The Intergenerational Effect of Cambodia's Genocide on Children's Education and Health

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There is clear evidence of the adverse economic, education, and health effects of conflicts or wars on individuals. We know very little, however, about the intergenerational effects of civil conflict. Ghobarah et al. (2004), examining World Health Organization data, focused on child health outcomes in the immediate aftermath of civil conflicts. No studies have examined whether such events affect the education and health outcomes of children born well after the conflict concluded.

We examine the effect of the genocide that occurred during the Khmer Rouge (KR) regime in Cambodia on the health and educational outcomes of children born to survivors years after the conflict ended. We exploit geographic variation in KR-related mortality rates, restrict the sample to individuals whose marital outcomes were most likely to have been affected by the genocide, and focus on the educational and health outcomes of their children conceived and born after the genocide ended. We find that in districts with high mortality rates during the KR regime, children born to parents who were of prime age for marriage during the 1970s and 1980s have poorer educational and health outcomes.

We investigate several potential mechanisms through which conflict-related or violent deaths may affect the outcomes of survivors' children born years after the genocide ended. One possibility is that mortality under the KR may influence children's outcomes through its direct effect on parents' education and health. It is also possible that geographic variation in parents' household earnings are associated with mortality rates during the KR regime. School attainment or grade progression rates may be lower in areas in which the KR regime most severely limited the ability of local institutions to provide public services. Another possibility is that the adverse effect of the genocide on the education and health outcomes of children

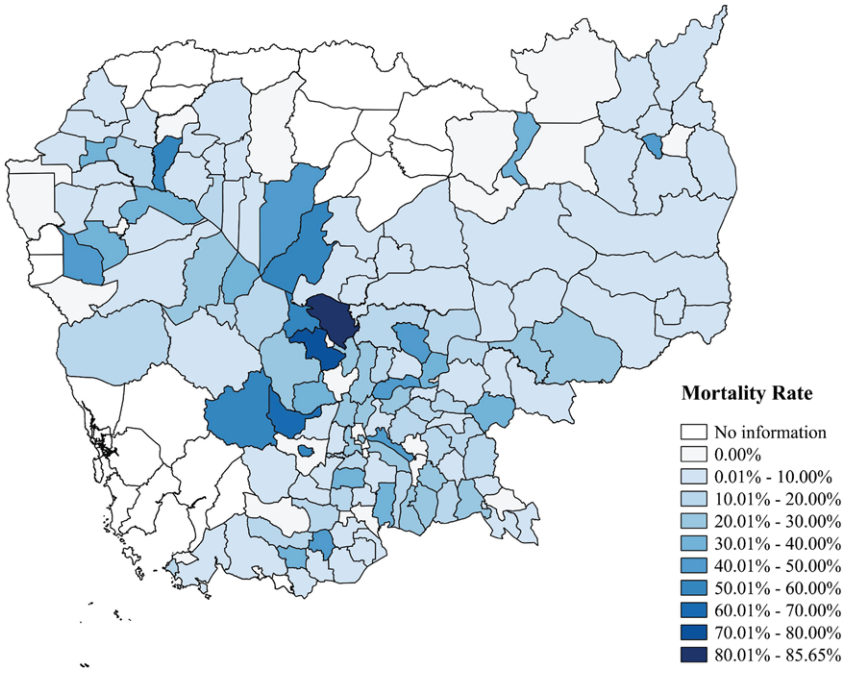
born to survivors after the conflict ended is mediated through the sex ratio and marriage market of the survivors' generation. Armed conflict results in higher battle-related or violent deaths for men, thus lowering the sex ratio (the number of men relative to women) and producing a shortage of men in the marriage market. At the same time, women of marriageable age during the period of conflict might delay their marriage. Following the conflict, rather than remain single, these older women, and especially those with poorer marriage prospects, marry "lower-quality" men.[1] The couples' less-advantaged circumstances then adversely affect their children's education and health prospects.

Background to the Cambodian genocide

The Khmer Rouge seized power in 1975 and ruled Cambodia from April 1975 to January 1979. The genocide that occurred during this period was characterized by massive destruction, violence, and death. The KR sought to create a "new" Cambodia based on the Maoist-Communist model, wherein all citizens would participate in rural work projects, often without adequate nutrition. Markets and currency were abolished, and Western medicine, religion, and anything associated with the previous regime were discarded. The KR also abolished traditional Cambodian social norms, culture, religion, organizations, networks, and family structure (Collier et al. 2003). The regime forced people to live in communal work camps under the control of the "*Angka*" (organization) with extremely strict rules and policies. Children, mostly from the age of 8, were sent to live with other children and were supervised by two or three senior KR officials. The KR destroyed nearly all school buildings, equipment for educational use, and libraries (Clayton 1998). The education system ceased at all levels and locales under the KR regime. Community and family members were encouraged to spy and report on one another, thereby destroying trust and establishing deeply rooted fear (Collier et al. 2003). The KR also targeted and killed persons of high social or professional status.

Indentured labor, food shortages, and the absence of modern medicine were responsible for large numbers of deaths. According to Yale University's Cambodian Genocide Database, roughly 1.4 million Cambodians were killed or died from starvation or exhaustion during the KR regime.[2] This represents roughly one-fifth of the total population. Figure 1 illustrates the geographic variation in the estimated KR mortality rates across districts in Cambodia. Adult males were the group most likely to die under the KR regime (de Walque 2005, 2006). A simulation study by Neupert and Prum (2005) found that males accounted for approximately two-thirds of deaths during the regime. Marriage rates were very low under the KR, but rebounded immediately after its collapse. The marriage boom after the KR was likely due to the delay in marriage by women who, based on their age,

FIGURE 1 Geographic distribution and intensity of mortality under the Khmer Rouge regime in Cambodia, 1975–79



NOTES: Mortality rate is the estimated number of deaths under the KR in a district, based on information in the CGD, divided by the sum of the estimated deaths under the KR and the number of individuals who were in the district before the genocide or were born in the district during the genocide. No information means that no information is available in the CGD on estimated deaths in that province under the KR regime. Districts in which the CGD indicates that there were no bodies or no mass graves due to the genocide are shown as having zero percent mortality rate.

would otherwise have married for the first time during the KR regime (de Walque 2005, 2006).

