Measuring Maternal Mortality through the Census: Rapier or Bludgeon?

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Abstract
There is increased demand for maternal mortality estimates as a result of the choice of the Maternal Mortality Ratio (MMR) as the key indicator for Millennium Development Goal 5. Given this strong demand, the United Nations Principles and Recommendations for Population Censuses suggests the inclusion of questions on recent household deaths, plus questions to identify pregnancy-related deaths in countries lacking empirical, national estimates. This paper evaluates the results of census-based measurement of pregnancy-related mortality using three different types of consistency checks from selected countries. Results from these evaluations are mixed. Overall, the census approach seems to produce robust estimates of the number of births. However, the consistency and plausibility of results relating to mortality vary substantially by country and by indicator. It is not clear whether the census-based methodology performs better or worse than the frequently used sibling histories. The results presented here clearly demonstrate the need for careful data evaluation and interpretation.

Introduction

The measurement of maternal mortality in the developing world has taken on increased urgency as a result of the choice of the Maternal Mortality Ratio (MMR) as the key indicator for Millennium Development Goal 5, the improvement of maternal health. However, measuring the MMR is difficult for a number of reasons. First, adequately recording adult deaths is problematic in countries lacking reasonably complete civil registration. Second, maternal deaths are relatively rare, numbering about one-twentieth the occurrences of under-5 deaths globally. Third, the identification of a maternal death requires the assignment of a cause of death, problematic in settings where few deaths are attended by a health professional. Given these issues, there is no consensus as to how best to measure the MMR.

Most efforts to measure the MMR in countries lacking complete civil registration have relied on one or more of three approaches. The first, and most widely used, approach is the sibling history – recording the ages of all living siblings and the age and year of death for dead siblings, with additional questions about the timing relative to pregnancy of deaths of women of reproductive age – in sample surveys, particularly the Demographic and Health Surveys program. The second much less common approach, often regarded as the “gold standard” for maternal mortality analyses, has been the Reproductive Age Mortality Survey (RAMOS), whereby multiple sources of data are used to identify the universe of maternal deaths in some time period, and follow-up interviews with family members plus review of any available medical records are used to identify true maternal deaths. A third approach which has been gaining in popularity in recent years is to include questions in the national census about household deaths in some defined period with additional questions for deaths of women of reproductive age concerning the timing of death relative to pregnancy; this approach has also been used in some very large household surveys. It should be noted that the sisterhood and census approaches typically use a definition of a “maternal” death that is based on the time of death relative to pregnancy (during or within 6 weeks or two months of the end of a pregnancy) and therefore measure pregnancy-related mortality, not true maternal mortality. The census approach can be combined with a verbal autopsy to try to get closer to the concept of a maternal death.

The Second Revision of the *Principles and Recommendations for Population and Housing Censuses* (2008) lists questions on household deaths as a core topic, with the suggestion that countries might want to add two questions related to cause of death – whether the death was from injury or (for a woman of reproductive age) whether she was pregnant, in childbirth or in the 6 weeks post-partum. These additions to the *Principles and Recommendations* are expected to increase the number of countries including such questions in their 2010 round census. The first systematic analysis of such data (Stanton et al. 2001) identified only 5 countries that had included the necessary questions in their 1990 round census; several additional countries in Latin America, sub-Saharan Africa and Asia included the questions in their 2000 round census.

The purpose of this paper is to evaluate experience to date with the census-based approach. No systematic evaluation has been carried out since that by Stanton et al. (2001); here we will examine experience from additional countries, using evaluation methods not used in the 2001 exercise, and comparing the census results to estimates from alternative approaches. Our strategy is to evaluate the approach through three types of consistency check: first, to compare estimates of pregnancy-related mortality from successive censuses in the same country; second, to compare estimates from censuses with estimates from sibling histories; and third, to compare such estimates with those from a RAMOS study. Since true values are not known, the evaluation is essentially an exercise in assessing plausibility and reliability, rather than validity.

Data Evaluation

It is widely acknowledged, in the *Principles and Recommendations* themselves and in numerous evaluations, that census or household survey data on household deaths in some defined reference period require careful evaluation and often substantial adjustment. We start by reviewing the internal data evaluation techniques available with some specific examples and discussion of the plausibility of the adjustments.

