Selective Mortality During the Khmer Rouge Period in Cambodia

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BETWEEN 1975 AND 1978, under the regime of the Khmer Rouge, Cambodia experienced massive killings and starvation, large-scale population transfers, forced labor on collective farms, and an almost complete destruction of the country's school system. The extreme atrocities endured by the Cambodians have been documented and identified as genocide;[1] yet few studies have quantified the extent or measured the long-term impact of these events. Using nationally representative household-level data from 2000, this study investigates the incidence of the mortality crisis over time and across socioeconomic and religious groups. The analysis was undertaken to determine the legacy of the Khmer Rouge period on the current population structure of Cambodia.

Using data on siblings' mortality from Cambodia's Demographic and Health Survey, I show that excess mortality was heavily concentrated in the period from 1974 to 1980. I also show that adult males were most likely to die, indicating that violent deaths represented a large share of the excess mortality. Individuals with an urban or educated background were more likely to die, establishing that they were especially targeted. Muslims were less likely to survive than members of other religious groups. Infant and under-five mortality reached very high levels during the Khmer Rouge period and, unlike the pattern in subsequent periods, was as high among urban and educated households as in rural and less educated families. The study contributes to the literature on the demographic consequences of internal political conflict and violence.[2]

Decomposition of Cambodia's mortality crisis

Estimates of mortality under the Khmer Rouge regime vary widely and are the subject of an intense debate, one that is sometimes more ideological than scholarly. This is not surprising, given that the government overthrown by the Khmer Rouge, led by Lon Nol from 1970 until 1975, was pro-American, that the Khmer Rouge under Pol Pot advocated a radical form of Marxism, and that the regime that wrested control of the country from the Khmer Rouge in 1979 was backed by the government of Vietnam. According to former members of the Khmer Rouge, the death toll did not exceed 20,000, while according to the Vietnamese government the number of victims exceeded 3 million (Heuveline 1998a).

An independent Finnish Inquiry Commission estimated the death toll at one million using demographic accounting (Kiljunen 1984). Probably the most careful exercise of demographic reconstruction, comparing the population structure before and after the mortality crisis, has been performed by Heuveline (1998a) using 1993 electoral lists.[3] He proposes, for the decade 1970–80, a central estimate between 2.2 million and 2.8 million excess deaths, although he does not exclude values as low as 1.2 million or as high as 3.4 million.

Sliwinski (1995) and Kiernan (1996) used the population sampling approach to estimate the extent of the Cambodian genocide by interviewing survivors and collecting information about death and survival in their families. Their estimates, however, were based on samples of convenience, limited by local constraints, and were not representative of the national population. The present study uses data on siblings' mortality collected in the 2000 Demographic and Health Survey of Cambodia (Kingdom of Cambodia 2001). With the primary goal of assessing maternal mortality, the survey collected information about all the siblings (78,852 in total) of a nationally representative sample of 15,557 women aged 15–49 years in 2000. The information includes sex, date of birth, whether the sibling is still alive, and, in cases where the sibling died, the date of death.

Even with a nationally representative sample, estimates based on a sample of survivors are subject to several shortcomings (Heuveline 1998b, 2001a, 2001b). First, the method relies on recall of past events and is therefore prone to misreporting. Several tests of data quality have been performed, and systematic reporting biases appear to be absent (Kingdom of Cambodia 2001): the sex ratios at birth fall within the internationally acceptable range, suggesting no serious differential under- or over-reporting of brothers or sisters. Similarly, the median year of birth is the same for respondents as for siblings, indicating that there is no underreporting of older siblings. Another issue is the possibility of double counting: if two sisters are interviewed, the same deaths and survivals will be reported twice. Although the possi-

bility of this occurring cannot be ruled out in the data set used, it is bound to be a minor problem in a random country-wide sample. Furthermore, as long as the analysis focuses on relative rather than absolute numbers, double counting of some deaths and survivals should not affect most ratios, as long as double counting occurs randomly.

