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Burden and causes of pregnancy-related mortality in The Gambia: evidence from census and health and demographic surveillance data

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ABSTRACT

Background The Gambia lacks capacity to estimate its burden and causes of pregnancy-related mortality (PRM) to guide reproductive health programming. We used census and Health and Demographic Surveillance System (HDSS) data from Farafenni and Basse to establish levels and causes of PRM in The Gambia.

Methods Using reported deaths and births in the 2013 Gambian census, national and regional pregnancy-related mortality ratios (PRMRatios) were derived as the ratio of pregnancy-related deaths (PRDs) per 100 000 live births (lbs). Verbal autopsies were interpreted using InterVA-5, and PRDs linked with extracted HDSS data to estimate annual PRMRatios.

Results The census yielded national PRMRatio of 861 per 100 000 lbs in 2012. Regional levels of 1877, 1232 and 1096 per 100 000 lbs were registered in rural regions of Kuntaur, Mansakonko and Basse, respectively; while urban areas of Banjul and Kanifing registered about half these levels. Women aged 15–19 and 40–49 had greater risks of dying from pregnancy-related causes. HDSS data produced lower PRMRatios (95% CI) ranging from 858 per 100 000 lbs (149–4969) for Farafenni in 2005, and 479 per 100 000 lbs (328–698) for Basse in 2008 to 184 (24–1450) and 173 (61–487) per 100 000 lbs, respectively. InterVA-5 returned pregnancy-induced hypertension and obstetric haemorrhage as the main causes, accounting for at least 70% of all PRDs.

Conclusion The census-based PRMRatios for 2012 were consistent with the sociodemographic and reproductive health indicators that prevailed at that time and represented the burden of PRM. While HDSS-derived PRMRatios were lower, the cause-of-death distribution produced was consistent with previous observations elsewhere.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Representative national and subregional levels of pregnancy-related mortality have never been estimated for The Gambia using census data, nor have the main causes of pregnancy-related deaths established to inform policy.

⇒ The country's Sustainable Development Goal (SDG) target for maternal mortality is based on a downward-biased Demographic and Health Survey-based pregnancy-related mortality estimate of 433 per 100 000 live births derived from sibling history data.

WHAT THIS STUDY ADDS

⇒ The burden of pregnancy-related mortality in The Gambia in 2012 was 861 per 100 000 live births, twice the level adopted in the national health policy, and subregional levels determined for the first time.

⇒ Coded verbal autopsies from health and demographic surveillance data sites revealed pregnancy-induced hypertension and obstetric haemorrhage among the main causes of pregnancy-related deaths in The Gambia, consistent with some continental and global observations.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ The Gambia's Reproductive and Child Health policy and programme need to be revised against the derived census-based pregnancy-related mortality ratio, and a new national SDG target for maternal mortality set accordingly.

INTRODUCTION

Maternal mortality continues to be a major global health concern, and has remained at exceptionally high levels in many parts of the developing world.[1–3] Being largely preventable even in most resource-challenged health delivery systems in the world, failure to reduce maternal mortality during the Safe Motherhood Movement led to a political decision to formulate a specific Millennium Development Goal (MDG) for the problem—MDG5, with the aim of reducing maternal mortality ratio (MMR) by 75%.[4]

More than half a million maternal deaths were estimated to have occurred globally in

2005, 50% of which were in sub-Saharan Africa and 45% in Asia. While countries and regions of the world with reasonable data registered declines in MMR at a rate of 2.5% per annum between 1990 and 2005, no discernible decrease was evident in sub-Saharan Africa over the same period.[3] In fact, sub-Saharan Africa accounted for two-thirds of the 295 000 global maternal deaths estimated to have occurred in 2017.[5] Notwithstanding the political will and commitment accorded to the problem at the global level, measurement of maternal mortality to track progress of attaining MDG5 had proven to be an arduous challenge because the data are often lacking in the countries where the problem is most severe.

By the end of the MDG period, the United Nations Maternal Mortality Estimation Inter-Agency Group (UNMMEIG) indicated that sub-Saharan Africa recorded the highest regional MMR of 546 per 100 000 live births (95% CI: 511 to 652), compared with a level of 12 per 100 000 live births (95% CI: 11 to 14) for high-income regions, and accounted for two-thirds of maternal deaths worldwide.[6 7] The attempt by the Global Burden of Disease (GBD) Study 2015[8]yielded a similar pattern of regional MMRs, although pegging that of sub-Saharan Africa at 375 per 100 000 live births (95% CI: 302 to 473) and that of high-income regions at 17 per 100 000 live births (95% CI: 16 to 18).[8] In addition to wide variation in MMR that exist between countries in the continent, the lack of relevant empirical health data to reliably establish prevailing national levels and trends poses significant obstacles to national reproductive health programme planning, resource allocation, implementation, monitoring and evaluation. While the UNMMEIG and GBD estimates may be useful in monitoring global and world regional levels and trends in maternal mortality, the statistical methods they adopt usually produce unreliable estimates to guide maternal health programme planning at country level.[9] Their main source of data for low-income and middle-income countries (LMICs) are Demographic and Health Survey (DHS)-based sibling histories analysed using the sibship survival method to produce estimates of maternal mortality. However, the data source and estimation methods have been proven to underestimate maternal mortality,[10] and hence inappropriate for use in guiding national and subnational reproductive health programmes.