In January 1979, the Vietnamese drove the KR to the border between Cambodia and Thailand and established the People's Republic of Kampuchea (PRK). The Vietnamese occupied Cambodia until 1989. When the KR regime fell in 1979, Cambodia was left with no institutions and infrastructure. There was no currency, no markets, no financial institutions, virtually no industry, and most roads were in disrepair (Ayres 2000). Armed conflicts between the PRK and the remnants of the KR continued in provinces along the border. There was also occasional fighting involving the remnants of the KR inside the country (Gottesman 2002).

Data

The data for this study are drawn from four sources: the 10 percent micro sample of the 1998 General Population Census of Cambodia (Census

1998), the 2004 Cambodia Socio-Economic Survey (CSES), the Cambodian Genocide Database (CGD), and the 1962 Cambodian Population Census (Census 1962).

The 10 percent micro sample of Census 1998 provides the earliest post-KR nation-wide information related to marital status, educational attainment, and other socio-demographic characteristics of individuals and households. The large sample size of Census 1998, merged with the CGD, allows more precise estimation of the effects of mortality under the KR regime on a range of outcomes. We limit the Census 1998 sample to individuals born in Cambodia, who make up 99.4 percent of the total sample, in order to exclude individuals who were not living in Cambodia while the KR was in power. The main limitations of Census 1998 are the absence of information on educational expenditure, children's height and weight, and parents' health status and earnings. Thus, we use CSES 2004, merged with the CGD, to examine the effects of mortality during the KR regime on children's educational expenses and health outcomes, as well as the influence of parental health and income.

Child sample and measures of children's educational and health outcomes

We study children who were born after 1980 and whose parents were aged 14–29 during the 1970s and 1980s. Restricting the sample to children whose parents were of prime marriage age during the 1970s and 1980s allows us to investigate the intergenerational effect of conflict as well as the sex ratio. We use both Census 1998 and CSES 2004 to examine children's educational outcomes and CSES 2004 to examine children's health outcomes.

We use two indicators to evaluate educational outcomes of children aged 6–17: whether children exhibit a normal grade progression and total spending on children's education. We use Census 1998 to code whether a child exhibits normal progression in school. This binary variable equals 1 if a child attends a grade level equal to, or higher than, the standard grade level for his or her age. We use CSES 2004 to construct total annual spending on children's education by summing school tuition fees, textbook and school supply costs, transportation and pocket money, and other school-related expenses.

For children's health, we use a sample of children aged 0–5 years old in CSES 2004, which contains information on height and weight only for children younger than age 5 years. We use height-for-age and weight-for-age Z-scores as measures of children's health outcomes. Height for age is a useful indicator of parents' investment in their children, as it depends on accumulated investment in nutrition and health care throughout childhood, while weight for age provides information on children's

current malnutrition and health status (Duflo 2000). We code children as stunted if their height-for-age Z-scores are lower than −2 (more than 2 standard deviations below the average of the reference population) and as underweight if their weight-for-age Z-scores are below the same threshold.

KR mortality rates

We use geographic variation in KR mortality rates across districts to examine the effect of the genocide on children's education and health. We construct KR mortality rates using data from the CGD and Census 1998. The CGD includes a district identifier of each KR mass gravesite and the estimated number of bodies at each mass grave. For some mass graves there are minimum and maximum estimates of bodies; in such cases, we use the average of the two estimates to construct district-level KR-related deaths. To obtain our preferred measure of KR mortality rates, we divide the estimated deaths under the KR in a district (based on information in the CGD) by the sum of the estimated deaths under the KR and the number of individuals who were in the district at the start of the KR regime (in 1975) and were still alive in 1998 (based on Census 1998 data).[3] Since we lack district-level information on the number of individuals who survived the KR regime but died between 1980 and 1998, the estimated KR mortality rates are inexact. Districts in five provinces are excluded from the analysis because no information is available in the CGD on estimated deaths under the KR regime.

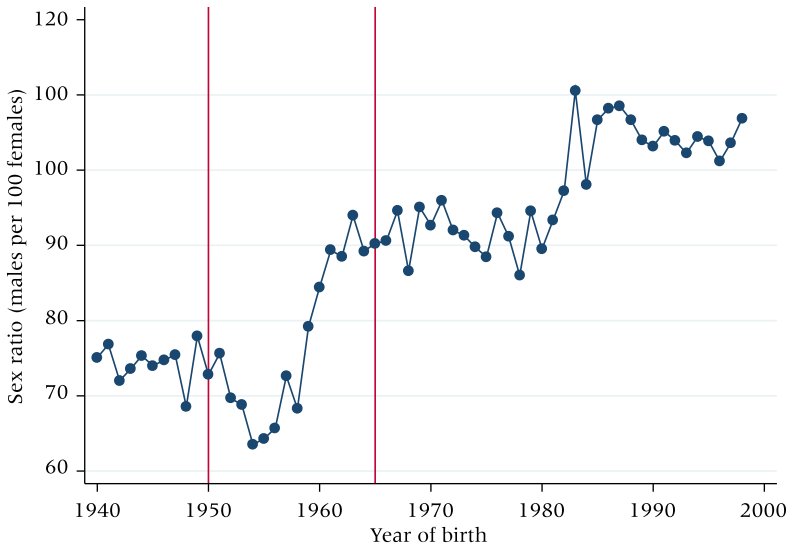
There was significant internal migration both during and after the KR regime. As a result, several alternative measures can be used in constructing the denominator of KR mortality rates. For example, the number of individuals born in the district, the number of individuals in the district in the middle of the KR regime, the number of individuals in the district at the end of the regime, and the number of individuals in the district at the time of Census 1998 are all potential alternatives.[4] Figure A1 (in the Appendix)[5] shows the correlations between various measures of KR mortality rates. Our preferred measure of KR mortality rates, which uses district population at the beginning of the KR regime, is strongly correlated with KR mortality rates based on birth district population, as well as with KR mortality rates based on district population in the middle and at the end of the KR regime. The correlations are all close to one. The measure based on district population at the time of Census 1998 is less strongly correlated with our preferred measure. In a discussion on robustness checks in the Appendix, we find that the main results are robust to using KR mortality rates based on district population at the time of Census 1998.