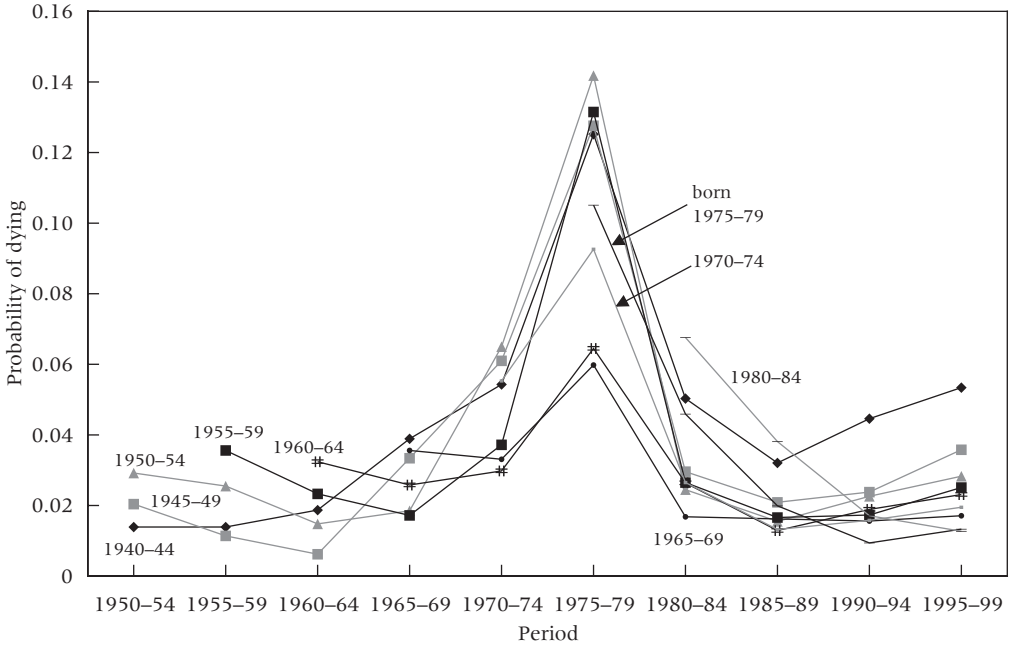
A more serious problem, however, is that in order for siblings living in 1975 to have a chance to be represented in a sample taken in 2000, at least one of the siblings needs to have survived until 2000. In other words, the survey misses families in which all siblings were killed during the genocide and is likely to over-sample families with survivors. This means that the survival probabilities of brothers and sisters are not independent,[4] and the lack of independence is likely to lead to a potentially serious underestimation of the extent of mortality. For this reason, the study focuses on relative rather than absolute numbers and does not attempt, as most previous studies have done, to calculate a specific estimate of the excess number of deaths during the Khmer Rouge period. The downward bias in measuring the level of mortality, inherent in the sample-based approach, does not necessarily affect relative comparisons of mortality patterns across different population groups. Although it is difficult to quantify the extent of the bias, it is very likely that, to the extent families belonging to different socioeconomic groups were differentially affected by violence, the sample-based approach would underestimate differences in mortality between such groups, since the families in which deaths were most likely to occur between 1975 and 1979 are probably underrepresented in the sample. I have also chosen not to include the respondent in the counts, but only her siblings; otherwise, mortality would be further underestimated since, by definition, respondents are all survivors. Another issue is international migration (widespread, as many Cambodians took refuge in neighboring Thailand or Vietnam): to the extent that families migrated and did not return to Cambodia, some bias might be introduced if those families experienced a different mortality rate compared with families who remained in Cambodia.[5]

Despite these shortcomings, the mortality estimates derived from the siblings' data from a large representative sample yield useful information. First, even if they underestimate the number of deaths, they provide a fairly accurate measure of the impact of mortality on the current population structure in Cambodia. Such data also allow us to address questions about the timing and the socioeconomic distribution of excess mortality that cannot be answered with the population reconstruction approach.

Extent and timing of excess mortality

Here I describe the impact of the excess mortality during the period on the current population structure in Cambodia.

FIGURE 1 Probability of dying during a five-year period, by birth cohort (sexes combined): Cambodia 1950–99



SOURCE: Siblings' mortality data from Cambodia Demographic and Health Survey, 2000.

The first point to establish is that excess mortality occurred during the Khmer Rouge period. Figure 1 plots, for each five-year birth cohort between 1940 and 1984, and for each five-year period between 1950 and 1999, the probability of dying during the five-year period.[6] Table 1 contains the underlying data, by sex, with standard errors and sample sizes, for the period 1965–89. The period 1975–79 stands out with much higher death probabilities. Further analysis by year (de Walque 2004) reveals that excess deaths were concentrated in the period from 1974 to 1980. In 1974, mortality is concentrated during the last months of the year, while in 1980 it is concentrated during the first months. Excess mortality thus peaked during the period that covers the end of the Lon Nol regime when it was fighting against the Khmer Rouge (end of 1974 until April 1975), the entire Khmer Rouge regime (April 1975–January 1979), and the period during which the Khmer Rouge and the Vietnamese fought for control of Cambodia (1979–80).

The temporal distribution of the death toll over 1970–80 has also been the subject of intense debate, partly for the ideological considerations mentioned above. The demographic reconstruction proposed by Heuveline (1998a), which starts from a baseline in 1962 and a population count in 1992, does not permit a precise measure of the timing of the deaths. The method used here indicates that, although mortality was already high, es-

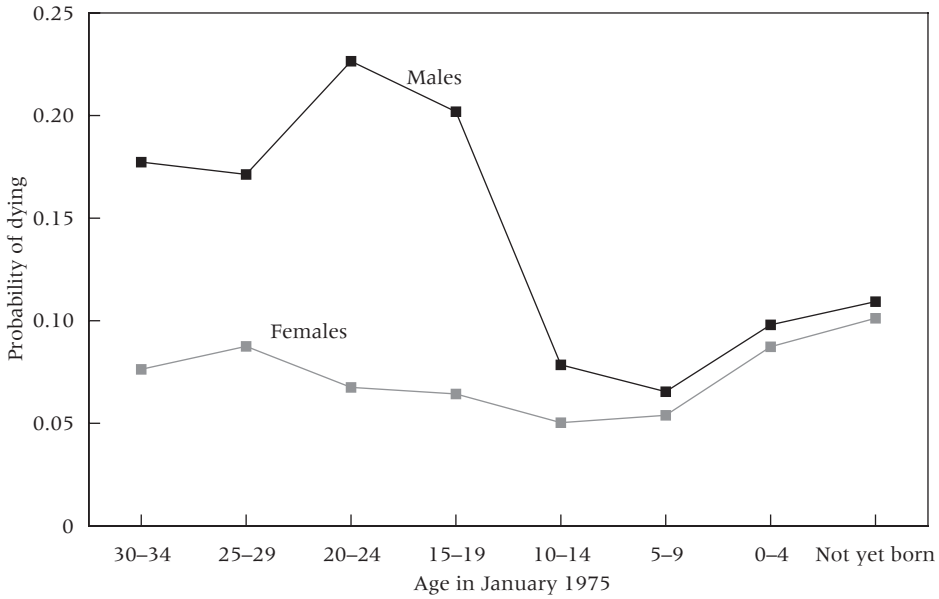
pecially in certain age groups, in the early 1970s, as well as in the early 1980s, the overwhelming portion of the excess mortality was concentrated between late 1974 and early 1980.

