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Mothers and Fathers : Education, Co-residence and Child Health

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Mothers and Fathers : Education, Co-residence and Child Health *

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Résumé

We use four waves of Demographic and Health Surveys from Zimbabwe to evaluate the effect of mother's and father's education on child health outcomes. We identify causal effects using the 1980 education reform. A simultaneous-equation model is estimated to take into account possible selection and endogeneity biases. Our results suggest some specialization within parents, as mothers and fathers do not affect the same health outcomes of their under-5 children. Fathers matter more than mothers, and mother's education improves health only when she is matched to a low-educated man. There is selection in our sample, as is usual. The inverse Mills ratio capturing the likelihood of living with one's father or mother significantly affects child health. Last, parental educational sorting is shown to be important, so that estimation that does not take both mother's and father's education into account will produce biased results.
JEL Codes : I10, I26, O12, J12, C36, C34
Keywords : Couples, Child's Health, Education, Reform, Sub-Saharan Africa.

Résumé

A partir de quatre vagues des Enquêtes Démographiques et de Santé conduites au Zimbabwe et de la réforme de l'éducation menée en 1980, nous nous intéressons à l'effet causal respectif de l'éducation de la mère et de l'éducation du père sur la santé des enfants de moins de 5 ans. Un modèle d'équations simultanées est estimé pour tenir compte d'éventuels biais de sélection et d'endogénéité. Nos résultats suggèrent une certaine spécialisation au sein du couple parental puisque les mères et les pères n'influencent pas les mêmes variables de santé de leurs enfants. Les pères semblent jouer un rôle plus important que les mères, et l'éducation des mères n'a d'effet sur la santé de leurs enfants que lorsque le niveau d'éducation du père est faible. Par ailleurs, nous mettons en évidence un phénomène de sélection dans notre échantillon. Les inverses des ratios de Mills, capturant la probabilité pour un enfant de vivre avec son père ou avec sa mère, ont

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un effet significatif sur la santé des enfants. Enfin, nous montrons qu'étant donné l'importance de l'homogamie d'éducation, ne pas tenir compte simultanément de l'éducation du père et de la mère dans l'estimation conduit à des résultats biaisés.
JEL Codes : I10, I26, O12, J12, C36, C34
Keywords : Couples, Santé des enfants, Education, Réformes, Afrique Subsaharienne.

1 Introduction

The factors leading to better health are as important to economists as to other researchers in social sciences and policy-makers. Out of the eight Millennium Development Goals, three concern health and access to health care in developing countries. The lack of resources at both the governmental and individual levels has long been highlighted as the main barrier to improving health in developing countries. Poor people in low-income countries face a variety of health-related risks, with young children paying most of the global disease burden.

Of the 56.8 million deaths in 2016, 9.9% were of children under the age of five. In Africa this figure reached 31%.[1] Over half of all deaths in low-income countries in 2016 were caused by so-called "Group I" conditions, which include communicable diseases, maternal causes, conditions arising during pregnancy and childbirth, and nutritional deficiencies. By way of contrast, only 6.7% of deaths in high-income countries were due to these causes[2] (World Health Organization 2018). These conditions caused 56% of all deaths in the WHO African Region in 2016. As such, most deaths could be avoided by adopting preventive actions (Banerjee and Duflo 2011) such as vaccination, water filtering, breastfeeding and the use of bed-nets. Education plays a key role here via its induced demand for prevention.

Since the model of health demand in Grossman (1972), the education-health relationship has appeared in a wide body of theoretical and empirical research. On average, the more-educated have better health and live longer than the less-educated (e.g. Lleras-Muney 2005). This is explained by lifestyles, working conditions and wages. Education not only affects the individual's own health, but parental education also impacts the health of their children.

There are many channels through which education might affect health. The first is wealth. The

1. Authors' calculations from World Health Organization (2018).
2. The gap was even larger in 2000 : 69.1% in low-income countries v.s. 6.6% in high-income countries.

educated are likely to have better labor opportunities and higher wages, so that they can more likely afford the cost of prevention, treatment and private health-insurance, and have better access to health care and health centers. Second, the educated are more likely to understand the prevention messages they receive than their less-educated counterparts. Third, they have greater incentives to invest in preventive behaviors as, given the wage differential, the gap in terms of the future loss from illness is higher for the educated than for the less-educated. Last, education teaches discipline, compliance with rules and exams, exertion of effort and accepting constraints, as noted in Basu (2002). As such, it might help educated people to adopt costly preventive behaviors. Most of these mechanisms also apply when explaining why parental education might help improve child health.

Using the four waves of the Demographic and Health Surveys in Zimbabwe[3] from 1999 to 2015, we examine the health outcomes of 21,976 children aged 0-4 born between 1994 and 2015. We compare the outcomes of children with educated mothers and fathers to those whose parents are less-educated.

The major problem in this comparison is the endogeneity of education, from the correlation between the unobservable characteristics leading to education and those leading to health investments. Two examples of these unobserved characteristics are ability and time preference. Education and health are two indicators of human capital. As such, investing in education and investing in health both imply costly investment today for a future uncertain benefit. In addition, if educated parents are in better health than are less-educated parents, this affects the child's health via the intergenerational transmission of health (Bhalotra and Rawlings 2011). We here exploit the exogenous increase in education produced by the 1980 reform to estimate the causal effect of mother's and father's education on child health.

A number of contributions have exploited exogenous variation in education to identify the causal relationship between education and outcomes such as employment, fertility and health. Recent articles have explored the relationship between education and health in developing countries, as

3. Zimbabwe is a low-income country of 16 million inhabitants (with GDP per capita of 2,085.7 current international $ in PPP in 2017 (World Bank, World Development Indicators) located in Southern Africa. The under-5 mortality rate was 70.7 in 2015 (World Health Organization 2017). Life expectancy at birth was 61 in 1985, 44 in 2002 and 60.3 in 2015 (World Bank, World Development Indicators). The large fall at the end of the 1990s reflects high HIV prevalence. The HIV prevalence rate in the Demographic and Health Surveys was 21% for women aged 15-49 and 15.5% for men in 2005 (vs. 16.7 and 10.5 respectively in 2015).

major reforms to the latter's school systems took place between 1970 and 2000. Using information on reforms allows us to estimate the causal effect of education on health outcomes in a quasi-experimental setting, as it provides exogenous variation in enrolment in Primary or Secondary school, the number of years of school or the likelihood of dropping out of school in instrumental-variable or regression-discontinuity approaches. Examples of these reforms are compulsory school-enrollment (Aguero and Bharadwaj 2014 ; Bharadwaj and Grepin 2015), the rise of the school-leaving age (Albouy and Lequien 2009 ; Kemptner *et al.* 2011), the supply of schools (Breierova and Duflo 2004 ; Silles 2009 ; Bhalotra and Clarke 2014), the implementation of Universal Primary Education policies (Behrman 2015 ; Osili and Long 2008) and changes in school fees (Silles 2009 ; Oyelere 2010). For instance, Grepin and Bharadwaj (2015) use the removal of Primary school fees and the building of Secondary schools in Zimbabwe to estimate the causal impact of mother's secondary education on child mortality, as well as mothers' age at marriage, age at first sex, age at first birth and ideal number of children.

Our work here also takes into account the marital education sorting of parents as an additional source of bias in the estimates, with the size of the bias being a priori even larger in articles that examine the effect of each parent's education in separate models. If the correlation between education levels is high, the estimate of the effect of mother's education on child's health without controlling for father's education may instead pick up the effect of father's education. The bias may also come from unobservable characteristics (such as ability and time preference) that drive (un)educated people to match together. Marital sorting has been documented in developed and developing countries (eg. Azam and Djemai 2019 ; Chiappori et al. 2009 ; Van Bavel and Klesment 2017).

Last, co-residence between parents and children might also bias the estimates, as it might not be random in the population and covers a non negligible share of children : only 52% of our survey children aged 0-4 live with both parents. It is well-established in the literature that children growing up in single-parent households acquire less human capital, whether the parents divorced or one died (see Fitzsimons and Mesnard 2013 ; Adda et al. 2011). Living with both parents, compared to living with only one or neither, is not random and affects child health. We treat this as a selection issue, as the education of the parent is not observed if he or she does not live in the same household as the observed child. The selection equations, one for each parent, are identified using exogenous variations in community practices (e.g. the % of mothers who give birth before being married). Our analysis of selection into co-residence provides new insights into the current literature on the education-health relationship that has to date neglected this dimension. Emran et al. (2018) documents this source of bias, calling it a truncation bias due to co-residency in the estimations of intergenerational mobility.

We also contribute to the literature on the respective role of mothers and fathers on child outcomes. The role of father's education has been overlooked in the current literature, with only relatively few contributions (Case and Paxson 2001, Breierova and Duflo 2004, Apouey and Geoffard 2016, Chou *et al.* 2010, De Neve and Subramanian 2017, Lindeboom *et al.* 2009, Alderman and Headey 2017). This could reflect the common wisdom that mothers matter more than fathers in raising children. Another purely-empirical reason is that mothers are more likely than fathers to live with their children in many countries, leading to empirical challenges when trying to evaluate the role of fathers. Case and Paxson (2001) study the role of father's and mother's education and co-residence in child health in the US, but without modeling selection into co-residence or marital sorting.

The father's contribution is modeled in three ways in recent work. First, the effect of the average mother's and father's education is estimated in Breierova and Duflo (2004). However, this does not allow us to consider differences between parents nor to use exposure to the reform as an instrumental variable, as men are usually older than their spouses. Second, two separate models are estimated, one controlling for mother's education and the other for father's education, as in Apouey and Geoffard (2016), Chou *et al.* (2010), De Neve and Subramanian (2017). From our viewpoint, this is debatable for two reasons : in the case of educational marital sorting, part of the effect of mother's education may reflect that of the father's, and there is no discussion about co-residence, even though the sample sizes vary from one estimation to the other. If one parent is absent because of divorce or death, the parent who is living with the child might compensate for the absence, and all the more so when (s)he is more educated and as such, has more room to adjust. Some papers have explored the role of the absence of one parent on the formation of human capital and suggest that human capital is greatly affected. One example is Adda *et al.* (2011), who evaluate the long-term consequences of parental death and find that mothers and fathers have differential effects on child cognitive and non-cognitive skills. The third approach is to estimate the effect of both mother's and father's education in the same equation, as in Lindeboom *et al.* (2009) and Alderman and Headey (2017). In the latter, maternal and paternal education are referred to even for non-biological parents, whereas the effect might be different, given work on child fostering and step-mothers (e.g. Case and Paxson 2001). In this paper, we focus on the role of biological mothers and fathers, and estimate their respective effects along with the complementarities via an interaction between the two education levels in a single equation.

Grepin and Bharadwaj (2015) and De Neve and Subramanian (2017) are closest to our analysis, as they consider the 1980 education reform in Zimbabwe to estimate the causal effect of parental education on child health. Grepin and Bharadwaj (2015) focus on the effect of maternal education on child mortality, while we here estimate the effect of father's and mother's education on child's current health and the conditions surrounding pregnancy and child birth. De Neve and Subramanian (2017) estimate the effect of both father's and mother's education on child malnutrition, as we do, but their estimation strategy differs from ours in several respects. First, they estimate the respective effects in separate regressions. Second, the outcomes are different. Third, they do not take marital sorting into account. Last, they do not model selection into co-residence.

The remainder of our paper is organized as follows. Section 2 describes the reform and its impact on parents' education. Section 3 then presents the data and Section 4 the estimation strategy. The empirical results are described in Section 5, and the robustness checks and extensions appear in Section 6. Last, Section 7 concludes.

2 The policy intervention

Zimbabwe officially gained independence from the United Kingdom in 1980. Before independence, there were enormous inequalities in education between Whites and Blacks. For Whites, who represented only 3.5% of the population, education was free and compulsory until the age of 15 and admission to Secondary school was automatic after the pupils passed their Primary school final exam (Dorsey 1989). However, education was neither free nor compulsory for Blacks, who faced considerable selection at each grade. As a result, in the 1970s, only 4% of Black pupils were in Secondary school : the analogous figure was 43% for White pupils (Dorsey 1989). There was also inequality between boys and girls. In 1975, the girl/boy ratio was 85% in Primary education and 71% in Secondary education (see Table 1).

The first Black majority government - led by the Zimbabwe African National Union (ZANU) party - came to power with independence in 1980. Education was one of its top priorities for two reasons : (1) to satisfy the electorate, who considered education as the principal route to salaried employment and the modern way of life ; and (2) as it considered this to be the main instrument to expand and modernize the country (Dorsey 1989). The new Constitution therefore declared education as a fundamental human right (Education Act 2004). From 1980 on, the Government launched a vast intervention campaign to raise school attendance and the education of every child (Colclough *et al.* 1990 ; Aguero and Bharadwaj 2014 ; Grepin and Bharadwaj 2015). This expansion concerned both girls and boys and covered the whole country.

The main policy changes took place in 1980 and can be summarized as follows :

1. Primary education became free and compulsory for all pupils. Given the official duration of Primary education, all children would leave school with at least 7 years of education.
2. Admission to Secondary school became automatic for all pupils, whatever their performance in the Primary-school final exam. Secondary education remained paying.
3. The removal of age-restrictions to allow older children to enter school.
4. The government changed the school zoning system that gave Whites access to the best schools ; it also introduced double-session schooling in almost all urban schools and some rural ones.

