g] 20% PPH,[c] 11% CS[e]). • 2% due to lack of equipment, supplies and drugs	• 16% died from lack of blood (22% APH,[g] 31% PPH,[c] 38% CS[e]) • 6% due to lack of equipment, supplies and drugs • 4% due to lack of anaesthetists	• Identify and correct problems in blood supply • Recruit, train and retain more anaesthetists in district hospitals

[a] MMR = maternal mortality ratio.
[b] MOHP= Ministry of Health and Population.
[c] PPH = postpartum haemorrhage.
[d] GP = general practitioner.

[e] CS = caesarean section.
[f] ANC = antenatal care.
[g] APH = antepartum haemorrhage.