Finding the Missing Maternal and Paternal Orphans

Shea O. Rutstein

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Cover Art: An ancient bronze sculpture of a female wolf suckling Romulus and Remus, the legendary orphan brothers from Roman mythology.

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ABSTRACT

The Demographic and Health Surveys provide information on maternal, paternal and double orphans, which can be used for estimates of the total number and number of HIV-related orphans for many countries. These estimates are almost always based on models that use mortality and fertility rates. For many countries, however, a principal model used by UNAIDS (SPECTRUM) gives up to twice the percentage of children who are maternal orphans as found in the DHS while at the same time giving about the same percentage of paternal orphans. The purpose of this study is to evaluate the declaration of orphanhood status in the DHS in order to examine the possibilities of model overestimation or survey under-declaration.

Given the lack of valid external sources of information on orphanhood, internal comparisons of the DHS data have been used for this evaluation. In the household member schedule of the surveys, the survival status of each child's parents is asked as well as the identification of each parent living in the household. Moreover, in an individual interview, women between the ages of 15 and 49 years are asked about the survival status of each of their births together with the household identification of each child living with her. The estimated percentage of children under 18 years of age whose mother is not living are reported as maternal orphans. The estimates vary from lows of 1.1 percent in the Dominican Republic and 1.9 percent in Mali to highs of 9.4 percent in Lesotho and 9.9 percent in Zimbabwe. The average value of the 27 surveys is 4.0 percent.

The information from both sources can be utilized to identify potentially hidden or under-reported orphans and children reported as maternal orphans but who have a mother living in the same household. Overall, from this approach there is a maximum

potential of 7.6 percent of children who are maternal orphans. This figure compares with the declared 4.0 percent. Variations in the maximum potential are wide, from lows of 3.4 percent in Nigeria and 4.0 percent in Mali to a high of 16.2 percent in Zimbabwe.

For paternal orphans, overall, there is a maximum potential of 9.4 percent of children who are paternal orphans. This figure compares with the average value of 8.1 percent for declared paternal orphans.

A second approach for estimating maternal orphanhood is to use information provided by respondents as to their sister's survival and for dead sisters, the number of the sister's children at the time of her death. With reasonable assumptions, the estimated percentage of orphans from female mortality rates and births to dead women varies from 5.4 percent to 7.1 percent.

The results of both approaches indicate approximately the same level of orphanhood, given reasonable assumptions. More importantly, the number of potentially hidden orphans is sufficient to raise the percentage of children who are maternal orphans to be in line with that estimated by the models. It is, therefore, concluded that the DHS household questionnaire understates by a substantial amount the number of maternal orphans. This understatement may result because of the phrasing of the question about parental survival, or may be a willful misdeclaration on the part of the respondent, perhaps to protect the adopted child and/or the adopting family. On the other hand, in at least one survey there is some evidence of overstatement of orphanhood status. It is possible that this overstatement is due to the external assistance provided to families with orphaned and vulnerable children, and given increases in the amount and extent of this targeted assistance, overstatement may become more prevalent in future surveys.

INTRODUCTION

The Problem

While orphanhood occurs within all societies and may peak temporarily in many countries due to war, violence and catastrophes, the HIV/AIDS epidemic is the most sustained, high-level and long-term cause of orphanhood, particularly maternal and double orphans, because it cuts short the lives of mothers and fathers in the prime childrearing ages.

The burden of raising the orphaned children falls most commonly on their grandparents, especially grandmothers, who often are in need of care and support themselves. The result is often a need for greater government support for AIDS orphans (Bock and Johnson, 2008). However, those who take on the burden of orphaned grandchildren are usually healthier than grandparents in general (Ice et al., 2008).

In Thailand, Safman (2004) finds that most of the children orphaned by AIDS were being cared for by members of their extended family, usually grandparents or maternal aunts. Many care-giving households experience significant financial hardship which might have implications for the children's long-term well-being and stability and for their opportunities for educational advancement.

Many other studies have noted the effects on households of caring for an orphan. For example, see Deininger et al. (2001), Madhavan and Schatz (2007), and Townsend and Dawes (2007).

Orphanhood also impacts the children themselves. Kang et al. (2008) found that adolescent girl orphans whose mothers have died are more likely to be sexually active, have had a sexually transmitted infection (STI), to have been pregnant and to be infected

with HIV. They are also more likely to be living in households headed by themselves or siblings. If their father died, they are more likely to be homeless and to have dropped out of school. Gregson et al. (2005) also found that orphans and vulnerable children have heightened risks of adverse reproductive health outcomes and higher risks of HIV infection.

From a study of demographic surveillance systems in South Africa, Tanzania, and Malawi, Hosegood et al. (2007) found that the living and care arrangements of orphans, particularly with the father, varied according to marriage, migration and adult mortality patterns, but that there was no evidence an important level of households that were headed by children in any of the areas.

The impact of orphanhood on children's schooling could be one of the most important effects of a parent's death. In rural Zimbabwe, for example, Nyamukapa and Gregson (2005) found that children whose mother had died have low primary school completion rates, reflecting adaptations and gaps in extended family orphan care arrangements. The sustained high levels of primary school completion, especially of girls, resulted from residence in households with female heads and greater access to external resources. For maternal orphans, low completion resulted from a lack of support from fathers and stepmothers as well as lessened external support due mostly to ineligibility. See other recent studies by Huber and Gould (2003), Case, Paxson and Ableidinger (2004), Guarcello, Lyon and Rosati (2004), Ainsworth, Beegle and Koda (2005), Yamano, Shimamura and Sserunkuumac (2005), Case and Ardington (2006), and Yamano (2006).

In a rare paper about the effects of AIDS orphanhood outside of Africa, Zhonghu HE and Chengye Ji (2007) did not find reduced nutritional status, but the authors did find that maternal, paternal and double orphans have psychological problems, such as depression and low self-esteem as well as a lower quality of life. These findings applied mainly for boys in rural Henan Province of China.

Lindblade et al. (2003) examined the health and nutritional status of orphans younger than 6 years old cared for by relatives in western Kenya. They found that 7.9 percent of the children had lost one or both their parents and that there was no difference between orphans and non-orphans regarding key health indicators such as prevalence of fever and malaria parasitaemia, history of illness, hemoglobin levels, height for age anthropometry Z-scores, but that weight for height Z-scores in orphans were almost 0.3 standard deviations lower than those of non-orphans. This association was more pronounced among paternal orphans and those who had lost a parent more than one year ago. These results suggest that the health status of surviving orphans living in their community is similar to that of the non-orphan population.

In a study of a rural population in South-West Uganda with a seroprevalence rate of 8 percent among adults, Kamali et al. (1996) found that slightly over 10 percent of children aged less than 15 years were reported to have lost one or both parents with the loss of the father alone more than twice as more common as loss of the mother alone. HIV-I seroprevalence rates were higher among orphans than among non-orphans and were up to six times higher in the 0-4 year age group. However, the authors found no significant difference in mortality between orphans and non-orphans.

However, a prospective cohort study of Manicaland (Watts et al., 2005) found that the standardized mortality ratio for orphans compared to non-orphans was 2.7 and for maternal and paternal orphans it was 6.1 and 1.7, respectively.

Policies

National and international policies to cope with the problems related to AIDS orphanhood and children made vulnerable due to HIV and AIDS have been discussed in Belsey (2005), and Gillespie, Norman and Finley (2005). A review index of policies has been prepared by Monasch et al. (2007).

Estimates and Models

UNICEF (2008) estimates that there were 132,700,000 orphaned children younger than 18 years in the world in 2005. Of these orphans, 15,200,000 (12 percent) were orphaned due to AIDS. In sub-Saharan Africa, of the 48,300,000 orphans, 12,000,000 (25 percent) were due to AIDS. The total number of orphans projected for 2010 in Sub-Saharan Africa is 53,100,000. These estimates come from models of the HIV/AIDS epidemic and sub-models on fertility and mortality of adults and mortality of children.

