



Article

Maternal mortality in a Kenyan pastoralist population

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Abstract

Objective: To measure maternal mortality among the Gabbra, a group of nomadic pastoralists living in a remote area of Kenya. *Method:* As part of a survey of 851 households, information on the number of sisters of respondents who died of pregnancy-related causes was collected and the data were used to calculate maternal mortality statistics using the sisterhood (an indirect) method. *Results:* The maternal mortality ratio for this population was 599 deaths per 100 000 births (95% C.I. 424–775). The lifetime risk of dying around childbirth is 1 in 30, and the proportion of ever-married sisters that died under 50 years of age who died from maternal causes is 0.48 (95% C.I. 0.38–0.58). *Conclusion:* The risk of dying of maternal causes is high in this population.

Keywords: Maternal mortality; Sisterhood method; Kenya; Nomadic pastoralists

1. Introduction

An estimated 500 000 women die each year from pregnancy-related causes, and the vast majority (99%) of these deaths occur in developing countries [1]. The disparity between maternal mortality ratios (MMR) in some parts of sub-Saharan Africa and the developed world is the greatest in health indicators yet reported. MMR in this area of Africa may be as much as 200 times those in developed countries [2]. There is thus considerable interest in reducing maternal mortality and morbidity, and information on the prevalence of

maternal deaths is needed as a first step to implementing prevention strategies. This information is not easily available in areas where the problem is most acute and a number of methods have been used to obtain estimates of maternal mortality. The main sources of data are vital registration, health service statistics and population-based enquiries [3]. However in many parts of the developing world vital registration systems have low levels of coverage and completeness and health service statistics tend to be biased towards a particular subset of women, either those at high risk of complicated births or those of high socioeconomic status. Population-based enquiries may therefore be necessary in areas where the former data

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sources are inadequate. The sisterhood method was developed as a convenient indirect method of estimating maternal mortality rates using data collected as part of a survey or census [4]. It only requires four questions to be added to a questionnaire if a survey is to be carried out in a relevant area, and, as information is collected on sisters, the number of interviewees needed is relatively small in high fertility areas as respondents will be able to provide information on several women (compared with the orphanhood or widowhood methods which involve questions about the respondents' mothers or spouses, respectively).

2. Data and methods

The data used for this analysis were obtained from a survey of 851 Gabbra households, undertaken during 1993–1994. The Gabbra are a group of camel-herding pastoralists living in northern Kenya in a very arid and remote area; medical care is limited to immunizations and contraception is unavailable. The vast majority of births take place at home, often with a traditional midwife as a

Table 1

Age-specific fertility rates (ASFR) for 1993

Age group	No. of women	ASFR
15–19	254	0.29
20–24	228	1.18
25–29	196	1.35
30–34	147	1.46
35–39	137	0.66
40–44	82	0.43
45–49	98	0.25
TFR	1142	5.63

helper. Girls are circumcised and infibulated at around the age of 5 years. Only women who are or who have been married reproduce in this society; widows are not permitted to remarry but may continue to give birth, although their fertility (controlled for age) is slightly lower than that of women whose husbands are still alive. The average age of marriage for women is 19 years and of first birth is 21 years. Most marriages are monogamous (88% of women are the only living wife of their

Table 2

Estimation of maternal mortality in the Gabbra using the sisterhood method

Age group of respondents (a)	No. of respondents (b)	Sisters ever married (c)	Maternal deaths (d)	Adjustment factor (e)	Sister units of risk exposure (f = ce)	Lifetime risk of maternal death (g = d/f)	Proportion of deaths due to maternal causes (h)
15–19	59	115 ^a	0	0.107	12	0	0
20–24	172	335 ^a	2	0.206	69	1/34	0.50
25–29	222	340	2	0.343	117	1/59	0.50
30–34	236	444	7	0.503	223	1/32	0.47
35–39	228	449	15	0.664	298	1/20	0.60
40–44	195	396	9	0.802	318	1/36	0.47
45–49	158	351	10	0.900	316	1/31	0.38
50–54	183	361	9	0.958	346	1/38	0.30
55–59	116	234	6	0.986	231	1/38	0.23
60–64	133	279	11	1.000	279	1/26	0.33
65+	188	374	11	1.000	374	1/34	0.18
Total	1890	3678	82		2583	1/31 ^b	0.33 ^c

^aAdjusted figures derived by multiplying the number of respondents by the average number of ever-married sisters per respondent reported for the age groups over 25 (1.94) to obtain the expected ultimate number of ever-married sisters for the younger age groups.

^bUsing only respondents under 50 years of age, the lifetime risk of maternal mortality is 1 in 30 and the MMR is 599 per 100 000.