These reforms had a huge affect on child education, as shown in Figure 1, which comes from household-level data in the 1999, 2005, 2010 and 2015 Demographic and Health Surveys. Note that Primary education lasts 7 years and Secondary education 6 years,[4] so pupils completing both

4. Lower Secondary education lasts 2 years while upper Secondary education lasts 4 years (WDI).

cycles have 13 years of education. The reform aimed to increase access to Secondary schools and so affected children at the end of Primary school, theoretically at age 14.[5] We can thus define as being exposed to the Education reform all children who were 14 or younger in 1980, in other words children born after 1966. The vertical line in Figure 1 corresponds to the 1966 cohort : individuals born after 1966 are treated by the 1980 reform.

We have three potential measures of education in the DHS to evaluate the causal impact of education on health : years of education, attendance at Secondary school and Primary-school completion. Grepin and Bharadwaj (2015) use Secondary-school attendance as their educational outcome. However, we do not believe that this is a valid variable. If treatment is defined by Secondary-school attendance, some "untreated" individuals may have completed Primary school, whereas they would not have done so prior to the reform. They are therefore wrongly considered as untreated : the reform did indeed increase their education. As a consequence, only Primary-school completion and years of education can be used as valid educational outcomes in this case. We prefer years of education, as this combines Primary-school completion and Secondary-school attendance.

Figure 1 depicts the proportion of mothers and fathers in each birth cohort who attended Secondary school for at least one year, who completed Primary school and their years of education. There are three main features. First, school attainment started to rise even among those not directly affected by the reform, in the sense that schooling was not compulsory for cohorts born before 1966. These cohorts were affected via easier school access after 1980. For example, women (men) born in 1950 had on average two (six) years of education, while the analogous figure for those born in 1960 was four (eight). Figures 1a and 1b show that this increase reflected both Primary- and Secondary-school attendance : the latter rose from effectively 0% (20%) for women (men) born in 1950 to 15% (40%) for those born in 1960. For the same two cohorts, Primary-school completion rose from 20% to 30% for women, and from 40% to 60% for men. The increase in education thus applied to both sexes.

Second, as shown in Figures 1a and 1b, the reform resulted in an expansion of pupils completing Primary school, but the largest change was found in Secondary education. It was this latter variable

5. Up to 1986 children started Primary school at age 7 (see Table 1).

that was used in Aguero and Bharadwaj (2014) and Grepin and Bharadwaj (2015) to estimate the causal effect of Secondary education. However, as noted above, we do not think that Secondary-school attendance is the best education-outcome variable to use for the instrumental estimation of the effect of education, as many of those who did not attend Secondary school were still affected by the education reform via the increase in Primary-school enrollment.

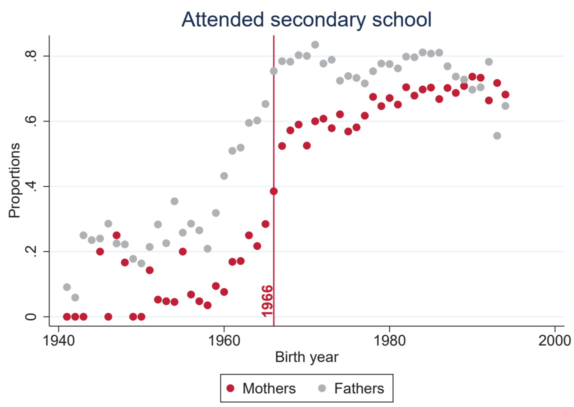
Last, even though the reform took place in 1980, the rise in school attendance was not immediate, taking four to five years as it took some time to train and recruit additional teachers and build new schools. The Government reconstructed all schools that had been destroyed during the war and built new Primary and Secondary schools, in particular in marginalized areas and disadvantaged urban centers (Kanyongo 2005). New teachers were also needed, and some of these were recruited from Secondary-school pupils. The World Development Indicators (World Bank) statistics in Table 1 show a huge jump in the number of Primary-school teachers between 1980 and 1985 and an even larger jump in Secondary-school teachers. As the number of enrolled pupils also rose, we can measure the potential quality of education by the number of pupils per teacher : this fell in Primary schools but rose in Secondary schools to reach a figure of 27 in 1990. Government expenditure on education rose sharply around the time of the reform, from 2.5% of GDP in 1980 to 12.5% in 1990.

TABLE 1 – Education indicators in Zimbabwe over the 1975-2000 period

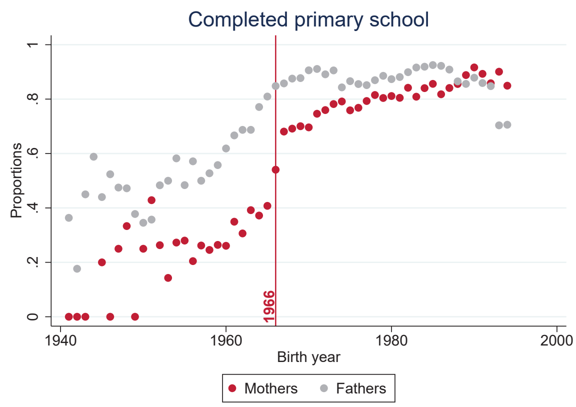
	1975	1980	1985	1990	1995	2000
Number of teachers - Primary	21,202	28,118	56,067	59,154	63,475	66,440
Number of teachers - Secondary	3,383	3,782	19,507	24,547	27,458	34,163
Teachers /1000 inhab. - Primary	3.44	3.86	6.33	5.65	5.45	5.31
Teachers /1000 inhab. - Secondary	0.55	0.53	2.25	2.41	2.42	2.79
Pupil/teacher ratio - Primary	40.69	43.92	39.50	35.78	39.11	37.03
Pupil/teacher ratio - Secondary	19.38	19.76	27.81	26.93	25.90	24.71
Girl/boy ratio - Primary	85.22	-	94.62	99.12	97.37	97
Girl/boy ratio - Secondary	71.26	-	68.46	88.00	83.66	88.00
Government funding (% of GDP)	-	2.5	7.4	12.5	-	-
Official entrance age - Primary	7	7	7	6	6	6
Official entrance age - Secondary	14	14	14	13	13	13

Source : World Development Indicators (World Bank).

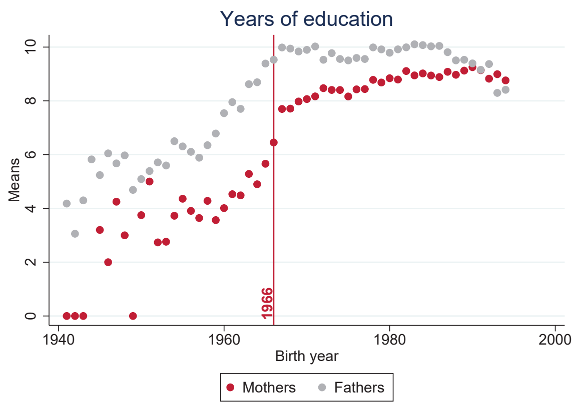
FIGURE 1 – Mother's and Father's education by birth year



(a) Attended Secondary school



(b) Completed Primary school



(c) Years of education

3 Data description

We use household-level data collected by the Demographic and Health Surveys in Zimbabwe. This survey is nationally representative of households and was collected in 1999, 2005, 2010 and 2015.[6] The sampling is in two stages in each survey round. First, enumeration areas are selected based on the most recent available census. Second, a complete listing of the households living in the

6. We cannot use the earlier surveys as the 1994 survey does not allow us to link the household children to their fathers, and many of the child-health outcomes that we use in the analysis are not included.

selected enumeration areas (or communities) is established in order to randomly select the sampled households, and in the latter every women aged 15-49, whether permanent residents or visitors (who slept in the household the night before the survey) are eligible for interview. We here use the data files from the household roster and the female questionnaire. The male questionnaire is used to construct measures to predict the child's probability of living with their father.

The household roster includes the complete list of household members and, for each member, age and the highest level of education. For children, the ID codes of the mother and father are listed if they live in the same household. As such, we have different types of households and family composition. We observe children who are not living with their parents (e.g. children fostered in another household) and children living with either one or both parents. By construction, if a sampled mother is not living with one of her children, this child is not a household member and is not present for the collection of anthropometric measures.

The analysis focuses on children aged between 0 and 59 months old, as mothers are asked specific questions about children in this age range as part of the female questionnaire. These questions cover delivery conditions, breastfeeding practices and vaccination. We also have anthropometric measures for children in this age group. The four rounds of survey data cover 21,976 children aged 0-4, of whom about half, 11,754, currently live with both parents and constitute our analytical sample.

The summary statistics for the entire sample and the analytical sample appear in Columns 1 and 2 of Table 2. A full description of the variables is provided in Appendix A. Over the entire sample, 50% of the children are girls, the average age is 2 and 28% live in urban areas. For 98% of the aged 0-4 children in sample households the mother is still alive, and for 95% the father is alive. Co-residence with the mother is 30 percentage points more likely than co-residence with the father : 85% of children live in the same household as their mother, and 55% in the same household as their father. The average age of mother at child birth is 26.4, and when the fathers are present their observed average age at birth is 33.7. This age difference corresponds to the usual age-difference figure found in existing work (e.g. d'Albis *et al.* 2012).

Table 2 – Descriptive statistics - Child characteristics and health outcomes

	(1) All	(2) Analytical sample	(3) Mother exposed	(4) Mother not exposed	(5) Father exposed	(6) Father not exposed
Panel A – *Child characteristics*						
Girl	0.50	0.50	0.50	0.50	0.50	0.50
Age	2.02	1.89	1.83	2.45	1.85	2.19
Urban	0.28	0.33	0.31	0.15	0.36	0.22
Poorest	0.25	0.24	0.24	0.34	0.23	0.29
Poorer	0.21	0.19	0.20	0.25	0.18	0.22
Middle	0.18	0.15	0.17	0.21	0.14	0.18
Richer	0.20	0.23	0.22	0.12	0.24	0.16
Richest	0.16	0.19	0.17	0.10	0.20	0.15
Number of under-5 children	1.75	1.68	1.73	1.75	1.66	1.79
Mother alive	0.98	1.00	1.00	1.00	1.00	0.99
Father alive	0.95	1.00	0.97	0.93	1.00	1.00
Mother present	0.85	1.00	1.00	1.00	0.98	0.97
Father present	0.55	1.00	0.63	0.66	1.00	1.00
Mother's age at birth	26.43	26.75	25.56	38.86	25.12	32.93
Father's age at birth	33.74	33.75	32.76	47.03	30.36	46.55
1999	0.17	0.17	0.14	0.62	0.10	0.42
2005	0.27	0.26	0.26	0.30	0.25	0.34
2010	0.27	0.27	0.28	0.06	0.30	0.15
2015	0.29	0.30	0.31	0.01	0.36	0.09
Panel B – *Outcomes*						
Number of prenatal visits	4.83	4.91	4.82	4.98	4.92	4.89
Prenatal visits ≥ 4	0.72	0.73	0.72	0.73	0.73	0.70
Home birth	0.27	0.28	0.26	0.38	0.26	0.37
Delivery with a doctor/nurse	0.56	0.65	0.67	0.49	0.66	0.53
Stunted	0.31	0.30	0.31	0.32	0.29	0.32
Severely stunted	0.11	0.11	0.11	0.12	0.10	0.12
Wasted	0.05	0.05	0.05	0.07	0.05	0.06
Height-for-Age Z-score	-1.29	-1.27	-1.29	-1.37	-1.25	-1.34
Weight-for-Age Z-score	-0.61	-0.60	-0.61	-0.74	-0.58	-0.66
Weight-for-Height Z-score	0.16	0.17	0.16	0.11	0.17	0.15
Number of types of complete vaccines	1.46	1.71	1.71	1.90	1.65	1.75
Complete vaccination	0.55	0.55	0.54	0.64	0.54	0.56
Slept under bed-net last night	0.10	0.13	0.12	0.04	0.13	0.10
N	21,976	11,754	17,411	1,232	9,521	2,512

Source : Authors' calculations from the Demographic and Health Surveys (surveys 1999, 2005, 2010 and 2015).
Notes : Unweighted statistics. The analytical sample covers 0-4 children who currently live with both parents. Exposed mothers or fathers are those born in or after 1966.

The summary statistics for the outcome variables appear in Panel B. These can be grouped into three categories : (1) outcomes related to prenatal care and birth, namely the number of antenatal visits, having had at least four prenatal visits, having been born at home and having been assisted by medical staff at birth ; (2) malnutrition (nutrition Z-scores and malnutrition status) ; and (3) prevention (vaccination and sleeping under a mosquito bed-net). [7]

27% of sample children were born at home, and 56% of births were assisted by medical staff. The average number of antenatal visits is quite high, 4.8, compared to the recommendations of the WHO, and 72% of children had at least four antenatal visits. We use the anthropometric measures in the survey to construct common malnutrition indicators : 31% of young children are stunted, 11% severely stunted [8] and 5% are wasted. [9] The average number of types of complete vaccines is 1.46 and 55% of children received the complete recommended immunization package (BCG, Diphteria-Pertussis-Tetanus, measles) while 11% slept under a bed-net the night before the survey.

Comparing the characteristics of sample children born to exposed mothers to those born to non-exposed mothers (columns 3 and 4, respectively), there is very little difference in some variables (child sex, for instance), while for others the observed differences reflect that, by definition, non-exposed mothers are older than exposed mothers and are more likely to come from the 1999 survey wave. Any differences thus contain both age and period effects. The observed children who are 0-59 months old at the time of the survey are more likely to be the first-borns of exposed mothers but not of non-exposed mothers, which is why age at birth is much higher in col. 4 than col. 3. Urban residence is much higher in the exposed sample than in the non-exposed sample, also due to large changes over time. Similar patterns are observed comparing children born to exposed (col. 5) and non-exposed (col. 6) fathers. Estimating a model with age and period effects is thus crucial to purge these observed differences between the treated and control groups.