The Gambia, like many other countries in sub-Saharan Africa, faces numerous challenges in the provision of comprehensive Reproductive and Child Health (RCH) services, and experiences high levels of maternal mortality and poor pregnancy outcomes.[1 8 11 12] The country registered a gross unmet need of about 80% for Emergency Obstetric Care (EmOC) in public health facilities in 2003, with a healthcare delivery system characterised at the time by poorly functioning referral system and paucity of skilled birth attendants in rural health facilities.[13] In response, The Gambia Government committed to improving maternal, newborn and child health by commissioning and providing Cabinet approval to a national RCH policy which covered the period 2007–2014.[14] The key policy objective was the reduction of maternal morbidity and mortality due to pregnancy, childbirth and unsafe abortion. Neither the RCH policy document nor the subsequent national health policy 2014–2020[13] indicated any intention of establishing the main causes of maternal mortality for use in service delivery design and implementation.

Several ad hoc attempts have been made to determine the level of maternal mortality in the country prior to the turn of the century, mainly from subnational populations. Estimated levels range from 2362 (95% CI: 1322 to 3896) in 1982–1983 to 424 (95% CI: 251 to 670) in 1993–1998.[15–17] A national survey using the 'Sisterhood' indirect method[16] yielded a MMR of 730 per 100 000 live births with a reference date of 1989; and the first nationally representative Gambian DHS in 2013 reported a directly estimated pregnancy-related mortality ratio of 433 per 100 000 live births (95% CI: 299 to 567) based on sibling histories.[18] The available estimates suggest a rather uncoordinated effort to reliably measure the prevailing national burden and regional variations of maternal mortality for healthcare delivery planning; as well as serve as benchmarks to monitor the extent to which MDG5 had been attained and set targets for the related Sustainable Development Goal (SDG) indicators.

This paper attempts to establish the national and subnational levels of pregnancy-related mortality in The Gambia in 2012 using data from the 2013 national census; and trends, variations and the cause-of-death distribution of pregnancy-related deaths from verbal autopsy (VA) in two regions of the country with health and demographic surveillance (HDSS) sites.

METHODS

Setting

Socioeconomic background

The Gambia is located in the bulge of the western coast of Africa bounded in the north, east and south by the Republic of Senegal, and the Atlantic Ocean in the west. With a total land area of 10 689km, it is one of the smallest countries in the world. The climate of the country is typically Sahelian, characterised by a distinct dry season from November to May, and a rainy season between June and October with the rainfall pattern reaching its peak in August. The distribution of rainfall is very irregular, thus making it vulnerable to recurrent droughts. The country is not endowed with any economically viable mineral resource, but offshore petroleum exploration has reached an advanced stage. The economy relies heavily on agriculture and tourism. Per capita GDP in 2010 was US$964 and declined to US$770 in 2020, ranking 173 out of 189 countries.[19]

The total population of The Gambia as at the national census in 2013 was 1.88 million with a growth rate of 3.2% per annum between 2003 and 2013[20]—one of the fastest in sub-Saharan Africa and with a potential of doubling in

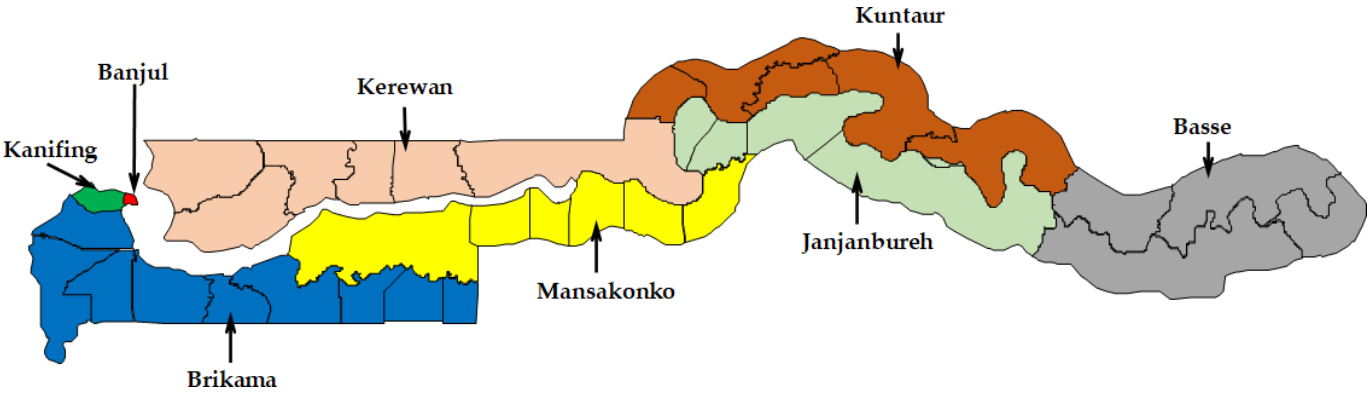


Figure 1 Map of The Gambia showing the eight administrative local government areas (LGAs).