<u>Internal Evaluation Methods</u>

The three key components of census data used to estimate PRMRs are: (1) numbers of deaths of women of reproductive age in a defined period, typically one year; (2) the proportion of such deaths that are pregnancy-related; and (3) the number of births in the same time period. We will illustrate the data evaluation methods used within each country using census information on female population and deaths (in a defined time period before the census) by age from consecutive pairs of censuses in selected countries, the proportions of deaths of women aged 15 to 49 (or whatever the age range reported to the census was) that occurred during pregnancy, childbirth or six weeks/two months post-partum by age group, and information on fertility (children ever born by age of mother, births by age of mother in a defined time period before the census) to estimate pregnancy-related mortality rates (PRMRates) and ratios (PRMRatios) for both censuses.

Information on deaths of women by age will be evaluated using the General Growth Balance (Hill, 1987) and Synthetic Extinct Generations (Bennett and Horiuchi 1981) methods. These methods compare the distribution of deaths by age to the evolution of the population age distribution over the intercensal period; thus if information on the age distribution of deaths is collected at the beginning or end of the intercensal period, the distribution must be adjusted to represent the average intercensal population. A recent simulation study (Hill, You and Choi 2009) clearly shows that these methods are strongly affected by net migration; these same simulations also show that limiting the analysis to the population aged 30 and over (above the age at which most migration happens) reduces the magnitude of the bias, and also shows that the errors from the two methods are generally in opposite directions. To limit bias, we will examine results based on both a full range of ages and on the population 30 and over, and average the coverage estimates obtained from the two methods. Final summary estimates of adult female mortality (such as the probability of dying between the ages of 15 and 50) obtained independently from the two censuses will be compared for plausibility.

Information on the proportion of pregnancy-related deaths among adult female deaths is evaluated in three ways: a comparison of the age pattern of pregnancy-related deaths with the age pattern of fertility (the risk event); a comparison with results of a model developed for the Interagency Maternal Mortality Estimates for 2005 (WHO, UNICEF, World Bank, UNFPA 2007); and a comparison of the pattern and level of the proportions between the two censuses. No formal adjustment method is available on the basis of these tests however.

Information on births will be evaluated using the synthetic cohort P/F Ratio method, which compares cumulated recent fertility rates to cumulated intercensal changes in average numbers of children ever born by cohorts (United Nations 1983). This methodology generally gives good results even in conditions of quite rapid fertility change.

<u>Comparisons of Results for Successive Censuses</u>

To our knowledge, four countries have included the questions necessary to estimate maternal mortality in two consecutive censuses. The countries (with census years) are: Benin (1992, 2002); Lao PDR (1996, 2006); Lesotho (1986, 1996); and Zimbabwe (1992 and 2002). Unfortunately we have been unable to find tabulations from the 2002 Benin census, so we will limit this section to an examination of the other three countries.

Where two successive censuses have collected information on household deaths in the year before the census, the death distribution methods outlined above can be applied in at least three different ways: using the deaths from the first census, the second census, or an average of the two. Whichever approach is used, it is necessary to take account of changes in age distribution between the two censuses, so we first calculate age-specific death rates from each census, then apply the death rates to an estimated intercensal population to obtain deaths by age for the intercensal period. If the methods are reasonably robust, estimates of overall adult female mortality should be reasonably consistent regardless of which way the methods are applied.

<u>Comparisons of Results with Sibling History Data</u>

Two countries, Benin and Zimbabwe, have included maternal mortality questions in their censuses and also carried out Demographic and Health Surveys with the maternal mortality module. We compare indicators of overall and pregnancy-related mortality for these countries from the different sources.

<u>Comparisons with Results from RAMOS Studies</u>

One country, Honduras, has included maternal mortality questions in its census and also carried out Reproductive Age Mortality Surveys (in 1992 and 2000). We compare the estimates of pregnancy-related mortality from these different types of data.