Based on model projections, UNICEF estimates that by 2010, nearly 15.7 million children will have lost at least one parent to AIDS, representing 30 percent of orphans from all causes (UNICEF, 2006). In that year, 5.7 million children are expected to be orphaned from all causes and one in eight children in Sub-Saharan Africa will be orphans. For sub-national estimates see AusAID (2006) and Watts et al. (2005).

Estimates of the number of orphans from AIDS and other causes are quite varied. Methods for the estimates are given in Gregson et al. (1994), Hunter and Williamson (2000), Johnson and Dorrington (2001 and 2006), the UNAIDS Reference Group on Estimates, Modelling and Projections (2002, 2003a, 2003b, 2007), and Grassly, Phil, and Timaeus (2005), Johnson (2004). They are critiqued by Monk (2002).

Grassly et al. (2004) examined the congruence of earlier model predictions of the number of orphans in sub-Saharan Africa with estimates based on household surveys. They found that survey estimates of maternal and paternal orphans were significantly lower than model estimates for 40 surveys in 36 countries of sub-Saharan Africa. They conclude that the over-estimates from models are probably because adult mortality from causes other than AIDS is lower than assumed in the models, but they caution that under-reporting of orphanhood in surveys may also play a role. Reducing adult mortality from causes other than AIDS would bring model estimates into close agreement with the surveys and suggest that the fraction of orphans attributable to AIDS is greater than estimated previously.

For some of the values in the later models, results from the Demographic and Health Surveys (DHS) are used for HIV prevalence. However, to date not much use has been made of the DHS data on adult mortality and orphanhood.

Purpose of the Analysis

Comparisons of the estimates of orphans produced by the Spectrum model with tabulations from DHS have been approximately consistent for children whose fathers have died but were inconsistent for children whose mothers have died. The Spectrum

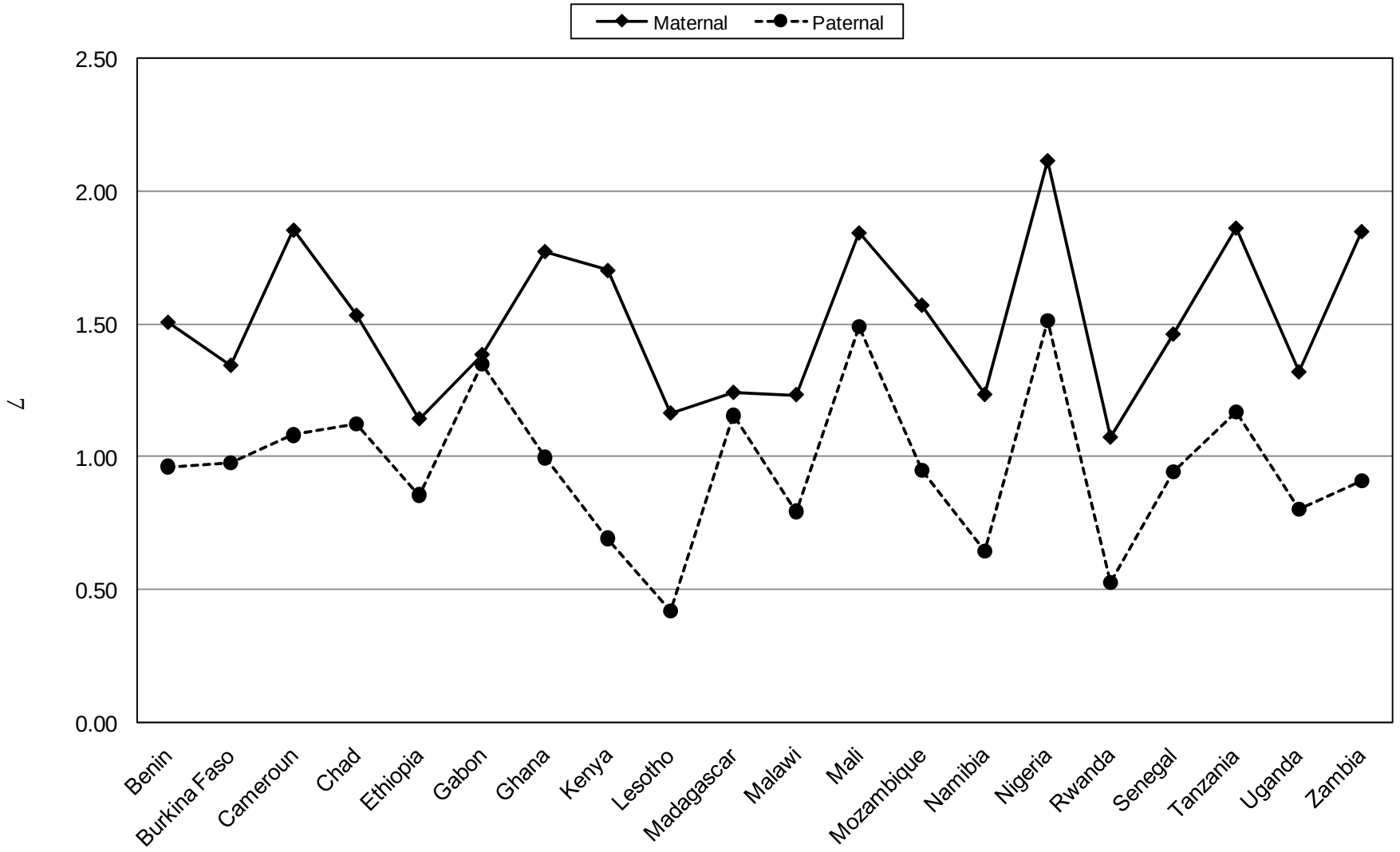
model gives about one and a half times the percentage of maternal orphans as do the DHS surveys (Figure 1).[1] This study has a dual purpose: 1) to analyze the data from recent sub-Saharan African and three other DHS surveys in order to detect missing or "hidden" orphans and/or misreporting of non-orphaned children as orphans; 2) to provide better estimates of female and male mortality rates and of the number of children of dead women for use in the Spectrum model.

Definition of Orphan

In this study, an orphan is a person under the age of 18 years who has had one or both of their biological parents die. A maternal orphan is a child whose mother has died; a paternal orphan is a child whose father has died; and a double orphan is a child whose both parents have died. Thus, the number of maternal orphans includes double orphans as does the number of paternal orphans.

[1] Figures 1 and 4 are limited to surveys compared with data provided from Spectrum model estimates.

Figure 1. Ratio of spectrum to DHS estimate of orphanhood



DATA AND METHODOLOGY

Data

The data for this study come from the latest sub-Saharan DHS surveys conducted between 2000 and the present that have datasets available for use. A few surveys are ongoing or have not yet released their datasets. Two countries, Eritrea and Mauritania, have restricted the use of their data. There are 24 country surveys from sub-Saharan Africa for this analysis. Three non-sub-Saharan surveys have been included as well, Cambodia, the Dominican Republic, and Haiti. The 27 surveys and their dates of fieldwork are listed in Table 1.

The Demographic and Health Surveys are surveys of the population living in households. Children whose parents have died and are not living in households (living in orphanages, hospitals, other group quarters, or living on the street) are not covered by the survey. Children who live in a dwelling which is not a group quarter are covered by the survey even though there may be no person over the age of 18 years in the household. It is believed that the percentage of children and orphans not covered by DHS is quite low but accurate figures are not frequently available for this estimation.