Sex ratios of the parents' generation

We use data from Census 1998 to calculate the district-level sex ratios of the population of prime marriage age in the 1970s and 1980s. These women and men were born between 1950 and 1965. The sex ratio for each district is defined as the ratio of men to women for those born between 1950 and 1965 who lived in that district in 1998. We use Census 1998 to plot the sex ratio of birth cohorts by birth year (1940–2000 birth cohorts) at the national level. As shown in Figure 2, the sex ratio starts to drop abruptly for cohorts born in 1950 and reaches a low point with the 1954–1956 birth cohorts. Although the sex ratio increases slightly for younger cohorts, it remains considerably less than 100. Only for cohorts born after the KR regime ended does the sex ratio return close to the normal level. The low sex ratios for cohorts born between 1950 and 1965, which were of prime marriage age during and after the KR regime, imply a shortage of men relative to women in local marriage markets. CSES 2004 data indicate that nearly all (97 percent) women born between those years were married for the first time between ages 15 and 30.

There are also several relevant district-level sex ratios for the 1950–1965 birth cohorts, given the existence of substantial post-KR internal migration. Our preferred measure is district-level sex ratios based on the district in which the individual resided at the time of Census 1998, rather than measures based on the district in which the individual lived previously. We

FIGURE 2 Sex ratio in 1998 by birth cohort for cohorts born 1940–2000, Cambodia



NOTES: Vertical lines indicate cohorts born in 1950 and 1965.
SOURCE: Census 1998.

prefer this measure since post-KR location is most likely to influence the marriage market outcomes of individuals who were of prime age in the post-KR period. Alternatively, we can measure district-level sex ratios based on the district in which the individual resided at birth, at the beginning of the KR regime, or immediately after the fall of the KR regime. Figure A2 shows correlations between various measures of sex ratios. Of these measures, the correlation between the measure based on current district of residence and the measure based on the district of residence at the end of the KR regime is the weakest. In the Appendix we further assess the robustness of the estimated effects of KR mortality rates on the sex ratios and marriage outcomes to post-KR internal migration by moving parents born in 1950–1965 back to the districts in which they lived after the fall of the KR regime.

Exogenous variation in KR mortality rates

We argue that the geographic variation in KR mortality rates at the district level is fairly exogenous. Panel A of Table 1 shows no statistically significant association between KR mortality rates and the pre-KR sex ratio, population density measures, or distance of a district to an urban center. Sex ratios in 1962 are unrelated to the KR mortality rates at the district level (column 1). KR mortality rates are also uncorrelated with various measures of population density in 1962 (columns 2–4). Similarly, district mortality rates under the KR regime are not correlated with distance to the provincial capital (column 5). In panel B, we demonstrate that the variables used to test for exogeneity in panel A are indeed correlates of current economic, educational, and health outcomes of older adults. These results indicate that the KR mortality rate is uncorrelated with characteristics that are predictive of economic and social well-being. Thus, geographical variation in KR mortality is likely exogenous.

Summary statistics

Summary statistics for the samples are presented in Table A1 (Census 1998) and Table A2 (CSES 2004). Table A1 shows that among children aged 6–17, only 11.3 percent in the mother sample and 11 percent in the father sample exhibit normal grade progression. The average KR mortality rate in the districts in which these children reside is 14.7 percent. The average sex ratio in the district in which people resided in 1998 was 77 males per 100 females in the mother sample and 79 per 100 in the father sample. An estimated 79 percent of women born between 1950 and 1965 were married in 1998, compared with 96 percent of men born during the same period. Mean years of schooling are only about 2.5 years for mothers in the sample and 4.2 years for fathers. A large fraction of the mothers married men younger than themselves: 19 percent in the mother sample and 18 percent

TABLE 1 Relationship between correlates of economic conditions, demographic characteristics, and mortality rates under the Khmer Rouge regime

	Panel A: Exogeneity of mortality rates under the Khmer Rouge regime				
Dependent Variable	Sex ratio in 1962 (1)	Density in 1962 (2)	Density — Men in 1962 (3)	Density — Women in 1962 (4)	Distance to capital district (5)
KR mortality rates	–0.022	–814.459	–417.384	–397.075	4.054
	(0.017)	(663.015)	(335.879)	(327.192)	(9.648)
R-squared	0.008	0.008	0.008	0.007	0.001
Observations	145	145	145	145	145
	Panel B: CSES 2004 for individuals born before 1950				
Dependent Variable	Mean years of schooling (1)	Mean monthly earnings (2)	Mean monthly household income (3)	Illness/injury during the past 30 days (4)	Disabled (5)
Sex ratio in 1962	4.469**	5.728***	5.834***	–0.314	–0.231
	(1.760)	(1.791)	(0.794)	(0.273)	(0.287)
Density in 1962 (in 10,000)	3.521***	1.140***	1.794***	0.105**	–0.054*
	(0.245)	(0.334)	(0.153)	(0.049)	(0.028)
Density—Men in 1962 (in 10,000)	6.925***	2.233***	3.527***	0.206**	–0.106*
	(0.507)	(0.675)	(0.315)	(0.097)	(0.056)
Density—Women in 1962 (in 10,000)	7.160***	2.327***	3.649***	0.216**	–0.110*
	(0.476)	(0.662)	(0.298)	(0.098)	(0.058)
Distance to capital district (in 10,000)	–288.508***	–113.597**	–148.448***	3.122	2.543
	(42.899)	(43.645)	(27.979)	(6.579)	(6.315)
Observations	141	125	141	141	141