Results

Internal Evaluation Illustrated by Honduras 1988 to 2001

Coverage of Adult Deaths The General Growth Balance (GGB) and Synthetic Extinct Generation (SEG) methods have been described elsewhere (Hill 1987; Bennett and Horiuchi 1981) and will not be described in detail here; for a sensitivity analysis, see Hill et al. (2009). Both methods use intercensal population growth rates to take into account past population dynamics and assess the completeness of death reporting relative to population reporting by comparing age distributions of deaths to age distributions of the living; they both assess completeness of death reporting relative to an average intercensal population age distribution, so household deaths by age reported either at the first or the second census are converted into age-specific rates, the rates then being used to estimate intercensal deaths by age. Both methods also lend themselves to graphical presentation of results. GGB plots recorded death rates above a range of ages x against residual estimates of the same rates derived from the difference between entry rates into the age range x and over less the growth rate of the population x and over. SEG estimates coverage of deaths at ages x and over by comparing an estimate of the population aged x based on deaths and population growth rates above age x to the recorded population aged x. Results from the SEG methodology are known to be sensitive to even quite small changes in census coverage. Bennett and Horiuchi (1981) suggest iteratively adjusting the census counts until the estimates of completeness of death recording by age are essentially flat; Hill et al. (2009) suggest using the estimate of relative census coverage derived from the GGB methodology; here we have used the latter approach throughout, and do not show the unadjusted SEG estimates.

Figure 1 shows the GGB and SEG (adjusted) graphs for the Honduras application. Table 1 shows the estimates of completeness of death recording based on two age ranges, 5+ to 65+ and 30+ to 65+, together with the implied probability of dying between the ages of 15 and 60, ${}_{45}q_{15}$, given each completeness estimate, and the GGB estimates of the ratio of coverage of the first (1988) to the second (2001) censuses. The methods all give broadly similar estimates of the completeness of coverage of adult female deaths, ranging from 54% (SEG adjusted) to 58% (GGB), and the differences between the two fitting ranges are very small, suggesting that net migration is not an issue in this application. The estimates of the female probability of dying between the ages of 15 and 60, ${}_{45}q_{15}$, range from 16.4% to 17.6%. In the Coale-Demeny (1983) "West" model life table system these probabilities of dying would correspond to expectations of life at birth of 68.9 to 67.8 years. These expectations of life are slightly lower than the estimates incorporated in the 2008 revision of the United Nations World Population Prospects (UN 2009), of 69.7 years for 1990-95 and 72.2 years for 1995-2000.

Proportion of Deaths of Women 15 to 49 Pregnancy-Related   No formal methods are available to evaluate the proportion of deaths of women of reproductive age that are reported as being pregnancy-related. One simple check on data plausibility is to examine the similarity of the proportionate distributions by age of pregnancy-related deaths and of births (Figure 2). The two series track fairly closely, though proportions of pregnancy-related deaths in the age groups 25-29 and 30-34 are lower than the corresponding proportions of births (consistent with below-average risks at these ages), whereas the opposite is true above age 35, consistent with higher than average risk.

A second approach is to compare the reported proportion to that predicted by a statistical model used in the WHO/Unicef/UNFPA/World Bank 2005 estimates. The data from the 2001 census (referring to deaths in the year 2000) indicate 11.9% of deaths of women aged 15 to 49 were pregnancy-related, whereas the WHO/Unicef/UNFPA/World Bank model estimates 20.5%. largely as a result of a low proportion of births attended by a skilled provider (only 56%). This comparison is scarcely reassuring, though the model has a wide margin of error.

Coverage of Births   The P/F Ratio method first proposed by Brass (1975) compares lifetime fertility (P) to cumulated current fertility (F). Brass suggested that lifetime fertility might be well reported by younger women, whereas current fertility might be misreported by similar proportions by women of all ages as a result of reference period error. P/F ratios for younger women could therefore be used to adjust the level of the current age-specific fertility rates that make up the F's. This methodology however assumes that fertility is constant. However, if information on lifetime fertility is available from two points in time, cohort changes can be cumulated to create hypothetical cohort parities which reflect effects of fertility change (Zlotnik and Hill 198?).

