

Fifty years of Sudanese hospital-based obstetric outcomes and an international partnership

VM Carlson,^a MI Omer,^b SA Ibrahim,^c SE Ahmed,^d KJ O'Byrne,^e LC Kenny,^f CA Ryan^g

^a School of Medicine, College of Medicine and Health, University College Cork, Cork, Ireland ^b Consultant Obstetrician and Gynaecologist, Department of Obstetrics and Gynaecology, Omdurman Maternity Hospital, Omdurman ^c Department of Paediatrics, Faculty of Medicine, University of Khartoum, Khartoum, Sudan ^d Department of Paediatrics and Child Health, College of Medicine and Health, University College Cork, Cork University Hospital, Wilton, Cork ^e School of Medicine, College of Medicine and Health, University College Cork, Cork

^f Department of Obstetrics and Gynaecology, Anu Research Centre, College of Medicine and Health, University College Cork, Cork

^g Departments of Neonatology, Paediatrics and Child Health, College of Medicine and Health, University College Cork, Cork University Maternity Hospital, Wilton, Cork, Ireland

Correspondence: Prof. CA Ryan, Departments of Neonatology, Paediatrics and Child Health, College of Medicine and Health, University College Cork, Cork University Maternity Hospital, Wilton, Cork, Ireland. Email tony.ryan@ucc.ie

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Objective To present 50 years of hospital-based maternal and perinatal outcomes in Sudan, and the role of an international collaboration with an Irish maternity hospital, over the period 2002–2009, in recent health-indicator improvements.

Design Retrospective descriptive study.

Setting Omdurman Maternity Hospital, Sudan.

Population All women who delivered at Omdurman Maternity Hospital, and their newborn infants, from July 1957 to October 2007, comprising 339 448 births.

Methods The original logbook data was extracted. Infant and maternal health indicators were calculated according to World Health Organization definitions.

Main outcomes measures Total annual births, maternal mortality ratio and maternal complications, neonatal mortality and stillbirth rates, and rates of delivery methods.

Results Total births increased 50-fold from 499 in 1958 to 24 913 in 2007. Significant reductions in morbidity and mortality began in the mid-1990s. From 2001 to 2007, maternal mortality fell from 329 to 36 per 100 000 live births: an 85% reduction. Stillbirth rates almost halved, from 35 to 19 per 1000 births in 2001 and 2007, respectively. Neonatal mortality rates remained largely static, at 24 per 1000 live births in 2007, but there is recent evidence of a decline.

Conclusion This hospital-based data offers a unique historical portrait of health outcomes in one of the largest maternity hospitals in Africa, and shows steady, sustained improvements in maternal, stillbirth and neonatal mortality rates since the 1990s. The partnership was associated with a number of positive infrastructural, educational, and staffing achievements. Whether it directly contributed to improved health outcomes has not been established.

Keywords International development, neonatal outcomes, obstetric outcomes, perinatal outcomes, Sudan.

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Introduction

According to the most recent World Health Statistics report from the World Health Organization in 2010,¹ Sudan's reported maternal mortality ratio (MMR) estimate was 1107 deaths per 100 000 live births. This is above the African regional estimate of 900 per 100 000 live births, and is significantly higher than the estimated MMR in the European region of 27 per 100 000 live births. Likewise, neonatal mortality in Sudan is significant, at 41 per 1000

live births, compared with less than ten per 1000 live births in Europe.¹

Omdurman Maternity Hospital (OMH), in metropolitan Khartoum, is the largest maternity hospital in Sudan. It was founded in 1957, the year following Sudanese independence from Anglo-Egyptian rule. In 2002, a number of UK- and Irish-trained Sudanese physician returnees were appointed in OMH, and were charged with improving health-systems management, and upgrading hospital facilities, equipment, staffing levels, training, and education.

