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Trends in Maternal Mortality, Al-Sadaka Teaching Hospital, Aden 2008-2018

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Abstract

Introduction: Although there has been a worldwide decline in maternal mortality over the past decades due to improved health services; it is still a major public health problem throughout the world. The aims of the present study were to assess the yearly maternal mortality ratio, to investigate the trend in maternal deaths and analyze some associated factors over the period 2008-2018.

Methods: This is a descriptive retrospective, hospital-based study carried out at Al-Sadaka Teaching Hospital over an 11-year period from 1st January 2008 to 31th Dec 2018 addressing pregnancy-related deaths.

Result: There were 57.203 live births, and 88 maternal deaths, giving a maternal mortality ratio of 153.84 per 100.000 live births. The highest maternal mortality ratio was observed in the year 2016 (313.59 per 100.000 live births), followed by 243.93 in the year 2017. Nearly three quarters (73.9%) of deaths were due to direct causes**.** The leading causes of direct maternal deaths were toxemia of pregnancy (27.3%) followed by obstetric hemorrhage (13.6%) and sepsis and anesthesia complication (8% each). Just more than half of maternal deaths (54.6%) occurred after delivery, and 17% occurred during labor whereas most of the remaining died in second half of pregnancy (21.6%). The majority of the causes was avoidable.

Conclusion: The majority of causes and contributory factors are preventable through combined safe motherhood strategies of focused antenatal care, prompt referral, active management of labor and immediate post-partum period and access to family planning.

Keywords: Maternal mortality, Direct and Indirect Causes, Toxemia of Pregnancy, Hemorrhage, Sepsis.

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منحى وفيات الأمهات في مستشفى الصداقة التعليمي في عدن، 2008 - 2018

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ملخص الدراسة

المقدمة: على الرغم من حدوث انخفاض عالمي في معدل وفيات الأمهات على مدار العقود الماضية بسبب تحسن الخدمات الصحية، إلا أنها لا تزال تمثل أحد مشاكل الصحة العامة الرئيسة في العالم. هدفت الدراسة تقييم نسبة وفيات الأمهات السنوية ومنحاها وتحليل بعض العوامل ذات الصلة للفترة 2008-2018

المنهجية: أجريت دراسة وصفية استرجاعية في مستشفى الصداقة التعليمي لفترة 11 عامًا (1 يناير 2008 إلى 31 ديسمبر 2018) للوفيات المرتبطة بالحمل.

النتائج: خلال فترة الدراسة، كان هناك 57.203 مولود حي و88 وفاة أمومة أي نسبة وفيات أمهات 153.84 لكل 100.000 مولود حي. لوحظت أعلى نسبة لوفيات الأمهات في عام 2016 (313.59 لكل 100000 مولود حي)، تليها 243.93 في عام 2017. ما يقرب من ثلاثة أرباع الوفيات (73.9%) كانت نتيجة لأسباب مباشرة. الأسباب الرئيسية لوفيات الأمهات المباشرة كانت ارتفاع ضغط الدم الحملي (27.3%)، يليها النزيف (13.6%) والانتان ومضاعفات التخدير بنسبة 8% لكل منهما. حدثت الوفاة بعد الولادة فيما يزيد قليلاً عن نصف وفيات الأمهات (54.6%)، و17% حدثت أثناء المخاض، ومعظم ماتبقي من الوفيات كانت في النصف الثاني من الحمل (21.6%). غالبية الأسباب كان يمكن تجنبها.

الاستنتاج: غالبية الأسباب والعوامل المساهمة يمكن الوقاية منها من خلال استراتيجيات الأمومة المأمونة للرعاية الصحية أثناء الحمل والإحالة الفورية للحالات الحرجة والمتابعة الفعالة اثناء المخاض وفترة ما بعد الولادة مباشرة وتوفير وسائل تنظيم الأسرة وسهولة الوصول اليها.

الكلمات المفتاحية: وفيات الأمهات، الأسباب المباشرة وغير المباشرة، ارتفاع ضغط الدم الحملي، النزف، الإنتان.