Violent mortality by birth cohort and sex

Excess mortality under the Khmer Rouge was not only attributable to war and executions; famine and very poor health conditions also contributed. However, the distribution of death probabilities by birth cohort between 1975 and 1979 illustrated in Figure 1 is evidence that a considerable proportion of the excess mortality is attributable to violent deaths: the birth cohorts most vulnerable to poor nutrition and diseases, such as children, did not experience the highest excess mortality. Indeed, the probability of dying between 1975 and 1979 ranges from 12 to 14 percent for individuals born between 1940 and 1959, who were aged 15–34 in 1975, while individuals aged 5 to 14 in 1975 experienced a probability of dying around 6 percent, and the probability that young children (born between 1970 and 1979) would not to survive until end of 1979 was 10 percent.

Figure 2 highlights that point by plotting the probability of dying during 1975–79 by birth cohort and sex. Mortality is higher among males, especially among adults. The fact that adult males in their prime are, by far,

FIGURE 2 Probability of dying between 1975 and 1979, by age in January 1975 and sex: Cambodia



SOURCE: From siblings' mortality data, Cambodia Demographic and Health Survey, 2000.

TABLE 1 Probability of dying from one five-year period to the next, by birth cohort and sex: Cambodia 1965–89

	1965–69			1970–74			1975–79			1980–84			1985–89		
Birth cohort	**All**	**Males**	**Females**	**All**	**Males**	**Females**	**All**	**Males**	**Females**	**All**	**Males**	**Females**	**All**	**Males**	**Females**
	20–24			**25–29**			**30–34**			**35–39**			**40–44**		
1940–44	0.0389	0.0618	0.0150	0.0543	0.0794	0.0293	0.1252	0.1773	0.0763	0.0503	0.0705	0.0335	0.0320	0.0488	0.0185
	[0.0055]	[0.0095]	[0.0050]	[0.0065]	[0.0109]	[0.0070]	[0.0099]	[0.0162]	[0.0112]	[0.007]	[0.0120]	[0.0079]	[0.0058]	[0.0104]	[0.0060]
	1,225	638	584	1,183	606	574	1,114	555	556	973	456	514	921	424	494
	15–19			**20–24**			**25–29**			**30–34**			**35–39**		
1945–49	0.0334	0.0419	0.0250	0.061	0.0921	0.0304	0.1276	0.1713	0.0875	0.0296	0.0345	0.0257	0.0209	0.0186	0.0229
	[0.0034]	[0.0054]	[0.0042]	[0.0046]	[0.0080]	[0.0047]	[0.0067]	[0.0109]	[0.0078]	[0.0036]	[0.0058]	[0.0046]	[0.0031]	[0.0043]	[0.0044]
	2,711	1,349	1,358	2,627	1,297	1,326	2,476	1,191	1,281	2,161	987	1,170	2,093	949	1,140
	10–14			**15–19**			**20–24**			**25–29**			**30–34**		
1950–54	0.0185	0.0233	0.0138	0.065	0.1011	0.0307	0.1418	0.2265	0.0675	0.0245	0.0353	0.0167	0.0155	0.0169	0.0144
	[0.0019]	[0.0031]	[0.0023]	[0.0036]	[0.0064]	[0.0035]	[0.0053]	[0.0093]	[0.0052]	[0.0025]	[0.0046]	[0.0027]	[0.0020]	[0.0033]	[0.0026]
	4,647	2,260	2,383	4,564	2,211	2,349	4,282	2,004	2,274	3,680	1,561	2,115	3,590	1,507	2,079
	5–9			**10–14**			**15–19**			**20–24**			**25–29**		
1955–59	0.0172	0.0218	0.0127	0.0372	0.0559	0.0188	0.1315	0.2019	0.0643	0.0265	0.0409	0.0148	0.0166	0.0250	0.0101
	[0.0015]	[0.0025]	[0.0019]	[0.0023]	[0.0039]	[0.0023]	[0.0041]	[0.0071]	[0.0042]	[0.0021]	[0.0039]	[0.0021]	[0.0017]	[0.0031]	[0.0018]
	6,852	3,405	3,442	6,726	3,328	3,393	6,490	3,159	3,326	5,666	2,546	3,116	5,523	2,457	3,062
	0–4			**5–9**			**10–14**			**15–19**			**20–24**		
1960–64	0.0258	0.0252	0.0266	0.0298	0.0316	0.0280	0.0645	0.0785	0.0503	0.0264	0.0355	0.0173	0.0129	0.0183	0.0075
	[0.0016]	[0.0022]	[0.0023]	[0.0017]	[0.0025]	[0.0024]	[0.0025]	[0.0039]	[0.0032]	[0.0017]	[0.0028]	[0.0019]	[0.0012]	[0.0021]	[0.0013]
	9,624	4,811	4,796	9,377	4,692	4,668	9,123	4,551	4,555	8,539	4,186	4,336	8,323	4,043	4,263