Mother and father education appear in Panel A of Table 3, and the full definition of the variables

7. The use of bed-nets is not asked in the 1999 survey wave. We do not analyze breastfeeding as 98% of children were breastfed.

8. Stunted children are too small for their age, that is their height-for-age Z-score is over two standard deviations below the reference value. Severely-stunted children have a HAZ score over three standard deviations below the reference value.

9. Wasted children are too thin for their height, that is their weight-for-height Z-score is over two standard deviations below the reference value.

is set out in Appendix Table A2. In the analytical sample in col. 1, the average number of years of schooling is 8.3 for mothers and 9.1 for fathers. 77% (81%) of mothers (fathers) completed Primary school, and 60% (68%) attended at least one year of Secondary school. Mothers' average age is 28.6 and that for fathers 35.6. Mothers have, on average, five siblings. In our sample, 93% of the mothers were exposed to the reform, as were 79% of fathers (see Table 3, panel C). Mothers exposed to the reform have an average of 8.6 years of education, versus 4.5 years for those not exposed. 80% of the exposed mothers (32% of non-exposed mothers) completed Primary school, and 64% attended Secondary school (16% of the non exposed). On average, fathers exposed to the reform had 9.7 years of education versus 6.7 years for those not exposed. The impact of the reform is then about three to four additional years of education for both men and women. Men had much more education than women before the reform, and this gender difference remains after the reform. 88% of the fathers exposed to the reform completed Primary school versus 55% of those not exposed, and 76% attended Secondary school versus 36% of the non-exposed. Women have the same level of education as men for those born after the mid-1990s.

For the control variables defined at the enumeration-area level, the average proportion of women (men) who are separated, divorced or widowed in the community is 16% (8%), the proportion with first child born before marriage is 12%, and the average proportion of polygamous households is 12%.

4 Econometric specification

We estimate the joint impact of father's and mother's education on a number of child-health outcomes. Given the way in which Demographic and Health Surveys are collected (as described below), this is only possible when the child lives with both parents. Our econometric strategy therefore tackles three econometric issues : i) the endogeneity of father's and mother's education ; ii) marital education sorting (i.e. homogamy) ; and iii) selection into co-residence, as the sample of children who live with both parents is not random.

Table 3 – Descriptive statistics - Parents' characteristics

	(1) Analytical sample	(2) Mother exposed	(3) Mother not exposed	(4) Father exposed	(5) Father not exposed
Panel A – *Education*					
Years of education (mother)	8.31	8.62	4.46	8.82	6.36
Completed Primary at least (mother)	0.77	0.80	0.32	0.82	0.54
Secondary school at least (mother)	0.60	0.64	0.16	0.66	0.37
Years of education (father)	9.08	9.33	5.61	9.71	6.65
Completed Primary at least (father)	0.81	0.84	0.42	0.88	0.55
Secondary school at least (father)	0.68	0.71	0.22	0.76	0.36
Panel B – *Controls*					
Mother's age	28.64	27.39	41.31	26.94	35.10
Mother's age at first union	18.72	18.78	19.24	18.70	18.79
Women separated (% in cluster)	0.16	0.17	0.16	0.16	0.17
First child born before marriage (% in cluster)	0.12	0.13	0.16	0.12	0.14
Number of mother's siblings	5.25	5.14	6.28	5.05	6.03
Father's age	35.64	34.62	49.43	32.21	48.74
Men separated (% in cluster)	0.08	0.09	0.09	0.08	0.09
Polygamous (% in cluster)	0.12	0.12	0.16	0.12	0.15
Panel C – *Exposure to the 1980 Education Reform*					
Mother exposed	0.93	1.00	0.00	1.00	0.67
Father exposed	0.79	0.85	0.01	1.00	0.00
N	11,754	17,411	1,232	9,521	2,512

Source : Authors' calculations from the Demographic and Health Surveys (1999, 2005, 2010 and 2015 waves).
Notes : Unweighted statistics. The analytical sample refers to the sample of 0-4 children who are currently living with both parents. Exposed mothers (resp. fathers) are mothers (resp. fathers) who were born in or after 1966.

4.1 The endogeneity of education

In the child's outcome equation, father's and mother's education are likely endogenous, leading to inconsistent estimates of the impact of education on health outcomes. Unobservable parental characteristics (such as time preference, ability and intrinsic motivation) make them more likely to invest both in their human capital (education) and the health of their children. In addition, education is correlated with parental health status, and healthy parents are more likely to have healthy children. Not controlling for parent's own health status can then lead to a second source of endogeneity bias.

We address this endogeneity issue using instrumental variables, where the instrument is exposure to the reform : fathers and mothers born in or after 1966 (i.e. who were 14 or younger in 1980, or were not yet born) were exposed to the 1980 education reform.[10] As shown in Figure 1, free and compulsory Primary education and easier access to Secondary education brought about an exogenous rise in years of education.

We estimate a 2SLS model with two first-stage regressions : one each for mother's and father's education. Those two-stage equations are defined as follows :

$$\begin{aligned} Educ_{iht}^{M} = b_0^M + b_1^M T^M + b_2^M (B^M - 1966) 1_{B^M < 1966} + b_3^M (B^M - 1966)^2 1_{B^M < 1966} + \\ b_4^M (B^M - 1966) 1_{B^M \geq 1966} + b_5^M (B^M - 1966)^2 1_{B^M \geq 1966} + X'_{iht} b_6^M + X'_{ht} b_7^M + \epsilon_{iht}^M \end{aligned} \tag{1}$$

$$\begin{aligned} Educ_{iht}^{F} = b_0^F + b_1^F T^F + b_2^F (B^F - 1966) 1_{B^F < 1966} + b_3^F (B^F - 1966)^2 1_{B^F < 1966} + \\ b_4^F (B^F - 1966) 1_{B^F \geq 1966} + b_5^F (B^F - 1966)^2 1_{B^F \geq 1966} + X'_{iht} b_6^F + X'_{ht} b_7^F + \epsilon_{iht}^F \end{aligned} \tag{2}$$

where i refers to the child ($i = 1, ..., N$; N denotes the size of the analysis sample),[11] h the

10. As a robustness check, we will remove from the analysis sample (i) children with at least one parent born between 1966 and 1970, as they may have benefited from higher school enrollment but of poor quality, and (ii) children who have at least one parent born between 1961 and 1965, as these parents are partially treated in that they were allowed to catch up.

11. We find the same results if we estimate these equations on the initial sample, i.e. the sample not restricted to having both mothers and fathers currently living with the observed child. These results are available upon request.

household and t the survey year. M denotes child i's mother and F the father. The dependent variables ($Educ^M$ and $Educ^F$) are the years of education reported by child i's mother and father respectively. This measure of education is used in our baseline model ; Primary-school completion will appear an alternative in a sensitivity analysis. Note that our education variable is strictly positive for almost all parents in the sample : only 3% of fathers and 5% of mothers have no education. This small share of zero values justifies our use of OLS regressions in the first stage.

T^M and T^F are dummy variables for the post-reform period : T^M (T^F) is one if the mother (father) was born in or after 1966, i.e. was 14 or younger in 1980, and zero otherwise. The direct impacts of the policy reform on education are given by b_1^M for the mother and b_1^F for the father. To reflect the different trends in education before and after the reform, as in Figure 1, we include pre- and post-reform quadratic trends, denoted respectively by $(B-1966)1_{B<1966}$ and $(B-1966)^2 1_{B<1966}$ pre-reform and $(B-1966)1_{B\geq 1966}$ and $(B-1966)^2 1_{B\geq 1966}$ post-reform, where B is the parent's birth year. The number of siblings is added to the list of instruments for the mother, but is not available for fathers. X_{iht} and and X_{ht} are sets of exogenous child and household variables that are also included in the outcome equation. Given our econometric strategy, other variables need to be included in these first-stage regressions : these will be described in Section 4.4, where the final model is set out.

Table 4 – The First-Stage estimates for mothers and fathers

	(1) Education^M	(2) Education^F	(3) Education^M	(4) Education^F
Exposed	1.244***	0.460**	3.101***	2.292***
	(0.445)	(0.207)	(0.167)	(0.103)
Pre-reform trend	0.329**	0.243***		
	(0.159)	(0.026)		
Pre-reform trend^2	0.014	0.003***		
	(0.011)	(0.001)		
Post-reform trend	0.121***	0.021		
	(0.019)	(0.017)		
Post-reform trend^2	-0.003***	-0.002***		
	(0.001)	(0.001)		
Number of mother's siblings	-0.004		-0.008	
	(0.011)		(0.011)	
Constant	8.223***	12.139***	7.450***	10.715***
	(0.664)	(0.833)	(0.542)	(0.837)
N	10,851	11,653	10,851	11,653
Adjusted R^2	0.39	0.41	0.38	0.38
F	59.17	73.56	62.67	70.29
p-value (F)	0.000	0.000	0.000	0.000
F (excluded instruments)	76.10	173.91	173.67	497.42
pvalue (excluded instruments)	0.000	0.000	0.000	0.000
Control variables X	YES	YES	YES	YES
Region FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Region × Year FE	YES	YES	YES	YES

Source : Authors' calculations from the Demographic and Health Surveys.
Notes : * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors clustered at the enumeration area level are in parentheses. Education is years of education. The control variables X are child sex and age, urban residence and household-wealth quintiles. The F-statistic of excluded instruments is obtained from the estimation of equations (1) and (2). There is no correction for selection into co-residence.

The estimation results from the first-stage equations (1) and (2) are presented in columns 1 and 2 of Table 4, respectively. Note that, for identification purpose, those equations also control for all the exogenous variables in the outcome equation. [12] The average number of school years is 1.2 years

12. In practice, as the first-stage and outcome equations are estimated simultaneously, we have as many first-stage

higher for mothers exposed to the reform compared to the non-exposed, with a corresponding figure of 0.46 years for fathers. The reform therefore had a much greater effect on mothers than fathers (and significantly so at the 1% level).[13] Our first-stage regressions are convincing ; the F-statistics on excluded instruments (exposure to the reform and its trends, along with the number of siblings for the mothers only) indicate that our instruments are not weak (F=121.7 for mothers ; F=141.6 for fathers).

Columns 3 and 4 relax the assumption of pre- and post-reform trends in access to education, and estimate years of education using only the binary treatment variable, as well as the number of siblings in the mothers' equation. The coefficient on reform exposure is much larger here in col. 3 (col 4) than in col. 1 (col. 2), with a very large estimated reform effect of 3.1 more education years for mothers and 2.3 more years for fathers, with again the difference between the two point estimates being significant at the 1% level.

4.2 Selection into marriage

Marital educational sorting may be an issue in our model. In the analysis sample, 89% of mothers who completed Primary school married men who also completed Primary school, and 85% of mothers who attended Secondary school married men who also attended Secondary school. There is consequently substantial correlation between mother's and father's years of education : 0.63. Women and men with similar education tend to live with or marry each other. As a result, the unobservable characteristics that explain mothers' education (such as intrinsic motivation) may well be correlated with unobservables that explain fathers' education.

In our final model, mother's and father's education are therefore estimated simultaneously, taking into account the correlation between the residuals of both equations (ϵ_{iht}^{M} and ϵ_{iht}^{F}). We find a positive and very-significant correlation (0.415) between these residuals (see Appendix Tables

regressions as outcomes. Given that the sample size varies slightly between outcomes, depending on the number of missing values, the results from the first-stage estimations may also vary. However, this turns out not to be the case : the results are very similar across outcomes and sample sizes. In this Section, and in the paper in general, we only report and comment on the first-stage regressions for the entire analytical sample. In the final specification, described in Section 4.4, the Inverse Mills ratio is included as a right-hand side variable to correct for possible selection bias.

13. The pre-reform level of education differs between mothers and fathers : see the descriptive statistics in Table 3 and Figure 1.

B2-B4) : men and women with similar intrinsic incentives or aspirations towards human-capital investment tend to live and have children with each other.

4.3 Selection into co-residence

Our ability to observe the dependent and independent variables of interest depends on the five types of setting in the data, as summarized in Table 5.

TABLE 5 – Selection issues

		Presence in the sampled household			Education		Type of health data	
	N	Child in the hh	Mother in the hh	Father in the hh	Mother's education	Father's education	current status	Birth info
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Type 1	2,863	No	Yes	Yes	8.35	NA	No	Yes
Type 2	11,773	Yes	Yes	Yes	8.30	9.08	Yes	Yes
Type 3	3,217	Yes	No	No	NA	NA	Yes	No
Type 4	286	Yes	No	Yes	NA	9.17	Yes	No
Type 5	7,249	Yes	Yes	No	8.4	NA	Yes	Yes

The analytical sample used to estimate the effect of mother's and father's education on child-health outcomes is restricted to sampled children who live with both parents (household composition of Type 2). If the three are listed as household members, we can match the children to their parents using their IDs, and the educational attainment of each parent is observed. In order to observe current health outcomes, we need either the mother to live in the household (as the birth history is asked of each mother) or the child to live in the household (and thus be present when the anthropometric measures are taken). Both types of outcomes are observed when the child and mother live in the same household.

In the four other cases, we do not have all of the necessary information (child-health outcomes and father's and mother's education). The different cases are summarized in Table 5. In Type 1 the child is not a household member, while the mother is (and maybe the father too). The mother declares the child in the birth history, but the child does not appear in the survey either because he/she is dead or is fostered in another household. As these children are not listed in the household roster, we cannot match them to their fathers, so that father's education is unobserved. There are

2,863 children of this type who will not appear in our analysis, including in the selection equation.