20 years. The total fertility rate (TFR) was 5.9 children per woman in 2013 and had only declined by 0.5 births per woman over four decades;[21] and contraceptive use among married women is 9%.[18] About half the entire female population aged 15 years and above cannot read or write.[22]

Healthcare delivery system

For administrative purposes, the country is divided into two contiguous urban municipalities (Banjul and Kanifing) and six rural local government areas (LGAs): Brikama, Mansakonko, Kerewan, Kuntaur, Janjanbureh and Basse (figure 1). National socioeconomic development policy planning and implementation are decentralised in these geographical divisions. However, the national public health service delivery system is decentralised in six health regions, each covering one or more LGAs. The national healthcare system has three tiers: primary and secondary healthcare both managed by Regional Health Directorates; and tertiary, that is, General or Teaching Hospitals, managed by boards as semiautonomous institutions.[23]

The primary healthcare (PHC) system comprises of village/community health posts located at PHC villages with more than 400 inhabitants. They are operated by volunteer village health workers and traditional birth attendants who provide basic services including maternity care (ie, antenatal care (ANC), delivery and postpartum care), treatment of minor illnesses and referrals. Community health nurses supervise clusters of village health posts from key PHC villages. Secondary healthcare services are provided at major and minor health centres strategically located across the country and conduct regular base and monthly outreach RCH clinics at key locations within their respective catchment areas. Services provided include, inter alia, maternity care, neonatal and child health and in-patient care. Operationally, minor health centres should provide basic EmOC, and major health centres provide comprehensive EmOC. These facilities refer to the main hospitals for specialised services. The personnel requirements and details of services provided at each type of facility are discussed in detail elsewhere.[13]

The national reproductive health policy is set within the framework of the national health policy, and therefore implies that the implementation of RCH services is within the context of PHC. This provides a wide coverage of basic maternal care at community and facility levels such that between 2008 and 2013, more than eight out of every 10 pregnant women received ANC from a skilled provider; more than three-quarters made four or more ANC visits during their pregnancy; 57% were attended by skilled personnel during delivery and 2% of all deliveries were by caesarean section.[18]

Health and Demographic Surveillance Systems (HDSS)

The national civil registration and vital statistics system is limited in scope and geographical coverage, and the data grossly incomplete for meaningful analysis even for the main urban area. Death certification (with stated cause of death) still occur only in the main hospitals; and deaths are usually registered only in rare circumstances where burial permits are required or for legal administration purposes. Deaths occurring at home, which constitute the majority, are rarely registered.[24] Therefore, nationally representative information on causes of death is non-existent.

However, such information is generated through the administration of VAs for deaths that occur in two HDSSs operated for research purposes. The Farafenni HDSS (FHDSS) is in the North Bank East Health Region in Kerewan LGA; and the Basse HDSS (BHDSS) covers the south bank of the Upper River Health Region in Basse LGA. The FHDSS, established in October 1981, covers a population of about 58 000 and its setting and operational procedures have been described in detail elsewhere.[25] Similar procedures are adopted at the BHDSS, which was established in July 2007 and prospectively follows more than 200 000 individuals.

Data

Census

The 2013 National Population and Housing Census questionnaire asked specific questions that generated relevant data for mortality estimation within the general population. For every household enumerated, details of deaths that occurred in the 12 month period prior to census night (15April 2013) were recorded; including sex and age at death. For every female deceased person aged

between 15 and 49 years, further enquiry was made to confirm whether the death occurred during pregnancy, while giving birth or within 6 weeks after termination of pregnancy. This is the first time such questions relating to pregnancy-related mortality were included in a Gambian census. A death with an affirmative response to any one of these questions was classified as a pregnancy-related death. The census also collected information on births within the 12 month period before enumeration, as well as the ages of the mothers.

An assessment of the completeness of reported deaths by age group using the Brass Growth Balance Method[26] yielded an implausible 41% over-reporting of female deaths; while the Preston and Coale Method[27] indicated an under-reporting of female deaths by 30%. The computed age-specific death rates revealed lower death rates for rural compared with urban females, and an indication that many of the unreported deaths were among rural females aged 55 years and over.[28] Therefore, the reported deaths of females aged 15–49 did not require any adjustment. The data on births in the 12 month period before the census were also evaluated and deemed of reasonable quality.[21]

The WHO defines a maternal death as 'the death of a woman while pregnant or within 42 days of the end of the pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes'.[29] Since causes of death were not collected in the 2013 Gambian Population and Housing Census, it is not possible to clearly distinguish the 'maternal' deaths from all the reported pregnancy-related deaths. As a result, pregnancy-related mortality indicators are determined instead of maternal mortality. A pregnancy-related death, also as defined by the WHO, is 'the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the cause of death'.[29]

Health and Demographic Surveillance Systems

At both HDSS sites, demographic events are updated through household visits conducted every 4 months since April 2007; and every 3 months in Farafenni prior to that time. New pregnancies are identified during these visits and followed up in subsequent visits to ascertain their outcomes. Every individual is also followed up until migration out of the surveillance area or death.

Routine administration of VA for every death in the Farafenni surveillance area commenced in 2005 using the WHO standard VA questionnaires.[30] VAs were administered retrospectively for deaths that occurred before 2005. Interviews were conducted by trained fieldworkers at least 40 days after death to allow the bereaved family to grieve. The main carers or close relatives present during the period of illness leading to death are eligible for the interviews. VAs were conducted in one of the three main local languages spoken in each of the surveillance areas, that is, Wollof, Mandinka and Fula in Farafenni; and Sarahule, Mandinka and Fula in Basse. In the training of the interviewers, a session focused specifically on determining and adopting the best possible phraseology of each question in all the languages to ensure that they were expressed similarly in meaning.