Cork University Maternity Hospital (CUMH) was founded from the amalgamation of three pre-existing maternity hospitals in Cork city, and was opened in 2007. As they prepared for transition, staff from all three hospitals committed themselves to donating extraneous supplies and equipment to a developing country. In the process of organising such a transfer, a formal partnership was formed with OMH.

The purpose of this report is to present the historical maternal and perinatal outcomes data from OMH, as well as the outputs and practical achievements of the partnership, and the possible impact of this partnership on maternal mortality and perinatal outcomes.

Methods

Context

Sudan was chosen as the target nation of the partnership in recognition of the large number of Sudanese doctors who had contributed to Irish maternity services, two of whom were in senior positions in obstetrics and neonatology at Cork. A further advantage was that most doctors in Sudan, to date, complete their education in English, thereby facilitating educational exchanges. The ignition point started with the establishment of a successful, continuing neonatal resuscitation programme in 2002, resulting from a collaboration between Cork and Khartoum. In addition, the Sudanese Ministry of Health had attracted a number of senior UK/Irish-trained Sudanese obstetricians, anaesthetists, and neonatologists home, with the promise of resources and political support for this large and historical public hospital. These physicians encouraged the implementation of several evidence-based/best practices aimed at reducing maternal and perinatal morbidity and mortality. Table 1 lists these changes.

Partnership objectives

The objectives of the Cork–Omdurman partnership project (COPP), defined following bilateral talks between the partners, were to develop an international healthcare partnership model in mother and child care, implemented through educational and research exchanges and the application of evidence-based practice, along with improvements in infrastructure undertaken in partnership with the Sudanese Ministry of Health.

Partnership delivery

Direct financial aid for the project was delivered via a grant of €165 000 from Irish Aid, the Government of Ireland's programme of assistance to developing countries. This was awarded in 2005 following a competitive application process. In addition to these funds, it was agreed that the Sudanese Ministry of Health would

match the Irish contribution with capital investment in OMH.

Delivery of the project was also realized through indirect financial aid. Broadly, this came in the form of equipment, organization, and education. The amalgamation of the three Cork maternity hospitals into a newly built facility allowed for the donation of a significant quantity of equipment in good working order, including beds, cots, incubators, warmers, ventilators, and surgical and anaesthetic equipment. Other project donations included infant clothing, medical books, urodynamic equipment, and an ambulance refitted by the Cork Fire Service. Organisational assistance was offered, pro bono, by Prospectus, a consulting agency based in Dublin, who helped develop a contract for the COPP. Finally, education was a longitudinal contribution to the project, delivered via scheduled visits to OMH. From the outset, a multidisciplinary approach was maintained, including doctors, midwives, and technicians from the two countries working collaboratively. Although most doctors in Sudan are educated in English, many of the midwives do not have English as a second language. Therefore, most of the midwives were trained in Arabic by Sudanese doctors, with the hopes for further cascade training in midwifery.

Data collection

Annual perinatal and obstetric outcomes data, including details of maternal mortality, perinatal mortality, delivery methods, and maternal complications, have been recorded in a logbook at OMH since its inception in 1957. These data enabled the evaluation of the outcomes of the partnership project, as well as a retrospective evaluation of historical trends. The logbook records were transcribed into Excel, and infant and maternal health indicators were calculated according to World Health Organization definitions.¹ A second logbook was maintained that contained contemporaneous records of deliveries complicated by mortality, and the underlying cause(s). Causes of maternal deaths (1990–2007) were retrieved manually from these records.