Children of Types 3, 4 and 5 currently live in the sampled households but are left out of the analysis sample as they do not live with both parents. Type-3 children live with neither parent, Type-4 children with their father but not their mother, and Type-5 children with their mother only. We have missing data on the birth-outcome variables for Types 3 and 4 children as the mother is not in the sampled household and so does not reply to the questionnaire recording that information. Current child weight and height is observed when the child is present in the household, that is for children of Types 2 to 5.

Of the 22,525 sampled children aged 0-4, 52.3% live with both parents (Type 2), 14.3% with neither (Type 3), 1.3% with their father only (Type 4) and 32.2% with their mother only (Type 5). The Type-2 percentage is fairly stable over time : 52% in 1999, 53% in 2005, 53% in 2010 and 55% in 2015. This low percentage of children living with both parents is not particular to Zimbabwe, although it does have one of the lowest percentages among African countries (according to Pilon and Vigniki (2006), who refer more broadly to children aged below 15).[14]

There are no great differences in school attainment across types. When mother's education is observed, this varies from 8.3 to 8.4 years (see col. 5 of Table 5), and for fathers from 9.08 to 9.17 (col. 6). However, Table 2 shows that our analytical sample differs somewhat from the whole sample : households in the analytical sample are richer, and are more likely to live in urban areas and have younger children. From Panel B, we see that their children also have better health outcomes, although these gaps are not large. Except for having been born with the help of medical staff and the number of vaccines, the statistics in columns 1 and 2 are quite similar.

Our estimations may suffer from selection bias due to the coresidence restriction, for which we need to correct. The unit of analysis here is all children 0-4 living in sampled households (i.e. children of Types 2-5), and selection bias is addressed via Heckman's two-step procedure.[15] We

14. In Namibia, only 26% of children below the age of 15 live with both parents, with an analogous figure of 33% in South Africa. This percentage rises to about 50% in Zimbabwe and Rwanda. But most countries have higher figures, such as Benin (65%), Ethiopia (71%) and Burkina Faso (78%) (Pilon and Vigniki 2006).

15. We estimate a selection equation to explain why parents may not live with their children. Only 2% of mothers and 5% of fathers of sample children are dead. Fathers/mothers who do not live with their child are therefore mainly parents who have decided not to live together : divorcees, temporary migrants who quit the household and those who have entrusted their child to somebody else's care. We hypothesise that all of these potential (unobserved) reasons can be summarized by one single selection equation, a hypothesis that is of course debatable.

estimate two probit selection equations, one each for the mother and father. Let $Coresidence^{M}_{iht}$ ($Coresidence^{F}_{iht}$) be a dummy for child i living with her mother M (father F) in survey t, and zero otherwise. We have :

$$Coresidence^{M}_{iht} = 1 \text{ if } Coresidence^{*M}_{iht} > 0, \text{ 0 otherwise}$$

$$Coresidence^{F}_{iht} = 1 \text{ if } Coresidence^{*F}_{iht} > 0, \text{ 0 otherwise}$$

where $Coresidence^{*M}_{iht}$ and $Coresidence^{*F}_{iht}$ are latent variables defined as follows :

$$Coresidence^{*M}_{iht} = a^{M}_{0} + Z'^{M}_{iht} a^{M}_{1} + X'_{iht} a^{M}_{2} + X'_{ht} a^{M}_{3} + \mu^{M}_{iht} \tag{3}$$

$$Coresidence^{*F}_{iht} = a^{F}_{0} + Z'^{F}_{iht} a^{F}_{1} + X'_{iht} a^{F}_{2} + X'_{ht} a^{F}_{3} + \mu^{F}_{iht} \tag{4}$$

As before, i indexes the child ($i = 1, ..., N_T$, where N_T denotes the size of the initial sample), h the household and t the year of the survey.

The estimation of these selection equations requires exclusion restrictions, i.e. variables that influence co-residence but have no direct effect on the outcome. We use community-level variables. For the mother, we use two variables (Z^{M}_{iht}) : the proportion of sampled women who gave birth to their first child before getting married in each community, and the proportion of sampled women who are currently divorced, separated or widowed in each community. For fathers, the excluded variables Z^{F}_{iht} are the proportion of sampled men currently divorced, separated or widowed in each community and the percentage of sampled men living in a polygamous household in each community. There are 1,418 different communities in our analytical sample, each of which is large enough to be distinct from the individual considered (comprising, on average, 11 households and 65 individuals). The models also inlcude child (X'_{iht}) and household (X'_{ht}) characteristics in the outcome equation as described below.

Table 6 – Selection equations for mothers and fathers (Equations (3) and (4))

	(1)	(2)
	Mother present	Father present
Separated (% in cluster)	-0.657***	-0.741***
	(0.126)	(0.116)
First child born before marriage (% in cluster)	-0.682***	
	(0.145)	
Polygamous (% in cluster)		0.436***
		(0.116)
Age	-0.301***	-0.069***
	(0.007)	(0.006)
Girl	0.003	-0.000
	(0.021)	(0.018)
Urban	0.298***	0.209***
	(0.056)	(0.053)
Poorest	0.120*	-0.108*
	(0.062)	(0.058)
Poorer	-0.049	-0.241***
	(0.061)	(0.057)
Middle	-0.107*	-0.367***
	(0.059)	(0.056)
Richer	0.121***	-0.057
	(0.046)	(0.039)
Constant	2.263***	1.093***
	(0.167)	(0.138)
N	21,975	21,924
Pseudo R^2	0.11	0.06
Correctly specified	63.78	62.02
Region FE	YES	YES
Year FE	YES	YES
Region × Year FE	YES	YES

Source : Authors' calculations from the Demographic and Health Surveys.
Notes : * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors clustered at the enumeration area level are in parentheses.

The selection-equation estimation results (3) and (4) appear in Table 6, cols. 1 and 2 respectively. All of the instruments are significantly related to the probability of co-residence at the 1% level, and are of the expected sign. We find that the greater the proportion of sampled women who gave birth to their first child before getting married in each community and the higher the proportion of sampled women who are currently divorced, separated or widowed in each community, the lower the probability that the child live with their mother. Equally, the higher the proportion of men who are currently divorced, separated or widowed in the community, the lower is the probability that the child live with their father, and the higher the proportion of men living in polygamous households, the higher the probability that the child live with their father. [16]

4.4 Final specification

Our final specification aims to identify the effect of parental education on a number of child-health outcomes. We address education endogeneity via the policy reform that allowed some parents to enroll in school and stay longer in school. We do so via 2SLS estimation. Selection into co-residence is taken into account using a two-step Heckman selection model, and marital homogamy using correlated error terms between fathers' and mothers' education. We use the procedure described in Wooldridge (2002, Chapter 17) to estimate a full model that takes all these issues into account in the five-equation model described below.

16. We may have expected this correlation to be of the opposite sign. However, polygamous fathers in Zimbabwe usually live in the same house with their different wives, especially in rural areas (OECD 2010).

$$
\begin{cases}
Coresidence^{*M}_{iht} = a^M_0 + Z'^M_{iht}a^M_1 + X'_{iht}a^M_2 + X'_{ht}a^M_3 + \mu^M_{iht}; i = 1, ..., N_T & (5) \\
\\
Coresidence^{*F}_{iht} = a^F_0 + Z'^F_{iht}a^F_1 + X'_{iht}a^F_2 + X'_{ht}a^F_3 + \mu^F_{iht}; i = 1, ..., N_T & (6) \\
\\
\begin{aligned} Educ^M_{iht} = b^M_0 + b^M_1 T^M + b^M_2(B^M - 1966)1_{B^M<1966} + b^M_3(B^M - 1966)^2 1_{B^M<1966} \\ +b^M_4(B^M - 1966)1_{B^M\geq 1966} + b^M_5(B^M - 1966)^2 1_{B^M\geq 1966} + b^M_6\lambda^M_{iht} + Z'^M_{iht}b^M_7 \\ +b^F_6\lambda^F_{iht} + Z'^F_{iht}b^F_7 + X'_{iht}b^M_8 + X'_{ht}b^M_9 + \epsilon^M_{iht}; i = 1, ..., N \end{aligned} & (7) \\
\\
\begin{aligned} Educ^F_{iht} = b^F_0 + b^F_1 T^F + b^F_2(B^F - 1966)1_{B^F<1966} + b^F_3(B^F - 1966)^2 1_{B^F<1966} \\ +b^F_4(B^F - 1966)1_{B^F\geq 1966} + b^F_5(B^F - 1966)^2 1_{B^F\geq 1966} + b^F_6\lambda^F_{iht} + Z'^F_{iht}b^F_7 \\ +b^M_6\lambda^M_{iht} + Z'^M_{iht}b^M_7 + X'_{iht}b^F_8 + X'_{ht}b^F_9 + \epsilon^F_{iht}; i = 1, ..., N \end{aligned} & (8) \\
\\
\begin{aligned} H_{iht} = c_0 + c^M_1 Educ^M_{iht} + c^F_1 Educ^F_{iht} + c^{FM}_1 Educ^F_{iht} * Educ^M_{iht} + c^M_2\lambda^M_{iht} + c^F_2\lambda^F_{iht} \\ +Z'^M_{iht}c^M_3 + Z'^F_{iht}c^F_3 + X'_{iht}c_4 + X'_{ht}c_5 + \nu_{iht}; i = 1, ..., N \end{aligned} & (9)
\end{cases}
$$

In equation (9), H_{iht} is child health, and $Educ^M_{iht}$ and $Educ^F_{iht}$ are continuous variables for mother's and father's years of education respectively. We also include an interaction between mother's and father's education, $Educ^F_{iht} * Educ^M_{iht}$, which allows us to test for complementarity between the two.

N is the size of the analytical sample. The outcome equation includes a number of exogenous variables that also appear in the selection and first-stage equations : X_{iht} includes child characteristics (age and sex) and X_{ht} household characteristics (household wealth quintiles, urban location, regional dummy variables, year fixed effects and the interaction between the region and year fixed effects). We could not include religion or household ethnicity.[17] The year dummies (1999, 2005, 2010 and 2015), region fixed-effects and their interactions are included in all equations.

As described in Wooldridge (2002), we correct for any selection bias by adding the Inverse Mills ratios from the probit estimation of equations (5) and (6) to both the first-stage ((7) and (8)) and outcome (9) equations. The two Inverse Mills ratios are λ^M and λ^F, and a test for selection bias is $c_2^M = 0$ and $c_2^F = 0$ in (9).

All exogenous variables should appear in the selection equation and be listed as instruments in the 2SLS procedure. However, in our case, some exogenous variables (such as the exposure to the reform variables) cannot be included in the selection equation as they are not observed for fathers and mothers who do not live with their child. Equations (5) and (6) are estimated separately via probits, and Equations (7) to (9) are estimated simultaneously using linear-probability models. This joint estimation allows us to take into account any correlation between the error terms : ϵ_{iht}^M and ϵ_{iht}^F may be correlated due to assortative matching ; ϵ_{iht}^M and ν_{iht} as well as ϵ_{iht}^F and ν_{iht} may also be correlated if mothers (fathers) have intrinsic characteristics that influence both their choice of education and their ability to improve their child's health. We later discuss the sign and significance of all these correlations. We do not consider any correlation between μ_{iht}^M and ϵ_{iht}^M, μ_{iht}^F and ϵ_{iht}^F or μ_{iht}^M, μ_{iht}^F and ν_{iht}, as these error terms refer to samples of different sizes. Last, note that standard errors are clustered at the enumeration area level in all equations as proportions computed at the enumeration area level are included in the set of right-hand side variables.

5 Results

5.1 The impact of mother's education only

We start our analysis by looking at the impact of mother's education on child-health outcomes, as this has been the focus of the literature on parental education and child health. As such, the role of the father in terms of his living with his children and education is not taken into account.

17. There is insufficient variation in religion : depending on the survey waves, 90-95% of mothers are Christians and 5-10% Atheists, and 65-80% of fathers are Christians and 20-25% Atheists. Moreover, ethnicity is not available in our survey waves.

The most naive approach is to estimate the effect of mother's education in the sample of children living with their mother, whatever the situation of the father : the child can either live with both parents or with the mother and not the father. We can argue that the estimated effect of mother's education here is unreliable for a number of reasons. First, if the child lives with both parents, and the father and mother have similar education, not controlling for father's education may overestimate the effect of mother's education, as the latter captures part of that of the father. Second, if the father does not live with his child, the educated mother might compensate for the father's absence so that the estimated effect might be larger than it would have been in the presence of the father.

We tackle these issues by estimating the effect of mother's education in different samples : first the sample of children who live with their mother (with the father being present or not) ; second, the sample of children who live with their mother and not their father ; and third, the sample of children who live with both parents. We compare the results across the different samples using the 95-percent confidence intervals.

Table 7 shows the benchmark results for the sample of all mothers living with their child, whatever the situation of the father. We then estimate equations (5), (7) and (9) without including any information on the father. Four estimates are shown : the OLS estimate (column 1), the 2SLS estimate (column 2), the OLS estimate correcting for selection (column 3) and the 2SLS estimate correcting for selection (column 4). The results in column 4 come from our preferred specification that deals with all the estimation issues discussed above ; this corresponds to the estimation of equation (9). However, columns 1 to 3 help us to understand how our results change when correcting for the endogeneity of education and selection.