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Introduction

Although there has been a worldwide decline in maternal mortality over the past decades due to improved health services, it is still a major public health problem throughout the world. Maternal death has important negative social and economic consequences on the society, and on the health and lives of family, especially on the new born babies, particularly under conditions of socioeconomic deprivation [1]. In the International statistical classification of diseases and related health problems (ICD), the World Health Organization (WHO) defines maternal death as: the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from unintentional or incidental causes [2].

The fifth Millennium Development Goal (MDG 5) addresses improving maternal health with a target of reducing the Maternal Mortality Ratio (MMR) by three-fourths (from 400/100,000 live births to 100/100,000) between 1990 and 2015. The 2010 report of the WHO/UNICEF/UNFPA/World Bank on global, regional, and country MMR estimates showed that while some countries have made substantial progress (such as Bhutan, Bolivia, China, Egypt, Equatorial Guinea, and Eritrea), others, mainly in sub-Saharan Africa (such as Chad and Zimbabwe) have made insufficient progress or none at all [3]. In a related context; the Sustainable Development Goals (SDGs) launched on 25 September 2015 and came into force on 1 January 2016 for the 15-year period until 31 December 2030. Among the 17 SDGs, the direct health-related targets come under SDG 3: Ensure healthy lives and promote well-being for all at all ages. In anticipation of the launch of the SDGs, WHO and partners released a consensus statement and full strategy paper on ending preventable maternal mortality (EPMM). The EPMM target for reducing the global MMR by 2030 was adopted as SDG target 3.1: reduce global MMR to less than 70 per 100 000 live births by 2030. Nearly five years into the Sustainable Development Goal (SDG) era, maternal mortality rates worldwide are still unacceptably high [4].

MMR in the world's least developed countries is high, estimated at 415 maternal deaths per 100,000 live births, which is more than 40 times higher than that for MMR in Europe, and almost 60 times higher than in Australia and New Zealand [5].

The global estimates for the year 2017 indicate that there were 295,000 maternal deaths; 35% lower than in 2000 when there were an estimated 451,000 maternal deaths. The global MMR in 2017 was estimated at 211 maternal deaths per 100,000 live births, representing a 38% reduction since 2000, when it was estimated at 342. The average annual rate of reduction in global MMR during the 2000–2017 period was 2.9%; this means that, on average, the global MMR declined by 2.9% every year between 2000 and 2017 [6]. In 2017, according to the Fragile States Index, 15 countries were considered to be "very high

alert" or "high alert" (from highest to lowest: South Sudan, Somalia, Central African Republic, Yemen, Syrian Arab Republic, Sudan, the Democratic Republic of the Congo, Chad, Afghanistan, Iraq, Haiti, Guinea, Nigeria, Zimbabwe and Ethiopia). These 15 countries had MMR in 2017 ranging from 31 (Syrian Arab Republic) to 1150 (South Sudan) [7]. The Fragile States Index is an assessment of 178 countries based on 12 cohesions, economic, social and political indicators, resulting in a score that indicates their susceptibility to instability. At the top of the range (most fragile), the scores are categorized as follows: > 110= very high alert; 100–110= high alert. These two categories include the 15 most fragile countries mentioned here. There are 10 other categories ranging from "very sustainable" to "alert", which include the remaining 163 countries.

In 2017, maternal mortality ratio for Yemen was 164 deaths/100,000 live births. Yemen MMR fell gradually from 462 deaths per 100,000 live births in 1998 to 164 deaths per 100,000 live births in 2017 [8]. There are three previous studies (theses) done about maternal mortality in Al-Sadaka Teaching Hospital. The first [9] included the years from 1995-1998 with MMR of 241.46, the second [10] from 2001-2003 with MMR of 246, and the third [11] from 2004-2006 with MMR of 159.42. per 100,000 live births. In addition, there is a published scientific paper discussed the trend of maternal mortality and some of its causes with MMR of 197 per 100.000 live births [12]. The present paper aimed to be a continuation of the previous assessment of the yearly maternal mortality ratio; and to investigate the trend of maternal mortality and its associated factors over the period 2008-2018.