Results

Obstetrical practices

The OMH data provides a unique picture of 50 years of obstetrical practice in a large developing country (Figure 1; Table 2). There was a consistent rise in the total number of births (Figure 1) from 499 in 1958 to 10 000 in the mid-1990s. In the following 10 years, the number of births more than doubled. Caesarean section rates rose steadily up to 10%, then plateaued until around 1990, after which a steady rise occurred to the current rate of 25%. Assisted delivery rates, mainly by forceps until the 1990s, have

Table 1. Partnership design and delivery of the Cork Omdurman Partnership Project (COPP)

Inputs	Project delivery	Evidence of delivery
<p>In order to accomplish our goals we developed and dedicated the following resources to COPP:</p> <p>1. Partnership and jointly agreed objectives developed</p> <p>2. Multidisciplinary educational visits to OMH (2002–2009)</p> <p>3. Evidence-based measures consolidated at OMH</p> <p>a. Magnesium sulphate/hydralazine for eclampsia</p> <p>b. Misoprostol for postpartum haemorrhage</p> <p>c. Improvements in blood-bank services</p> <p>d. Prophylactic antibiotics</p> <p>e. Thromboprophylaxis</p> <p>f. Improvements in anaesthetic services</p> <p>g. Guidelines and management protocols</p> <p>h. Audit and quality control</p> <p>i. Expansion/upgrade of antenatal care</p> <p>j. Continuous training</p> <p>k. 24-hour consultant cover on OMH site</p> <p>l. NRP training</p> <p>4. Irish Aid Grant Application and equipment from Cork hospitals to be matched by Sudan Ministry of Health in capital development and improved infrastructure at OMG</p> <p>5. Other COPP activities included: Staff coffee mornings for fundraising Baby clothing and medical book collections Ambulance refitted by Team B, Cork Fire Service</p>	<p>In order to deliver COPP, we conducted the following activities:</p> <p>Health professionals who travelled to OMH Five midwives Two obstetricians Two paediatricians Four EMTs One administrator One respiratory technician Two biomedical technicians</p> <p>Direct financial aid, matched by the Sudanese Ministry of Health Irish Aid grant €165 000 (2005)</p> <p>Indirect financial aid, matched by the Sudanese Ministry of Health Used equipment: as new est. €1.2 million, packed and delivered to OMH in five containers</p> <p>Organisational Prospectus pro bono partnership contract (equiv. €20 000)</p> <p>Educational 19 sessions with nine visits in multidisciplinary teams</p>	<p>COPP produced the following evidence of service delivery:</p> <p>Nine team visits to OMH</p> <p>Two return visits from OMH</p> <p>One new special care baby unit (Ministry of Health) and equipped (Irish Aid)</p> <p>One new general laboratory (Ministry of Health) and equipped (Irish Aid)</p> <p> Beds, cots, incubators, warmers, ventilators, anaesthetic equipment, transferred from three Cork maternity hospitals (Erinville, St Finbarr's, and Bon Secours hospitals)</p> <p>OMH hygiene audit carried out and audit loop closed</p> <p>Arrangements for OMH waste to be disposed by a private company</p> <p>One incinerator installed</p> <p>Two commercial washing machines for OMH laundry</p> <p>One IT technician from OMH visited Cork (2006)</p> <p>Two biomedical engineers from Cork visited OMH (2009)</p> <p>English language</p> <p>Seven provider NRP courses</p> <p>450 doctors trained</p> <p>Seven instructor NRP courses delivered</p> <p>Arabic language</p> <p>Two provider NRP courses</p> <p>83 midwives trained</p> <p>Four obstetrical management and emergency courses</p> <p>Three emergency response courses</p> <p>One ambulance sent to OMH</p>

consistently been under 5%. The rapid rise in caesarean sections that began in the 1990s was associated with a fall-off in the number of assisted deliveries, which were almost non-existent in 2007.