In the case of Honduras, information on lifetime fertility (children ever born) by age group of women is available from the 1988 and 2001 censuses. Age specific fertility rates can also be calculated for both censuses from information on births in the year before each census. The hypothetical cohort P/F Ratio method can therefore be applied to evaluate the completeness of reporting of recent births, and to arrive at an adjustment if necessary. Table 3 shows the results. For the age groups 20-24 to 30-34, the P/F ratios are almost exactly 1.0, indicating a very high degree of consistency of reporting of lifetime and recent fertility in this population and confirming that no adjustment is needed of information on recent births. It is often the case that the ratios for the age group 15-19 are different from the rest, as in this application, because the method of interpolating age-specific rates to cumulative fertility does not work well at young ages where rates are changing fast with age (United Nations 1983). Above age 35, the P/F ratios fall a bit below unity, suggesting some slight omission of children ever born by the older women.`

Comparisons of Results for Successive Censuses

The first comparison is of the overall level of adult female mortality. Table 3 compares results by method (GGB, Adjusted SEG), age range of fit (5 to 65, 30 to 65) and approach to estimating the age pattern of intercensal deaths (first census, second census, both). Comparable values are the adjusted intercensal value of 45q15, the probability of dying between 15 and 60. Differences by method and age range are generally small, so interest focuses on differences by the source of data of the information on deaths by age. Results are very disappointing. For GGB fitted to the age range 5+ to 65+, the adjusted 45q15's are, for Lao, 0.36, 0.27 and 0.32 using the age distribution of deaths from the first census, second census, and average of the two respectively; for Lesotho, 0.29, 0.36 and 0.34, and for Zimbabwe, 0.24, 0.71 and 0.50. Clearly, the adjustment methodologies are not at all robust to the source of the data, with the differences being particularly large for Zimbabwe where the age distribution of deaths changed greatly as a result of the HIV epidemic. It is reasonable to assume that the averaged value provides the best estimate for the intercensal period, but the large differences cast doubt on the use of deaths from only one of the two censuses as a basis for adjustment.

The second comparison is of the proportion of deaths reported to be pregnancy-related. Table 4 shows the proportions of deaths pregnancy-related by age from the two censuses of Lao and Zimbabwe. The overall proportion of deaths pregnancy-related in Lao rises from 22% to 27% from 1995 to 2005, and the increases are very marked for women in the prime reproductive years.. This pattern would be consistent with a sharp decline in non-pregnancy-related mortality in Lao, with little decline in pregnancy-related mortality. In Zimbabwe, the proportion pregnancy-related drops substantially from 1992 to 2002, from 11% to 7%, but the proportions under the age of 25 are quite similar. Given the sharp increase in HIV-related deaths between the two censuses, the changes seem plausible, but cannot be directly evaluated.

Comparisons of Results with Sibling History Data

A small number of countries have included questions about pregnancy-related mortality in their national census and also conducted a Demographic and Health Survey with the maternal mortality module. However, it is not easy to compare results because reference periods differ. It is important to bear in mind that the census approach typically mixes different reference periods. The evaluation and adjustment methods compare intercensal deaths to intercensal population change; the resulting estimates of mortality should therefore reflect intercensal average mortality, not the mortality at the beginning or end of the intercensal period. The information on the proportion of deaths that are pregnancy-related, on the other hand, are appropriate for the reference period of the question on household deaths, typically the year before one or other of the two censuses. The DHS data, on the other hand, are typically reported for a reference period of either five or seven years before the survey.

The closest overlap is for Zimbabwe (censuses in 1992 and 2002, with DHS maternal mortality modules in 1999 (reported for the 5 years before the survey) and 2005/06, reported for the seven years before the survey; Burkina Faso is also fairly close, with censuses in 1996 and 2006 (but information on maternal mortality only in 2006) and DHS maternal mortality module in 1998/99 (reported for a reference period of 5 years before the survey).

Comparisons can be made both of female mortality from all causes (for the age range 15 to 50, and summarized as the probability of dying between 15 and 50, ${}_{35}q_{15}$) and of the proportions of deaths by age that were reported to be pregnancy-related (it would also be possible to make comparisons of fertility indicators, but these are usually non-problematic). Table 5 shows the various comparisons. The census-based age-specific mortality rates are shown both as observed (calculated for the intercensal period, in the case of Burkina Faso applying the age-specific rates for 2006 to the intercensal population age distribution and in the case of Zimbabwe averaging the 1992 and 2002 age-specific rates to the intercensal population age distribution) and as adjusted using the General Growth Balance adjustment for the age range 5+ to 65+. The DHS age-specific rates are as reported in the relevant final report. For all cases the ASMR's have been converted into probabilities of dying and chained together to estimate the probability of dying between 15 and 50, ${}_{35}q_{15}$.