	Not yet born			0–4			5–9			10–14			15–19		
1965–69	0.0356	0.0352	0.0361	0.0331	0.0339	0.0319	0.0598	0.0654	0.0539	0.0168	0.0207	0.0127	0.0162	0.0234	0.0088
	[0.0018]	[0.0025]	[0.0026]	[0.0017]	[0.0025]	[0.0025]	[0.0024]	[0.0035]	[0.0032]	[0.0013]	[0.0021]	[0.0016]	[0.0013]	[0.0022]	[0.0014]
	10,443	5,323	5,110	10,054	5,113	4,931	9,717	4,871	4,778	9,118	4,598	4,511	8,964	4,501	4,454
				Not yet born			**0–4**			**5–9**			**10–14**		
1970–74	n.a.			0.0553	0.0595	0.0512	0.0926	0.0980	0.0873	0.0265	0.0247	0.0285	0.0132	0.0187	0.0075
				[0.0022]	[0.0031]	[0.0030]	[0.0028]	[0.0041]	[0.0040]	[0.0016]	[0.0022]	[0.0025]	[0.0012]	[0.0020]	[0.0013]
				10,646	5,500	5,127	10,040	5,170	4,851	9,097	4,653	4,425	8,827	4,527	4,281
							Not yet born			**0–4**			**5–9**		
1975–79	n.a.			n.a.			0.1051	0.1093	0.1012	0.0459	0.0466	0.0455	0.0199	0.0211	0.0188
							[0.0032]	[0.0046]	[0.0046]	[0.0023]	[0.0033]	[0.0034]	[0.0016]	[0.0023]	[0.0022]
							8,655	4,505	4,127	7,734	4,006	3,705	7,383	3,820	3,540
										Not yet born			**0–4**		
1980–84	n.a.			n.a.			n.a.			0.0676	0.0692	0.0658	0.0381	0.0382	0.0378
										[0.0026]	[0.0037]	[0.0038]	[0.0021]	[0.0029]	[0.0030]
										8,739	4,532	4,187	8,136	4,208	3,909
													Not yet born		
1985–89	n.a.			n.a.			n.a.			n.a.			0.0676	0.0705	0.06485
													[0.0028]	[0.0041]	[0.0039]
													7,703	3,795	3,894

NOTES: Age ranges shown are for the beginning of the five-year period. For a few data points, sibling's sex was unknown; thus the number of males and females does not exactly add up. Standard errors appear in brackets, with sample sizes below.
SOURCE: Siblings' mortality data from Cambodia Demographic and Health Survey, 2000 (Kingdom of Cambodia and ORC Macro 2001).

the most likely to die during the Khmer Rouge period indicates that violent deaths made a major contribution to excess mortality.[7] A result of this differential mortality by birth cohort and sex is that there are serious imbalances in the current (2005) population structure of Cambodia, including a pronounced relative shortage of males especially in the 45–60 age groups.

Mortality by socioeconomic status and religion

It is generally believed that the Khmer Rouge deliberately targeted educated and urban Cambodians, who were seen as obstacles to the creation of a "new society." However, this claim, based on widespread anecdotal evidence and survivors' accounts, has not been quantified reliably. Only Sliwinski (1995), who, because of constraints at the time of his survey, uses a nonrepresentative sample of survivors (63 Cambodian refugee households in France; 589 refugee households in Thailand; and 644 households in the Phnom Penh area), provides estimates of selective mortality. He found that better-educated individuals were more likely to have died between 1975 and 1979 and that those in certain professions—army officers, police, managers, and the clergy—were at very high risk. He also provides estimates of mortality rates by province.

The data collected in the nationally representative Demographic and Health Survey provides no direct information on the socioeconomic status of respondents' siblings. By using information about the respondents, however, it is possible to gain a sense of the socioeconomic status of the family. One variable indicates whether the respondent lived in a rural or urban area during her childhood. For women born before 1975, this allows a determination of whether her family was of rural or urban origin. Given the large internal migrations that occurred under the Khmer Rouge, the strategy is less reliable for younger women. Similarly, for women who could have attended secondary school before 1975 (secondary schools were closed under the Khmer Rouge), their educational levels can be considered a good indicator of the social and educational status of their family.[8] (Only a minority of Cambodian girls attended secondary school in the 1960s and early 1970s.)

Table 2 uses this strategy to examine mortality differentials between 1975 and 1979 by socioeconomic status by sex, for all ages. A comparison of the first two columns indicates that members of a family who lived in an urban area before 1975 were more likely to die, and that this was true for both sexes. The third and fourth columns establish that individuals who had a sister who attended secondary school prior to 1975 were more likely to experience excess mortality. This difference is much larger, and statistically significant, for males.[9] In computing the educational measure by residence (the lower right corner of Table 2), the difference by educational status of the sister is much larger and only significant among families of urban origin. Figures 3 and 4 further examine these differentials by birth cohort. Figure 3 indicates that,

TABLE 2 Selective mortality (probability of dying between 1975 and 1979) by socioeconomic status: Cambodia