In the OLS specification in column 1, the education coefficient has the expected sign, as more education is associated with better health : in Panel A there are more prenatal visits, a greater probability of having attended at least four prenatal visits and the birth being assisted by a doctor or a nurse, and a lower probability of home birth. In Panel B, mother's education is also associated with improved child nutrition, reducing the probability of child stunting, severe stunting and wasting, and increasing the three Z-scores (height-for-age, weight-for-age and weight-for-height). Last, the OLS estimates in Panel C suggest that mother's education increases vaccine use. All of the estimated coefficients are significant, except for that on bed-net use (although mother's education may be associated with children living in lower-risk malaria environments). We here look at the use of bed-nets, rather than the fact of owning them, so that we estimate their effective coverage.

Column 2 reports the IV point estimates of mother's education on the various outcomes. The IV estimates for many outcomes are of the same (positive) sign as the OLS estimates, but are not significant. The effect of mother's education remains statistically significant on the probabilities of home birth and complete vaccination. The same results are found in column 4, taking into account selection into co-residency, except that there is a counterintuitive negative effect on the number of vaccines. More generally, the results suggest that selection into co-residency with the mother does not drive the previous results, as the findings are similar between cols. 1 and 3 for OLS, and between cols. 2 and 4 for IV.

The findings in cols. 1 and 2 of Table 7 can be compared to those in De Neve and Subdramanian (2017) for the probabilities of being stunted and wasted via OLS and IV. Our results are in line with theirs, as the OLS estimates of the effect of maternal schooling are negative and significant, while the IV estimates are insignificant.

We now restrict the sample to children who live with their mother and whose father is not present in the household (Table 8), reducing the sample from about 18,000 observations to about 7,000. In column 4 we find, as in Table 7, that children with more-educated mothers have a lower probability of being born at home. While mother's education significantly influences the Z-scores and nutrition status in the OLS models (cols. 1 and 3), the IV coefficients are insignificant in cols. 2 and 4. The point estimates are however very similar to those in Table 7. On the contrary, the coefficients for the prevention variables are no longer significant in Table 8 (even though their values lie in the confidence intervals of those in Table 7). Prevention behaviors may then be more affected by fathers, so that the coefficients on these variables in Table 7 are not accurately estimated. The impact of mother's education may partly capture that of father's education (especially if they have similar education). This also means that when the father does not live with his children, the mother does not compensate for his absence by adopting preventive behaviors.

Table 7 – The impact of mother's education only (whole sample)

	(1)	(2)	(3)	(4)
			Correcting for selection	
	OLS	IV	OLS	IV
Panel A – *Prenatal Care*				
Number of prenatal visits	0.105***	0.026	0.104***	0.025
N=13,405	[0.086,0.125]	[-0.034,0.086]	[0.085,0.124]	[-0.035,0.085]
Prenatal visits ≥ 4	0.012***	0.007	0.012***	0.006
N=13,405	[0.009,0.015]	[-0.004,0.017]	[0.009,0.015]	[-0.004,0.017]
Home birth	-0.027***	-0.027***	-0.027***	-0.027***
N=16,867	[-0.030,-0.025]	[-0.038,-0.017]	[-0.030,-0.024]	[-0.038,-0.017]
Birth assisted by medical staff	0.025***	-0.011	0.025***	-0.011
N=18,594	[0.022,0.028]	[-0.038,0.015]	[0.022,0.028]	[-0.038,0.017]
Panel B – *Nutrition*				
Stunted	-0.009***	0.005	-0.009***	0.004
N=15,507	[-0.012,-0.006]	[-0.006,0.015]	[-0.012,-0.006]	[-0.007,0.014]
Severely stunted	-0.002**	0.003	-0.002**	0.002
N=15,507	[-0.005,-0.000]	[-0.005,0.010]	[-0.005,-0.000]	[-0.005,0.010]
Wasted	-0.001*	-0.001	-0.001	-0.001
N=15,392	[-0.003,0.000]	[-0.007,0.005]	[-0.003,0.000]	[-0.007,0.005]
HAZ	0.032***	-0.001	0.032***	0.002
N=15,507	[0.021,0.042]	[-0.038,0.036]	[0.022,0.042]	[-0.034,0.039]
WAZ	0.033***	-0.000	0.033***	0.001
N=15,934	[0.025,0.041]	[-0.028,0.027]	[0.025,0.041]	[-0.027,0.028]
WHZ	0.018***	-0.010	0.017***	-0.011
N=15,392	[0.008,0.027]	[-0.044,0.024]	[0.008,0.027]	[-0.044,0.023]
Panel C – *Prevention*				
Number of types of complete vaccines	0.021***	-0.031	0.020***	-0.037
N=18,594	[0.013,0.028]	[-0.077,0.015]	[0.013,0.028]	[-0.084,0.011]
Complete vaccination	0.011***	0.012**	0.011***	0.009*
N=15,084	[0.008,0.014]	[0.003,0.022]	[0.008,0.014]	[-0.000,0.019]
Slept under net last night	0.001	0.000	0.001	-0.000
N=14,760	[-0.002,0.003]	[-0.004,0.004]	[-0.001,0.003]	[-0.004,0.004]
Control variables X	YES	YES	YES	YES
Control variables Z	NO	NO	YES	YES
Region FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Region × Year FE	YES	YES	YES	YES

Source : Authors' calculations from the Demographic and Health Surveys.
Notes : * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 95% confidence intervals in brackets. Robust standard errors clustered at the enumeration area level. The control variables X are child sex and age, urban residence and household-wealth quintiles. Columns (3) and (4) also control for the Inverse Mills ratio obtained for mothers. The control variables Z are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage in the cluster.

Table 8 – The impact of mother's education only (mothers who live without the father)

	(1)	(2)	(3)	(4)
			Correcting for selection	
	OLS	IV	OLS	IV
Panel A – *Prenatal Care*				
Number of prenatal visits	0.081***	0.076	0.081***	0.077
N=5,093	[0.052,0.111]	[-0.024,0.177]	[0.051,0.111]	[-0.023,0.176]
Prenatal visits ≥ 4	0.010***	-0.003	0.010***	-0.002
N=5,093	[0.005,0.015]	[-0.021,0.016]	[0.005,0.015]	[-0.021,0.016]
Home birth	-0.026***	-0.025***	-0.026***	-0.025***
N=6,226	[-0.031,-0.022]	[-0.041,-0.008]	[-0.031,-0.022]	[-0.041,-0.009]
Birth assisted by medical staff	0.025***	-0.009	0.024***	-0.010
N=6,877	[0.020,0.029]	[-0.051,0.033]	[0.020,0.029]	[-0.051,0.031]
Panel B – *Nutrition*				
Stunted	-0.012***	-0.000	-0.012***	-0.000
N=5,749	[-0.017,-0.007]	[-0.018,0.017]	[-0.017,-0.007]	[-0.018,0.018]
Severely stunted	-0.006***	-0.003	-0.006***	-0.002
N=5,749	[-0.009,-0.002]	[-0.015,0.010]	[-0.009,-0.002]	[-0.015,0.010]
Wasted	-0.003**	-0.002	-0.003**	-0.002
N=5,703	[-0.006,-0.001]	[-0.012,0.008]	[-0.006,-0.001]	[-0.012,0.008]
HAZ	0.043***	0.005	0.043***	0.004
N=5,749	[0.027,0.059]	[-0.057,0.066]	[0.027,0.059]	[-0.057,0.064]
WAZ	0.040***	0.004	0.041***	0.003
N=5,896	[0.027,0.053]	[-0.043,0.051]	[0.028,0.054]	[-0.043,0.050]
WHZ	0.019**	-0.007	0.019**	-0.008
N=5,703	[0.003,0.035]	[-0.065,0.051]	[0.004,0.035]	[-0.066,0.050]
Panel C – *Prevention*				
Number of types of complete vaccines	0.027***	-0.056	0.027***	-0.061
N=6,877	[0.014,0.039]	[-0.136,0.025]	[0.015,0.039]	[-0.143,0.022]
Complete vaccination	0.012***	0.011	0.012***	0.010
N=5,661	[0.007,0.017]	[-0.006,0.027]	[0.007,0.017]	[-0.007,0.026]
Slept under net last night	0.004**	0.001	0.004**	0.000
N=5,406	[0.000,0.008]	[-0.004,0.005]	[0.001,0.008]	[-0.004,0.005]
Control variables X	YES	YES	YES	YES
Control variables Z	NO	NO	YES	YES
Region FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Region × Year FE	YES	YES	YES	YES

Source : Authors' calculations from the Demographic and Health Surveys.
Notes : * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 95% confidence intervals in brackets. Robust standard errors clustered at the enumeration area level. The control variables X are child sex and age, urban residence and household-wealth quintiles. Columns (3) and (4) also control for the Inverse Mills ratio obtained for mothers. The control variables Z are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage in the cluster.

Last, Table 9 shows the estimated effect of mother's education in the analytical sample (children who live with both parents). Here the mother does not have to compensate for the absence of the father, as he is present. In the full specification (col. 4), the IV coefficients for all variables are now lower than those in Table 8. Mother's education has a direct impact on the prenatal-care variables : education increases the probability of having at least four prenatal visits and reduces the probability of home birth. The nutrition coefficients lie in the confidence intervals of those reported in Table 8, but are not significant. Prevention behaviors remain insignificant, which could again indicate that prevention is only driven by fathers.

5.2 The impact of mother's and father's education

We here use the analytical sample to jointly estimate the effect of father's and mother's education and the interaction between them. The estimates from the four specifications are summarized in Tables 10-12. Given the interaction, the total effect of mother's education on health depends on the father's education when the interaction term is significantly different from zero ; the same holds for the total effect of father's education. The total effect of mother's and father's education for any level of education of the other parent and the associated 95-percent confidence intervals are depicted in Figures 2-5 for the IV specification correcting for selection (column 4 of Tables 10-12). The estimated coefficients here can be compared to those in Table 9 from the same sample but without controlling for the presence of the father, in order to evaluate the bias in the previous estimates. The full results, showing the estimates on the control variables, the Inverse Mills ratios and the correlation between the unobservables are in Appendix Tables B2-B4.

The effects of education on prenatal care and birth outcomes : Overall, our findings on prenatal care and birth suggest that mother's education has a mixed effect on the four outcomes, while father's education consistently and significantly improves prenatal care and the presence of a skilled health assistant during birth (see Table 10 and Figure 2).

First, the number of prenatal visits significantly falls with mother's education for low values of father's education (when he has no education or only one year of schooling) and increases with mother's education for high values of father's education (17 years of schooling or more). However,

Table 9 – The impact of mother's education only (analytical sample)

	(1)	(2)	(3)	(4)
			Correcting for selection	
	OLS	IV	OLS	IV
Panel A – *Prenatal Care*				
Number of prenatal visits	0.126***	0.010	0.118***	0.006
N=8,303	[0.102,0.150]	[-0.070,0.091]	[0.094,0.142]	[-0.075,0.087]
Prenatal visits ≥ 4	0.014***	0.013*	0.014***	0.013*
N=8,303	[0.011,0.018]	[-0.000,0.027]	[0.010,0.017]	[-0.000,0.027]
Home birth	-0.027***	-0.025***	-0.025***	-0.024***
N=10,631	[-0.031,-0.024]	[-0.038,-0.012]	[-0.029,-0.022]	[-0.037,-0.011]
Birth assisted by medical staff	0.025***	-0.020	0.023***	-0.019
N=11,705	[0.021,0.029]	[-0.055,0.014]	[0.019,0.027]	[-0.056,0.018]
Panel B – *Nutrition*				
Stunted	-0.007***	0.007	-0.007***	0.008
N=9,746	[-0.011,-0.003]	[-0.006,0.020]	[-0.011,-0.004]	[-0.006,0.021]
Severely stunted	-0.001	0.004	-0.001	0.005
N=9,746	[-0.003,0.002]	[-0.005,0.014]	[-0.003,0.002]	[-0.005,0.015]
Wasted	-0.000	-0.001	-0.000	-0.001
N=9,678	[-0.002,0.002]	[-0.008,0.007]	[-0.002,0.002]	[-0.008,0.006]
HAZ	0.025***	-0.002	0.025***	-0.005
N=9,746	[0.012,0.038]	[-0.050,0.045]	[0.012,0.037]	[-0.053,0.043]
WAZ	0.029***	-0.000	0.028***	-0.002
N=10,026	[0.019,0.039]	[-0.036,0.036]	[0.018,0.038]	[-0.038,0.035]
WHZ	0.018***	-0.009	0.017***	-0.011
N=9,678	[0.006,0.030]	[-0.054,0.036]	[0.005,0.029]	[-0.057,0.035]
Panel C – *Prevention*				
Number of types of complete vaccines	0.017***	-0.019	0.013***	-0.023
N=11,705	[0.008,0.027]	[-0.079,0.041]	[0.004,0.023]	[-0.086,0.041]
Complete vaccination	0.011***	0.013**	0.010***	0.009
N=9,411	[0.007,0.015]	[0.000,0.025]	[0.006,0.013]	[-0.003,0.021]
Slept under net last night	-0.001	0.001	-0.000	0.000
N=9,354	[-0.004,0.002]	[-0.004,0.005]	[-0.003,0.003]	[-0.005,0.005]
Control variables X	YES	YES	YES	YES
Control variables Z	NO	NO	YES	YES
Region FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Region × Year FE	YES	YES	YES	YES

Source : Authors' calculations from the Demographic and Health Surveys.
Notes : * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 95% confidence intervals in brackets. Robust standard errors clustered at the enumeration area level. The control variables X are child sex and age, urban residence and household-wealth quintiles. Columns (3) and (4) also control for the two Inverse Mills ratios. The control variables Z are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage in the cluster, the proportion of sampled men who were previously married and the proportion of polygamous households in the community.

for the average values of father's education, mother's education does not affect prenatal visits. By way of contrast, the impact of father's education is mostly positive and significant as soon as the mother has more than 7 years of schooling, with an impact that rises significantly with the mother's education as the effect sizes at the bottom and top of the mother's-education distribution are significantly different. This suggests some reinforcement of the positive effect of father's education when the mother is herself educated. The change is quite large, as at most any one-year increase in father's education increases the number of prenatal visits by 0.3 on average.