For Burkina Faso, the DHS ${}_{35}q_{15}$ falls almost exactly half way between the observed and adjusted census value; the age patterns of the rates are rather different however, almost flat from the DHS but rising rather steadily for the census. For Zimbabwe, the 1994-99 DHS ${}_{35}q_{15}$ is below both the observed and the adjusted census values, but the 1999-2006 DHS ${}_{35}q_{15}$ is above both the census estimates. In the absence of valid estimates, we have no sure way of knowing which if any of the estimates is correct.

The comparisons of proportions of deaths pregnancy-related is also inconclusive. For Burkina Faso, the proportion pregnancy-related in 2005 is only 13%, whereas for the period 1994-98 the DHS gives an estimate of 22%; here the DHS estimate is more in line with what one might expect than the 2006 census value. For Zimbabwe, the 1992 census gives 11%, the 2002 census 7%, and the 1999 DHS for the period 1994-99 13%. Given the likely impact of HIV on female deaths, it is impossible to assess the plausibility of the various estimates, but it is concerning that they are not more similar.

<u>Comparisons with Results from RAMOS Studies</u>

Reproductive Age Mortality Surveys (RAMOS) are often regarded as the "gold standard" for measuring maternal mortality, since they attempt to identify every death of a woman of reproductive age in some reference period, and ascertain whether the death was maternal. Comparisons of census-based estimates with RAMOS results are thus of particular interest. However, only one country to our knowledge has conducted Reproductive Age Mortality Surveys and included maternal mortality questions in a census. Honduras carried out RAMOS studies in both 1990 and 1997 (Melendez et al., 1999, and included maternal mortality questions in the 2001 census, with an analysis reported by Hill et al. (2009). The census estimate of the PRMR for 2001 (168) is somewhat higher than the 1997 RAMOS estimate of the PRMR (147) and substantially higher than the 1997 estimate of the MMR (108) (Melendez et al., 1999: 24). The final report on the second RAMOS reports a reduction in the PDPR from 21 percent in 1990 to 12 percent in 1997 (Melendez et al., 1999: 19). The census estimate of the PDPR for

2001 of 10.4 percent is thus consistent with the survey data, assuming a continued gradual decline after 1997.

A comparison of the components of the census and RAMOS estimates indicates that the PRMRs differ primarily because the census analysis arrives at a substantially lower estimate of the number of births (170,889) than that assumed by the 1997 RAMOS calculations (190,887); the numbers of pregnancy-related deaths are virtually identical. The estimated MMRs differ by a larger amount because the census analysis assumes that the PRMR estimates the MMR, whereas in the 1997 RAMOS less than 75 percent of pregnancy-related deaths were identified as maternal.

Discussion

The above examination of the performance of census questions to estimate maternal (or pregnancy-related) mortality gives decidedly mixed results. The methods for assessing the completeness of recording of adult deaths are clearly sensitive to the age pattern of reported deaths, and where successive censuses can be compared (the only examples are for countries of sub-Saharan Africa) the age pattern is observed to change substantially. As a result, any adjustment factors have to be treated with great caution. Proportions of household deaths reported as pregnancy-related seem plausible in some applications (e.g. Honduras) but not others (Burkina Faso). On the other hand, though not examined in any detail here, the census approach seems capable of producing quite robust estimates of numbers of births.

It certainly seems that the population census approach to measuring maternal mortality is more a bludgeon than a rapier: the estimates are quite uncertain based on results from varying evaluation methods. It was hoped that the provision of new census-based pregnancy-related mortality data from an array of countries over the past eight year since the original assessment of this method, including some having included the pregnancy-related questions in two consecutive censuses, would produce generally consistent patterns regarding data quality and plausibility and would therefore allow for generalizations about the value of the approach. This is not the case; the consistency and plausibility of results presented in this paper vary substantially by country and by indicator of mortality. It is not clear, however, that the census-based results are systematically less satisfactory than the use of sibling histories. Collecting relevant data in the national population census seems a worthwhile contribution to a national data base, particularly given the relatively low cost of adding pregnancy-related questions to a census already designed to include household death questions. The results presented here clearly demonstrate the need for careful data evaluation and interpretation.