Mortality and morbidity

The records for maternal mortality (Figure 1) began in 1970, and numbers fluctuated between 250 and 725 maternal deaths per 100 000 live births for several decades. There

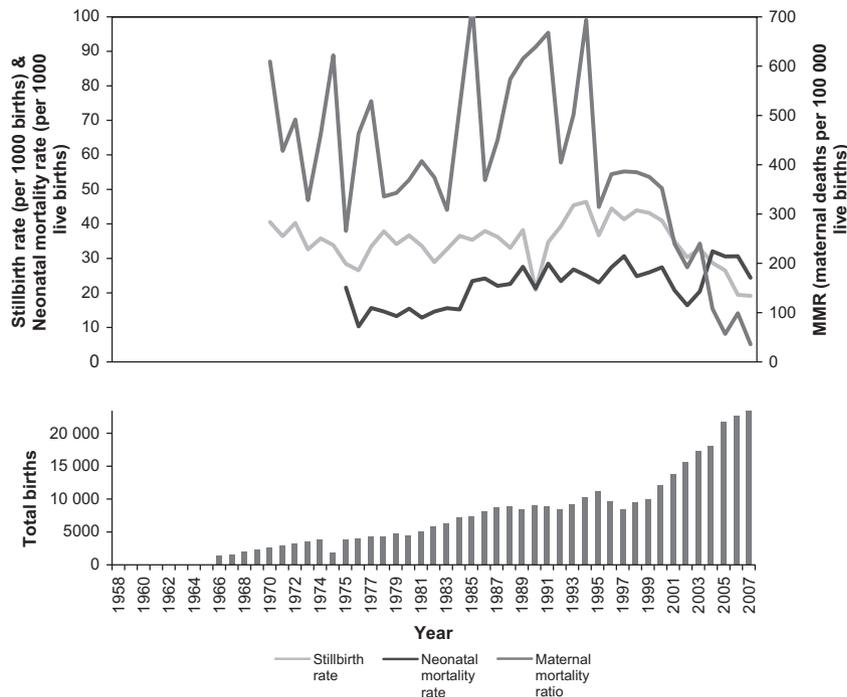


Figure 1. Total births and maternal and perinatal mortality, Omdurman Maternity Hospital, 1958–2007.

was a persistent drop from 1997 to a ratio of 36 per 100 000 live births in 2007.

The causes of in-hospital maternal deaths were examined over 17 years (1990–2007; Table 2). The cause was identified in 70% of cases, and the most common among these known causes of maternal death included: hypertensive disorders (16%); haemorrhage (16%); hepatitis/hepatic failure (11%); sepsis (10%); and pulmonary embolism (4%). Other direct and indirect causes of maternal deaths were 5 and 9%, respectively. Although deaths from haemorrhage and hepatic failure have remained constant, there was a gradual fall in deaths from sepsis over the course of the 17-year period. Deaths from hypertensive disorders spiked intermittently, and one such death occurred in 2007.

Rates of obstetric complications including ante- and postpartum haemorrhage, pre-eclampsia, and eclampsia are shown in Table 2. The incidence of antepartum haemorrhage rose until 1970, followed by a rapid decline in the late 1970s. In subsequent years, rates remained steady around 20 per 1000 births. Rates began a steady decline in 1993, and have remained under 20 per 1000 births. Postpartum haemorrhage data were tabulated from the late 1970s onwards, and remained around ten per 1000 births until the early 1990s, from which time a steady drop has been seen. Rates of pre-eclampsia fluctuated between 30 and 60 per 1000 births until starting a decline in 1999 to levels below ten per 1000 births in recent years. Data for eclampsia were recorded from 1974 onwards, and rates gradually rose until starting to decline slightly in the mid-

1990s, and have remained largely static at levels just below 10 per 1000 births.

Despite the cause of death being unknown in 30% of cases, case fatality rates (CFRs) were calculated for haemorrhage and hypertensive disorders from 1990 to 2006 (Table 3). Both CFRs fluctuated over the years, but exhibited the longest sustained declines from 2002 (haemorrhage) and 2003 (hypertensive disorders), respectively.

Between 1970 and the late 1990s, stillbirths persistently remained around the level of 30–40 per 1000 births (Figure 1). Rates began to decline around 1999, dropping by more than one-third to a level of 19 per 1000 births in 2007. Neonatal mortality remained <20 per 1000 live births until 1985, then rose slightly to rates between 20 and 35 per 1000 live births for the following 20 years (Figure 1).