*** p<0.01, ** p<0.05, * p<0.10.
NOTE: All observations measured at the district level. Values for the dependent variables in columns 1–4 of panel A are from Census 1962. In panel B, each estimate is derived from a separate regression with one explanatory variable. Robust standard errors in parentheses.

in the father sample, with a mean spousal age gap of approximately 2.9 years in the mother sample and 2.3 years in the father sample. A large fraction of the mothers married men with less education than themselves: 14 percent in the mother sample and 15 percent in the father sample, with an average spousal education gap of about 1.7 years in the mother sample and 1.6 years in the father sample. Their joint years of education is roughly 6.8.

Table A2 shows that average expenditure on children's education is roughly 91,000 Riels (US$22) per year, or approximately 1 percent of average annual household income. Among children younger than 5 years in 2004, roughly 45 percent in the mother sample and 43 percent in the father sample are stunted. The mean height-for-age Z-score is –1.05 in the mother sample and –0.85 in the father sample. Approximately 30 percent of children younger than 5 in the mother sample and 28 percent in the father sample are underweight. The mean weight-for-age Z-scores are –0.80 in the mother sample and –0.53 in the father sample. On average, 26 percent

of mothers and 22 percent of fathers had an illness or injury in the 30 days preceding the survey. The fraction of parents with a disability is also quite high: 5.6 percent in the mother sample and 9.5 percent in the father sample.

Effects of KR mortality on children's education and health

We employ a reduced-form specification to estimate the effects of KR mortality rates on the education and health of children born after the genocide ended:

$$Outcome_{ij} = \gamma_0 + \gamma_1 DR_j + \gamma_2 \mathbf{C}_{ij} + \varepsilon_{ij} \quad (1)$$

where $Outcome_{ij}$ is the educational or health outcome of child i in district j. Children's education variables are the likelihood of children exhibiting normal grade progression and expenditure on children's education. Children's health outcomes are their height-for-age and weight-for-age Z-scores. DR_j denotes the mortality rate during the KR regime in district j. $\mathbf{C}_{ij}$ is a vector of the characteristics of child i living in district j. We expect $\gamma_1 < 0$, implying that KR mortality rates negatively affect children's outcomes. By using the KR mortality rates in the district in which an individual currently resided, we estimate the effects of the intensity of the genocide on the outcomes of children in the current location. If children of migrants are inherently different from children of non-migrants and the KR mortality rates are correlated with parents' migrant status, then our approach may be problematic. Thus, we include parents' migration status in $\mathbf{C}_{ij}$, which takes the value one if a child's parent moved to the location in which he or she currently resides during the post-KR period. Parents might favor sons over daughters or vice versa (e.g., Dahl and Moretti 2008), and, if so, it is possible that parents would engage in gender-biased investment in children's health or education. As a result, we also include the sex of child i living in district j in $\mathbf{C}_{ij}$. Since the likelihood of normal grade progression may decline and school expenses increase with the age of a child, we further control for the child's age when examining children's educational outcomes. ε_{ij} is the error term. We cluster standard errors at the district level and include sampling weights.

We report the reduced-form estimates of the effects of the genocide on children's educational and health outcomes in Table 2. Panel A reports the results for the sample of children whose mothers were born in 1950–1965; panel B presents the results for children whose fathers were born in the same years. The results in columns 1–2 indicate that the likelihood of children experiencing normal grade progression is lower in high-mortality districts for both the mother and father samples. Each additional percentage point increase in the KR mortality rate reduces the likelihood of children experiencing normal grade progression by 0.065 percentage points. As the average KR mortality rate is 0.147 and the average normal

TABLE 2 Effects of mortality rates under the Khmer Rouge regime on children's educational and health outcomes

	Census 1998		CSES 2004					
	Normal grade progression likelihood		School expenditure		Height-for-age Z-score		Weight-for-age Z-score	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Children of mothers born 1950–1965								
KR mortality rates	–0.065*	–0.063*	–85.248	–67.940	–1.506**	–1.469**	–0.670	–0.646
	(0.035)	(0.032)	(58.668)	(52.263)	(0.697)	(0.690)	(0.442)	(0.436)
Age	–0.016***	–0.016***	16.453***	16.088***				
	(0.001)	(0.001)	(2.717)	(2.577)				
Male		0.001		–6.057		–0.093		0.042
		(0.002)		(4.820)		(0.194)		(0.138)
Migrant – mother		0.036***		55.482***		0.214		0.299
		(0.009)		(20.187)		(0.508)		(0.330)
Migrant – father		0.036***		22.997**		0.021		–0.169
		(0.007)		(9.564)		(0.471)		(0.298)
R-squared	0.030	0.041	0.038	0.049	0.005	0.005	0.002	0.003
Observations	191041	191041	7168	7168	1267	1267	1267	1267