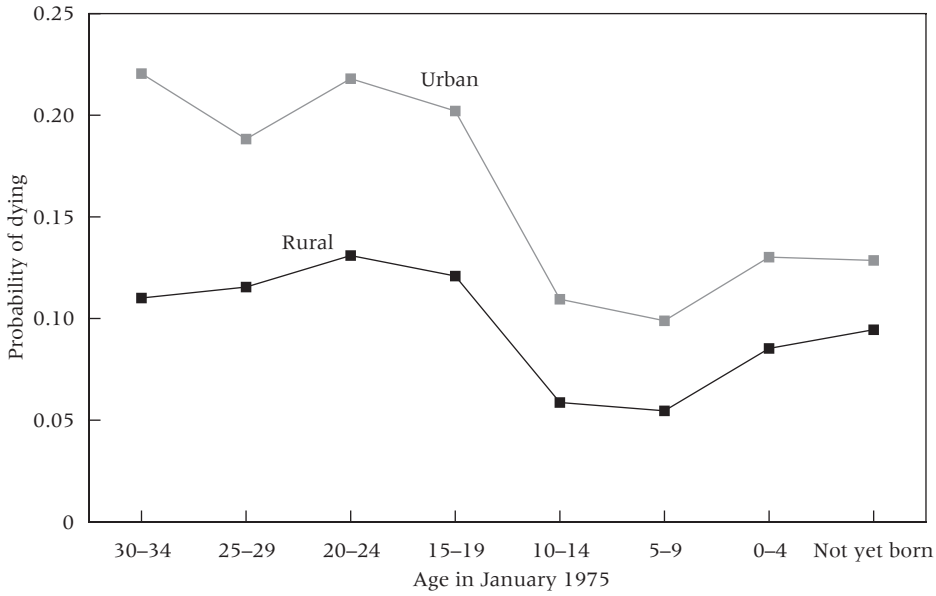
	Family origin		Sister's education prior to 1975	
	Rural	Urban	Secondary	Less than secondary
Both sexes	0.0889	0.1472	0.1644	0.1068
	[0.0015]	[0.0044]	[0.0120]	[0.0028]
	33,677	6,416	954	12,085
Males	0.1169	0.1848	0.2551	0.1472
	[0.0024]	[0.0068]	[0.0204]	[0.0045]
	16,725	3,196	457	5,957
Females	0.0612	0.1104	0.0795	0.0677
	[0.0018]	[0.0055]	[0.0121]	[0.0032]
	16,906	3,204	494	6,109
Family of rural origin	n.a.	n.a.	0.1221	0.1018
			[0.0145]	[0.0029]
			507	10,282
Family of urban origin	n.a.	n.a.	0.2232	0.1450
			[0.0200]	[0.0086]
			434	1,671

NOTES: The probability of dying between 1975 and 1979 is estimated for individuals alive in 1975. Standard errors appear in brackets, with sample sizes below. Urban or rural origin is determined by whether the sister, born before 1975, lived in a rural or an urban area during her childhood. For sister's education, only siblings of sisters born before 1960 are considered. For a few data points, sibling's sex was unknown; thus, numbers of males and females do not exactly add up.
SOURCE: Siblings' mortality data from Cambodia Demographic and Health Survey, 2000.

although the differential is higher for adults, the excess mortality among families of urban origin is present for all birth cohorts. This might be because as part of the Khmer Rouge "Year Zero" experiment, all major cities were evacuated by force and the urban population was relocated in the countryside. On the other hand, Figure 4 shows that the differential by educational achievement of the sister prior to 1975 is concentrated among adults,[10] suggesting that educated adults were especially targeted. In most developing countries, urban residents and the better-educated experience lower mortality.

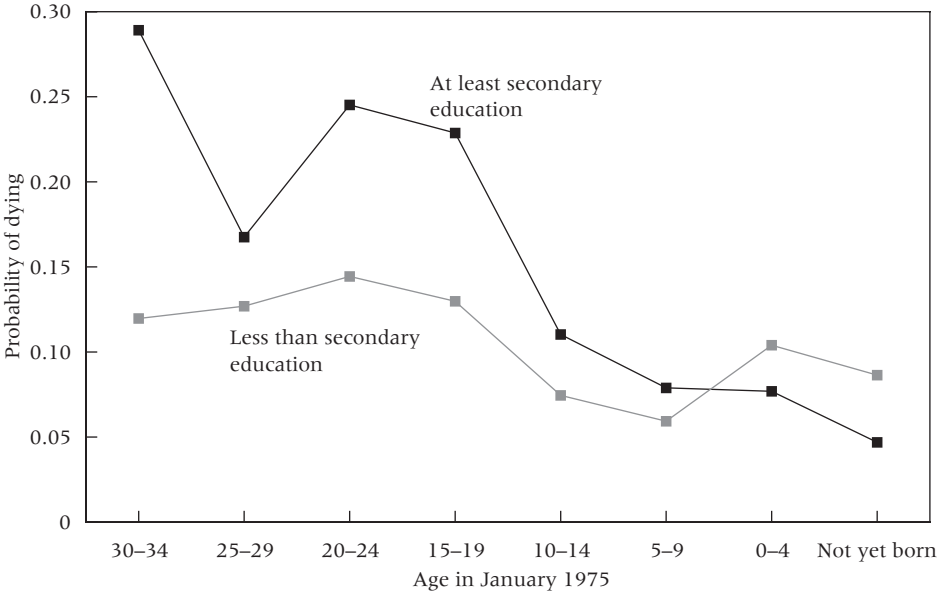
Cambodia's Demographic and Health Survey also includes information about the respondent's religion. Using the siblings' mortality data, I assume that brothers and sisters shared the same religion. The first column of Table 3 reports death probabilities for 1975–79 for all ages. Muslims are more likely to have died (13.3 percent) than the Buddhist majority (9.4 percent). Christians (5.4 percent) and members of other religions (6.6 percent) seem to have been at slightly lower risk. The small sample size for Christians, however, reduces the significance of the comparison. The last three columns in the table verify the robustness of these differences by religious affiliations in

FIGURE 3 Probability of dying between 1975 and 1979, by age in 1975 and family's urban or rural origin: Cambodia



SOURCE: Siblings' mortality data from Cambodia Demographic and Health Survey, 2000.

FIGURE 4 Probability of dying between 1975 and 1979, by age in 1975 and educational attainment of a sister before 1975: Cambodia



SOURCE: Siblings' mortality data from Cambodia Demographic and Health Survey, 2000.