Table 1. Results of maternal orphan analyses

Country	Survey year	Maternal Orphans							Paternal Orphans				Ratio reported maternal/ paternal	Ratio max maternal/ paternal	Mean number of children born to dead women
		% Maternal orphan	% Mother's status unknown	Potential Hidden Orphans from relation-ship structure	Potential Hidden Orphans not found in birth history	"Orphans" found in birth history	Adopted, fostered children in birth history	Max % maternal orphans	% Paternal orphan	% Father's status unknown	Potential Hidden Orphans from relation-ship structure	Max total paternal orphans			
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Benin	2006	2.55	0.05	2.9	0.01	0	0.07	5.50	5.28	0.07	1.08	6.43	0.48	0.85	2.24
Burkina Faso	2003	2.31	0.39	2.1	0.00	0	0.02	4.80	4.79	0.31	0.39	5.49	0.48	0.87	NA
Cameroun	2004	2.72	0.03	1.8	0.00	0	0.01	4.51	5.75	0.92	0.10	6.77	0.47	0.67	2.16
Chad	2004	3.48	0.00	2.2	**16.23**	0	0	**21.93**	7.03	0.00	0.40	7.44	0.49	**2.95**	NA
Congo (Brazzaville)	2005	3.87	0.05	4.2	0.00	0	0.02	8.08	6.59	0.28	0.46	7.33	0.59	1.10	NA
Côte d'Ivoire	2005	2.74	0.04	9.0	0.00	0	0.88	11.82	6.06	0.28	3.55	9.89	0.45	1.20	**0.38**
Ethiopia	2005	3.44	0.05	1.1	0.00	0	0.79	4.59	6.60	0.11	0.15	6.86	0.52	0.67	1.83
Gabon	2000	2.03	0.21	5.3	NA	NA	NA	7.34	3.21	0.34	1.16	4.70	0.63	1.56	2.36
Guinea	2005	2.47	0.04	1.8	0.00	0	0.91	4.36	4.88	0.11	0.24	5.23	0.51	0.83	2.07
Kenya	2003	3.36	0.05	0.7	0.20	0.0045	0.24	4.28	7.80	1.69	0.18	9.67	0.43	0.44	2.27
Lesotho	2004	9.40	0.35	0.2	0.00	0	0	9.95	23.56	3.26	0.03	26.86	0.40	0.37	2.00
Madagascar	2003/4	2.32	0.14	2.2	0.00	0	1.51	4.62	3.99	0.79	0.08	4.86	0.58	0.95	2.42
Malawi	2004	4.54	0.03	2.2	0.28	0	1.25	7.02	7.72	0.29	0.29	8.30	0.59	0.85	2.32
Mali	2001	1.87	0.14	1.8	0.18	0	0.40	3.99	3.51	0.20	0.21	3.93	0.53	1.02	2.01
Mozambique	2003	4.66	0.07	3.8	0.01	0	2.27	8.50	9.42	0.59	0.16	10.17	0.49	0.84	1.97
Namibia	2000	3.04	0.05	5.0	0.16	0	1.28	8.25	6.75	0.47	2.33	9.55	0.45	0.86	1.76
Namibia	2006	7.14	0.06	9.1	0.83	0	1.57	16.21	12.51	0.69	2.18	15.38	0.57	1.05	1.82
Niger	2006	2.47	0.01	3.4	0.00	0	1.01	5.86	3.61	0.03	0.68	4.31	0.69	1.36	2.25
Nigeria	2003	2.23	0.04	1.1	0.00	0	0.43	3.37	4.21	0.07	0.14	4.42	0.53	0.76	NA
Rwanda	2005	7.30	0.23	1.2	0.00	0	0.82	8.72	17.15	1.10	0.12	18.38	0.43	0.47	2.08
Tanzania	2004	3.81	0.06	5.5	NA	NA	NA	9.28	7.86	0.76	0.73	9.35	0.48	0.99	NA
Uganda	2006	6.42	0.15	2.5	0.03	0.0066	1.05	9.07	11.99	0.40	0.56	12.96	0.54	0.70	2.19
Zambia	2001/2	5.26	0.03	3.0	0.00	0	1.93	8.28	10.31	0.30	0.11	10.72	0.51	0.77	2.15

(Cont'd)

Table 1 – cont'd

Country	Survey year	Maternal Orphans							Paternal Orphans				Ratio reported maternal/ paternal	Ratio max maternal/ paternal	Mean number of children born to dead women
		% Maternal orphan	% Mother's status unknown	Potential Hidden Orphans from relation-ship structure	Potential Hidden Orphans not found in birth history	"Orphans" found in birth history	Adopted, fostered children in birth history	Max % maternal orphans	% Paternal orphan	% Father's status unknown	Potential Hidden Orphans from relation-ship structure	Max total paternal orphans			
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Zimbabwe	2005/6	9.88	0.16	4.5	1.80	0.0770	4.49	16.24	19.69	1.53	1.56	22.78	0.50	0.71	NA
Cambodia	2005	2.61	0.09	1.8	0.17	0	0.88	4.64	6.98	0.19	0.48	7.65	0.37	0.61	1.41
Dom. Rep.	2002	1.05	0.03	7.4	0.00	0	5.05	8.45	2.51	0.10	0.80	3.41	0.42	2.48	2.24
Haiti	2005	4.45	0.06	6.5	0.00	0	2.61	11.04	8.21	0.29	1.56	10.06	0.54	1.10	NA
Average		*3.98*	*0.10*	*3.4*	*0.80*	*0.0035*	*1.18*	*7.64*	*8.07*	*0.56*	*0.73*	*9.37*	*0.51*	*0.93*	*2.08*

NA indicates data are not available.

Bold indicates an anomalous result.

The DHS survey includes a household questionnaire which contains a schedule of all usual household members and all other persons who slept in the household the night before the interview. Visitors and household employees who do not sleep in the household but who are present the day of the interview are not included in the schedule to avoid double coverage bias. In most countries, household members who did not sleep in the dwelling the night before the interview are also excluded, producing a "de facto" household population since including them would produce a double coverage if they slept in another household that night. In a few countries all household members are included but overnight visitors are excluded to produce a "de jure" household population. A *de jure* approach is used where the census used the same approach.

Estimation of Maternal Orphans

In the household schedule, age, sex, and relationship to the household head are asked for each person on the schedule. For children under age 18 years, the household respondent is asked, "Is (NAME)'s natural mother alive?" and "Is (NAME)'s natural father alive?" The responses to these questions are "Yes", "No" and "Don't Know". For the determination of orphanhood, a *de jure* approach is taken (i.e. usual household members) even if the reported population distributions from the survey are *de facto* based. A child is considered to be an orphan if the response is "No" to either question. Therefore, for children for whom the answer is "Don't Know", it is assumed that the parent is alive.

Estimation of "Hidden Orphans" Using Relationship to Household head

Since the respondent for the household schedule can be any "responsible" person, for various reasons orphans in the household may not be declared as such: they may be adopted and are considered to be part of the family with the care-taker being considered the mother; the child may not have been told that s/he is an orphan or has been adopted; other family members, neighbors and acquaintances may not know the child's status and the family wants to hide it to avoid stigma or discrimination; the respondent does not understand that the question is only about the child's biological parent.

The methodology of this analysis is to use information on relationship to household head for both the mother and the child and the father and the child. The line number in the schedule of the living mother of each child was obtained with the following two questions: "Does (NAME)'s natural mother usually live in this household or was she a guest last night? And "IF YES: What is her name?". The line number of the mother is recorded if the mother is in the household schedule. If she lives and slept elsewhere, then a value of 0 is given for the line number. Then for children whose mother has a line number, the relationship of the mother to the head is compared with the relationship of the child to the head. A child is considered as a potential maternal orphan if the child was declared as adopted or fostered in her/his relationship to head or if the mother's and child's relationships were inconsistent.

The consistent relationships are given below.

Mother's relationship to head	Child's relationship to head	Potential orphan
Head, wife of head, co-spouse of head	Child of head	No
Daughter, daughter-in-law	Grandchild	No
Grandchild	Grandchild or other relative	No
Mother of head	Brother, sister of head	No
Sister of head	Other relative	No
Other relative, mother-in- law	Other relative	No
Not related	Not related	No
Any	Adopted, fostered child	Yes
Other combinations		Yes

The tabulation of potential orphans is done only for children whose mother is living in the household.

The household relationship methodology is analogous for paternal orphans.

Estimation of "Hidden Orphans" Using the Birth History

Another way of estimating "hidden maternal orphans" is to compare children declared as having a mother in the household schedule with the birth history of that mother taken during the mother's interview.