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Table 1: Application of GGB and SEG to Honduras, 1988 to 2001: Females

Parameter Estimated	General Growth Balance		Synthetic Extinct Generations	
Age Range Fitted:	5+ to 65+	30+ to 65+	5+ to 65+	30+ to 65+
Completeness of death recording (%)	58.3	57.0	55.5	54.1
Estimated 45q15	0.164	0.168	0.172	0.176
Estimated ratio of coverage of 1988 census to that of 2001	1.041	1.032	(1.041)	(1.032)

Table 2: Hypothetical Cohort P/F Ratio Method: Honduras 1988 to 2001

Age Group	Average Parity P 1988	2001	Inter-censal	Age-Specific Fertility Rates 1988	2001	Inter-censal	Cumulated Current Fertility F	P/F Ratios
15-19	0.249	0.234	0.234	0.115	0.087	0.101	0.259	0.903
20-24	1.220	1.148	1.148	0.243	0.178	0.211	1.138	1.009
25-29	2.483	2.163	2.148	0.244	0.165	0.204	2.184	0.983
30-34	3.738	3.161	3.089	0.206	0.131	0.168	3.099	0.997
35-39	4.759	4.069	3.733	0.160	0.095	0.127	3.826	0.976
40-44	5.586	4.786	4.137	0.086	0.048	0.067	4.278	0.967
45-49	5.984	5.369	4.343	0.019	0.013	0.016		

Table 3: Applications of Death Distribution Methods to Pairs of Censuses: Lao PDR, Lesotho and Zimbabwe

Method	Age Range	Indicator	Deaths From		
			First Census	Second Census	Both Censuses
Lao People's Democratic Republic 1995 to 2005					
GGB	5 to 65	Coverage Census 1:2	1.009	1.040	1.023
		Completeness of Death Reporting	0.568	0.491	0.529
		Adjusted 45q15	0.357	0.268	0.317
Adjusted SEG	5 to 65	Completeness of Death reporting	0.562	0.499	0.530
		Adjusted 45q15	0.362	0.269	0.320
GGB	30 to 65	Coverage Census 1:2	1.007	1.047	1.027
		Completeness of Death Reporting	0.566	0.499	0.533
		Adjusted 45q15	0.358	0.264	0.316
Adjusted SEG	30 to 65	Completeness of Death reporting	0.561	0.497	0.528
		Adjusted 45q15	0.362	0.270	0.321
Lesotho 1986 to 1996					
GGB	5 to 65	Coverage Census 1:2	1.124	1.099	1.107
		Completeness of Death Reporting	0.318	0.649	0.499
		Adjusted 45q15	0.293	0.357	0.337
Adjusted SEG	5 to 65	Completeness of Death Reporting	0.330	0.717	0.524
		Adjusted 45q15	0.299	0.354	0.337
GGB	30 to 65	Coverage Census 1:2	1.097	1.075	1.082

		Completeness of Death Reporting	0.302	0.649	0.475
		Adjusted 45q15	0.306	0.370	0.350
Adjusted SEG	30 to 65	Completeness of Death Reporting	0.335	0.729	0.532
		Adjusted 45q15	0.295	0.350	0.333
Zimbabwe 1992 to 2002					
GGB	5 to 65	Coverage Census 1:2	1.199	0.990	1.103
		Completeness of Death Reporting	1.184	0.787	0.958
		Adjusted 45q15	0.244	0.714	0.496
Adjusted SEG	5 to 65	Completeness of Death Reporting	1.061	0.731	0.886
		Adjusted 45q15	0.289	0.727	0.538
GGB	30 to 65	Coverage Census 1:2	1.194	0.795	1.048
		Completeness of Death Reporting	1.189	0.518	0.835
		Adjusted 45q15	0.243	0.852	0.545
Adjusted SEG	30 to 65	Completeness of Death Reporting	1.075	0.731	0.883
		Adjusted 45q15	0.286	0.739	0.542