^cUsing only respondents under 50 years of age, the proportion of sisters dead from maternal causes is 0.48.

husband) and polygyny seems to be related to the number and sex of children that the first wife has given birth to. The probability of a man taking a second wife while the first is still alive increases if the first wife has few or no sons (having few or no daughters also has a slight effect) [5,6]. The total fertility rate (TFR) for this population is 5.63 (see Table 1 for age-specific fertility rates in 1993). This is similar to the average for rural Kenya of 5.89 [7]. We believe our TFR to be a slight underestimate of fertility as, although women were asked to list all live births, they were often reluctant to talk about children who had since died, and some women may not have given complete birth histories.

The following information is required to calculate maternal mortality using the sisterhood method: the age of each respondent, the number of sisters who have been exposed to the risk of death from maternal causes, the number of these sisters who have died and whether these deaths were related to maternity. Those sisters who are at risk of maternal deaths may be defined either as the number of sisters who reach childbearing age (usually 15) or the number of ever-married sisters. The latter definition is used in this study as unmarried women do not reproduce in this society. Information from both men and women was included in the analysis. There is no reason to assume that one sex will be better informed than the other on the fate of their sisters as women leave their natal

home on marriage; analyzing the data from men and women separately gives results not significantly different from those obtained from the entire data set.

Table 2 shows the information collected in 5-year age groups. In order to calculate the risk over the entire childbearing period for each age group the number of ever-married sisters was multiplied by an adjustment factor (previously calculated, see [4]). This adjusted figure was then used to obtain an estimate of the lifetime risk of dying from maternal causes. The following formula was used to calculate the MMR:

$$\text{MMR} = 1 - [(\text{Probability of survival})^{1/\text{TFR}}]$$

3. Results

The total number of people interviewed for this survey was 2043, and data suitable for analysis were obtained from 1890 individuals (the remainder were uncertain of their age), of whom 1270 were under 50 years of age. It is usual to restrict analysis to respondents under the age of 50 to avoid bias due to poor memory in older respondents (any maternal deaths of their sisters would have occurred some time ago) and because fertility may have changed during the period for which we are estimating mortality rates. This results in a relatively small number of respondents,

Table 3
Maternal mortality estimates from sub-Saharan Africa using the sisterhood method

Location	No. of respondents	Lifetime risk of maternal death	MMR (deaths/100 000 births)	Proportion of maternal deaths	Reference
North Bank Division, Gambia	1652	1 in 17	1005	0.29	[4]
Northern Burkina Faso	4923	1 in 18	854	0.24	[K. Hampshire. Personal communication, 1996]
Niger	3058	1 in 14	1050		[17]
Sudan	5860	1 in 27	537	0.34	[13]
Djibouti	7463	1 in 20	740	0.26	[14]
Northeastern Kenya	1890	1 in 31	571	0.48	This study
Northwestern Tanzania	2865	1 in 52	297	0.14 ^a	[16]
Southern Malawi	3333	1 in 33	409	0.12	[15]

^aCalculated using some respondents over 50 years of age.

but maternal mortality is high in this area, so a significant number of maternal deaths was reported and we feel that using these data to calculate maternal mortality rates is justified; we have also attached confidence intervals to our results [8].

Respondents under 50 years of age in this survey reported 45 sisters dead from maternal causes (all respondents reported a total of 82 maternal deaths). Using only younger respondents the lifetime risk of maternal mortality in this population is therefore estimated to be 0.033 (1 in 30) and the MMR is 599 deaths per 100 000 births (95% C.I. 424–775). The proportion of ever-married sisters dying from maternal causes is 0.48 (95% C.I. 0.38–0.58). Our estimate of maternal mortality covers the period approximately 12 years before the survey took place [4]. It should be noted that the possible underreporting of births mentioned earlier would have the effect of increasing the TFR and slightly reducing the MMR.

4. Discussion

These figures indicate high levels of maternal mortality in this population. This is not unexpected given that medical care which may have a significant impact on MMR (e.g. the use of antibiotics and cesarean sections) is unavailable in this area [9]. Although no other studies in Kenya have used the sisterhood method, two other studies have used population-based enquiries to estimate maternal mortality in this country. The estimate of maternal mortality for the Gabbra agrees well with the MMR of 660 per 100 000 births found in the Kwale District of the Coast Province [10] despite the availability of medical care in this district (72% of women attended an antenatal clinic at least once during pregnancy and 13% delivered in hospital). Both these estimates differ from a ratio of 80 maternal deaths per 100 000 births calculated from a longitudinal study in the northwestern part of the Machakos District 80 km east of Nairobi [11]. However, this latter figure was based on only four deaths, and adult mortality in general was calculated to be remarkably low in this area [12].