In the DHS, women between the ages of 15 and 49 years are eligible for an individual interview during which women are asked about all the children to whom they have given birth. A maternal orphan or other non-biological child who was being cared for by a woman may have been reported as having a mother in the household schedule (which could be answered by someone other than the care-taker) but would not be reported by the "mother" as having been born to her. Among other information, the birth history records the sex, birth date, survival status of each of her children as well as that child's line number in the household schedule. Using this information, each child whose identified mother was individually interviewed was attempted to be located in the birth history of the mother, first by using the child's household schedule line number and then by searching the age and sex of her surviving children. Each child that was not found in the birth history then is a potential hidden orphan.

Given that there is no birth history asked of men even where men are interviewed, this methodology cannot be applied for paternal orphans.

Estimation of non-Orphaned "Orphans"

Each child in the birth history is also compared with the report of its mother's survival in the household schedule using the household schedule's line number recorded in the birth

history. Since only living women are individually interviewed, all these children should have surviving mothers.

Another check for mis-declared maternal orphans can be made by looking at the household relationship of children in the birth history. They may have been declared as adopted or fostered. However, since the mother has included them in the birth history, they may simply be the children of a former relationship. Because of the lack of more detailed information, we consider them neither as over-stated maternal orphans nor hidden maternal orphans, although some may be.

Calculation of Adult Mortality Rates

Many of the DHS surveys include a module to estimate the level of maternal mortality. However, the data collected by this module can also estimate adult female and male mortality rates. It proceeds by asking respondents about their biological siblings, i.e. the brothers and sisters born to their biological mother. For each sibling starting with the oldest, the name, the sex and survival status are asked. For living siblings, the current age is asked. For siblings who have died, the respondent is asked how many years ago and at what age the death occurred.

Using this information, the number of dead sisters and brothers can be calculated by age group for time periods prior to the survey. Additionally, the number of persons-years is calculated by age group. The quotient of these two numbers gives the age-specific mortality rate for the time period. The DHS usually uses the time period (0-6 years prior to the survey) as a compromise between recency of the maternal mortality rates and reduction in sampling error of the rate. Longer periods have been investigated

but tend to produce lower maternal mortality estimates. Though not thoroughly investigated, the declining of the rates with increased time period appears to be a structural effect of the age eligibility criteria for interview.

Another structural effect is that the age distribution of siblings is far from the age distribution of the population and of respondents. This discrepancy is due to the fact that young siblings (e.g. born 15 years ago) can only be reported by respondents who are older than they are. Similarly older siblings (49 years and older) can only be reported by younger respondents. Therefore, the likelihood that a sibling will be reported depends on how long ago the sibling was born, first rising and then falling with the respondent's age. For the overall mortality rates for ages 15-49 (or other wide age group), the rates are age-standardized to that of the respondents.

Calculation of the Number of Children of Dead Women

For sisters who died at 12 years of age or more, the respondent is asked: "How many live born children did (NAME) give birth to during her lifetime (before this pregnancy)?". (The words in parentheses are for women who died during pregnancy.) The question is asked for all non-surviving sisters, not just for maternal deaths. The answers provide the data for the mean number of children born to dead women. The average includes women who did not have any live births. Sisters for whom the respondent did not know the answer are excluded from the calculation of the mean.

RESULTS

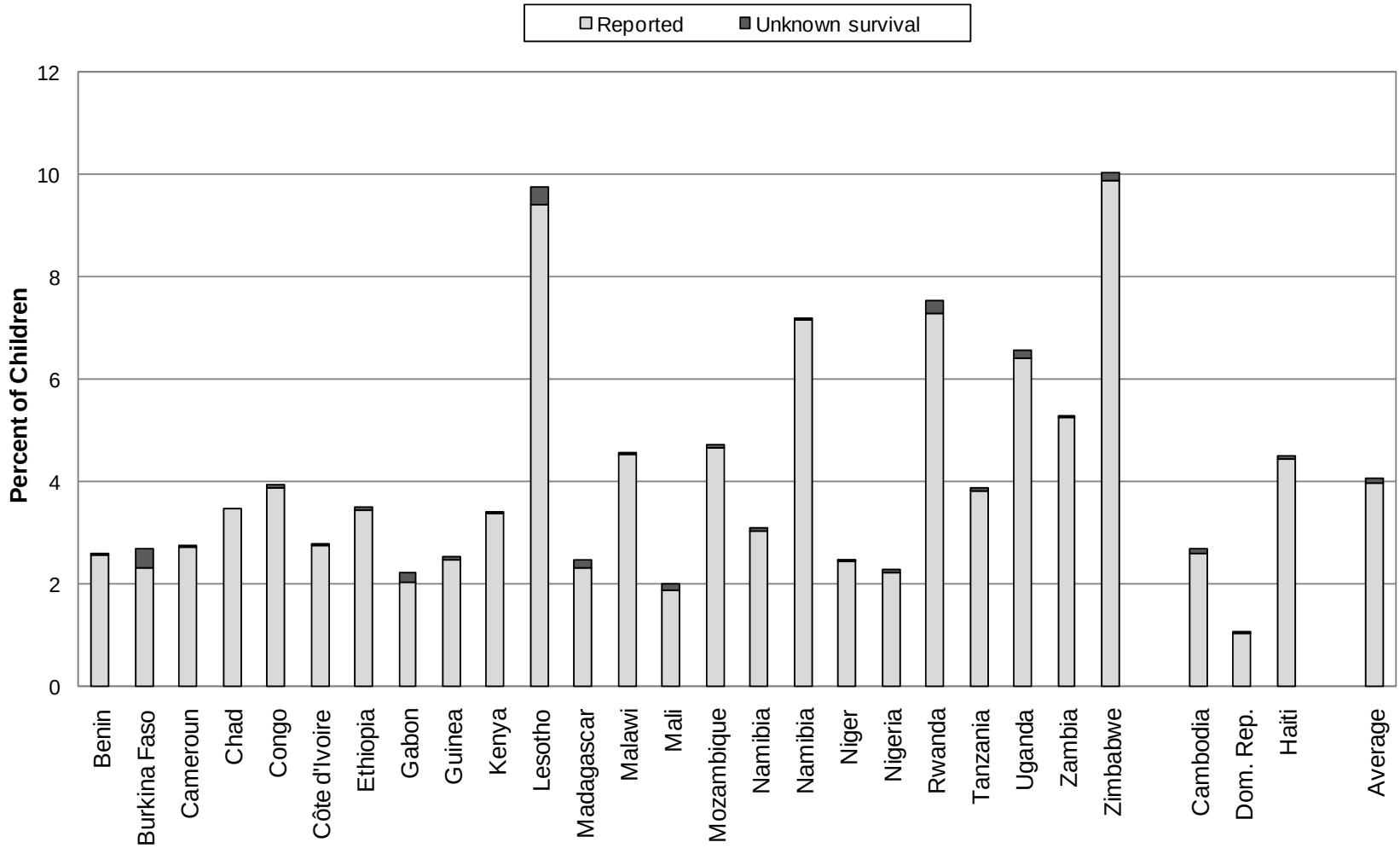
Maternal Orphans

The column one of Table 1 gives the estimated percentage of children under 18 years of age whose mother is not living, that is, reported maternal orphans. The estimates vary from lows of 1.1 percent in the Dominican Republic and 1.9 percent in Mali to highs of 9.4 percent in Lesotho and 9.9 percent in Zimbabwe. The unweighted average value of the 27 surveys is 4.0 percent (Figure 2).

Some of the household respondents did not know the survival status of some of the children's mothers. On average, this occurred for only 0.1 percent of children, reaching a high of 0.4 percent in Burkina Faso and Lesotho (column 2 of Table 1 and Figure 2).

Column 3 of Table 1 gives the percent of children (whose mothers live in the household) who have discrepant relationships with the head of the household or who were declared directly as adopted or fostered. These are potential orphans if the mother declared in the schedule was not the biological mother. The percentages vary from lows of 0.2 percent in Lesotho and 0.7 percent in Kenya to 7.4 percent in the Dominican Republic and 9.0 percent in Côte d'Ivoire. The average over the 27 surveys is 3.4 percent.