Table 4: Proportions of Deaths of Women Reported as Pregnancy-Related: Successive Censuses of Lao PDR and Zimbabwe

Age Group	Lao PDR		Zimbabwe	
	1995	2005	1992	2002
15-19	0.151	0.325	0.142	0.143
20-24	0.306	0.617	0.153	0.145
25-29	0.316	0.597	0.130	0.096
30-34	0.315	0.370	0.104	0.070
35-39	0.268	0.181	0.091	0.052
40-44	0.174	0.042	0.062	0.026
45-49	0.074	0.002	0.043	0.014
Total	0.225	0.273	0.109	0.073

Table 5: Comparison of Indicators Between Census and DHS Data: Burkina Faso and Zimbabwe

Age Group	Burkina Faso: Age-Specific Mortality Rates			Burkina Faso: Proportion Pregnancy-Related		Zimbabwe: Age-Specific Mortality Rates				Zimbabwe: Proportion Pregnancy-Related		
	1996-2006 Censuses		1994-1998 (1998 DHS)	2006	1994-1998	1992-2002 Censuses		1994-1999 (1999 DHS)	1999-2006 (2005 DHS)	1992	2002	1994-1999 (1999 DHS)
	Observed	Adjusted*		Census	(1998 DHS)	Observed	Adjusted*			Census	Census	
15-19	0.00201	0.00349	0.00402	0.169	0.275	0.00277	0.00289	0.00282	0.00269	0.142	0.143	0.169
20-24	0.00276	0.00480	0.00511	0.195	0.288	0.00685	0.00715	0.00601	0.00547	0.155	0.145	0.195
25-29	0.00330	0.00574	0.00402	0.174	0.194	0.01336	0.01395	0.01117	0.01225	0.130	0.096	0.107
30-34	0.00440	0.00766	0.00458	0.105	0.125	0.01854	0.01935	0.01472	0.02042	0.104	0.070	0.101
35-39	0.00401	0.00698	0.00447	0.121	0.227	0.02116	0.02208	0.01573	0.02504	0.091	0.052	0.088
40-44	0.00496	0.00863	0.00743	0.071	0.182	0.01795	0.01874	0.01285	0.02523	0.062	0.026	0.041
45-49	0.00458	0.00798	0.00578	0.023	0.100	0.01802	0.01881	0.01316	0.02548	0.043	0.014	0.000
Total				0.130	0.218					0.109	0.073	0.127
35q15	0.1220	0.2027	0.1623			0.3896	0.4027	0.3178	0.4421			

Figure 1A: Application of General Growth Balance Method to Honduras Females 1988 to 2001