VA data were transformed from InterVA-4 into the InterVA-5[31] input format for cause-of-death determination. Responses for questions in the InterVA-5 format that could not be derived from the original data were coded as missing. InterVA-5 probabilistic model was applied for cause-of-death assignment with malaria prevalence set as 'high' and HIV prevalence as 'low' for both surveillance sites, reflecting the situation in The Gambia between 2003 and 2012. The InterVA-5 outputs were merged with the individual demographic details from the database at each site. All deaths returned by InterVA-5 as pregnancy-related according to the disease codes of version 10 of the International Statistical Classification of Diseases and Related Health Problems, ICD-10,[32] were collectively coded accordingly for analysis.

ESTIMATION METHODS

The pregnancy-related mortality ratio (PRMRatio) is computed as the ratio of pregnancy-related deaths in a defined period to 100 000 live births. Similarly, the pregnancy-related mortality rate (PRMRate) is obtained as the ratio of pregnancy-related deaths within a specific period to 1000 person-years of women aged 15–49 years. Using the 2013 census data and applying them to a prescribed template of estimating pregnancy-related mortality from deaths reported by households,[33] these indicators were derived for The Gambia as a whole, as well as by LGA and among 5 year age groups of women to identify women with the greatest risks of pregnancy-related mortality by age group and LGA of residence. All estimates refer to the mid-point of the 12 month period prior to the census, that is, 15 October 2012.

The female-based extracted data sets from the respective HDSS databases were analysed using STATA V.17.[34] Annual estimates of pregnancy-related mortality rates were derived by survival analysis techniques for the period 2003–2012 for the Farafenni HDSS; and 2008–2012 for Basse HDSS. The corresponding annual numbers of pregnancy-related deaths and total births in the year were fitted to a Poisson regression model to derive annual pregnancy-related mortality ratios for the same periods. Statistical significance at the 95% confidence level was determined using likelihood ratio test.

Ethical approval

The Joint MRCG/Gambia Government Ethics Committee, approved the continuous operation of the Farafenni and Basse HDSS sites and all instruments used to collect household and individual level information, including the VA questionnaires (L2014.E05v2). Verbal consent was obtained for the administration of all VAs.

Table 1 Pregnancy-related mortality rates and ratios in The Gambia by area of residence and LGA

	Total women aged 15–49	Births in 12 months before census	Pregnancy-related deaths	All deaths	Proportion of deaths related to pregnancy (iii/iv)	Pregnancy-related mortality rate (iii/i)	Fertility rate (ii/i)	Pregnancy-related mortality ratio (100 000* vi/vii)
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
The Gambia	471 542	48 421	417	1578	26%	0.00088	0.1027	861
Urban	233 223	21 669	161	634	25%	0.00069	0.0929	743
Rural	238 319	26 752	256	944	27%	0.00107	0.1123	957
Banjul	8099	573	3	15	20%	0.00037	0.0707	524
Kanifing	104 709	8862	55	288	19%	0.00053	0.0846	621
Brikama	174 469	18 208	134	559	24%	0.00077	0.1044	736
Mansakonko	19 255	2273	28	86	33%	0.00145	0.1180	1232
Kerewan	52 567	6558	55	186	30%	0.00105	0.1248	839
Kuntaur	23 024	2398	45	102	44%	0.00195	0.1042	1877
Janjanbureh	30 565	3343	29	133	22%	0.00095	0.1094	867
Basse	58 854	6206	68	209	33%	0.00116	0.1054	1096

LGAs, local government areas.

Patient and public involvement

There was no patient or public involvement in the design, implementation or reporting of this study.

RESULTS

Census

A total of 48 421 births and 417 pregnancy-related deaths within 42 days postpartum were reported to have occurred in The Gambia within the 12 month period prior to the 2013 population census. The pregnancy-related deaths represent about a quarter (26%) of all deaths among women aged 15–49. This implied a pregnancy-related mortality rate of 0.88 per 1000 person years of women aged 15–49; and pregnancy-related mortality ratio of 861 per 100 000 live births for The Gambia in 2012 (table 1).

Levels of pregnancy-related mortality ratio varied significantly between LGAs. The highest level of 1877 per 100 000 live births was recorded in Kuntaur LGA, where two out of every five deaths among women aged 15–49 were pregnancy related. Mansakonko LGA followed with 1232 per 100 000 live births, and then Basse LGA with 1096 per 100 000 live births. The main urban areas of Banjul and Kanifing recorded pregnancy-related mortality ratios of about half of those observed in the predominantly rural LGAs.

The age-pattern of PRMRatios by LGA suggests that women in the youngest age group of 15–19 and the oldest age groups of 40–44 and 45–49 displayed the greatest risks of dying from pregnancy-related causes (table 2). In Mansakonko LGA, women aged 40–44 and 45–49 recorded age-specific PRMRatios of 6250 and 5128 per 100 000 live births, respectively; while that of those aged 15–19 was 2256 per 100 000 live births. However, the risks recorded for all age groups in Kuntaur LGA were high.