Methods

This is a descriptive retrospective, hospital-based study, which was carried out at Al-Sadaka Teaching Hospital, from 1 Jan 2008 to 31th Dec 2018. Data were collected from the records included age of the mother, parity, residency, type of obstetric causes and the mode and place of delivery. The years 2012 was excluded because of missed files. Furthermore, 2015 was also excluded due to the lack of well-functioning registration in this year of intense fighting. All pregnancy-related deaths (maternal deaths) of patients were managed at the hospital in the study period. The WHO-ICD was used to categorize maternal deaths [2]:

- ***Direct obstetric deaths* (*or direct maternal deaths*)**

Those "resulting from obstetric complications of the pregnant state (pregnancy, labor and puerperium), and from interventions, omissions, incorrect treatment, or from a chain of events resulting from any of the above".

- ***Indirect obstetric deaths (or indirect maternal deaths)***

are those maternal deaths "resulting from previous existing disease or disease that developed during pregnancy and not due to direct obstetric causes but were aggravated by the physiologic effects of pregnancy".

The standard definition of MMR was used indicating the number of maternal deaths during a given time period per 100,000 live births during the same time period [7].

Data analysis

Descriptive analysis was done by the software Statistical Package for Social Sciences (SPSS) version 20. Categorical variables are presented as frequencies and percentages while numerical variables are presented as means (with standard deviation) or medians analyzed and processed.

Ethical consideration

Verbal informed permission was obtained from the Medical directors of obstetrics and gynecology department of Al-Sadaka Teaching Hospital.

Results

During the study period, there were 57.203 live births, and 88 maternal deaths in AL–Sadaka Teaching Hospital, giving a maternal mortality ratio of 153.84 per 100,000 live births. As shown in Table 1, the highest MMR was observed in the year 2016 (313.59 per 100,000 live births), followed by 243.93 in the year 2017, while the lowest was observed in 2013 and 2014, giving MMR of 73.74 and 75.87 per 100,000 live births respectively.

Table1: MMR in Al-Sadaka Teaching Hospital, 1st January 2008 to 31st of December 2018

Year	Live Birth	Maternal Death	Ratio
2008	5311	6	112.97
2009	5540	6	108.30
2010	5996	8	133.42
2011	5869	10	170.39
2012*	---------	---------	----------
2013	6781	5	73.74
2014	6590	5	75.87
2015 **	---------	---------	----------
2016	5421	17	313.59
2017	7379	18	243.94
2018	8316	13	156.33
Total	57203	88	153.84

Ratio per 100.000 live births **files were lost*
*** files not registered (the year of the war)*

There was definite increase in the MMR in the years 2016 and 2017 as shown in Figure 1.

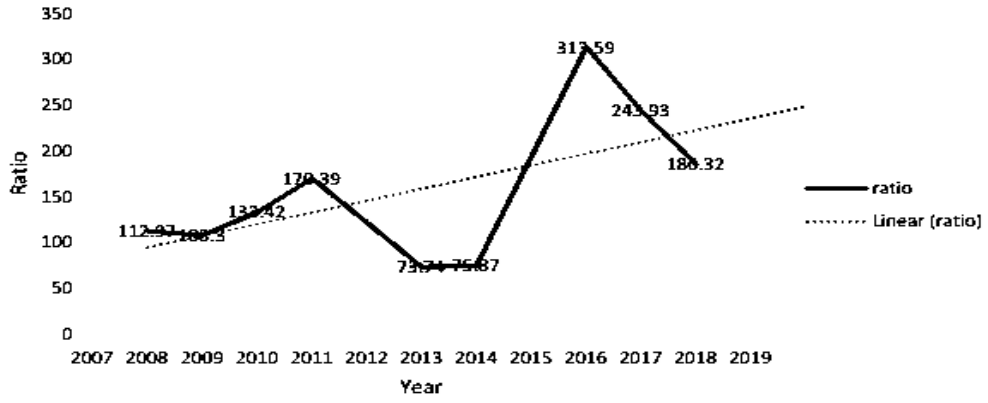

Figure 1: Trend of MMR in Al-Sadaka Teaching Hospital from 2008 to 2018

As seen in Table 2, the leading causes of direct maternal deaths were toxemia of pregnancy (27.3%); followed by obstetric hemorrhage (13.6%) and pregnancy-related infection and anaesthesia complication with 8% for each. The indirect causes of maternal deaths occurred in 26.1%, with pulmonary embolism as main cause (6.8%) followed by anaemia (4.5%).