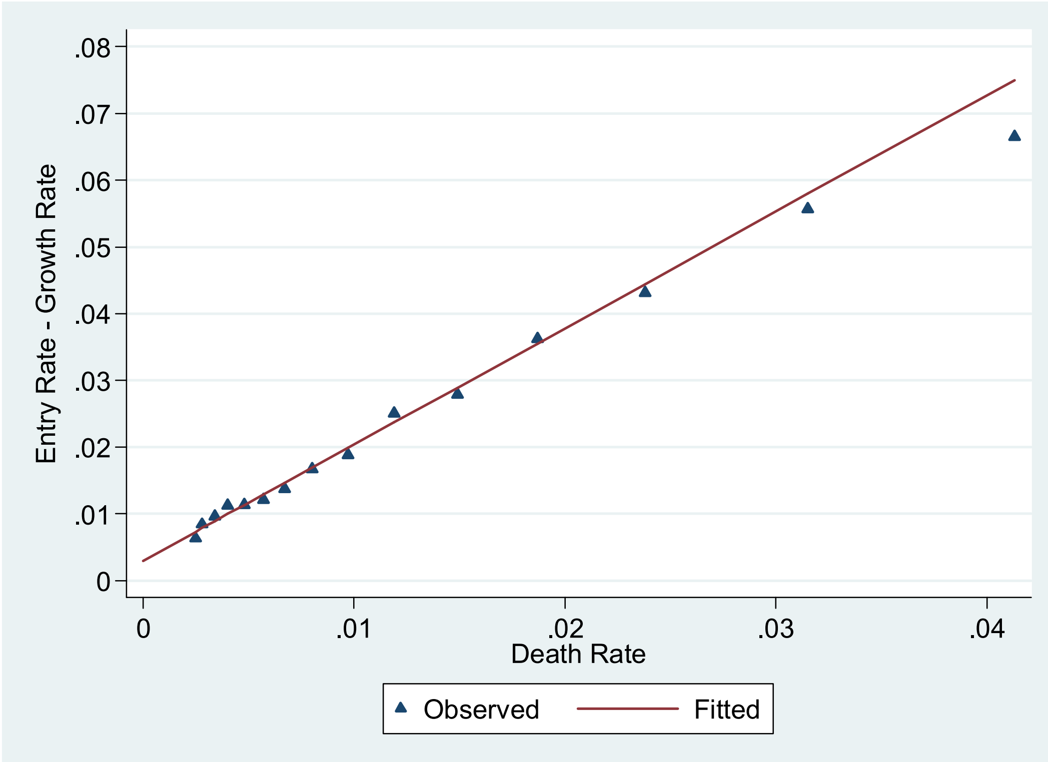

Figure 1B: Application of Adjusted Synthetic Extinct Generations Method to Honduras Females 1988 to 2001

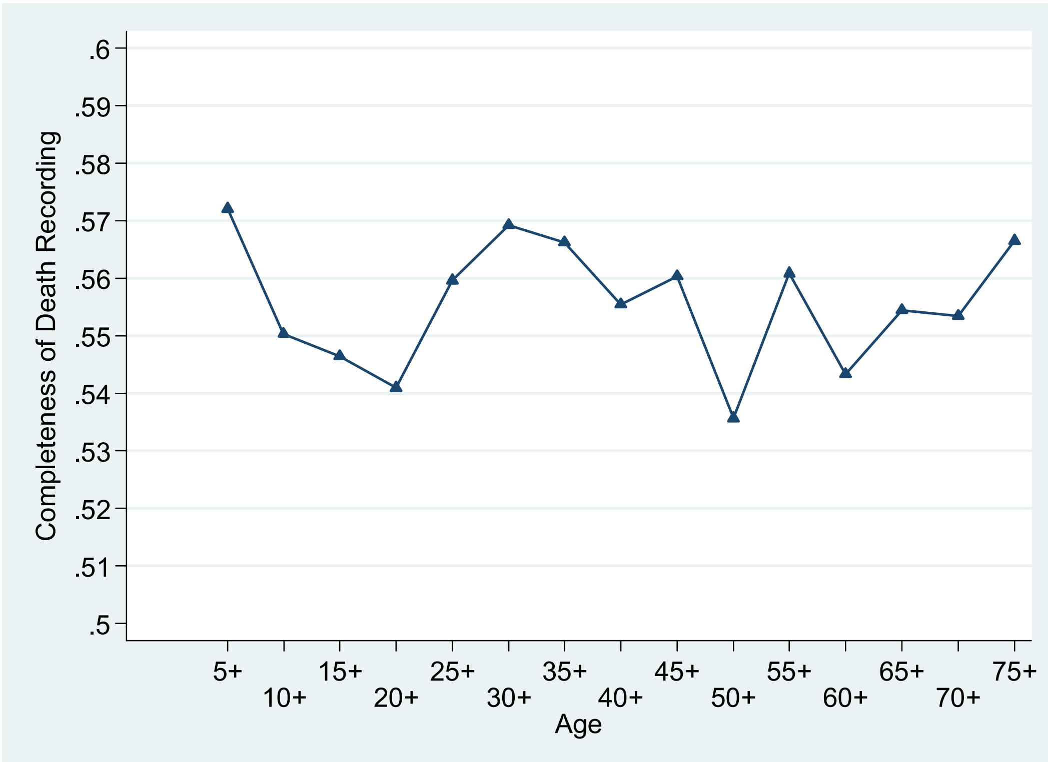

Figure 2. Proportion of All Births and Pregnancy-Related Deaths in Each Age Group: Honduras 2001