We do not have a complete data set on the causes of neonatal deaths in OMH. However, in 1 month in 2009, 2600 births resulted in 206 neonatal admissions, 41 of whom died (20%). Of the 153 term babies admitted, 20 died, the majority (13) from asphyxia. The remaining deaths were to the result of congenital anomalies and infection. Of the 53 preterm infants admitted that month, 21 died (40%), mainly from respiratory failure and infection. The annual death rate among neonatal admissions was 13% in 2009, a significant improvement from over 30% prior to 2007.

Partnership outputs

The outputs of the partnership project are presented in Table 1.

Table 2. Maternal morbidity and mortality, Omdurman Maternity Hospital, 1958–2007

Year	Rates of obstetric complications				Major causes of maternal mortality			
	Antepartum haemorrhage	Postpartum haemorrhage	Pre-eclampsia	Eclampsia	Hypertensive disorders	Haemorrhage	Sepsis/infection	Hepatitis/hepatic failure
	per 1000 births				n (% of total maternal deaths)			
1958	22	–	34	–	–	–	–	–
1959	17	–	33	–	–	–	–	–
1960	54	–	42	–	–	–	–	–
1961	23	–	55	–	–	–	–	–
1962	37	–	47	–	–	–	–	–
1963	42	–	54	–	–	–	–	–
1964	62	–	62	–	–	–	–	–
1965	44	–	58	–	–	–	–	–
1966	46	–	64	–	–	–	–	–
1967	46	–	49	–	–	–	–	–
1968	30	–	56	–	–	–	–	–
1969	34	–	40	–	–	–	–	–
1970	32	–	47	–	–	–	–	–
1971	29	–	46	–	–	–	–	–
1972	25	–	45	–	–	–	–	–
1973	18	–	40	–	–	–	–	–
1974	28	–	31	–	–	–	–	–
1974a*	2	–	33	3	–	–	–	–
1975	22	–	39	5	–	–	–	–
1976	18	–	59	4	–	–	–	–
1977	25	11	55	6	–	–	–	–
1978	28	14	84	6	–	–	–	–
1979	20	10	42	3	–	–	–	–
1980	21	12	41	4	–	–	–	–
1981	25	8	39	5	–	–	–	–
1982	21	8	66	6	–	–	–	–
1983	20	9	60	5	–	–	–	–
1984	22	14	51	7	–	–	–	–
1985	21	8	46	8	–	–	–	–
1986	19	12	38	6	–	–	–	–
1987	20	7	42	6	–	–	–	–
1988	16	10	39	9	–	–	–	–
1989	20	10	51	8	–	–	–	–
1990	14	11	50	8	7 (11)	4 (7)	6 (10)	7 (11)
1991	20	11	68	11	6 (11)	7 (12)	0 (0)	6 (11)
1992	16	9	53	9	7 (21)	5 (15)	1 (3)	7 (21)
1993	22	6	45	11	11 (23)	5 (11)	4 (9)	0 (0)
1994	14	7	36	10	11 (17)	8 (13)	11 (17)	4 (6)
1995	15	5	43	7	7 (21)	5 (15)	8 (24)	0 (0)
1996	18	5	44	9	5 (15)	4 (12)	13 (39)	1 (3)
1997	17	4	38	9	9 (27)	3 (9)	4 (12)	1 (3)
1998	16	6	41	9	5 (13)	2 (5)	3 (8)	5 (13)
1999	13	5	42	9	8 (21)	5 (13)	7 (18)	0 (0)
2000	13	4	36	6	5 (16)	4 (13)	2 (6)	1 (3)
2001	8	3	32	5	2 (6)	5 (14)	4 (11)	6 (17)
2002	8	3	30	7	10 (34)	4 (14)	1 (3)	6 (21)
2003	8	5	19	9	6 (15)	5 (13)	3 (8)	3 (8)
2004	6	4	20	9	1 (5)	4 (21)	3 (16)	3 (16)
2005	5	5	22	6	1 (8)	4 (33)	0 (0)	2 (17)
2006	8	2	18	8	3 (13)	1 (4)	2 (9)	4 (17)
2007	4	2	20	6	1 (13)	3 (38)	0 (0)	1 (13)

*July–December only. Prior to 1975, annual data collected from July–June of the following year. Dates prior to 1975 indicate the year data collection was completed.