Table 2: Causes of Maternal Death

Cause of death	No.	%
Direct		
Toxemia	24	27.3
Haemorrhage	12	13.6
Pregnancy related infection	7	8.0
Anaesthesia Complication	7	8.0
Rupture uterus	6	6.8
GTD*	3	3.4
Sudden Death	3	3.4
Ectopic pregnancy	2	2.3
Hyperemesis Gravidarum	1	1.1
Total	65	73.9
Indirect		
Pulmonary Embolism	6	6.8
Anaemia	4	4.5
Unclassified	3	3.4
IHD**	2	2.3
DKA***	2	2.3
Renal Failure	2	2.3
Liver disease	2	2.3
Bronchial asthma	1	1.1
Necrotizing fascitis	1	1.1
Total	23	26.1

** Gestational Trophoblastic Disease*
*** Ischemic Heart Disease *** Diabetic Keto Acidosis*

Table 3 illustrates the maternal deaths according to some characteristics related to maternal mortality. Nearly half of maternal deaths (51.1%) was in the age group 20-29 years and one third (36.4%) occurred in the age group 30-39 years. Regarding parity, nearly half of maternal deaths (56.8%) was observed among mothers with parity of 1-3, followed by mothers with parity between 4-5 (27.3%). Regarding residency, 43.2% of maternal deaths occurred among the mothers from Aden, followed by mothers from Lahj (22.7%).

Table 3: Maternal Deaths in Relation to Age, Parity and Place of Residence

Item	No. of maternal death	%
Age		
< 20	6	6.8
20 – 29 years	45	51.1
30 – 39 years	32	36.4
40 – 49 years	5	5.7
Total	88	100
Mean ±SD	27.93 ± 6.51259	
Parity		
Nullipara	2	2.3
1–3 children (pluriparous)	50	56.8
4 – 5 children	24	27.3
≥ 6 children	12	13.6
Total	88	100
Median: 2 children		
Residence		
Aden	38	43.2
Lahj	20	22.7
Al-Dhala'a	8	9.1
Abyan	5	5.7
Shabwa	2	2.3
Taiz	5	5.7
Al-Hudida	6	6.8
Unknown	4	4.5
Total	88	100

Table 4 shows that just more than half of maternal deaths (54.6%) occurred after delivery, and 17% occurred during labor and most of the remaining died in second half of pregnancy (21.6%).

Table 4: Distribution of Maternal Death According Gestational Timing

Time of Death	No. of Maternal Deaths	%
Before 20 weeks	6	6.8
After 20 weeks	19	21.6
During Labor	15	17.0
During puerperium	48	54.6
Total	88	100

Table 5 shows that slightly more than half of maternal deaths (55.7%) had occurred after admission by 2 days, and one fifth of the deaths occurred within one hour of admission (20.4%).

Table 5: Distribution of Maternal Death according to admission death interval (ADI)

ADI	No. of Maternal Deaths	%
1 hour	18	20.4
1day-< 2day	49	55.7
2 day- < 3 days	10	11.4
≥ 3 days	11	12.5
Total	88	100

In Table 6, nearly one third of the maternal deaths (30.7%) happened following cesarean deliveries while 26.1% were following hospital vaginal deliveries (vaginal deliveries and VBAC). Home vaginal delivery contributed only to 10% of the deaths, and one fourth (25%) of the cases died while pregnant. Seven cases died following early pregnancy termination and not included.