Second, mother's education has no significant effect on the probability of having at least four prenatal visits for any level of father's education. Father's education matters and increases this probability, and significantly so when the mother has over 7 years of schooling. This is in line with the estimates for the continuous number of visits variable.

Third, Figures 2c and 2d respectively refer to home birth and the birth being assisted by a doctor or a nurse. While the likelihood of home birth falls significantly with the mother's education if the father is uneducated, mother's education also significantly reduces the probability of being born with the assistance of medical staff, whatever father's education. The 95-percent confidence intervals here for the effect of mother's education overlap for all values of father's education. The estimated effects of father's education are much more intuitive, as it reduces the likelihood of home birth, and significantly so for low values of mother's education (below 10 years of schooling). The likelihood of skilled health professionals being present during birth significantly rises with father's education and the size of the effect falls with mother's education (Figure 2d). In other words, the effect of father's education is not the same when matched to low- rather than highly-educated mothers.

Ignoring father's education in the previous results (Table 9) leads us to overestimate the effect of mother's education ; part of the effect of father's education was picked up by that of the mother. Overall, these results underline that both parents' education help us to understand the distribution of prenatal care in Zimbabwe.

Our regressions control for household relative wealth, so that parental education is therefore not proxying wealth. They also control for living in an urban/rural area, and for regional and time fixed effects (as well as the interaction between the two). The education coefficient thus does not reflect differences in the regional supply of health care, nor differences between the urban and rural supply of health care within regions. We capture some (but probably not all) of the intra-regional differences in health-care supply. As such, the education coefficients mostly reflect differences in knowledge of good practices, the ability to understand public-health prevention campaigns and the incentives to adopt them.

Note that when we control for selection into co-residence, the Inverse Mills ratios are sometimes significant (see Table B2). However, this selection has only a very small effect on the estimated coefficients. Finally, the correlations in the unobservables are very significant : the unobserved characteristics that lie behind mothers' and fathers' education also affect their childcare, through better pregnancy and birth conditions, nutrition and prevention (the other two outcomes considered below).

The effects of education on nutritional status : Table 11 and Figures 3 and 4 show the impact of education on outcomes related to child growth and malnutrition, based on the anthropometric measures. Neither parent's education significantly affects these health indicators. The coefficient of the interaction term is significant for the WAZ score and the probability of stunting, but the size of the estimate is too small to make the total effect significant. Figures 3 and 4 show that, given the confidence intervals, neither father's nor mother's education are significant, whatever the level of education of the other parent. Our regressions control for household wealth, which mostly attracts very significant coefficients (Appendix Table B3) : children in wealthier households have better nutrition. Again, even though the Inverse Mills ratio appear in these equations (see Table B3), the estimated coefficients are very similar independent of selection into co-residence, suggesting only a small selection bias.

The effects of education on prevention : Table 12 and Figure 5 present a number of outcome variables linked to preventive behavior, such as the number of types of complete vaccines, and the probability that the child have all her vaccines or slept under a mosquito bed-net the previous night. The significance of the interaction variables again reveals some complementarity or substitutability

Table 10 – Prenatal - The impact of mother's and father's education (Equation 9)

		(1)	(2)	(3)	(4)
				Correcting for selection	
Dependent variable		OLS	IV	OLS	IV
Number of prenatal visits	Educ^M	-0.026	-0.125**	-0.038	-0.132**
		[-0.071,0.019]	[-0.231,-0.018]	[-0.084,0.007]	[-0.239,-0.026]
N=8,242	Educ^F	-0.079***	-0.019	-0.084***	-0.023
		[-0.125,-0.032]	[-0.114,0.075]	[-0.131,-0.037]	[-0.117,0.072]
	$\text{Educ}^M \times \text{Educ}^F$	0.015***	0.014***	0.016***	0.015***
		[0.010,0.020]	[0.009,0.020]	[0.011,0.021]	[0.010,0.020]
Prenatal visits $\geq$ 4	Educ^M	0.007*	-0.000	0.006*	-0.001
N=8,242		[-0.000,0.015]	[-0.019,0.018]	[-0.001,0.014]	[-0.019,0.018]
	Educ^F	-0.003	0.008	-0.003	0.009
		[-0.010,0.004]	[-0.007,0.024]	[-0.010,0.004]	[-0.007,0.024]
	$\text{Educ}^M \times \text{Educ}^F$	0.001**	0.001**	0.001**	0.001**
		[0.000,0.001]	[0.000,0.001]	[0.000,0.001]	[0.000,0.001]
Home birth	Educ^M	-0.035***	-0.020**	-0.032***	-0.018**
N=10,553		[-0.041,-0.028]	[-0.037,-0.002]	[-0.039,-0.025]	[-0.035,-0.001]
	Educ^F	-0.019***	-0.027***	-0.017***	-0.026***
		[-0.025,-0.012]	[-0.041,-0.013]	[-0.024,-0.011]	[-0.040,-0.012]
	$\text{Educ}^M \times \text{Educ}^F$	0.001***	0.001***	0.001***	0.001***
		[0.001,0.002]	[0.001,0.002]	[0.001,0.002]	[0.001,0.002]
Birth assisted by medical staff	Educ^M	0.036***	-0.038**	0.033***	-0.039**
		[0.029,0.043]	[-0.069,-0.007]	[0.026,0.040]	[-0.073,-0.006]
N=11,612	Educ^F	0.023***	0.064***	0.022***	0.063***
		[0.017,0.030]	[0.047,0.082]	[0.016,0.029]	[0.045,0.081]
	$\text{Educ}^M \times \text{Educ}^F$	-0.002***	-0.002***	-0.002***	-0.002***
		[-0.002,-0.001]	[-0.003,-0.002]	[-0.002,-0.001]	[-0.003,-0.001]
Control variables X		YES	YES	YES	YES
Control variables Z		NO	NO	YES	YES
Region FE		YES	YES	YES	YES
Year FE		YES	YES	YES	YES
Region × Year FE		YES	YES	YES	YES

Source : Authors' calculations from the Demographic and Health Surveys.

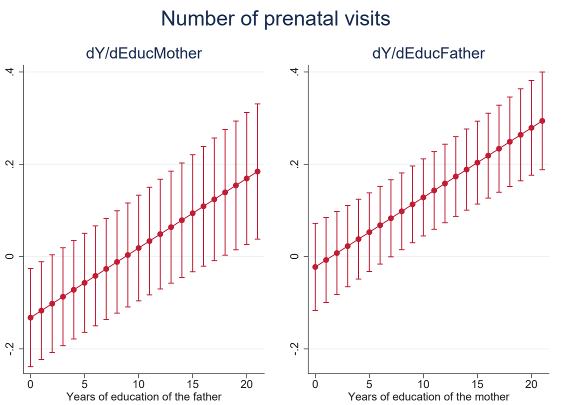
Notes : * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 95% confidence intervals in brackets. Robust standard errors clustered at the enumeration area level. The control variables X are child sex and age, urban residence and household-wealth quintiles. Columns (3) and (4) also control for the two Inverse Mills ratios. The control variables Z are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage in the cluster, the proportion of sampled men who were previously married and the proportion of polygamous households in the community.

Table 11 – Nutrition - The impact of mother's and father's education (Equation 9)

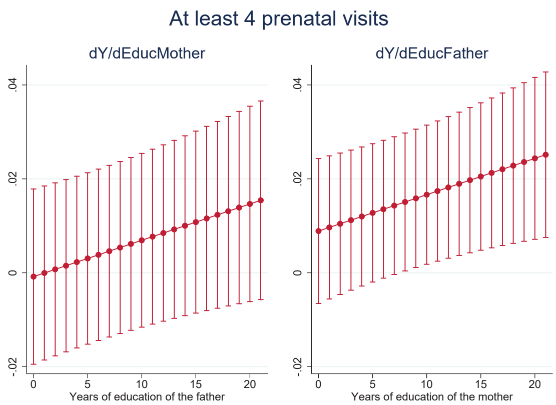
		(1)	(2)	(3)	(4)
				Correcting for selection	
Dependent variable		OLS	IV	OLS	IV
Stunted	$Educ^M$	0.003	0.012	0.003	0.012
N=9,675		[-0.004,0.010]	[-0.005,0.028]	[-0.004,0.010]	[-0.005,0.028]
	$Educ^F$	0.007**	0.008	0.007**	0.009
		[0.000,0.014]	[-0.006,0.022]	[0.000,0.014]	[-0.005,0.023]
	$Educ^M \times Educ^F$	-0.001***	-0.001***	-0.001***	-0.001***
		[-0.002,-0.000]	[-0.002,-0.000]	[-0.002,-0.000]	[-0.002,-0.000]
Severely stunted	$Educ^M$	0.003	0.008	0.003	0.009
N=9,675		[-0.003,0.008]	[-0.005,0.021]	[-0.002,0.008]	[-0.004,0.022]
	$Educ^F$	0.001	-0.000	0.001	-0.000
		[-0.004,0.006]	[-0.012,0.011]	[-0.004,0.006]	[-0.011,0.011]
	$Educ^M \times Educ^F$	-0.000	-0.000	-0.000	-0.000
		[-0.001,0.000]	[-0.001,0.000]	[-0.001,0.000]	[-0.001,0.000]
Wasted	$Educ^M$	-0.000	-0.002	0.000	-0.002
N=9,607		[-0.004,0.003]	[-0.010,0.007]	[-0.003,0.004]	[-0.010,0.007]
	$Educ^F$	0.002	0.002	0.002	0.002
		[-0.002,0.005]	[-0.004,0.008]	[-0.002,0.005]	[-0.005,0.008]
	$Educ^M \times Educ^F$	-0.000	-0.000	-0.000	-0.000
		[-0.000,0.000]	[-0.000,0.000]	[-0.000,0.000]	[-0.000,0.000]
HAZ	$Educ^M$	-0.002	-0.034	-0.002	-0.035
N=9,675		[-0.028,0.023]	[-0.092,0.025]	[-0.028,0.023]	[-0.094,0.023]
	$Educ^F$	-0.007	0.006	-0.008	0.005
		[-0.031,0.016]	[-0.043,0.054]	[-0.032,0.016]	[-0.044,0.053]
	$Educ^M \times Educ^F$	0.002**	0.002*	0.002*	0.002
		[0.000,0.005]	[-0.000,0.005]	[-0.000,0.005]	[-0.000,0.005]
WAZ	$Educ^M$	0.002	-0.018	-0.001	-0.020
N=9,953		[-0.018,0.022]	[-0.062,0.027]	[-0.021,0.019]	[-0.065,0.025]
	$Educ^F$	-0.011	-0.012	-0.012	-0.014
		[-0.029,0.007]	[-0.048,0.024]	[-0.031,0.006]	[-0.050,0.022]
	$Educ^M \times Educ^F$	0.003***	0.002**	0.003***	0.002**
		[0.001,0.005]	[0.000,0.004]	[0.001,0.005]	[0.001,0.004]
WHZ	$Educ^M$	0.005	-0.009	0.002	-0.012
N=9,607		[-0.018,0.028]	[-0.065,0.046]	[-0.021,0.025]	[-0.068,0.044]
	$Educ^F$	-0.008	-0.014	-0.010	-0.015
		[-0.029,0.013]	[-0.054,0.027]	[-0.031,0.011]	[-0.055,0.025]
	$Educ^M \times Educ^F$	0.001	0.001	0.002	0.001
		[-0.001,0.004]	[-0.001,0.003]	[-0.001,0.004]	[-0.001,0.004]
Control variables X		YES	YES	YES	YES
Control variables Z		NO	NO	YES	YES
Region FE		YES	YES	YES	YES
Year FE		YES	YES	YES	YES
Region × Year FE		YES	YES	YES	YES

Source : Authors' calculations from the Demographic and Health Surveys.
Notes : * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 95% confidence intervals in brackets. Robust standard errors clustered at the enumeration area level. The control variables X are child sex and age, urban residence and household-wealth quintiles. Columns (3) and (4) also control for the two Inverse Mills ratios. The control variables Z are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage in the cluster, the proportion of sampled men who were previously married and the proportion of polygamous households in the community.