TABLE 3 Selective mortality (probability of dying between 1975 and 1979) by socioeconomic status and religion: Cambodia

		Linear regressions with probability of death in 1975–79 as dependent variable		
Probability of dying	**Independent variable**	**All**	**Sister born before 1975**	**Sister born before 1960**
Buddhists	Male	0.048	0.0604	0.0901
0.0949		[0.0029]***	[0.0033]***	[0.0061]***
[0.0014]				
42,780	Muslim	0.0398	0.0324	0.0355
		[0.0122]***	[0.0137]**	[0.0210]*
Muslims				
0.133	Christian	–0.0442	–0.0878	–0.1416
[0.0105]		[0.0258]*	[0.0256]***	[0.0129]***
1,029				
	Other religion	–0.0296	–0.0245	–0.0599
Christians		[0.0097]***	[0.0128]*	[0.0247]**
0.0547				
[0.0216]	Family of rural origin	—	–0.0601	–0.0535
112			[0.0053]***	[0.0096]***
Other religion	Sister with secondary education	—	—	0.0469
0.0667				[0.0131]***
[0.0066]				
1,430	Year of birth dummies included	Yes	Yes	Yes
	R^2	0.0230	0.0314	0.0461
	N =	52,277	40,009	12,866

NOTES: The probability of dying between 1975 and 1979 is estimated for individuals alive in 1975. Standard errors appear in brackets, with sample sizes below. The three righthand columns give coefficients of linear regressions where the death probability between 1975 and 1979 is the dependent variable. The omitted dummy for religion in the regressions is Buddhist. Rural origin and education of the sister are determined as in Table 2.
— = variable not entered in the regression.
*, **, ***: significant at the 10, 5, and 1 percent confidence level.
SOURCE: Siblings' mortality data from Cambodia Demographic and Health Survey, 2000.

a regression analysis. Controlling for sex and year of birth, and then further for family background[11] (urban, secondary education) as in Table 2 does not modify the conclusion that Muslims were at greater risk than Buddhists and that Christians and members of other religions were at lower risk. The results should be viewed with caution given the limited sample size (some of the coefficients are significant only at the 10 percent level) for some religions, especially Christians, and the other limitations of our data set (sample of survivors and absence of information about migration). The regressions nevertheless confirm that, when age, sex, and religion are controlled, urban and better-educated families were at greater risk.[12]

Validity of the estimates

Elsewhere (de Walque 2004) I have compared the results obtained using a sample-based approach and Heuveline's (2001b) demographic reconstruction approach for evaluating the level of excess mortality in Cambodia during the Khmer Rouge and have shown that the former is likely to underestimate the extent of mortality because the data used are, by definition, a sample of survivors. Families in which all siblings died are not included in the counts, and families that experienced a large proportion of casualties are less likely to be included. Families with a large migration rate are also less likely to be counted.

The downward bias inherent in the sample-based approach when estimating absolute death counts should not necessarily affect comparisons of relative mortality patterns across different populations. Nevertheless, two caveats are in order regarding the estimates of selective mortality. Although it is difficult to quantify the extent of the bias, it is likely that the sample-based approach would underestimate differences in mortality across socioeconomic groups of the type illustrated by Figures 3 and 4. For example, if particular socioeconomic groups were especially targeted and victimized, the probability that the entire household or a large fraction of it would not survive is higher. Therefore, targeted households would have a lower probability of being included in the sample of survivors, and their mortality experience would not be reflected. This assumes that the downward bias implied by the sample of survivors is larger for targeted groups than for other groups and that therefore the differences in mortality rates across socioeconomic groups are also underestimated.

Migration flows during or after the mortality crisis further modify the composition of the sample in 2000 compared to the population in 1975. To the extent that migration varied across socioeconomic groups and was also correlated with the probability of survival, estimates of selective mortality could be biased. Given the paucity of migration information in the data, it is not possible to account for this potential bias.

Infant and under-five mortality

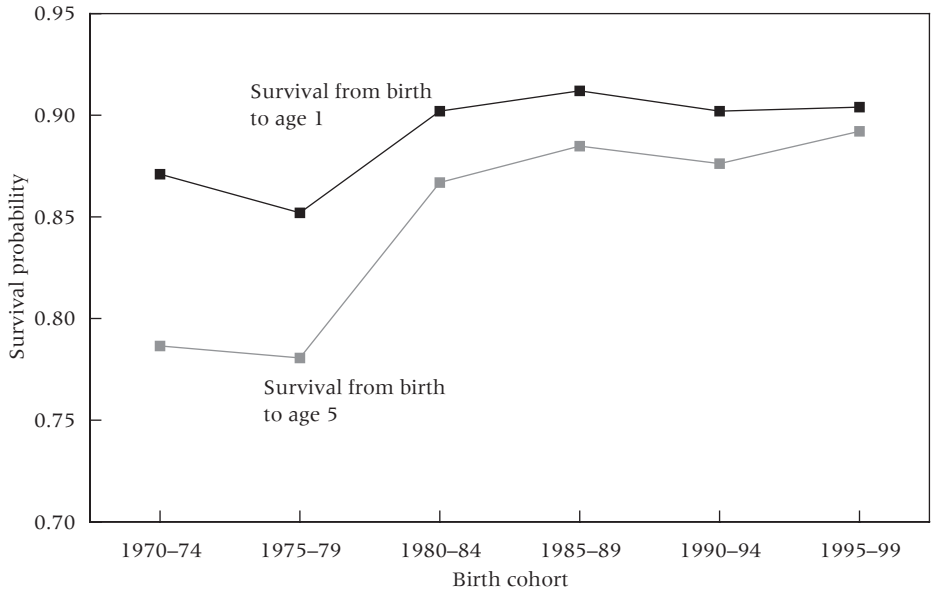
In Table 1, constructed from siblings' mortality data, the last row of each column shows the probability of dying within the next five-year period for individuals who will be born during this five-year interval. This estimate can provide a raw measure of the magnitude of infant and child mortality. It is not very reliable, however, because, unlike the estimates for older individuals, these unborn individuals are not necessarily at risk from the beginning of the five-year period. A better statistic would be the probability that each newborn survives his first year (infant mortality) and his first five years

(under-five mortality). This measure can be calculated from the birth histories in the Cambodia Demographic and Health Survey, which records, for each woman interviewed, data on all births, including whether the child survived and (if applicable) the date of death.[13]

Figure 5 plots the one-year and five-year survival probabilities by birth cohort. Infant and under-five mortality tend to be underestimated for earlier birth cohorts. Given the retrospective nature of the birth-history data, only women who survived until 2000 are interviewed. Women who died before 2000 might have been more likely to have children who died as well.