B. Children of fathers born 1950–1965

KR mortality rates	–0.065*	–0.065*	–84.832	–69.338	–1.357*	–1.332*	–0.356	–0.322
	(0.036)	(0.033)	(67.166)	(60.812)	(0.734)	(0.731)	(0.498)	(0.491)
Age	–0.018***	–0.017***	14.936***	14.734***				
	(0.001)	(0.001)	(2.428)	(2.341)				
Male		0.000		–5.344		–0.256		–0.192
		(0.002)		(4.255)		(0.203)		(0.137)
Migrant – mother		0.033***		50.649***		0.108		0.249
		(0.010)		(17.541)		(0.396)		(0.280)
Migrant – father		0.041***		28.270***		0.177		0.104
		(0.007)		(8.302)		(0.367)		(0.256)
R-squared	0.033	0.044	0.033	0.045	0.003	0.005	0.000	0.003
Observations	175751	175751	7767	7767	1717	1717	1717	1717

*** p<0.01, ** p<0.05, * p<0.10.
NOTE: All specifications include sampling weights. Samples in columns 1 and 2 include children aged 6–17 in 1998. Samples in columns 3 and 4 are children aged 6–17 in 2004. The samples in columns 5–8 are children younger than 5 in 2004. Robust standard errors clustered by district (145 districts) in parentheses.

grade progression rate is 0.113, the likelihood of children experiencing normal grade progression would have been 8 percent higher in the absence of the genocide. Adding controls for the sex of the child and the post-KR internal migrant status of each parent does not greatly affect the estimates, even though migrants' children tend to do better. Thus, gender-based investment and internal migration of parents are unlikely to bias our estimates in this context. The estimated effect on children's normal grade progression implies that for every one standard deviation increase in the intensity of the genocide, the likelihood of children's normal grade progression falls by roughly 0.03 standard deviations.

Columns 3–4 of Table 2 show that expenditures on children's education are negatively associated with variation in KR mortality rates in both the mother and father samples, but the relationship is not statistically significant in either sample. Regarding children's health, the results in columns 5–8 suggest that, in districts with high KR mortality rates, children's height-for-age and weight-for-age Z-scores are lower in both the mother and father samples. However, the effects are statistically significant only for the height-for-age Z-scores. For every one percentage point increase in KR mortality rates, a child's height-for-age Z-score falls by 0.015 standard deviations in the mother sample and 0.013 standard deviations in the father sample. These effect sizes translate to a decrease of 0.06 standard deviations in the mother sample and a decrease of 0.05 standard deviations in the father sample for every one standard deviation increase in the intensity of the genocide. As the average KR mortality rate is 0.147 and the average height-for-age Z-score is –1.05, the average height-for-age Z-score would have been 20 percent higher in the mother sample and 18 percent higher in the father sample in the absence of the genocide.

Overall, the genocide in Cambodia under the KR regime negatively affected the likelihood of normal grade progression and height of children born after 1980.

Channels through which conflict may affect children's education and health

Education, income, and health of parents

We investigate whether geographic variation in KR mortality rates influences geographic variation in parents' education, income, and health status. We use four sets of observations: 1) mothers born between 1950 and 1965 with children aged 0–17; 2) the husbands of these mothers; 3) fathers born between 1950 and 1965 with children aged 0–17; and 4) the wives of these fathers. The samples used are much larger than the samples used to examine children's height-for-age Z scores as we include all parents with children aged 0–17.

The internal migration that occurred after the fall of the KR regime has implications for estimating the effects of KR mortality rates on parental outcomes. It is more likely that parental education and health were affected by the intensity of the genocide in the district in which they resided at the time of the KR regime, rather than where they resided in 1998. Because Census 1998 contains information about how long migrants have lived in the district in which they were currently residing and the district(s) in which they previously resided, we can estimate the effect of KR mortality rates on parents' educational attainment using KR mortality rates for their district of residence in the middle of the KR regime (i.e., 1977). We also estimate the effect of KR mortality rates in the district in which they resided in 1998 on parental education, and in the regression we control for whether the parent is a post-KR migrant. CSES 2004 does not contain information about the district in which an internal migrant previously lived, but does contain information on whether a person ever moved from another district and how long the person has been living in his or her current district. Thus, we include a dummy variable denoting whether a person is a post-KR migrant when examining the effects of KR mortality rates in the district in which the person currently resides on parental earnings and health.

Panel A in Table A3 shows no evidence that geographic variation in KR mortality rates in the current district of residence influences parents' completed years of schooling. Similarly, panel B shows no evidence that geographic variation in KR mortality rates in the district of residence during the KR regime affects parents' completed years of schooling. Thus, internal migration that occurred after the fall of the KR regime does not influence our findings. These results are consistent with Islam et al.'s (2016) findings that geographic variation in the intensity of the genocide did not lead to geographic variation in educational attainment of the school-age population during the KR regime. Therefore, negative shocks to parental education due to the conflict are unlikely to be the channel through which geographic variation in the intensity of the genocide influences children's educational and health outcomes.

Panel C in Table A3 shows no evidence that mortality under the KR in the current district of residence directly affects parents' log monthly earnings or monthly household income. Note that the results are not sensitive to controlling for the migration status of parents. Panel D presents the effects of KR mortality on a number of parental health measures. In the sample of mothers born between 1950 and 1965 and the sample of fathers married to mothers born in those years, there is no statistically significant relationship between KR mortality rates and any of the health measures examined (columns 1 and 2). In the father sample, the KR mortality rate does not have a statistically significant correlation with the majority of health indicators. The exceptions are difficulty with mobility (column 3) and difficulty speaking (columns 2 and 3). The majority of health indicators are

uncorrelated with KR mortality rates, and those coefficients that are significant are small or have the wrong sign; therefore, the evidence that genocide affects children's outcomes through its influence on parental health is weak at best.