Table 3. Case fatality rates for the leading causes of maternal mortality, Omdurman Maternity Hospital, 1990–2006*

Year	Haemorrhage			Hypertensive disorders		
	Cases	Deaths	Case fatality rate	Cases	Deaths	Case fatality rate
1990	223	4	1.8	535	7	1.3
1991	270	7	2.6	698	6	0.9
1992	210	5	2.4	521	7	1.3
1993	256	5	2.0	508	11	2.2
1994	212	8	3.8	475	11	2.3
1995	222	5	2.3	557	7	1.3
1996	222	4	1.8	504	5	1.0
1997	179	3	1.7	392	9	2.3
1998	213	2	0.9	478	5	1.0
1999	180	5	2.8	518	8	1.5
2000	206	4	1.9	506	5	1.0
2001	165	5	3.0	505	2	0.4
2002	174	4	2.3	574	10	1.7
2003	230	5	2.2	483	6	1.2
2004	181	4	2.2	517	1	0.2
2005	222	4	1.8	616	1	0.2
2006	238	1	0.4	588	3	0.5

*2007 data omitted because morbidity data were only available until October.

Discussion

In this study we presented 50 years of previously unpublished, historical data of facility-based obstetric, maternal, and infant health outcomes in one of the largest maternity hospitals in Africa. We have also described the outputs and outcomes of a hospital-based international health partnership. Although the practical outputs of this project are manifold (Table 1), the improvements in health care outcomes in OMH preceded the partnership programme. However, these gains in health outcomes were sustained and consolidated during the partnership years (2002–2009). It is important to recognise that the mortality figures, both maternal and neonatal, recorded at OMH represent institutional perinatal deaths. These in-hospital data are a subset of total maternal mortality, as only 18% of births in Sudan are delivered in a healthcare facility, and only 13.2% are delivered in a public hospital.² Many women present for the first time to OMH in labour or with established pregnancy-related complications. Most mothers with uncomplicated deliveries are discharged within a few hours of delivery, and follow-up is seldom available.

From small beginnings in 1958, when just 499 babies were delivered, the annual number of births at OMH has increased 50-fold in 50 years to 24 913 births. Significant improvements in maternal mortality began in the mid-

1990s. In the lifespan of the international partnership, a reduction in maternal mortality by 85% was recorded. In absolute numbers, 32 women died of pregnancy-related conditions in 2001, compared with just seven in 2007. Still-birth rates have almost halved, and neonatal mortality rates, which had remained largely static up to 2007, are beginning to fall, associated with developments in infrastructure, equipment, staff education, and the appointment of further neonatologists. Although these are all short-term, hospital-based health outcomes, we are nevertheless comparing 'like with like' data, collected monthly since 1957 by the nuns of the hospital foundation order.

The OMH data provide a unique picture of obstetrical practice in one of the largest urban maternity hospitals in sub-Saharan Africa. Ante- and postpartum haemorrhage, pre-eclampsia, and stillbirths all began to decline in the mid- to late-1990s. Rates of eclampsia have remained more or less static over time, despite the wide variation in other indices of morbidity and recent improvements. A rapid rise in caesarean section rates, following a plateau between 1966 and 1990, coincided with the introduction of vacuum delivery, and a subsequent drop in all instrumental deliveries. The rise in caesarean sections in the 1990s was considerably later than the steady rise of caesarean sections in the developed world that began in the 1980s.³ This rise in caesarean sections has been associated with a drop in maternal mortality, but it could prove to be a double-edged sword. Caesarean section rates in OMH are double the level of 15% recommended by the WHO. Whether retraining in assisted deliveries, or introducing interventions such as electronic and scalp sampling fetal monitoring and ultrasonography (which are currently not part of routine delivery room practices in OMH), would affect caesarean section and neonatal mortality ratios is speculative.