Figure 2. Reported maternal orphans



The estimation of hidden orphans using the comparison of the mother's birth history with the household schedule is given in column 4 of Table 1. In 14 of the 25 surveys with appropriate information, no hidden orphans were found. In all the other surveys except Zimbabwe and Chad only a handful of potential hidden orphans were found. In Zimbabwe, 1.8 percent of children could not be found in the birth history. In Chad where household schedule line numbers of children were not recorded in the birth history, over 16 percent of children could not be found in the birth history. This large percentage is very anomalous and could be due to misestimating ages and/or birth dates in both sources of data. Excluding the results for Chad, 0.8 percent of children of interviewed mothers are potential hidden orphans.

The search for mis-reported orphans using the declaration of the mother's survival status for children in the birth history yields comforting results. Only in three surveys are any found, no more than 0.08 percent of children (Zimbabwe, see column 5 of Table 1).

Birth history children who are "adopted or fostered" according to their relationship with the head of the household have percentages that are larger, up to 5.1 percent of children in the birth history in the Dominican Republic. The average number of such children is relatively low, 1.2 percent. However, as indicated above, they may be correctly classified if the children are from a former relationship of the mother (or if a brother, sister or other relative is the head of the household and has adopted/fostered the child).

The maximum percentage of potential maternal orphans can be obtained by summing columns 1 through 4 of Table 1 and subtracting column 5. The result is shown in column 7. Overall, there is a maximum potential of 7.6 percent of children who are

maternal orphans. This figure compares with the declared 4.0 percent. Variations in the maximum potential are wide, from lows of 3.4 percent in Nigeria and 4.0 percent in Mali to a high of 16.2 percent in Zimbabwe (excluding Chad because of an anomalous value).

Paternal Orphans

Column 8 of Table 1 gives the estimated percentage of children under 18 years whose father is not living, that is, reported paternal orphans. The estimates vary from a low of 2.5 percent in the Dominican Republic to a high of 23.6 percent in Lesotho. The average value of the 27 surveys is 8.1 percent.

Some of the household respondents did not know the survival status of some of the children's fathers. On average, this occurred for only 0.6 percent of children, reaching a high of 3.3 percent Lesotho (column 9 of Table 1).

Column 10 of Table 1 gives the percent of children (whose fathers live in the household) who have discrepant relationships with the head of the household or who were declared directly as adopted or fostered. These are potential paternal orphans if the father declared in the schedule was not the biological father. The percentages vary from lows of 0.03 percent in Lesotho and 0.08 percent in Madagascar to 2.3 percent in Namibia 2000 and 3.6 in Côte d'Ivoire. The average over the 26 surveys is 0.7 percent, far lower than that of maternal orphans.

The maximum percentage of potential paternal orphans can be obtained by summing columns 8, 9 and 10 of Table 1. The result is shown in column 11. Overall, there is a maximum potential of 9.4 percent of children who are paternal orphans. This figure compares with the declared 8.1 percent. Variations in the maximum potential are

wide, from lows of 3.4 percent in the Dominican Republic and 3.9 percent in Mali to highs of 22.8 percent in Zimbabwe and 26.9 percent in Lesotho.

Columns 12 and 13 of Table 1 compare the reported maternal and paternal orphans and the maximum potential maternal orphans using a ratio of the maternal to the paternal. The numbers of reported maternal orphans are on average 51 percent of the numbers of reported paternal orphans. The relationship changes substantially once potentially "hidden" orphans are included. Column 13 indicates that including the "hidden" orphans increases the ratio of maternal to paternal to 93 percent. Ratios in column 13 for the individual surveys range from lows of 37 percent in Lesotho and 44 percent in Kenya to highs of 156 percent in Gabon and 248 percent in the Dominican Republic (excluding Chad). Excluding Chad, six surveys have maternal to paternal ratios that exceed 110 percent, which is thought to be unlikely and therefore not all of the potential maternal orphans may truly be orphans.

Adult Mortality

Twenty-five countries included a sibling history and provide data for calculating adult mortality rates. Adult male mortality rates by age group and for ages 15-49 are given in Table 2, and adult female mortality rates are given in Table 3. The rates are for the period 0-6 years prior to the survey. Rates for the period 0-4 years prior were also tabulated (see appendix tables), but tended to produce slightly lower mortality rates, perhaps due to the reluctance to acknowledge a recent death or a lack of knowledge of that death. (Siblings whose survival status is unknown are excluded from both the denominator and the numerator of the death rates.)

Table 2. Adult male mortality rates 0-6 prior to survey, by report of siblings

Country	Year	Age group							
		15-19	20-24	25-29	30-34	35-39	40-44	45-49	15-49
Benin	2006	2.2	2.3	3.3	4.7	5.4	8.1	9.2	4.3
Burkina Faso	2003	2.1	3.4	4.2	7.0	6.6	9.9	11.3	5.4
Cameroun	2004	2.9	3.7	5.9	7.6	10.5	12.4	12.4	6.3
Chad	2004	4.3	3.3	5.4	6.6	4.9	8.4	7.0	5.3
Congo	2005	4.5	4.9	5.0	7.2	11.4	11.7	14.0	7.0
Côte d'Ivoire	2005	3.0	3.0	3.7	9.4	9.6	13.8	19.2	6.6
Ethiopia	2005	4.0	4.6	5.6	7.1	6.9	8.0	10.1	5.9
Gabon	2000	1.8	2.7	4.3	5.3	6.2	13.8	14.1	5.0
Guinea	2005	4.5	3.0	3.8	7.1	6.2	10.2	9.8	5.9
Kenya	2003	1.8	3.7	4.5	8.4	9.3	13.0	14.1	6.2
Lesotho	2004	3.1	5.9	11.2	20.5	26.1	32.8	27.0	14.3
Madagascar	2003/4	2.6	1.8	2.4	4.1	4.1	6.5	11.1	4.0
Malawi	2004	3.4	5.9	9.1	14.4	20.3	22.5	23.2	11.1
Mali	2001	3.0	2.9	4.2	5.7	5.6	9.5	9.4	5.0
Mozambique	2003	2.9	3.6	4.9	8.1	10.0	12.3	11.6	6.5
Namibia	2000	1.8	3.9	6.2	10.2	12.5	14.0	12.3	7.2
Namibia	2006	2.3	4.0	7.8	16.6	20.3	26.9	25.2	11.5
Niger	2006	3.3	3.2	3.1	3.5	3.0	5.4	4.3	3.5
Rwanda	2005	4.5	5.9	6.8	9.0	11.9	13.6	14.3	8.2
Uganda	2006	2.4	4.3	7.7	10.6	16.1	22.5	23.1	9.5
Zambia	2001/2	4.1	6.2	11.7	22.8	30.0	29.5	22.8	14.0
Zimbabwe	2005/6	1.7	3.4	9.0	20.1	27.7	37.1	36.5	13.3
Cambodia	2005	1.6	2.5	4.1	6.9	6.2	8.9	10.5	5.2
Dom. Rep.	2002	2.0	2.2	3.3	3.2	3.6	5.0	6.9	3.4
Haiti	2005	2.0	3.2	4.6	5.5	6.9	7.8	9.2	4.7
Average		*2.9*	*3.7*	*5.7*	*9.3*	*11.3*	*14.5*	*14.7*	*7.2*

Table 2a. Adult male mortality rates 0-6 prior to survey, by report of siblings, according to level 15-49