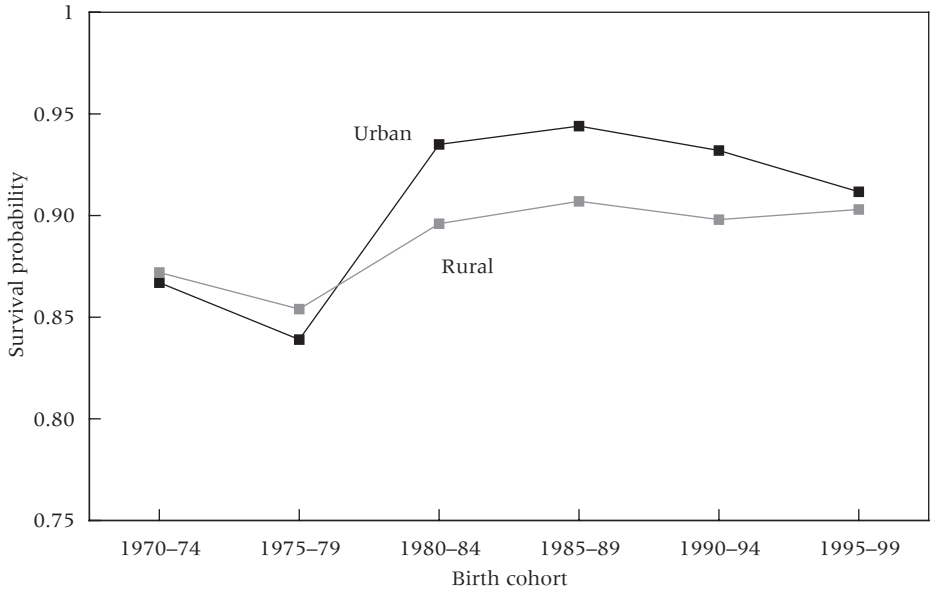
Despite this underestimation of infant and child mortality for children from earlier cohorts, Figure 5 shows that infant and under-five mortality were very high for children born during 1970–79. A child born between 1975 and 1979 had roughly a 15 percent risk of dying within the first year of life and a 22 percent chance of dying before the fifth birthday. Compared to other birth cohorts, infant mortality peaks for the 1975–79 birth cohort, and under-five mortality is highest for the 1970–74 and 1975–79 birth cohorts.[14] It is also striking that for cohorts born during the 1970s, child mortality (mortality between ages one and five) is a substantial component of under-five mortality, whereas for later birth cohorts most of the mortality is concentrated during the first year of life. The analysis did not show significant differences in the infant and under-five mortality by sex.

FIGURE 5 One-year and five-year survival probabilities, by birth cohort: Cambodia 1970–99



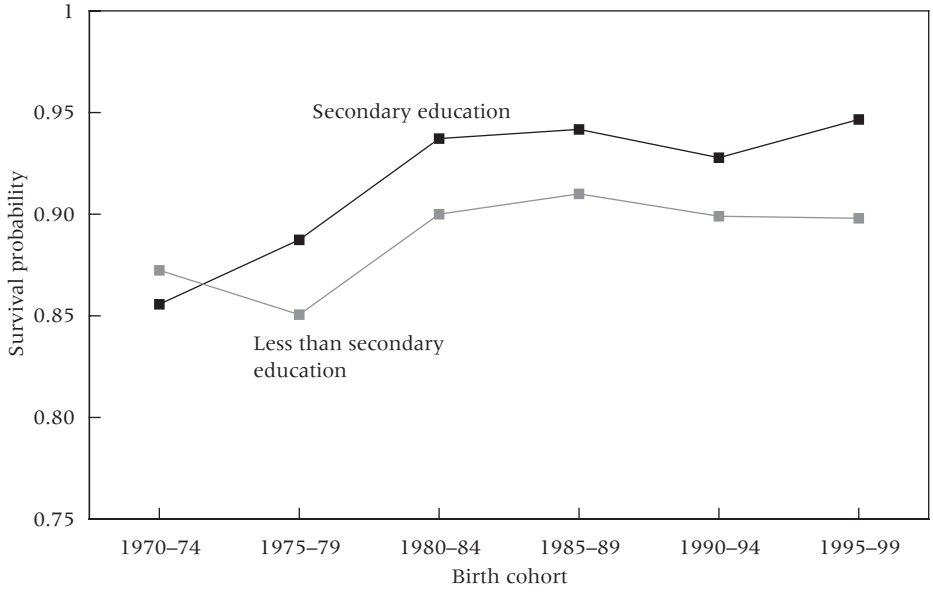
SOURCE: From birth histories in Cambodia Demographic and Health Survey, 2000.

FIGURE 6 Probability of survival from birth to age 1, by birth cohort and urban or rural residence: Cambodia 1970–99



SOURCE: From birth histories in Cambodia Demographic and Health Survey, 2000.

FIGURE 7 Probability of survival from birth to age 5, by birth cohort and mother's level of education: Cambodia 1970–99



SOURCE: From birth histories in Cambodia Demographic and Health Survey, 2000.