The findings so far imply that the estimated effects of the genocide on children's outcomes are unlikely to have come through its direct effects on parental education, income, and health. The proviso to this conclusion is that, in Table A3, the measures of parental income and health are current measures, while the effect on children's education (delayed grade progression and especially stunting, which is usually caused by poor living conditions in the first years of life) might have occurred several years ago, even though it is established with current measures. In other words, even though we cannot measure a statistical effect of KR mortality on current parental income and health, the genocide could have resulted in temporary periods of parents' lower income and poor health, which would have occurred during critical ages for their children's development and would have had an effect in the form of delayed school progression and stunting. While we attempt to account for observable channels, there may also be factors that we cannot fully or properly capture owing to limits on data availability. For example, parental depression caused by exposure to the genocide could be one channel explaining the lower outcomes for children. Table A3 contains a variable that could be linked to depression—"psychological or behavioral difficulties"—but it is unlikely that this measure captures the extent of depression in the same way as would a psychometrically valid measure of depression.

Quality of public services

Post-genocide reconstruction and development could be more challenging in areas in which the KR regime was more destructive and killings were more intensive. The brutality of the KR regime could significantly reduce the ability of local institutions to provide public services, including education, and the effect could persist years after the genocide ended, which, in turn, may adversely affect the outcomes of children. Since we could obtain only a proxy for school quality, we check whether this alternative measure is related to lower grade progression rates in places where mortality rates under the KR regime are high. Specifically, we examine whether the literacy rates of cohorts born between 1966 and 1979, who were most likely to have attended school in the post-KR period, are correlated with mortality rates under the KR regime. When using Census 1998 data, we focus on the relationship between an indicator of literacy and KR mortality rates in the district of residence immediately after the fall of the KR regime. When using CSES 2004 data, we estimate the relationship between an indicator of literacy and KR mortality rates in the district of current residence, while

TABLE 3 Effects of mortality rates under the Khmer Rouge regime on literacy rates

	Males born 1966–1979			Females born 1966–1979		
	Literate	Can write	Can read	Literate	Can write	Can read
	(1)	(2)	(3)	(4)	(5)	(6)
KR mortality rates	0.032	0.021	0.038	0.035	0.039	0.049
	(0.021)	(0.044)	(0.042)	(0.025)	(0.040)	(0.038)
Years of schooling	0.064***	0.064***	0.062***	0.095***	0.106***	0.104***
	(0.002)	(0.005)	(0.005)	(0.002)	(0.006)	(0.006)
Age	–0.007***	0.001	0.001	–0.002***	0.005***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Migrant		–0.019	–0.017		–0.023	–0.026*
		(0.013)	(0.012)		(0.015)	(0.014)
R-squared	0.433	0.410	0.405	0.536	0.556	0.549
Observations	20525	5777	5777	34419	6439	6439

*** p<0.01, ** p<0.05, * p<0.10.
NOTE: All specifications include sampling weights. Sample includes only individuals who had ever attended school. These individuals mostly have attended school in the post-KR period. Columns 1 and 4 are based on Census 1998 data, and the mortality rates used are based on the district of residence in 1980. Columns 2, 3, 5, and 6 are based on CSES 2004 data, and the mortality rates are based on the district of current residence. Robust standard errors clustered by district (145 districts) in parentheses.

controlling for post-KR migration status. Columns 1–3 of Table 3 report the results for males and columns 4–6 report the results for females. For those who had ever attended school, the correlations between the various measures of literacy and mortality rates are positive and not statistically significant. Thus, there is no evidence that the quality of post-KR public services was exceptionally low in districts where the intensity of the genocide was high.

Sex ratios and the marriage market

The genocide in Cambodia resulted in unbalanced sex ratios for the 1950–1965 birth cohorts across districts. As men of marriageable age became scarce relative to women, the marriage market tightened in the post-KR period. The tightened marriage market affected the marital outcomes of parents and could also have had adverse intergenerational effects on children born years after the conflict ended. Given the limited information in the available datasets, we focus on measures of marital outcomes that can be constructed from basic demographic and education characteristics and information about the interrelationships of household members in Census 1998. The outcome variables include the sex ratio in the district in which a person currently lives, the likelihood of being married at the time of the survey, the likelihood that a woman marries a younger man (or that a man is a younger husband), the spousal age gap, the likelihood that a woman marries a less-educated man (or that a man is a less-educated husband),

the spousal education gap, and the person's age at first marriage. For the sex ratio and the likelihood of being married, we focus on individuals born in 1950–1965. For other outcomes, we focus on parents born in 1950–1965 to be consistent with the children's sample. The samples of parents are larger than the samples of individuals as some parents have more than one child appearing several times in the sample.[6]

In the female sample in Table 4, a higher KR mortality rate significantly reduces the sex ratio of the 1950–1965 birth cohorts (column 1). It also decreases the likelihood of being married, but the effect is not statistically significant (column 2). Therefore, despite the shortage of men of similar ages, the probability of women being married remains largely unchanged, consistent with the findings of de Walque (2006). Our results imply that many women ended up marrying men outside their ideal age range, perhaps reflecting their eagerness to get married after the KR regime fell. Indeed, our estimates in panel A confirm that women are more likely to marry a younger spouse, and that the spousal age and education gaps are reduced, when there is an increase in KR mortality rates (increasing the number of women relative to the number of men). The estimates are mostly statistically significant, except for the likelihood of marrying a less-educated husband. The median spousal age difference is 5 years for individuals born before 1940 (not shown), who most likely married before the KR regime, but it falls to 2 years for the 1950–1965 birth cohorts. The lower sex ratio also reduces the spousal education gap (column 6). In a traditional society like Cambodia, there is a strong stigma against women who never marry, so parents with unmarried daughters are less demanding of potential sons-in-law. The smaller spousal age and educational gaps indicate that women married husbands who were less educated and otherwise less advantaged.