	Age group							
Country	**15-19**	**20-24**	**25-29**	**30-34**	**35-39**	**40-44**	**45-49**	**15-49**
Lesotho	3.1	5.9	11.2	20.5	26.1	32.8	27.0	14.3
Zambia	4.1	6.2	11.7	22.8	30.0	29.5	22.8	14.0
Zimbabwe	1.7	3.4	9.0	20.1	27.7	37.1	36.5	13.3
Namibia 2006	2.3	4.0	7.8	16.6	20.3	26.9	25.2	11.5
Malawi	3.4	5.9	9.1	14.4	20.3	22.5	23.2	11.1
Uganda	2.4	4.3	7.7	10.6	16.1	22.5	23.1	9.5
Rwanda	4.5	5.9	6.8	9.0	11.9	13.6	14.3	8.2
Namibia 2000	1.8	3.9	6.2	10.2	12.5	14.0	12.3	7.2
Congo	4.5	4.9	5.0	7.2	11.4	11.7	14.0	7.0
Côte d'Ivoire	3.0	3.0	3.7	9.4	9.6	13.8	19.2	6.6
Mozambique	2.9	3.6	4.9	8.1	10.0	12.3	11.6	6.5
Cameroun	2.9	3.7	5.9	7.6	10.5	12.4	12.4	6.3
Kenya	1.8	3.7	4.5	8.4	9.3	13.0	14.1	6.2
Ethiopia	4.0	4.6	5.6	7.1	6.9	8.0	10.1	5.9
Guinea	4.5	3.0	3.8	7.1	6.2	10.2	9.8	5.9
Burkina Faso	2.1	3.4	4.2	7.0	6.6	9.9	11.3	5.4
Chad	4.3	3.3	5.4	6.6	4.9	8.4	7.0	5.3
Cambodia	1.6	2.5	4.1	6.9	6.2	8.9	10.5	5.2
Mali	3.0	2.9	4.2	5.7	5.6	9.5	9.4	5.0
Gabon	1.8	2.7	4.3	5.3	6.2	13.8	14.1	5.0
Haiti	2.0	3.2	4.6	5.5	6.9	7.8	9.2	4.7
Benin	2.2	2.3	3.3	4.7	5.4	8.1	9.2	4.3
Madagascar	2.6	1.8	2.4	4.1	4.1	6.5	11.1	4.0
Niger	3.3	3.2	3.1	3.5	3.0	5.4	4.3	3.5
Dom. Rep.	2.0	2.2	3.3	3.2	3.6	5.0	6.9	3.4

Table 3. Adult female mortality rates 0-6 prior to survey, by report of siblings

Country	Year	Age group							
		15-19	20-24	25-29	30-34	35-39	40-44	45-49	15-49
Benin	2006	1.7	2.2	3.2	4.4	4.1	5.6	5.9	3.5
Burkina Faso	2003	2.4	3.9	4.9	5.7	5.4	6.7	5.4	4.5
Cameroun	2004	3.1	5.3	7.9	7.5	8.3	8.7	10.8	6.4
Chad	2004	5.7	5.8	4.9	7.2	5.2	6.0	8.7	6.0
Congo	2005	2.3	4.9	6.0	9.7	9.0	12.6	7.1	6.4
Côte d'Ivoire	2005	3.6	5.1	6.5	12.8	8.3	8.2	6.5	6.7
Ethiopia	2005	3.9	5.3	6.5	8.0	8.1	7.5	9.5	6.4
Gabon	2000	2.0	3.0	4.3	4.7	6.0	8.2	12.3	4.4
Guinea	2005	4.3	5.1	4.5	5.6	6.4	8.9	9.2	5.9
Kenya	2003	2.8	4.7	6.6	9.1	9.0	10.9	10.3	6.6
Lesotho	2004	3.4	6.5	14.8	17.7	18.6	20.1	18.7	11.9
Madagascar	2003/4	1.9	2.7	2.9	3.8	3.8	6.5	5.1	3.5
Malawi	2004	4.1	8.6	11.4	15.5	17.1	17.9	18.6	11.3
Mali	2001	3.7	4.2	4.8	4.5	5.4	7.4	7.7	5.0
Mozambique	2003	3.7	4.5	5.7	6.4	7.0	10.4	10.7	6.1
Namibia	2000	2.1	4.0	6.3	6.7	5.9	5.8	8.8	5.0
Namibia	2006	3.3	5.1	9.2	13.4	14.3	13.4	17.7	9.2
Niger	2006	3.4	4.3	4.3	4.2	4.3	5.7	4.1	4.2
Rwanda	2005	3.9	6.2	7.6	8.8	9.4	10.6	10.7	7.3
Uganda	2006	3.6	4.2	7.5	11.7	13.5	14.9	14.5	8.3
Zambia	2001/2	4.4	9.7	17.6	21.7	24.2	20.9	19.3	14.3
Zimbabwe	2005/6	2.7	5.5	12.3	20.4	25.0	25.2	25.5	12.7
Cambodia	2005	1.0	1.7	2.8	4.0	3.9	5.1	6.0	3.1
Dom. Rep.	2002	1.0	1.1	1.6	1.8	2.5	2.6	2.8	1.8
Haiti	2005	2.5	3.1	4.3	6.4	7.5	9.4	7.4	4.9
Average		*3.0*	*4.7*	*6.7*	*8.9*	*9.3*	*10.4*	*10.5*	*6.6*

Table 3a. Adult female mortality rates 0-6 prior to survey, by report of siblings, according to level 15-49

	Age group							
Country	**15-19**	**20-24**	**25-29**	**30-34**	**35-39**	**40-44**	**45-49**	**15-49**
Zambia	4.4	9.7	17.6	21.7	24.2	20.9	19.3	14.3
Zimbabwe	2.7	5.5	12.3	20.4	25.0	25.2	25.5	12.7
Lesotho	3.4	6.5	14.8	17.7	18.6	20.1	18.7	11.9
Malawi	4.1	8.6	11.4	15.5	17.1	17.9	18.6	11.3
Namibia 2006	3.3	5.1	9.2	13.4	14.3	13.4	17.7	9.2
Uganda	3.6	4.2	7.5	11.7	13.5	14.9	14.5	8.3
Rwanda	3.9	6.2	7.6	8.8	9.4	10.6	10.7	7.3
Côte d'Ivoire	3.6	5.1	6.5	12.8	8.3	8.2	6.5	6.7
Kenya	2.8	4.7	6.6	9.1	9.0	10.9	10.3	6.6
Ethiopia	3.9	5.3	6.5	8.0	8.1	7.5	9.5	6.4
Congo	2.3	4.9	6.0	9.7	9.0	12.6	7.1	6.4
Cameroun	3.1	5.3	7.9	7.5	8.3	8.7	10.8	6.4
Mozambique	3.7	4.5	5.7	6.4	7.0	10.4	10.7	6.1
Chad	5.7	5.8	4.9	7.2	5.2	6.0	8.7	6.0
Guinea	4.3	5.1	4.5	5.6	6.4	8.9	9.2	5.9
Namibia 2000	2.1	4.0	6.3	6.7	5.9	5.8	8.8	5.0
Mali	3.7	4.2	4.8	4.5	5.4	7.4	7.7	5.0
Haiti	2.5	3.1	4.3	6.4	7.5	9.4	7.4	4.9
Burkina Faso	2.4	3.9	4.9	5.7	5.4	6.7	5.4	4.5
Gabon	2.0	3.0	4.3	4.7	6.0	8.2	12.3	4.4
Niger	3.4	4.3	4.3	4.2	4.3	5.7	4.1	4.2
Madagascar	1.9	2.7	2.9	3.8	3.8	6.5	5.1	3.5
Benin	1.7	2.2	3.2	4.4	4.1	5.6	5.9	3.5
Cambodia	1.0	1.7	2.8	4.0	3.9	5.1	6.0	3.1
Dom. Rep.	1.0	1.1	1.6	1.8	2.5	2.6	2.8	1.8

The mortality rates increase with age as expected with a curious plateauing for age group 45-59 (Figure 3). For age groups under 30-34 years, female rates are a little higher than male rates on average. Beginning with the age group 35-39 years male rates exceed those of females by increasing amounts. The ratio of male to female mortality is shown in Table 4, which indicates that the overall sex ratio is 107 for ages 15-49 years.

In the second panels of Tables 2 and 3 (labeled 2a and 3a), the countries are ordered by the level of the 15-49 mortality rate to show the wide variation among countries. For men, the rates vary from 3.4 in the Dominican Republic to 14.3 in Lesotho. For women the rates vary from 1.8 in the Dominican Republic to 14.3 in Zambia. Zimbabwe has the highest five-year age group mortality rates for both women and men, reaching 37.1 for men age 40-44 and 25.5 for women 45-49.