Figure 6 compares the one-year survival probability for children of rural and urban backgrounds,[15] and Figure 7 makes the comparison for different schooling levels of the mother. In both cases, there were no statistically significant differences between the two groups for birth cohorts born in the 1970s, whereas, for subsequent cohorts born after the mortality crisis, urban children were less likely to die (the difference is statistically significant for children born between 1980 and 1994) as were children whose mothers had at least some secondary education (difference significant for all birth cohorts from 1980). During the Khmer Rouge period, the usual infant and child survival advantage conferred by urban residence and better education was lost.

Conclusion

This study used siblings' mortality data from the 2000 Cambodia Demographic and Health Survey to analyze the impact of genocide during the Khmer Rouge regime (1975–79) on current population structure. Excess mortality was extremely high and heavily concentrated during 1974–80. Adult males were the most likely to experience excess mortality, indicating that violent death played a major role. Individuals from families with an urban or an educated background were also more likely to die. This confirms the claims made by informed observers that the better-educated and urban populations were especially targeted. Infant and early childhood mortality also reached very high levels during the period. The findings demonstrate the utility of siblings' mortality and birth-history data available in Demographic and Health Surveys for analyzing the magnitude and long-term demographic impacts of mortality crises.

Notes

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1 See, e.g., Banister and Paige Johnson 1993; Chandler 1996; Kiernan and Boua 1982; Kiernan 1993; Kiernan 1996; Kiljunen 1984; Sliwinski 1995; Vickery 1984.

2 See Collier and et al. 2003; Collier and Hoeffler 2001; Collier 1998, 1999. With the notable exception of the work by Verwimp (2005, 2004, 2003a, 2003b) on the genocide in Rwanda, few studies have used micro-level household data to examine the demographic consequences of conflict. See also Brück (2000 and 2001) on Mozambique and Justino on India (2001).

3 Earlier estimates based on the reconstruction approach include Ea (1981), Banister and Paige Johnston (1993), and Vickery (1984).

4 In a simple regression, controlling for year of birth and sex, a 10 percentage point increase in the proportion of siblings who died (excluding the individual under consideration) leads to a 4 percentage point increase in the probability of any given sibling having died.

5 Information about past international migration is scant in the 2000 Cambodia Demographic and Health Survey. It is known whether a respondent always resided at the same place or not. If not, the length of stay at the current residence and the type (urban, rural, abroad) of previous residence is known. It was therefore possible to identify 130 respondents whose previous place of residence was abroad. The mortality experienced during 1975–79 by the siblings of respondents whose previous residence was abroad and who later returned to Cambodia differs from the experience of the rest of the population: for all ages and both sexes together, their death probability 1975–79 was 5.1 percent (C.I. 3.00–7.18), while for siblings for whom there is no indication that the sister migrated abroad, the death probability was 9.6 percent (C.I. 9.33–9.87). This seems to point to lower mortality for families who migrated abroad. However, the survey gives an incomplete picture of international migration: there is no information about when the migration took place, and the survey yields information in cases only where the residence that immediately preceded the current one was abroad. In addition, the survey misses families who left Cambodia permanently.

6 In all figures and tables included in this study, the data have been weighted with the sample weights provided by the data provider (Kingdom of Cambodia and ORC Macro 2001).

7 This point was first made by Heuveline (1998a). Based on survivors' accounts, Sliwinski (1995) provides a breakdown of mortality by type of death (execution, famine, war, natural, and type missing). A revealing comparison with "normal" mortality rates by age and sex before the mortality crisis can be made by looking at the estimates by Migozzi (1973) for 1958–59 in Cambodia: at that time, the age pattern of mortality displayed the usual J-shape with very high mortality for young children, declining rapidly until adolescence and increasing thereafter, first slowly until age 50 years and then more steeply. Migozzi estimates that, because of high rates of maternal mortality between 15 and 40, women were at higher risk than men in 1958–59.

8 According to the breakdown in birth cohorts in this study, this applies to women born before 1960.

9 The sample sizes are smaller in the third and fourth columns because they include only siblings of women born before 1960, while the first two columns include siblings of women born before 1975.

10 The differences are significant only for the birth cohorts aged 30–34, 20–24, and 15–19 years in 1975.

11 To control for the urban origin of the family, I restrict the analysis to siblings of sisters born before 1975; and to control further for the education of the sister, I focus on siblings of sisters born before 1960. This explains the reduction in sample sizes between columns 2 and 3 and 3 and 4 in Table 3.

12 These results on differential mortality by religious affiliation do not entirely support the conclusions from previous studies. Sliwinski (1995), using a sample that was not nationally representative, concluded that Muslims from the Cham ethnic group were at high risk (ethnicity is not recorded in the Cambodian Demographic and Health Survey). The results from Table 3 point in the same direction and support the evidence gathered by Kiernan (1996) that Chams were especially targeted. However, Sliwinski reports higher mortality for Catholics than for Muslims. The estimates for Christians in Table 3, admittedly based on a small sample, go in the other direction. Sliwinski (1995) recognizes that the high mortality among Catholics might have been attributable to the fact that they were better-educated and urban rather than to their religious affiliation.

13 One-year and five-year survival probability could also be calculated from the siblings' mortality data. But, in order to compare child mortality in 1975–79 with current levels, it is preferable to use information about children than about the siblings of women aged 15–49 in 2000, as the children are on average younger. Also, it is preferable to use the characteristics of the mother rather than those of the sister as an explanatory variable.

14 For the probability of surviving the first five years, the 1970–74 birth cohort was at risk during part of the 1975–79 period.

15 When analyzing adult mortality, I used the rural/urban background of the sister during her childhood (only if she was born before 1975); in the analysis of child mortality I used the current rural/urban residence of the mother.

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