Table 3 gives maternal mortality data from six other published African studies which have used the sisterhood method [4,13–17] as well as un-

published data from Burkina Faso. Only studies using this method were included for comparison because other methods of calculating maternal mortality statistics may give widely differing results. Using hospital data may considerably overestimate MMR, for example, if only women who have developed life-threatening conditions during labor tend to use hospitals, or conversely may underestimate maternal deaths where hospitals are used by wealthy women. It can be seen from this table that maternal mortality is high in all the African populations where the sisterhood method has been used (cf. MMR of about 30 for the developed world as a whole [18]). When comparing levels of maternal mortality, the proportion of deaths that are due to maternal causes may be a more useful statistic to use than the MMR. This is because the MMR will be high if mortality rates in the population in general are high. In the area where this survey took place, mortality rates are not generally very high for rural Kenya despite its remote location (for example the infant mortality rate is 65.9 per 1000 births for the Eastern Province of Kenya compared with a 95.6 average for the whole of rural Kenya [6]). Yet the proportion of deaths due to maternal causes is the highest observed of any of the sample of studies.

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References

- [1] World Health Organisation. *Maternal mortality rates: a tabulation of available information*. 2nd ed. Geneva: World Health Organisation, Division of Family Health, 1986.
- [2] Koblinsky MA. Beyond maternal mortality — magnitude, interrelationship and consequences of women's health, pregnancy-related complications and nutritional status on pregnancy outcomes. *Int J Gynecol Obstet* 1995; 48 Suppl: S21–S32.
- [3] Graham W. Maternal mortality: levels, trends and data

- deficiencies. In: Feachem R, Jamison D, editors. *Disease and mortality in sub-Saharan Africa*. Oxford: Oxford University Press, 1991: 101–126.
- [4] Graham W, Brass W, Snow RW. Estimating maternal mortality: the sisterhood method. *Stud Fam Plann* 1989; 20: 125–135.
- [5] Mace R. Biased parental investment and reproductive success in Gabbra pastoralists. *Behav Ecol Sociobiol* 1996; 38: 71–85.
- [6] Mace R. When to have another baby: a dynamic model of reproductive decision-making and evidence from Gabbra pastoralists. *Ethology and Sociobiology* 1996; 17: 1–11.
- [7] Kenya Demographic Health Survey, 1993. Kenya National Council for Population and Development, 1994.
- [8] Hernandez B, Chirinos J, Romero M, Langer A. Estimating maternal mortality in rural areas of Mexico: the application of an indirect demographic method. *Int J Gynecol Obstet* 1994; 46: 285–289.
- [9] Maine D. *Safe motherhood programs: options and issues*. New York: Columbia University, Center for Population and Family Health, 1991.
- [10] Boerma J, Mati J. Identifying maternal mortality through networking: results from coastal Kenya. *Stud Fam Plann* 1989; 20: 245–253.
- [11] van Ginneken J, Muller A. *Maternal and child health in rural Kenya: an epidemiological study*. London: Croom Helm, 1984.
- [12] Muller A, van Ginneken J. Morbidity and mortality in Machakos, Kenya, 1974–1981. In: Feachem R, Jamison D, editors. *Disease and mortality in sub-Saharan Africa*. Oxford: Oxford University Press, 1991: 264–285.
- [13] Ministry of Economic and National Planning, Khartoum, Sudan. *Sudan demographic health survey 1989/1990*. Columbia, MD: Institute for Resource Development/Macro International, 1991.
- [14] David P, Kawari S, Graham W. Estimating maternal mortality in Djibouti: an application of the sisterhood method. *Int J Epidemiol* 1991; 20: 551–557.
- [15] Chiphangwi JD, Zamaere TP, Graham WJ, Duncan B, Kenyon T, Chinyama R. Maternal mortality in the Thyolo district of southern Malawi. *East Afr Med J* 1992; 69: 675–679.
- [16] Walraven GEL, Mkanje RJB, van Roosmalen J, van Dongen PWJ, Dolmans WMV. Assessment of maternal mortality in Tanzania. *Br J Obstet Gynaecol* 1994; 101: 414–417.
- [17] De Groof D, Seyni Bagnou A, Sekou H. Estimating maternal mortality in rural Niger using the indirect sisterhood method. *Ann Soc Belg Med Trop* 1993; 73: 279–285.
- [18] AbouZahr C, Royston E. *Maternal mortality: a global factbook*. Geneva: World Health Organisation, 1991.