Health and Demographic Surveillance System

A 10-year prospective follow-up of 19 873 women of reproductive age in Farafenni yielded 78 083 years of exposure to the risk of pregnancy and pregnancy-related mortality (table 3). A total of 3259 deaths from all causes were registered, of which a little under three quarters (74%) had VAs administered. The VA interpretation returned 56 pregnancy-related deaths. In Basse, 48 720 women aged 15–49 followed-up for 5 years yielded 152 536 years

Table 2 Age pattern of pregnancy-related mortality ratios (per 100 000 live births) in The Gambia by area of residence and LGA

Age group	The Gambia	Urban	Rural	Banjul	Kani-fing	Bri-kama	Mansa-konko	Kere-wan	Kun-taur	Janjan-bureh	Basse
15–19	1340	1174	1434	5000	1066	1307	2256	917	2703	1160	1083
20–24	613	611	614	662	629	551	183	538	1783	1209	240
25–29	822	641	975	*	560	691	1379	836	1143	758	1399
30–34	705	449	928	*	310	474	1010	1158	2009	156	1430
35–39	1076	1174	995	*	962	1090	376	382	2075	880	2208
40–44	1626	1387	1813	*	604	1405	6250	2703	4717	1515	*
45–49	1490	2542	815	*	2299	913	5128	*	*	2174	2439

*No pregnancy-related death reported for the age group and LGA in the year prior to the census.
LGA, local government area.

Table 3 Annual estimates of pregnancy-related mortality rates and ratios in Farafenni (2003–2012) and Basse (2008–2012) HDSS sites

Year	Woman-years of exposure	Live births	All deaths	Number of VAs conducted	VA coverage	Number of deaths pregancy related	Proportion of deaths related to pregnancy related	regnancy-related mortality rate* (95% CI)		Pregnancy-related mortality ratio (95% CI)	
Farafenni HDSS											
2003	5372	1362	482	367	76%	6	1.24%	1.12	(0.51 to 2.49)	441	(198 to 981)
2004	8810	1546	429	322	75%	13	3.03%	1.48	(0.86 to 2.55)	841	(144 to 4925)
2005	8485	1632	406	298	73%	14	3.45%	1.65	(0.98 to 2.79)	858	(149 to 4969)
2006	8240	1611	370	269	73%	6	1.62%	0.73	(0.33 to 1.63)	373	(54 to 2571)
2007	8112	1836	331	244	74%	7	2.11%	0.86	(0.42 to 1.81)	382	(58 to 2526)
2008	7887	1782	325	242	74%	0	–	–		–	
2009	7737	1562	266	198	74%	2	0.75%	0.26	(0.07 to 1.04)	129	(12 to 1413)
2010	7825	1746	256	193	75%	1	0.39%	0.13	(0.02 to 0.91)	58	(4 to 1059)
2011	7815	1803	213	155	73%	3	1.41%	0.38	(0.13 to 1.20)	167	(19 to 1481)
2012	7800	2176	181	133	73%	4	2.21%	0.51	(0.20 to 1.37)	184	(24 to 1450)
Total	78083	17056	3259	2421	*74%*	*56*	*1.72%*				
Basse HDSS											
2008	26649	5648	1739	1153	66%	27	1.55%	1.01	(0.70 to 1.48)	479	(328 to 698)
2009	28741	6363	1608	1015	63%	27	1.68%	0.94	(0.65 to 1.37)	425	(171 to 1055)
2010	30226	6681	1491	875	59%	18	1.21%	0.60	(0.38 to 0.95)	270	(102 to 714)
2011	32173	6915	1598	861	54%	15	0.94%	0.47	(0.29 to 0.78)	217	(80 to 595)
2012	34748	7552	1241	595	48%	13	1.05%	0.37	(0.22 to 0.65)	173	(61 to 487)
Total	152536	33159	7677	4499	*59%*	*100*	*1.30%*				

**Per 1000 woman-years.*
†Per 100000 live births.
HDSS, Health and Demographic Surveillance System.

of exposure to similar risks. Out of 7677 deaths from all causes over the period, 59% had VAs administered, which returned 100 pregnancy-related deaths. Except for the year 2012 for Basse HDSS when just under half of all deaths registered (48%) had VAs administered, VA coverage was consistent over time and across 5 year age groups of women at both sites.

The estimated trends of PRMRates and PRMRatios as presented in table 3 depict similar patterns for both sites. PRMRates for Farafenni range from 1.12 per 1000 woman-years (95% CI: 0.51 to 2.49) in 2003 to 0.51 per 1000 woman-years (95% CI: 0.20 to 1.37) in 2012, peaking at 1.65 (95% CI: 0.98 to 2.79) in 2005 and recording no pregnancy-related death in 2008. That of Basse HDSS maintained a consistent decline from 1.01 per 1000 person-years (95% CI: 0.70 to 1.48) in 2008 to 0.37 (95% CI: 0.22 to 0.65) in 2012. The highest corresponding PRMRatios recorded were 858 deaths per 100000 live births (95% CI: 149 to 4969) for Farafenni in 2005, and 479 per 100000 live births (95% CI: 328 to 698) for Basse in 2008. Both sites recorded PRMRatios of 184 and 173 per 100000 live births, respectively in 2012 (table 3).

Causes of pregnancy-related deaths

Pregnancy-induced hypertension and obstetric haemorrhage were the main causes of pregnancy-related deaths in both Farafenni and Basse HDSS sites over the 10 and 5 year respective periods of follow-up (table 4). Among the deaths due to pregnancy-induced hypertension, half of those in Farafenni and 41% of those in Basse were reported as not pregnant in the administration of their VAs; and all obstetric haemorrhage fatalities returned by InterVA-5 were reported to have died in the postpartum period. These two causes collectively accounted for more than 70% of all pregnancy-related deaths in both sites (figure 2, panel A). Other reported causes of significance are pregnancy-related sepsis in Basse and abortion-related conditions in Farafenni.