Maternal mortality remains a major challenge to health systems worldwide. Reliable information about the rates and trends in maternal mortality is essential for resource mobilisation, and for the planning and assessment of progress towards Millennium Development Goal 5 (MDG5),⁴ the target for which is a 75% reduction in MMR by 2015. In the present study, approximately one-third of maternal deaths were not classified, possibly because of a lack of antenatal care, laboratory diagnostic restrictions, or the absence of an autopsy service in the hospital. The accuracy of our data regarding the causes of maternal deaths, and therefore also the case fatality rates, is limited by such under-reporting of morbidity and causes of mortality. Nevertheless, given that there are wide regional variations in the causes of maternal deaths in developing countries, the in-hospital causes of maternal deaths in this study were consistent with the WHO regional analysis of maternal mortality in Africa, in which hypertensive disorders, haemorrhage, sepsis, and pulmonary embolism predominate.⁵

How can maternal mortality be reduced further and sustained? Less than one-third of women delivering at OMH receive antenatal care.^{6,7} Improved antenatal care, early recognition of high-risk mothers, prompt management of hypertensive disorders, and preventing sepsis and haemorrhage are all major challenges. Many women present with their health already seriously compromised: some are in extremis from eclampsia, anaemia, haemorrhage, obstructed labour, or sepsis. The role of antenatal care in reducing maternal mortality is under debate; however, measures aimed at screening for, treating, and preventing chronic conditions of pregnancy (anaemia, hypertensive disorders, etc.) appear to be most effective in reducing maternal mortality and morbidity.^{8–10} There is evidence that packaging effective maternal and neonatal care with pre-conceptual care works synergistically to reduce both maternal and neonatal mortality further than any of the interventions on their own, or in pairs.¹¹ Furthermore, evidence-based interventions grouped into packages have been shown to be more cost-effective than individual interventions on their own.^{10,11}

Priorities in decreasing maternal mortality include the management of hypertensive disorders, preventing sepsis, and preventing and managing haemorrhage.⁵ Magnesium sulfate is the agent most commonly used in the treatment and prophylaxis of eclampsia, and it has now been introduced into obstetric practice at OMH, along with hydralazine.¹² Improved hand hygiene practices and judicious use of antibiotics were among the practices introduced to reduce the incidence of sepsis. Rapid access to supplies of safe blood is a key element in emergency obstetrical care, and a necessary component of any package of interventions introduced to reduce maternal mortality.¹³ Blood transfusion services were improved at OMH, with the addition of a small laboratory with blood grouping and viral testing facilities. However, there is as yet no national blood transfusion service in Sudan, and OMH has a limited stock of blood. Patients in need of blood transfusion often need to find their own donor, usually a family member. In addition to access to blood supplies, the inclusion of uterotonics in the active management of the third stage of labour, for the prevention of postpartum haemorrhage, is recommended by the WHO.¹⁴ Although oxytocin and ergometrine/methylethergometrine are preferred, the low cost, stability at room temperature, and various routes of administration of misoprostol make it an alternative in low-resource settings. Despite debate about the safety and optimal dose of misoprostol,¹⁵ the WHO continues to recognize its value in preventing maternal mortality in developing nations.¹⁶ Furthermore, two recent double-blinded, randomised trials have shown that misoprostol is a suitable alternative to oxytocin in the treatment of postpartum haemorrhage in settings in which

oxytocin is not readily available.^{17,18} At OMH, misoprostol is used routinely for the active management of the third stage of labour in high-risk patients (grand multipara, multiple gestation, prolonged labour, past history of postpartum haemorrhage, etc.), and is also the first-line treatment for all patients with postpartum haemorrhage. The rationale for its use in these situations includes many of the aforementioned reasons: ease of administration and dosage, affordability, and simpler storage. Thus, the introduction of misoprostol into obstetric practice at OMH is in alignment with recent guidelines and findings. Oxytocin is in fact available at OMH, but is reserved for the active management of the third stage of labour in low-risk patients.