Figure 3. Average mortality rates by age group and sex 24 countries

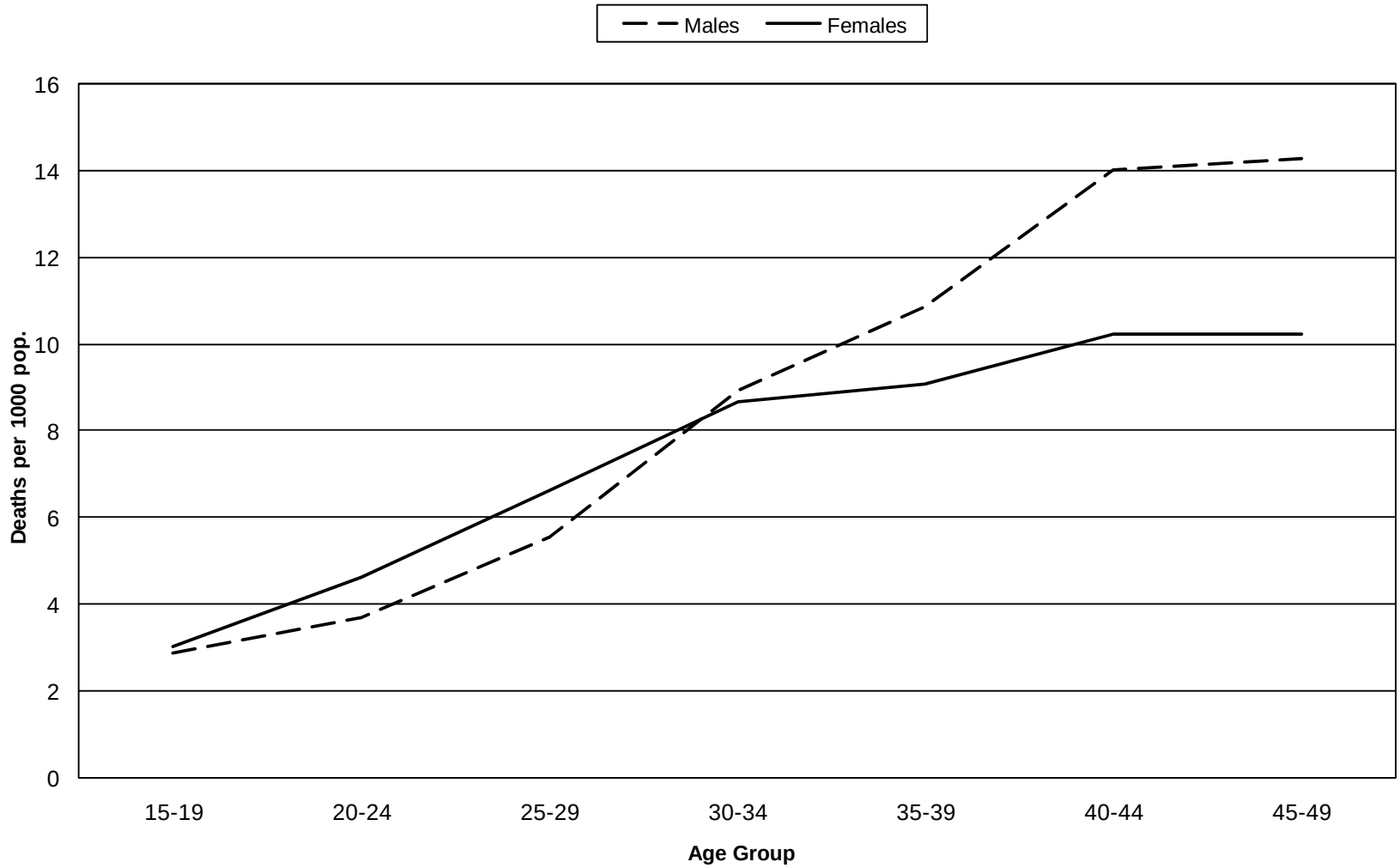


Table 4. Ratio of adult male to female mortality rates 0-6 prior to survey, by report of siblings

Country	Age group							
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	15-49
Benin	126	108	101	108	131	145	157	123
Burkina Faso	88	88	87	123	122	148	211	119
Cameroun	95	71	75	100	127	143	115	99
Chad	76	56	109	91	94	140	80	88
Congo	193	100	84	74	126	92	196	109
Côte d'Ivoire	82	59	57	73	115	170	294	98
Ethiopia	102	86	86	88	85	106	106	93
Gabon	94	88	100	112	104	169	114	112
Guinea	105	59	86	127	96	115	107	100
Kenya	66	79	68	93	103	119	136	94
Lesotho	91	90	76	116	140	163	144	120
Madagascar	142	64	83	109	108	100	218	114
Malawi	83	69	80	93	119	126	124	98
Mali	81	69	87	126	104	128	122	101
Mozambique	79	80	85	126	144	119	108	106
Namibia 2000	85	96	98	153	213	242	140	142
Namibia 2006	69	79	85	123	142	202	142	124
Niger	97	74	72	84	69	95	105	83
Rwanda	115	95	89	103	127	128	133	111
Uganda	66	102	103	90	119	151	160	114
Zambia	93	64	66	105	124	141	118	98
Zimbabwe	64	61	74	98	111	147	143	105
Cambodia	161	145	150	171	162	176	175	166
Dom. Rep.	207	206	205	179	146	189	251	195
Haiti	80	104	108	85	92	83	124	96
Average	*95*	*80*	*84*	*103*	*120*	*137*	*140*	*107*

Children of Dead Women

Column 14 of Table 1 gives the mean number of children of dead women for the 20 countries with appropriate data. In three countries the maternal mortality module was not used, and in four others with the module, the question on number of children was not asked. The average of the country mean numbers of children born to dead women was 2.1. This average excludes the value for Côte d'Ivoire, which has an anomalous value of

0.4 children. All other countries have values that range from 1.4 in Cambodia to 2.4 in Madagascar, although most fall in the range of 2.0 to 2.2.

Comparison of Orphans and Children of Dead Mothers

In Table 1, adding the various categories of reported, hidden and over-reported orphans (the sum of columns 1 to 4 less column 5), gives the maximum estimate of the percent of children who may be orphans (column 7). This maximum estimate excludes the percentages in column 6, which represent children found in the birth history but related to the household head as adopted or fostered. Overall, the maximum percentage is 7.6 percent.

In order to evaluate this number, the percentage of orphans is estimated from the female mortality rates and the overall mean number of children of dead women, using a very simple model and some reasonable assumptions of fertility and mortality. The calculation is shown in Table 5.

Table 5. Calculation of potential maternal orphans from mortality and number of births to dead women under different assumptions of under 18 mortality (U18MR) and general fertility rate (GFR)

	Assumptions			
	U18MR=150 GFR=200	U18MR=150 GFR=250	U18MR=200 GFR=200	U18MR=200 GFR=250
	(1)	(2)	(3)	(4)
Radix (100,000 women)	100,000	100,000	100,000	100,000
Female mortality rate 15-49	0.00652	0.00652	0.00652	0.00652
Annual number of deaths	652	652	652	652
Deaths in 18 years	11,729	11,729	11,729	11,729
No. of children of dead women	2.10	2.10	2.10	2.10
Number of orphaned children	24,583	24,583	24,583	24,583
Under 18 mortality rate for orphans (assumed)	0.150	0.150	0.200	0.200
Surviving orphans	20,895	20,895	19,666	19,666
GFR. (assumed)	0.200	0.250	0.200	0.250
Births per year for surviving women	17,654	22,068	17,654	22,068
Births in 18 years	317,777	397,221	317,777	397,221
Under 18 mortality rate for non-orphans (assumed)	0.150	0.150	0.150	0.150
Surviving non-orphans	270,110	337,638	270,110	337,638
Total children surviving	294,693	362,221	294,693	362,221
Pct maternal orphans	7.09	5.77	6.67	5.43
Maximum of estimated percentage orphans	7.31	7.31	7.31	7.31

Using a radix of 100,000 women 15-49 and an annual average female mortality rate of 6.52 deaths per 1,000 women 15-49, 652 women would die per year. Since orphans refer to children less than 18 years of age, the number of dead women is

multiplied by 18 to get the total number of women who died or 11,729. Using 2.1 as the mean number of live births of these women, the total number of births would be 24,583. Mortality rates then need to be applied to these children in order to estimate the number of living orphans at the time of the survey. Assuming an under-18 years-of-age mortality rate of 150 deaths per 1,000 births gives 20,895 surviving orphans.