Similar effects of the genocide on the sex ratio and marriage outcomes of males born in 1950–1965 appear in the male sample in Table 4. There is a strong negative and statistically significant relationship between KR mortality rates on the one hand and the sex ratio and the likelihood of a man being younger than his wife on the other (Panel B, columns 1 and 3). Spousal age gaps and education gaps also decrease as KR mortality rates rise (columns 4 and 6). In particular, the effect on the spousal age gap is much larger in the male sample than in the female sample, while the effect on the spousal education gap is smaller in the male sample.

Column 7 of Table 4 indicates a significant positive relationship between KR mortality rates and mother's age at first marriage (panel A). The estimate implies that women delay marriage in response to the shortage of men. On the other hand, although the father's age at first marriage falls in areas in which the genocide was more intensive, the effect is not statistically significant. The difference in the effects of the genocide on father's and mother's age at first marriage roughly equals the spousal age gap.

TABLE 4 Effects of mortality rates under the Khmer Rouge regime on the sex ratio and marriage outcomes

	Sex ratio (1)	Married (2)	Husband's age < Wife's age (3)	Spousal age gap (4)	Husband's education < Wife's education (5)	Spousal education gap (6)	Age at first marriage (7)
A. Mother born 1950–1965							
KR mortality rates	–0.082**	–0.025	0.035*	–0.431*	0.012	–0.336**	0.442**
	(0.032)	(0.021)	(0.021)	(0.231)	(0.016)	(0.157)	(0.205)
Age		–0.007***	–0.002***	0.110***	0.001*	0.042***	
		(0.000)	(0.001)	(0.007)	(0.000)	(0.005)	
Migrant – self	0.058***	0.018***	–0.027***	0.530***	0.002	0.184***	0.151***
	(0.011)	(0.005)	(0.007)	(0.082)	(0.004)	(0.041)	(0.048)
Migrant – spouse			0.017***	–0.209***	0.013**	0.107**	0.228***
			(0.006)	(0.075)	(0.005)	(0.048)	(0.058)
R-squared	0.087	0.006	0.001	0.010	0.001	0.005	0.002
Observations	97739	97739	191041	191041	191041	191041	190518

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TABLE 4 (continued)

	Sex ratio (1)	Married (2)	Husband's age < Wife's age (3)	Spousal age gap (4)	Husband's education < Wife's education (5)	Spousal education gap (6)	Age at first marriage (7)
B. Father born 1950–1965							
KR mortality rates	–0.084***	–0.002	0.041**	–0.497***	0.010	–0.268*	0.060
	(0.029)	(0.006)	(0.018)	(0.179)	(0.018)	(0.160)	(0.232)
Age		0.002***	–0.015***	0.231***	–0.002***	0.093***	
		(0.000)	(0.000)	(0.004)	(0.000)	(0.004)	
Migrant – self	0.056***	–0.001	–0.014***	0.347***	0.013**	0.162***	0.405***
	(0.010)	(0.003)	(0.005)	(0.053)	(0.005)	(0.045)	(0.058)
Migrant – spouse			–0.005	0.078	0.001	0.181***	0.408***
			(0.005)	(0.056)	(0.004)	(0.041)	(0.062)
R-squared	0.061	0.002	0.030	0.072	0.001	0.019	0.009
Observations	75613	75613	175751	175751	175751	175751	175751

*** p<0.01, ** p<0.05, * p<0.10.

NOTE: Sampling weights are used in all specifications. Samples in columns 1 and 2 are based on individual adults of the parental generation, while samples in columns 3 to 7 are based on the children's samples. Age at first marriage is inferred from own age and age of the oldest child in the household. The sample size for mother's age at first marriage is smaller as we exclude women with inferred age of first marriage lower than 12. Robust standard errors, clustered by district, are given in parentheses.

Because some members of the 1950–1965 birth cohorts moved more than once after the fall of the KR regime, the marriage market that affected them the most might not be where they currently live, but where they lived immediately after the fall of the KR regime. We investigate how this possibility might affect our results by re-estimating the effects of KR mortality rates on the sex ratios and marriage outcomes of the 1950–1965 cohorts using KR mortality rates in the district in which they resided immediately after the fall of the KR regime (see Table A4). The estimates are broadly consistent with those reported in Table 4. These results are not unexpected given the high correlation (shown in Figure A2) between the sex ratios in the district in which people currently reside and the sex ratios in the district in which they lived after the fall of the KR regime.

The influence of various channels on children's outcomes

Because KR mortality rates affect both the health and the marriage market prospects of parents, we examine the role that these channels may play in influencing children's outcomes by adding factors that capture their influence as additional explanatory variables in Equation (1). If these factors play a role in influencing children's outcomes, then adding them as control variables will reduce the estimated effects of KR mortality on children's outcomes. For marriage market factors, we focus on the sex ratios of the parental generation and the joint years of parental schooling. The sex ratio is a convenient measure of the tightness of the marriage market and can serve as a proxy for a variety of unobserved marriage outcomes. Having shown previously that the spousal education gap narrows with the intensity of the genocide, and given that parental education is likely correlated with children's normal grade progression, we also include joint years of parental schooling as an explanatory variable. Among the health measures examined, parents having difficulty with mobility is the only health indicator that is consistently negatively associated with the intensity of the genocide. Thus, we include a dummy variable set equal to 1 if either parent has difficulty with mobility as an explanatory variable, in order to examine whether the health of parents serves as a channel through which the genocide affects the height of their children.