DISCUSSION

The 2013 national population and housing census is the first to include questions on pregnancy-related mortality, and therefore the most extensive of such an enquiry ever to be conducted in The Gambia. However, household respondents who were unaware of the pregnancy status of deceased women in their households were likely to under-report pregnancy-related deaths.[35] In The Gambia, concealment of pregnancy, especially in the first trimester or ahead of its obvious visibility, is a common practice usually associated with protection against evil spirits and miscarriage.[36] Also, in conservative

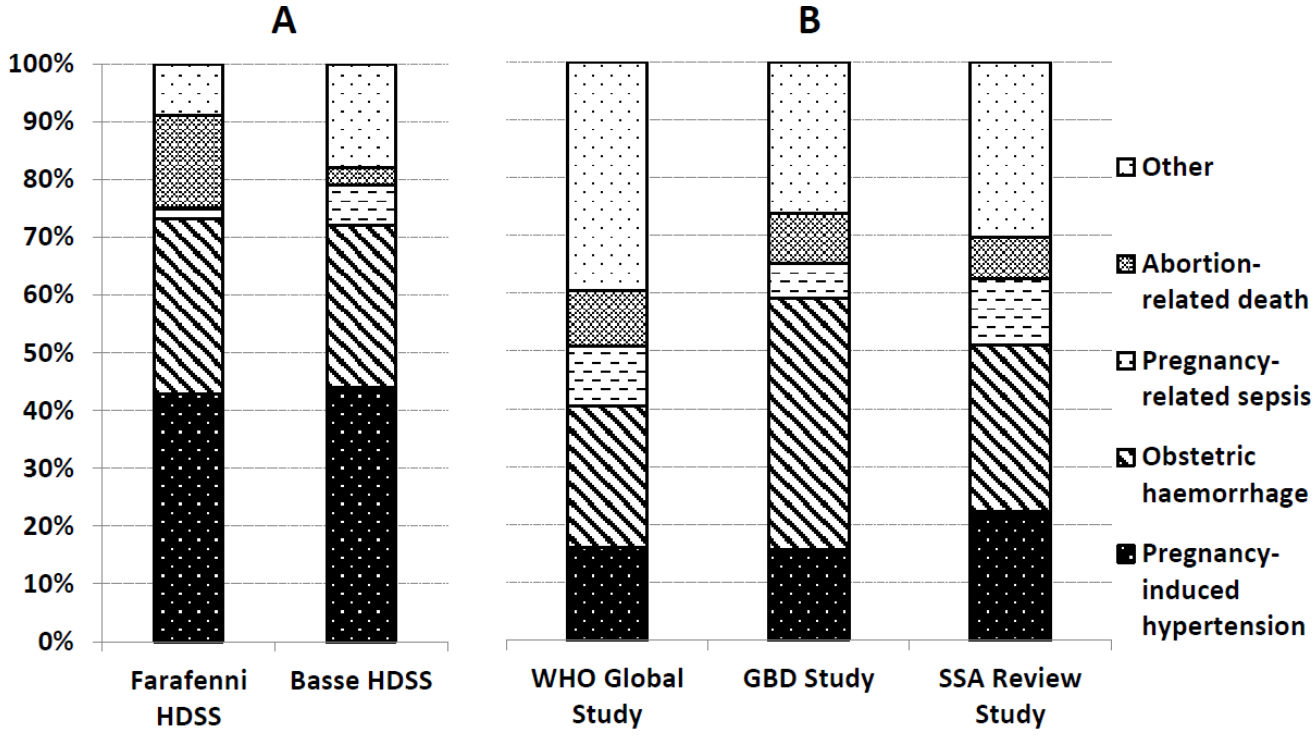
Table 4 Cause of death by reported pregnancy status in VA at time of death and HDSS site

Cause of death	Farafenni HDSS				Basse HDSS			
	Not pregnant	Pregnant	Within 6 weeks post-termination	*Total*	Not Pregnant	Pregnant	Within 6 weeks post-termination	*Total*
Pregnancy-induced hypertension	12	8	4	24	18	9	17	44
Obstetric haemorrhage	–	–	17	17	–	–	28	28
Pregnancy-related sepsis	–	–	1	1	1	–	6	7
Abortion-related death	2	2	5	9	–	–	3	3
Other	1	–	4	5	3	2	13	18
Total	15	10	31	56	22	11	67	100

HDSS, Health and Demographic Surveillance System; VA, verbal autopsy.

rural societies that frown on pregnancies out of wedlock and where unsafe abortion practices are expected to be prevalent, deaths resulting from such circumstances are likely to be unreported. It is apparent from all these scenarios that household respondents could have knowingly or unknowingly classify deaths of women of reproductive age as non-maternity related, thereby resulting in an undercount of pregnancy-related deaths in the census enquiry. Therefore, the estimated level of 861 pregnancy-related deaths per 100 000 live births for The Gambia in October 2012 can be regarded as the minimum that could have prevailed at the time. This is almost twice the pregnancy-related mortality ratio of 433 (95% CI: 299 to 567) per 100 000 live births obtained from The Gambia DHS 2013 conducted around the same time with the census but with a reference date of August 2009 and was based on fewer than 100 reported pregnancy-related deaths over a 7 year period.[18]

While there are no other estimates to independently verify the plausibility of the national estimate from the



Sources: *WHO Global Study* - [48]
GBD Study – [4]
SSA Review Study - [49]

Figure 2 Pregnancy-related cause-of-death distributions in Farafenni and Basse HDSS sites compared with previously reported distributions. GBD, Global Burden of Disease; HDSS, Health and Demographic Surveillance System; SSA, . sub-Saharan Africa.