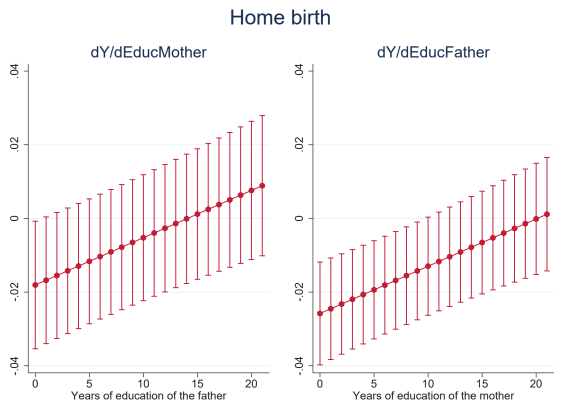
FIGURE 2 – The effect of mother's and father's education on birth outcomes



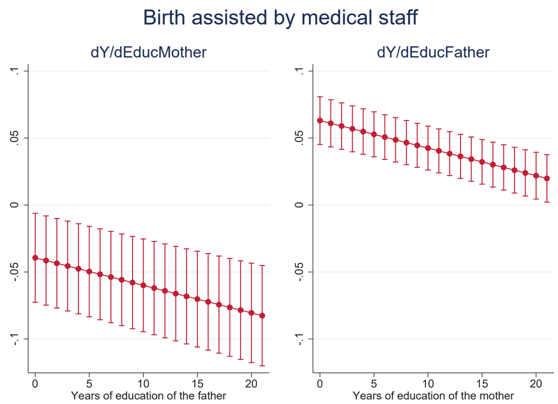
(a)



(b)



(c)

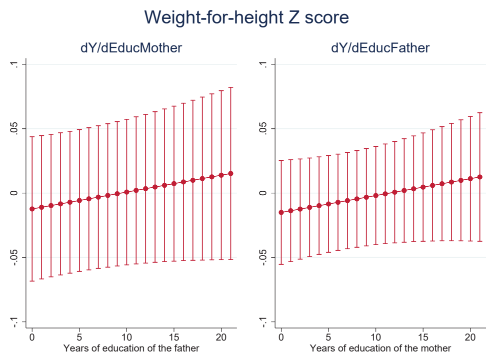


(d)

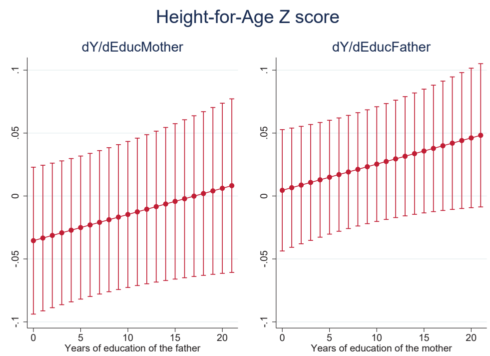
between father's and mother's education. Mother's education has no effect on vaccination if the father is not educated. However, father's education has a strong effect : whatever the mother's education, more-educated fathers are more likely to vaccinate their children, so that the distribution of father's education drives the distribution of vaccination. Last, Figure 5c depicts the total effect of parental education on the child's use of bed-nets. Mother's education matters negatively for low levels and positively for high levels of father's education, while father's education significantly reduces bed-net use for high levels of mother's education. It could again be the case here that

Figure 3 – The effect of mother's and father's education on nutritional outcomes (scores)

(a)



(b)



(c)

more-educated parents live in neighborhoods with less malarial risk.

Note that some control variables in our regressions, such as wealth and urban residence, are potentially not exogenous. In a robustness analysis, we exclude these two in turn in the estimation. The estimated impact of education on child health is robust to their exclusion.[18]

Overall, both mother's and father's education affect pre-natal care, nutrition and prevention behaviors. There is strong complementarity in parental education, so that excluding father's education from the regressions produces over-estimated coefficients on mother's education. It could be said that there is some "specialization" in the couple, with perhaps the father having the most

18. The results are available from the authors on request.

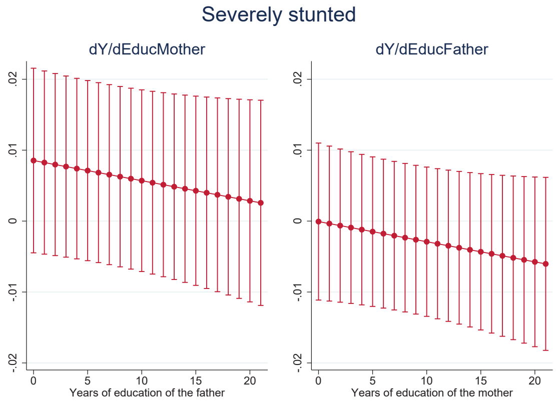
Table 12 – Prevention - The impact of mother's and father's education (Equation 9)

		(1)	(2)	(3)	(4)
				Correcting for selection	
Dependent variable		OLS	IV	OLS	IV
Number of types of complete vaccines N=11,612	Educ^M	0.038***	-0.042	0.031***	-0.054
		[0.019,0.056]	[-0.129,0.044]	[0.012,0.050]	[-0.145,0.038]
	Educ^F	0.025***	0.083***	0.022**	0.085***
		[0.007,0.042]	[0.027,0.140]	[0.004,0.040]	[0.027,0.142]
	$\text{Educ}^M \times \text{Educ}^F$	-0.003***	-0.003***	-0.002**	-0.003***
		[-0.004,-0.001]	[-0.005,-0.001]	[-0.004,-0.000]	[-0.004,-0.001]
Complete vaccination N=9,338	Educ^M	0.014***	-0.000	0.011***	-0.004
		[0.007,0.022]	[-0.018,0.017]	[0.004,0.019]	[-0.021,0.013]
	Educ^F	0.008**	0.026***	0.006*	0.024***
		[0.001,0.016]	[0.011,0.040]	[-0.001,0.014]	[0.009,0.038]
	$\text{Educ}^M \times \text{Educ}^F$	-0.001	-0.001	-0.000	-0.000
		[-0.001,0.000]	[-0.001,0.000]	[-0.001,0.000]	[-0.001,0.000]
Slept under net last night N=9,285	Educ^M	0.007**	0.008**	0.007***	0.008**
		[0.002,0.012]	[0.001,0.015]	[0.002,0.013]	[0.001,0.015]
	Educ^F	0.005**	0.003	0.005**	0.003
		[0.000,0.009]	[-0.006,0.013]	[0.000,0.010]	[-0.007,0.012]
	$\text{Educ}^M \times \text{Educ}^F$	-0.001***	-0.001***	-0.001***	-0.001***
		[-0.001,-0.000]	[-0.001,-0.000]	[-0.001,-0.000]	[-0.001,-0.000]
Control variables X		YES	YES	YES	YES
Control variables Z		NO	NO	YES	YES
Region FE		YES	YES	YES	YES
Year FE		YES	YES	YES	YES
Region × Year FE		YES	YES	YES	YES

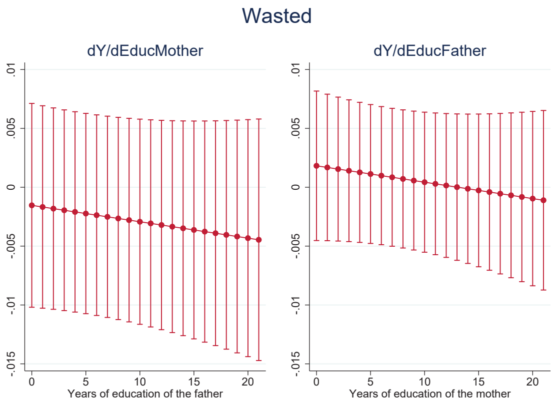
Source : Authors' calculations from the Demographic and Health Surveys.
Notes : * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 95% confidence intervals in brackets. Robust standard errors clustered at the enumeration area level. The control variables X are child sex and age, urban residence and household-wealth quintiles. Columns (3) and (4) also control for the two Inverse Mills ratios. The control variables Z are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage in the cluster, the proportion of sampled men who were previously married and the proportion of polygamous households in the community.

FIGURE 4 – The effect of mother and father's education on nutritional outcomes (status)

(a)



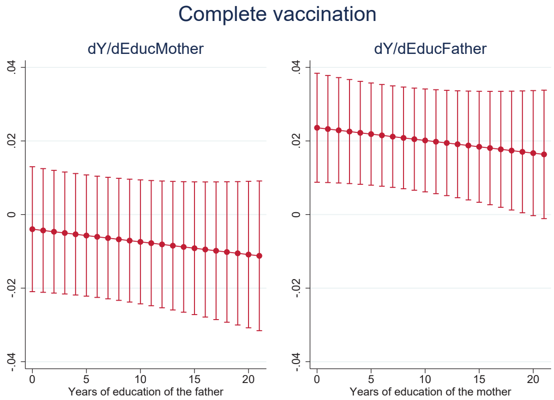
(b)



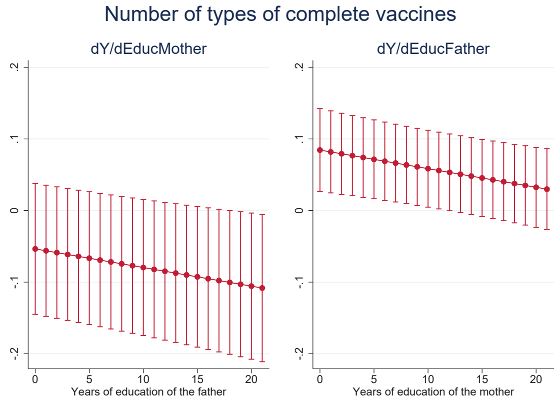
(c)

influence on child health : this seems to be the case for pre-natal visits, birth conditions and vaccination. When mother's education does significantly influence the outcomes, it is when her partner is less-educated. The current literature focusing on mothers may then produce misleading results, as was the case here for Zimbabwe.

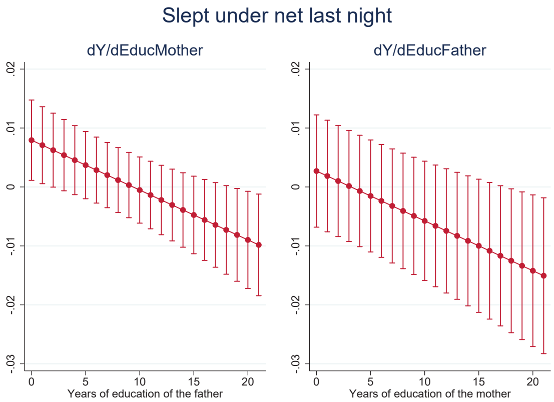
FIGURE 5 – The effect of mother's and father's education on prevention



(a)



(b)



(c)

5.3 The impact of father's education only

Symmetrically, we can estimate the impact of father's education on its own, without taking into account mother's education. The results in Table 13 for the analytical sample show that father's education has a large effect on all of the prenatal-care and prevention-behavior variables (except use of a bed-net), but continues to have no impact on nutrition. This latter result confirms that in De Neve and Subramanian (2017), who find no significant causal effect of father's schooling on child stunting, being underweight or wasting. Father's education affects many more variables than does mother's education in the IV specification (see Table 9, cols. 2 and 4). These results confirm the considerable impact of father's education on child health outcomes, which has often been neglected in the literature.

6 Robustness Checks and Extensions

We carry out a number of robustness checks to see whether our core estimates of education (mother's, father's and their interaction in col. 4 of Tables 10-12) are robust to changes in the sample and the measure of education, and to adding control variables. The results appear in the Appendix.

6.1 Sample restriction

In our analytical sample, 93% of mothers and 79% of fathers were exposed to the reform. We therefore have far more treated individuals, which can render the identification of the impact of education on child outcomes difficult. We thus restrict the sample to households surveyed in the 1999 and 2005 waves in order to reduce the number of individuals exposed to the reform. In this sample, 86% of mothers were exposed to the reform and 64% of fathers. The smaller number of observations here may produce a lack of statistical power. However, the first-stage estimates are still valid (see the high values of the F-statistics) and convincing : mothers born after 1966 have 1.05 more years of education ; for fathers, this figure is 0.68 (Appendix Table D1). In the second stage, our main results continue to hold (Appendix Table D2). We again have a strong effect of the father on prenatal care, birth conditions and prevention, and still do not find any significant effect of parental education on nutrition.

We then remove from the initial sample children whose father and/or mother was born between 1966 and 1970. This allows us to exclude parents who experienced lower-quality education during the first years of the reform. Using this restriction, we exclude individuals who are the most affected by the reform. For fathers, the treatment variable in the first stage is therefore no longer significant, even though the pre- and post-reform trends still are (Appendix Table D3). For mothers, the reform continues to significantly increase years of education, by 1.22. Again, our main results still hold

Table 13 – Impact of father's education only (analytical sample)

	(1)	(2)	(3)	(4)
			Correcting for selection	
	OLS	IV	OLS	IV
Panel A – *Prenatal Care*				
Number of prenatal visits	0.086***	0.083***	0.082***	0.081***
N=8,258	[0.064,0.109]	[0.023,0.144]	[0.060,0.104]	[0.020,0.142]
Prenatal visits $\geq$ 4	0.008***	0.017***	0.008***	0.018***
N=8,258	[0.005,0.012]	[0.007,0.028]	[0.004,0.011]	[0.007,0.029]
Home birth	-0.017***	-0.028***	-0.016***	-0.027***
N=10,574	[-0.020,-0.014]	[-0.038,-0.018]	[-0.019,-0.013]	[-0.037,-0.017]
Birth assisted by medical staff	0.017***	0.033***	0.016***	0.032***
N=11,641	[0.014,0.021]	[0.024,0.043]	[0.013,0.019]	[0.022,0.042]
Panel B – *Nutrition*				
Stunted	-0.004**	0.003	-0.004**	0.004
N=9,696	[-0.008,-0.001]	[-0.007,0.013]	[-0.007,-0.001]	[-0.007,0.014]
Severely stunted	-0.002	0.000	-0.002	0.001
N=9,696	[-0.004,0.000]	[-0.007,0.008]	[-0.004,0.001]	[-0.007,0.008]
Wasted	0.001	0.000	0.001	-0.000
N=9,628	[-0.001,0.002]	[-0.004,0.005]	[-0.001,0.002]	[-0.005,0.004]
HAZ	0.020***	0.015	0.019***	0.012
N=9,696	[0.009,0.032]	[-0.021,0.050]	[0.007,0.031]	[-0.023,0.048]
WAZ	0.020***	0.007	0.019***	0.006
N=9,974	[0.011,0.029]	[-0.018,0.033]	[0.010,0.028]	[-0.019,0.032]
WHZ	0.010*	-0.002	0.009*	-0.003
N=9,628	[-0.001,0.021]	[-0.031,0.027]	[-0.002,0.020]	[-0.032,0.026]
Panel C – *Prevention*				
Number of types of complete vaccines	0.010**	0.040***	0.008*	0.037***
N=11,641	[0.001,0.019]	[0.013,0.067]	[-0.001,0.017]	[0.010,0.065]
Complete vaccination	0.007***	0.021***	0.007***	0.019***
N=9,358	[0.004,0.011]	[0.011,0.031]	[0.003,0.010]	[0.009,0.029]
Slept under net last night	-0.002	-0.002	-0.002	-0.002
N=9,312	[-0.005,0.001]	[-0.010,0.007]	[-0.005,0.001]	[-0.010,0.006]
Control variables X	YES	YES	YES	YES
Control variables Z	NO	NO	YES	YES
Region FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Region $\times$ Year FE	YES	YES	YES	YES

Source : Authors' calculations from the Demographic and Health Surveys.
Notes : * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 95% confidence intervals in brackets. Robust standard errors clustered at the enumeration area level. The control variables X are child sex and age, urban residence and household-wealth quintiles. Columns (3) and (4) also control for the two Inverse Mills ratios. The control variables Z are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage in the cluster, the proportion of sampled men who were previously married and the proportion of polygamous households in the community.