Table 5 reports the estimated effects of KR mortality rates on the likelihood of children's normal grade progression and height-for-age Z-score after controlling for the parents' marriage market channel and poor physical mobility channel. Columns 1 and 5 show that the sex ratio of the parental generation is statistically significant and that including it as an explanatory variable reduces the negative effect of KR mortality rates on the likelihood of children's normal grade progression by roughly 15 percent. Columns 2 and 6 show that adding joint years of parental schooling and an

TABLE 5 Influence of parental marriage market and health on children's outcomes

	Children's outcomes in mother sample				Children's outcomes in father sample			
	Normal grade progression likelihood		Height-for-age Z-score		Normal grade progression likelihood		Height-for-age Z-score	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
KR mortality rates	–0.050	–0.034	–1.438**	–1.360**	–0.053*	–0.037*	–1.289*	–1.190
	(0.031)	(0.022)	(0.667)	(0.670)	(0.032)	(0.021)	(0.723)	(0.719)
Age	–0.016***	–0.018***			–0.017***	–0.018***		
	(0.001)	(0.001)			(0.001)	(0.001)		
Male	0.001	0.000	–0.096	–0.095	0.000	–0.001	–0.259	–0.254
	(0.002)	(0.002)	(0.194)	(0.193)	(0.002)	(0.002)	(0.203)	(0.203)
Migrant – mother	0.031***	0.018***	0.202	0.150	0.029***	0.015***	0.086	0.050
	(0.008)	(0.005)	(0.514)	(0.510)	(0.009)	(0.005)	(0.404)	(0.405)
Migrant – father	0.033***	0.018***	0.016	0.024	0.039***	0.019***	0.170	0.148
	(0.006)	(0.004)	(0.465)	(0.464)	(0.006)	(0.004)	(0.363)	(0.364)
Sex ratio of parental generation	0.119*	0.109**	0.308	0.340	0.103	0.095**	0.427	0.438
	(0.064)	(0.046)	(1.342)	(1.343)	(0.066)	(0.047)	(1.353)	(1.344)
Joint parental education		0.016***		0.026		0.016***		0.030*
		(0.001)		(0.019)		(0.001)		(0.016)
Parent has difficulty with mobility				–0.403				–0.855**
				(0.544)				(0.431)
R-squared	0.042	0.108	0.005	0.007	0.045	0.114	0.005	0.009
Observations	191041	191041	1267	1267	175751	175751	1717	1717

*** p<0.01, ** p<0.05, * p<0.10.

NOTE: All specifications include sampling weights. Samples are the same as those reported in Table 2. Robust standard errors clustered by district (145 districts) are provided in parentheses.

indicator of poor parental mobility reduces the negative effect on normal grade progression by roughly 45 percent. The reduction is mostly driven by joint years of parental schooling, as poor parental physical mobility is not statistically significant. Further, the effect of KR mortality rates on the likelihood of children's normal grade progression becomes statistically insignificant in the mother sample. In contrast, columns 3 and 6 show that including the sex ratios of the parental generation in the regression does not influence the effect of KR mortality rates on children's height-for-age Z-score. The sex ratio variable is also not statistically significant. Adding joint parental education and an indicator for poor parental mobility changes the estimated effect of KR mortality rates on children's height-for-age Z score in the father sample. The reduction in the observed effect is primarily driven by parental health, given that the indicator for poor parental mobility is strongly statistically significant and large.

The preceding analysis suggests that the effect of the genocide on the marriage market of parents was likely an important channel through which the genocide negatively affected the educational outcomes of children. As we noted earlier, there may well be other unobserved factors for which we cannot control. Nonetheless, there appears to be some evidence that parental difficulty with mobility may partly account for the negative effect of the genocide on children's health, although other measures of parental health seem unrelated to children's health.

Conclusion

This article examined the effects of the genocide that occurred in Cambodia during the KR regime from 1975 to 1979 on the health and education of children born after the regime fell. We found that greater intensity of mortality during the genocide had an adverse effect on the education and health of children born to parents years after the conflict concluded. Had the genocide not occurred, the average normal grade progression rate of children would have been 8 percent higher and the average height-for-age Z-score of children would have been 18–20 percent higher. There are several potential channels through which the genocide might have had adverse effects on children, including the effect of the conflict on the education and health of parents. While we do not argue that the marriage market was the main channel, especially in terms of children's health, our analysis suggests that the marriage market channel plays an important role in explaining the intergenerational effect on education outcomes. There is some evidence that poor parental mobility has an effect on children's stunting, although other indicators of parental health are unrelated to children's outcomes. While we have attempted to account for a range of observable channels, we cannot rule out that unobservable channels contribute to poorer outcomes for children.

Notes

This article is based on Chapter 3 of the second author's Ph.D. thesis, completed in the Department of Economics, Monash University. She acknowledges financial support for the duration of her Ph.D. candidature from an Australian Leadership Award.

1 One might question whether women marrying younger men entails marrying men of lower quality. Our premise is that assortative mating is associated with higher satisfaction levels with one's spouse because couples involved in homogamous marriages will have more shared values, have more empathy for each other, and be better able to communicate. Couples with different levels of human capital may have expectations with respect to their partner that go unfilled, leading to lower levels of marital satisfaction (see e.g., Rainer and Smith 2012).

2 The CGD was initially developed by Yale University and has been updated by the Documentation Center of Cambodia (DC-Cam). We use data from both sources. See http://www.yale.edu/cgp/ and http://www.d.dccam.org/Database/Index1.htm for details on the CGD and DC-Cam database.

3 Living persons born between 1975 and 1979 are allocated to their districts of birth and included in the denominator.

4 Census 1998 contains information about the district of birth, whether a person has always lived in the district in which he or she currently resides, where a person previously lived if the person ever moved, and how long the person has lived in the district in which he or she currently resides if the person ever moved. We use this information to construct various estimates of the district population at different points in time.

5 Appendix is available at the supporting information tab at wileyonlinelibrary.com/journal/pdr.

6 The results are similar if we include each parent once in the sample.

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