Table 6: Distribution of Maternal Death According Place and Mode of Delivery

Place of delivery	No. of Maternal Deaths	%
Home delivery	9	10.2
Hospital delivery		
• Cesarean delivery	27	30.7
• Vaginal delivery	20	22.7
• VBAC*	3	3.4
• Not delivered	22	25.0
Total	81*	92.0

**7 case of early pregnancy termination not included*
**VBAC vaginal birth after cesarean*

Table 7 shown that delay in seeking medical care accounted for 28.4% of the maternal death. Delay in transportation was associated with 17% of the deaths; and failure to recognize danger occurred in 15.9%. Unavoidable maternal death accounted for 13.6% and delay in receiving care at institution accounedt for 12.5% of the maternal deaths.

Table 7: Main Avoidable Factors Contributing to Maternal Death

Factors	No.	%
Delay in seeking medical care	25	28.4
Delay transportation	15	17.0
Delay in receiving care at institution	11	12.5
Failure to recognize danger	14	15.9
Non avoidable#	12	13.6
Unclassified*	11	12.5
Total	88	100

 # due to unpreventable causes
** due to paucity of information in the files*

Discussion

The MMR is an important public health indicator that reflects both the quality of health care services and the women's status and importance in their society [13].

In the present series, MMR was 153.84 per 100.000 live births. This figure is lower than three previously reported figures in the same study setting [9,10,12]. However, it approximates the results of Basorra in 2007 [11]. There was continuous decrement in the MMR from 2008 till 2014, then there is sharp rise of about 313.59 and 243.93 in 2016 and 2017, respectively. Unfortunately, the admission files of the year 2015 were lost and unregistered, as we anticipate higher MMR. Decades of underdevelopment and years of intense fighting have left essential public services, including crucial healthcare for mothers and babies, on the brink of total collapse. The MMR in 2018 was estimated at 156.3 maternal deaths per 100,000 live births, representing a 56% reduction since 2001, when it was estimated at 358 [12]. It is clear that there is definite decrease in the MMR in the study period in comparison with the previously estimated ratios in the same hospital [9,10,12].

During the period of study, approximately three quarter (73.9%) of maternal deaths were due to direct causes, and one quarter due to indirect causes. The direct causes of maternal deaths are the same around the world, although the distribution of causes differs somewhat from region to region [3]. Deaths attributed to hypertensive disorders, are the first leading cause of death (27.3%) in the present study, and approximately double than hemorrhage in causing maternal death (13.6%). This is contradictory to what was reported by most of the previous studies in the same hospital [9-11] and in some other developing countries, as the leading cause of death was hemorrhage [3,14]. Only one study by Al-Kaaky *et al* [12], found equal frequencies for hemorrhage and toxemia (23.5%) in causing maternal death. Deaths due to hemorrhage decrease in the last periods and this is explained by proper early interventions and the availability and safety of blood transfusion [15,16]. The present findings also indicate low percentage of puerperal sepsis as a cause of maternal death (8%). In a study about puerperal sepsis at the same hospital, maternal deaths were encountered in 2.2% of the cases only [17].

According to the Global Burden of Disease study (GBD) 2015 [18], which covered the period from 1990 to 2013, the most common causes are postpartum bleeding (15%), complications from unsafe abortion (15%), hypertensive disorders of pregnancy (10%), postpartum infections (8%), and obstructed labour (6%). Deaths from hypertensive disorders are also falling globally, but not as dramatically as in the UK [19,20]. Recent evidence indicates that mortality (for the woman and baby) from eclampsia remains high, and higher-risk groups exist that should be strongly prioritized in research and policy [21,22].

Though complication of anesthesia and surgery may not be categorized among the major causes of death

[18], they are important among the causes (8%) in this study. This should serve as a warning signal to care providers that more serious efforts should be paid for such causes. Similar result was obtained by previous studies in the same hospital [11,12]. However, data from the pregnancy mortality surveillance program of the Centers for Disease Control and Prevention (1979 through 1990) include 155 maternal deaths caused by anesthesia related complications representing 3.8% deaths [23]. Also, a similar result was found in a recent study from Nigeria [24].