In order to calculate the number of births to surviving women, an assumed general fertility rate of 200 births per 1,000 women 15-49 is applied to the number of surviving women (100,000 – 11,729 = 88,271) to give 17, 654 per year. Multiplying by 18 gives a total number of births of 317,777. Again, the under 18 mortality rate is applied to these births to yield an estimated number of surviving children under age 18 years of surviving mothers. The same 150/1,000 is assumed although there are many reasons to believe that the mortality rate for orphaned children should be higher. This calculation yields 270,110 surviving non-orphans.

Therefore, the total number of children alive at the time of the survey is the sum of the surviving orphans and non-orphans, 294,693. The estimated percentage of maternal orphans from this simple procedure is 7.1 percent. This figure is quite close to 7.3 percent, the estimated maximum number of maternal orphans.

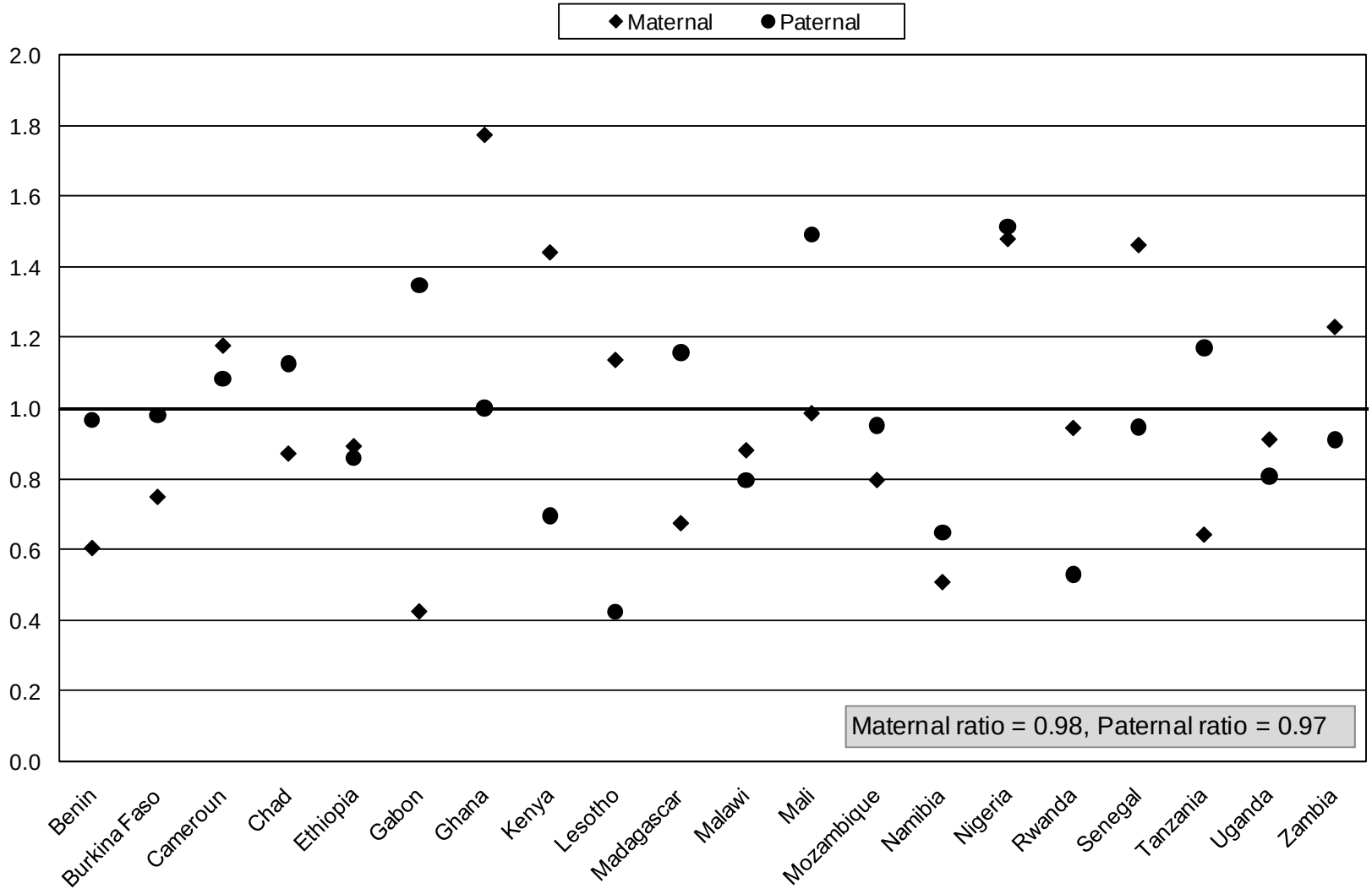
Changes in the assumed fertility and mortality rates do vary. The estimated percentage of maternal orphans is summarized in the table below.

GFR births/1,000	200	250	200	250
U18 MR orphans /1,000	150	150	200	200
U18 MR non-orphans /1,000	150	150	150	150
% orphans	7.1	5.8	6.7	5.4

It can be seen that with reasonable assumptions, the estimated percentage of orphans from female mortality rates and births to dead women varies from 5.4 percent to 7.1 percent. These values are substantially above the overall average of 3.9 percent calculated from direct reporting, indicating that there may be a substantial number of "hidden" orphans.

Figure 4 compares the Spectrum estimates of maternal and paternal orphans to the adjusted (maximum potential) estimates of the DHS data for countries of sub-Saharan Africa. Overall, there is a very good relationship between the two, again indicating quite a large number of "hidden" maternal orphans. However, there are still substantial variations for individual countries, which need further investigation.

Figure 4. Ratio of spectrum to adjusted DHS orphanhood estimates



SUMMARY AND CONCLUSIONS

The Demographic and Health Surveys provide information on maternal, paternal and double orphans used for estimates of the total number and number of HIV-related orphans for many countries. These estimates are almost always based on models that use mortality and fertility rates. However, for many countries, a principal model used by UNAIDS (SPECTRUM) gives roughly up to twice the percentage of children who are maternal orphans as that found in the DHS while at the same time giving about the same percentage of paternal orphans. It is the purpose of this study to evaluate the declaration of orphanhood status in the DHS in order to examine the possibilities of model overestimation or survey under-declaration.

Given the lack of valid external sources of information on orphanhood, internal comparisons of the DHS data have been used for this evaluation. In the household member schedule of the surveys, the survival status of each child's parents is asked as well as the identification of each parent living in the household. Moreover, in an individual interview, women between the ages of 15 and 49 years of age are asked about the survival status of each of their births together with the household identification of each child living with her.

The information from both sources can be utilized to identify potentially hidden (under-reported) orphans and children reported as orphans but who have a mother living in the same household. A second approach is to use information provided by respondents as to their sister's survival and for dead sisters, the number of the sister's children at the time of her death. Using this information, the percentage of children who are maternal orphans can be estimated.

The results of both approaches indicate approximately the same level of orphanhood, given reasonable assumptions. More importantly, the number of potentially hidden orphans is sufficient to raise the percentage of children who are maternal orphans to be in line with that estimated by the models. It is therefore concluded that the DHS household questionnaire understates by a substantial amount the number of maternal orphans. This understatement may result because of the phrasing of the question about parental survival, or may be a willful misdeclaration on the part of the respondent, perhaps to protect the adopted child and/or the adopting family. On the other hand, in at least one survey there is some evidence of overstatement of orphanhood status. It is possible that this overstatement is due to the external assistance provided to families with orphaned and vulnerable children, and given increases in the amount and extent of this targeted assistance, overstatement may become more prevalent in future surveys.

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