2013 census data, a comparison is attempted using census-based estimates of PRMRatio for Sierra Leone and Ghana, vis-à-vis the socioeconomic and demographic indicators prevalent in each country at or around the time their respective estimates refer to. Fertility, adolescent pregnancy, contraceptive prevalence rate (CPR) and women's education are correlated with pregnancy-related mortality in developing countries.[2 12 37] With an entrenched tradition of early engagement in childbearing and half (49%) of women having given birth by age 20, The Gambia had a relatively high TFR of 5.6 births per woman in the 3 year period preceding the 2013 census, a low CPR of 9% and half the female population aged 15 years and over could not read or write.[18] In comparison, Sierra Leone's 2015 Population and Housing Census registered a national PRMRatio of 997 per 100 000 live births[38] with a corresponding TFR of 4.9, CPR of 17% and literacy level of 35% among women aged 15 years and over.[39] Similarly, the 2010 population census of Ghana recorded a PRMRatio of 485 per 100 000 live births[40] with TFR of 4.0, CPR of 23.5% and literacy level of 62.9%.[41] All three countries—The Gambia, Sierra Leone and Ghana—had similar levels of ANC uptake (86.2%, 97.1% and 95.4%, respectively); proportion of health facility deliveries (62.6%, 64.0% and 57.1%) and proportion of deliveries attended by skilled personnel (57.2%, 60.0% and 58.7%).[18 39 41] It is therefore apparent from these country scenarios that the combination of socioeconomic factors reported for The Gambia plausibly underlie the level of PRMRatio yielded by the census data.

Likewise, the census data facilitated estimation of PRMRatios for each of the eight LGAs of the country for the first time. Kuntaur, Mansakonko and Basse LGAs registered the highest PRMRatios of 1877, 1232 and 1096 per 100 000 live births, respectively. These three regions of the country do not have tertiary or referral hospitals that provide emergency obstetric services. Furthermore, they are characterised by attributes that correlate with high pregnancy-related mortality. TFR was 7.2 children per woman in Kuntaur, 6.3 in Mansakonko and 7.0 in Basse, with corresponding CPRs of 4.2%, 8.0% and 1.3%; and under-5 mortality rates of 70, 63 and 92 per 1000 live births, respectively.[18] Despite registering relatively high uptake of antenatal services in all these three LGAs (89.9%, 85.6% and 82.4%, respectively), they were the regions in the country with the lowest proportions of health facility deliveries (39.1%, 53.6% and 31.3%), and deliveries attended by skilled personnel (33.3%, 54.8% and 30.9%, respectively).[18] Kuntaur is the most under-served LGA in the country in terms of healthcare service delivery. It is the only region that is far removed from tertiary healthcare services, with extremely long distances to cover to referral centres or presence of physical barriers that add to travel time. Sixty-four per cent of women aged 15–49 in this region cited 'distance to health facility' as their main problem in accessing healthcare.[18] The lower PRMRatios in Banjul and Kanifing LGAs reflect the stark difference in access to private and public tertiary referral centres that provide basic and emergency obstetric services and care. Against this background, the regional pattern of PRMRatios depicted by the 2013 census is therefore plausible.

The age pattern of PRMRatios from the census data is consistent with observations in other regions and the general literature suggesting that adolescent mothers and women older than 40 years are at greater risk to pregnancy-related mortality.[10 42] There is a possibility of significant under-reporting of pregnancy-related deaths among adolescents, especially in the more conservative communities in rural Gambia where pregnancy out of wedlock and abortions are socially unacceptable and frowned on.[43] As a result, the true level of PRMRatios for women aged 15–19 and 20–24 years are likely to be higher than 1340 and 613 per 100 000 live births revealed by the 2013 census data. Advanced maternal age and increasing parity, which are prevalent due to high TFR, are established independent risk factors of obstetric haemorrhage that affect women over 40 years old.[44 45]

In contrast with the census-based estimates of PRMRatios, the VA data from the Farafenni and Basse HDSS sites yielded average annual proportions of deaths pregnancy-related of less than 2% in both sites (see table 3); and the resulting annual estimates of PRMRatio were much lower, especially in the later period from 2010 and characterised by wide uncertainty intervals. The missing VAs—for a quarter of all deaths in Farafenni and about half in Basse—have undoubtedly contributed to the low numbers of pregnancy-related deaths identified and low levels of PRMRatio estimates, especially in Basse. This implies that the InterVA-5 algorithm alone is exceptionally inadequate in yielding reliable estimates of PRMRatios that are representative of regions in which demographic surveillance sites are located. Despite earlier claims of similarity of outputs when compared InterVA-4 using Afghan data,[31] there are more recent observations suggesting that the algorithm is less accurate at ascertaining causes and circumstances of pregnancy-related death than its earlier version, InterVA-4, especially when compared with physician review.[46] Notwithstanding this shortcoming, InterVA-5 has succeeded in producing pregnancy-related cause-of-death structures at both Farafenni and Basse similar to those observed in other continental and global studies as shown in figure 2, panel B.[4 47 48] All three studies reveal that at least 40% of pregnancy-related deaths are attributed to the two main causes, namely pregnancy-induced hypertension and obstetric haemorrhage. In the cases of the Farafenni and Basse HDSS sites, these causes were responsible for over 70% of all pregnancy-related deaths identified by InterVA-5, implying that they perhaps present the greatest challenges to Gambian women and the country's RCH programme. A recent study conducted at the country's main referral hospital confirmed that haemorrhage (26.5%) and hypertensive disease (19.8%) were the main causes of maternal mortality between 2007 and 2014.[49] With a relatively high