With regard to the distribution of the characteristics among the affected mothers; womae in the age group 20-29 years and pluriparous had significantly increased of risk of maternal deaths (51.1% and 56.8% respectively). For parity, most countries show a J-shaped relation with maternal mortality, where there is an increased risk in the first pregnancy, lowest risk in the second, third and continually increasing risk in the fourth and subsequent pregnancies [25]. Our findings are contradictory to that as deaths are higher among pluriparous. The present findings are similar to the findings obtained by Basorra [11] and Al-Kaaky *et al* [12].

Teenage mothers (those less than 20 years) and mothers of 35 years old or more have a high mortality compared with those 20-29 years old, mainly because of an increased risk of obstructed labor in teenage mothers. Women over 35 years have a much higher maternal mortality rate than younger women, mainly because of an increased risk of hypertension and haemorrhage [25]. Unfortunately, this study found the most vulnerable age group are those between 20-29 year.

In most of the maternal deaths' cases and in some countries where mortality levels are still alarming as many avoidable factors continue to be identified. Investigators have found that 63% to 80% of the direct maternal deaths and 88% to 98% of all maternal deaths could probably have been avoided by proper handling [26]. In the present study, as many as 43.2% of deaths occurred in women who had reasonable potential access to health care as they lived in Aden. This is an unexpected finding and it carries wider implications. Most of the death cases delivered at hospital with only 10% delivered at home, because too many women reported for treatment when their illness had reached an advanced stage.

A closer look at the obstetrics and gynecological history showed that problems usually starts around the second to third trimester of pregnancy, yet the period around delivery and few hours or days after delivery accounts for most of the deaths [24]. Starrs [27] has stated that 61% of the maternal deaths occur in the postpartum period and more than half of these take place within a day of the delivery, while deaths during pregnancy occur in 24% and those during labor in 16%. The GBD study [18] found that nearly a quarter of deaths occurred antepartum (24·6%), a quarter intrapartum and immediately postpartum (27·7%), a third subacute and delayed postpartum (35·6%); with biggest absolute change in intrapartum deaths which decreased by more than 35%. In the

present series, 54.6% of death occurred in the puerperium, 17% during delivery, and 28.4% died while they are still pregnant.

While some of the major causes of maternal deaths are amenable to prevention such as hypertension, the vast majority of the contributory factors to maternal death falls in the same category and include social factors such as low socio-economic status, poverty, ignorance, socio-cultural barriers to accessing antenatal care, poor personal attitude to health care, self-risk perception, transportation logistics, and delay in making referrals from other health facilities [24].

Two nationwide studies in Brazil pointed to flaws in care associated with maternal death: The Network for Surveillance of Severe Maternal Morbidity and the Birth in Brazil study. These investigations show that maternal deaths or near-misses caused by pregnancy-related complications were associated with barriers to access specific healthcare services and with inadequate monitoring of complications in the hospital setting [28,29]. Delay in seeking care (28.4%) with failure to recognize dangerous signs (15.9%) were important contributors to death. Delayed transportation contributes to 17% and delay in receiving care at an institution found in 12.5%. Factors associated with delay in seeking care in this study are from the mother's own surrounding and environment and could be attributed to social behavior and beliefs, low education, poverty, residence far away from the health centers and lack of information.

Limitation

The lack of well-functioning registration and vital statistics systems, leads to incompleteness and un-registration of all death cases. Furthermore, absence of maternal death audit and in-depth systematic review of maternal deaths contribute to misclassification of causes of death, so, similar future deaths still occur and cannot be prevented.

Conclusion

The MMR during the period of the study was 153.84 per 100,000 live births. Hypertensive diseases were the significant cause of maternal death. The majority of causes and contributory factors of reported maternal deaths are preventable through combined safe motherhood strategies of focused antenatal care, prompt referral, active management of labor and immediate post-partum period.

The solution to many of the contributory factors lies in appropriate-policies, improved budgetary allocation to health care, improved donor support, and capacity building of Health Care Workers.

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