Why is neonatal mortality in OMH lagging behind improvements in maternal mortality rates? When maternity care began to be upgraded in OMH in the late 1990s, efforts were initially specifically and rightly directed towards reducing maternal mortality. Stillbirth, but not neonatal mortality, ratios paralleled the reduction in maternal mortality. In developed countries, declines in neonatal mortality in the last 30 years are often attributed to neonatal intensive care interventions such as the use of surfactant, mechanical ventilation, and pressors, none of which were part of routine neonatal care in OMH. An alternative to the 'better neonatal care' hypothesis is the 'better babies' hypothesis: that with improvements in obstetrical care, the infants delivered are healthier, and therefore have better survival rates. Indeed, in a study of survival among very low birthweight babies in the USA, one-third of the decline in neonatal mortality was attributed to 'better babies' and two-thirds to 'better neonatal care'.¹⁹ Based on the brief review of the causes, neonatal mortality in OMH is consistent with findings that, globally, the major causes of neonatal death are infection, pre-term birth, and asphyxia, and that 60–80% of these deaths occur in those of low birthweight.²⁰ The implications for OMH are that for more term babies to survive there must be a reduction in term asphyxia (better babies). Improvements in the nutrition, general health, and antenatal monitoring of the pregnant population; increased use of antenatal steroids; and up-skilling in neonatal nursing must occur for more aggressive respiratory and cardiovascular support to have an impact on premature deaths.^{10,20,21} Recent research in OMH has shown that the main predictors of preterm birth are a history of miscarriage, previous preterm birth, caesarean section, recent dental manoeuvre, and vaginal bleeding in the index pregnancy. A short interpregnancy interval (<18 months), and low or high body mass index (BMI) were also predictors of preterm birth.⁶ Thus, current efforts at OMH are being made in the areas of the early recognition of high-risk mothers, malaria prophylaxis, folic acid supplementation, and general nutrition.

The Cork–Omdurman partnership project attained a number of positive infrastructural, educational, and staff training and retention achievements. The primary aim of this partnership was not about giving the Sudanese partners a ‘product’, but about a practical, hands-on process of working together to meet defined needs built on a platform of evidence-based practices. The multidisciplinary nature of the partnership on both sides (medical, midwifery, biotechnical, paramedical, and administrative) cannot be overemphasised. This partnership strengthens the case for similar global health collaborations between developed and developing countries.²² In working together as partners, we need to be very sensitive to environment and culture. Of practical importance in this project was the role of the Irish-based Sudanese doctors, who acted as connectors, aiding with communication and cultural understanding on both sides. Although the partnership has formally concluded at this point, sustainability is dependent on local commitment that enables doctors to stay in Sudan and drive the aims of the project forward, reversing the usual ‘brain drain’ seen in similar situations.^{23–25}

Disclosure of interests

None to declare.

Contribution to authorship

VMC was involved in the analysis of the data, preparation of graphs and tables, data interpretation, and drafting, revision, and finalising of the article. KJO'B was involved in data collection and analysis. CAR was involved in study conception and design, study supervision, data interpretation, and revision, and finalising the article. LCK was involved in study supervision, data interpretation, and revision and finalising the article. MIO, SAI, and SEA were involved with data interpretation and finalising the article. CAR is the guarantor.

Details of ethics approval

No ethical approval was required by OMH to access and report on the logbook of maternal and perinatal outcomes data.

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