uptake of ANC services (86.2%), and 99.1% of mothers with a live birth in the 5 year preceding the 2013 DHS reporting having had their blood pressures measured during ANC,[18] it is obvious that there exists a significant service gap between the identification and management of pre-eclampsia and eclampsia cases in The Gambia's healthcare delivery system. While the measurement of blood pressure at ANC visits may be part of the standard service provided for all pregnant women, there is a need to assess and document the quality and intensity of care in relation to the identification, management and follow-up of women with pregnancy-induced hypertension.

The government of The Gambia adopted the 2013 DHS reported level of pregnancy-related mortality of 433 per 100 000 live births in its healthcare delivery programme, starting with the national health sector strategic plan for 2014–2020 where it projected to reduce pregnancy-related mortality by 25% to 315 per 100 000 live births by 2020.[13] The derived census-based national estimate, representing the most robust and closest to the real burden of twice the assumed level of pregnancy-related mortality, will inevitably pose significant implications for national RCH policy, programme planning and implementation. This demonstrates the fear usually expressed by health indicator measurement experts of the risk of using readily available although unreliable estimates from national DHS or modelled outputs of the UNMMEIG and GBD study by policy makers and programme managers, thereby encouraging less investment in national efforts to collect requisite data for measurement, analysis and monitoring of relevant national and subnational RCH indicators.[9] If the Gambia government decides to adopt the census-derived national and regional estimates that prevailed in 2012, they can serve as reliable and appropriate baseline measures, for the first time in the history of The Gambian Ministry of Health, for monitoring progress towards the maternal mortality SDG indicator. Furthermore, the cause-of-death structure obtained from the Farafenni and Basse HDSS sites can be compared with those recorded in main referral hospitals and used routinely for informing the RCH programme, targeting prevalent causes of pregnancy-related mortality. The national RCH policy should focus more resources at secondary and tertiary health facilities for the identification of pregnancy-induced hypertensive diseases during and after termination of pregnancy, as well as tackle postpartum haemorrhage and sepsis.

A recent attempt to quantify the burden of pregnancy-related mortality and duration of risk following childbirth in sub-Saharan Africa, which included data from both the Farafenni and Basse HDSSs, suggests that women remain at 20% higher risk of pregnancy-related death until 4 months postpartum—substantially longer than the 42-day duration implied in the definition of pregnancy-related death.[50] Hence, this study shows the need for national RCH programme planners to synthesise the available evidence in effective maternity care, and engage in implementation research to identify and correct impeding factors relating to the provision of effective RCH services to curb the high incidence of pregnancy-related mortality in The Gambia. Continuous improvement on complete capture and centralisation of service delivery data (such as pregnancy outcomes, registration of births and deaths, cause(s) of death, etc) can serve to provide periodic estimates of pregnancy-related mortality ratios and other RCH indicators of interest, as well as provide a platform to expand towards a fully fledged national Civil Registration and Vital Statistics system.

CONCLUSIONS

This study is yet another reaffirmation that the sibling survival method adopted in producing DHS pregnancy-related mortality estimates suffer significant downward biases, and therefore cannot be depended on for routine estimation of PRMRatios in LMICs for policy, programme planning and monitoring purposes, especially in relation to the SDG targets for pregnancy-related mortality. The census-derived estimates are more reliable and can be included as baseline estimates in the country's RCH programme should it be revised accordingly.

However, with only one set of census-based estimates, trends in national and subnational PRMRatios in The Gambia cannot be inferred from this study, as there is no conclusive evidence to suggest that PRMRatios have been declining or otherwise since 2012. As a result, methodological exploration will be required to determine national and regional levels and trends in PRMRatios in The Gambia between 2012 to date. An attempt can be made in the Basse HDSS to triangulate HDSS data, health facility records and field interviews to confirm pregnancy-related deaths, derive the PRMRatio based on these updated records and compare with the estimate yielded by the 2013 census data for the districts of Fulladu East and Kantora covered by the Basse HDSS. The forthcoming 2023 population census will present an opportunity to better understand intercensal levels and trends in pregnancy-related mortality in the country.

VA data from the HDSS sites have depicted prevalence of similar cause-of-death structures for pregnancy-related deaths in the eastern and middle parts of The Gambia between 2003 and 2012, with pregnancy-induced hypertension and obstetric haemorrhage being the two most common causes. With the documented high uptake of ANC services across the country during that period, and during which blood pressure was measured for every attendant, it is apparent that there existed a huge service gap between identification of cases of hypertensive disease in pregnancy and their subsequent management either onsite or by referral to higher level facilities. An update of the cause-of-death structures at both sites since 2012 will serve as a useful guide in the update of the national RCH policy and programme, especially with respect to strategies for

managing hypertension during and after termination of pregnancy; and measures for preventing haemorrhage during or after delivery.

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