(Appendix Table D4). The size of the effects is very similar to those obtained for the full sample (apart from some of the nutrition variables). As such, i) educational quality may not have fallen that much shortly after the reform and ii) if it did fall it was not by enough to outweigh the effect of more years of parental education on child-health outcomes.

We last remove children whose father and/or mother was born between 1961 and 1965, and who were partially treated, but defined as untreated in the previous analysis : they were between 15 and 19 years old in 1980. As shown in Figure 1, education had already started to rise for individuals born before 1966. This sample restriction allows us to exclude individuals who, because of the reform, went back to school whereas they had abandoned school before the reform (i.e. over-aged individuals). These individuals may have been the most keen to learn, [19] and therefore also the most likely to adopt attitudes towards increased prevention, pre-natal care and nutrition. They might thus produce under-estimated coefficients. The first-stage estimates are still valid here (Appendix Table D5). For both parents, the coefficient on the treatment variable is however much larger than in the baseline. This is unsurprising, given the bigger jump in education between the pre-1961 and post-1965 cohorts in Figure 1. Again, our estimates of the effect of education on child health remain very similar to those in the full sample (Appendix Table D6), except for the two number of pre-natal visit variables. Mother's education no longer affects the number of pre-natal visits, except via the interaction term, and education no longer significantly influences the probability of having over four pre-natal visits.

6.2 Controlling for other reforms that occurred during the period

Given Zimbabwe's independence, the education reform occurred at the same time as other reforms, mainly in the social sector, of which the main one concerned health care (Grepin and Bharadwaj 2015). No other major reform (of transport, the labor market etc.) was carried out immediately following independence. The health-care reforms likely improved individual health from 1980 on, whatever their age. The parents in our sample, who were alive in 1980 or born soon after, were affected by these reforms via an increased supply of health care and a better

19. As these individuals were enrolled in school even though they were not obliged to do so.

immunization program (Grepin and Bharadwaj 2015). These reforms may have changed their own decisions about education and health, which will feed through to the decisions they take regarding their children. We may worry that part of the effect of the health-care reform may be captured by the education variable. We however think that this is unlikely. As stated by Grepin and Bharadwaj (2015), the health-care reform was not age-specific : all individuals were covered. There is no reason to believe that those born after 1966 were more affected than those born before 1966. Moreover, our sample children were born many years after the reform. This does not mean that all children faced the same health-care system, but controlling for region and time-specific effects helps to purge our estimates from this source of variation.

To better control for the economic and social development of Zimbabwe over time we add some new control variables, defined by the child's year of birth :[20] GDP per capita, life-expectancy at birth, the urbanization rate and the under-5 mortality rate (from the WDI). Even though these additional variables are significant for some outcomes, they do not change the estimates on our key variables (see Appendix Tables E2-E4).

6.3 Controlling for the presence of other adults in the household

Each household is on average composed of two individuals aged 15 or more. However, 25% of households are composed of three adults. Other adults who live in the household may influence parental decisions over their children (for example, education and health), especially if these adults were affected by the education reform. In particular, in some households both the parents and grand-parents may have been exposed to the 1980 education reform. This intergenerational effect of education on child health is estimated using the information collected in the household roster on household composition. This allows us to determine how many adults (distinguishing men and women) aged 15 or over live in the household, and how many were exposed to the 1980 education reform. Including these variables reduces the impact of parents' education for most outcome

20. Ideally, we would like to include variables reflecting the economic and social context faced by each parent around 1980. To be identified, these should vary by the parents' age in 1980 (access to health care for individuals aged under 15, for individuals aged 15-25 ; the employment rate of individuals aged 25-45, etc). Such information is, of course, not available. Moreover, these variables would be collinear with the birth cohort. We thus chose to use variables defined by the child birth year.

variables. However, the fall is only slight, and the estimated coefficients still lie in the confidence interval of those obtained in the baseline. The presence of other adults in the household does not much influence the behavior of parents regarding their children's health. However, these adults do have a direct impact on child-health outcomes, and especially on prevention (see Appendix Tables E5-E7).

6.4 Use of a different measure of education

We last consider whether our core results are robust to the measure of education, and now consider having completed Primary school (Appendix C, Tables C1 to C3). Interestingly, education still has no effect on nutrition and we continue to observe the predominant impact of father's education on prenatal care and prevention. Overall, we find the same qualitative results, although we cannot directly compare the size of the estimated coefficients to those in the previous specification.

7 Conclusion

Our main results regarding parental education and child health are as follows. Father's education consistently and significantly improves prenatal care and birth conditions, whatever the level of mother's education. On the contrary, mother's education has a mixed impact on these outcomes. Moreover, child nutrition, once wealth is controlled for, is not influenced by parental education. Last, father's education has a much larger impact on the prevention variables than does mother's education, whatever the level of mother's education.

Overall, our results underline the predominance of father's education in determining child health. The model with mother's education only yields over-estimates of its impact on child health : mother's education matters less when father's education is controlled for. As such, the results in the existing literature without father's education overestimate the impact of mother's education. This comes about due to the assortative matching in our sample : men and women with similar intrinsic motivations or aspirations towards investment in human capital tend to live and have children together. Mothers who live separately from the father do not compensate for the father's absence, as the impact of mother's education in this case remains very similar to that obtained for children living with both parents.

Last, our results show that education is a tool that can reduce inequalities in child-health outcomes. And as education has risen over recent decades, we may predict that hopefully child health will drastically increase in line, and that the considerable burden of disease and death borne by children will fall.

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Mothers and Fathers: Education, co-residence and child health: Appendix

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Appendix A: Data description

Table A1. Description: Child characteristics and Health outcomes

Panel A – *Child characteristics*	
Girl	Dummy for female
Age	Child's current age in years
Urban	Dummy for living in urban area
Wealth quintile	Quintiles of wealth (where wealth is a measure based on a principal component analysis using dwelling characteristics and ownership of durable goods at the household level)
Mother alive	Dummy for child's mother is still alive
Father alive	Dummy for child's father is still alive
Mother present	Dummy for child i is living with her mother
Father present	Dummy for child i is living with her father
Panel B – *Outcomes*	
Number of prenatal visits	Number of antenatal visits during pregnancy
Prenatal visits ≥ 4	Dummy for the number of antenatal visits was 4 or more (as recommended by the WHO)
Home birth	Dummy for the birth taking place at home
Delivery with a doctor/nurse	Dummy for the birth being assisted by a doctor or nurse
HAZ*	Height-for-Age Z-score
WAZ*	Weight-for-Age Z-score
WHZ*	Weight-for-Height Z-score
Stunted*	Dummy for the Height-for-Age Z-score being more than 2 standard deviations below the reference
Severely stunted*	Dummy for the Height-for-Age Z-score being more than 3 standard deviations below the reference
Wasted*	Dummy for the Weight-for-Height Z-score being more than 2 standard deviations below the reference
Number of types of complete vaccines	Number of types of vaccines child i received with full immunization (BCG, Diphteria-Pertussis-Tetanus, measles)
Complete vaccination	Dummy for child i having received the complete recommended immunization package (BCG, Diphteria-Pertussis-Tetanus and measles) (i.e. the number of types of complete vaccines is 3)
Slept under net	Dummy for child i slept under a bednet the night before the survey

* The z-scores are calculated via the *zscore06* Stata command using child's age in months, weight, height and sex. Nutritional status (stunted, severely stunted and wasted) are created using these scores.

Table A2. Description: Parent's characteristics
(observed only if child i is living with her father/mother)

Mother's age at birth	Mother's age at child i's birth
Father's age at birth	Father's age at child i's birth
Mother's age at first union	Mother's age at her first union
Mother's age	Mother's age at the time of the survey
Father's age	Father's age at the time of the survey
Mother exposed	Treatment status, =1 if the mother was born in 1966 or later (i.e. was $\leq$14 in 1980), 0 otherwise
Father exposed	Treatment status, =1 if the father was born in 1966 or later (i.e. was $\leq$14 in 1980), 0 otherwise
Years of education (mother)	Mother's number of years of education, continuous measure
Complete Primary at least (mother)	Dummy for the mother completed Primary school at least
Secondary school at least (mother)	Dummy for the mother attended Secondary school (at least 1 year)
Years of education (father)	Father's number of years of education, continuous measure
Complete Primary at least (father)	Dummy for the father completed Primary school at least
Secondary school at least (father)	Dummy for the father attended Secondary school (at least 1 year)
Women separated (% in cluster)	% of sampled women who are separated, divorced or widowed in each community (cluster)
First child born before marriage (% in cluster)	% of sampled women who gave birth to their first child outside of marriage in each community
Number of mother's siblings	Mother's number of siblings
Men separated (% in cluster)	% of sampled men who are separated, divorced or widowed in each community
Polygamous (% in cluster)	% of polygamous households in each community

Appendix B: Additional tables

Table B1. First-Stage estimates for mothers and fathers with correction for selection into co-residence

	(1) Education^M	(2) Education^F
Exposed	1.299***	0.421**
	(0.438)	(0.205)
Pre-reform trend	0.295*	0.248***
	(0.156)	(0.026)
Pre-reform trend^2	0.011	0.003***
	(0.011)	(0.001)
Post-reform trend	0.123***	0.022
	(0.019)	(0.017)
Post-reform trend^2	-0.003***	-0.002***
	(0.001)	(0.001)
Number of mother's siblings	-0.001	
	(0.011)	
Mills^M	-2.693	-0.690
	(1.909)	(2.029)
Mills^F	23.187***	12.304
	(7.817)	(7.857)
Constant	1.925	6.706**
	(2.206)	(3.114)
N	10,839	11,641
Adjusted R^2	0.40	0.41
F	60.18	69.25
p-value (F)	0.000	0.000
F (excluded instruments)	76.35	172.94
pvalue (excluded instruments)	0.000	0.000
Control variables X	YES	YES
Control variables Z	YES	YES
Region FE	YES	YES
Year FE	YES	YES
Region × Year FE	YES	YES

Source: Authors' calculations from the Demographic and Health Surveys.
Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors clustered at the enumeration area level in parentheses. Education is number of years. The X control variables are child sex and age, and urban residence and household wealth quintiles. The Z control variables are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage, and the proportions of sampled men who were previously married and of polygamous households in the cluster. The F-statistic of the excluded instrument comes from the estimation of Equations (7) and (8) (with correction for selection into coresidence).

Table B2. Prenatal Care - The impact of mother's and father's education (analytical sample) (Equation 9)

	(1) Number of prenatal visits	(2) Prenatal visits ≥ 4	(3) Home birth	(4) Birth assisted by medical staff
Educ^M	-0.132**	-0.001	-0.018**	-0.039**
	[-0.239,-0.026]	[-0.019,0.018]	[-0.035,-0.001]	[-0.073,-0.006]
Educ^F	-0.023	0.009	-0.026***	0.063***
	[-0.117,0.072]	[-0.007,0.024]	[-0.040,-0.012]	[0.045,0.081]
$\text{Educ}^M \times \text{Educ}^F$	0.015***	0.001**	0.001***	-0.002***
	[0.010,0.020]	[0.000,0.001]	[0.001,0.002]	[-0.003,-0.001]
Girl	-0.019	-0.005	-0.007	-0.004
	[-0.126,0.087]	[-0.024,0.014]	[-0.022,0.009]	[-0.022,0.014]
Age	0.207**	0.023	0.023*	-0.013
	[0.004,0.410]	[-0.011,0.057]	[-0.000,0.047]	[-0.042,0.017]
Urban	-0.075	0.052	-0.109***	0.101*
	[-0.735,0.585]	[-0.055,0.160]	[-0.190,-0.029]	[-0.005,0.207]
Poorest	-1.381***	-0.157***	0.299***	-0.355***
	[-1.947,-0.815]	[-0.251,-0.064]	[0.216,0.382]	[-0.480,-0.229]
Poorer	-1.302***	-0.179**	0.278***	-0.296***
	[-2.144,-0.460]	[-0.317,-0.040]	[0.164,0.392]	[-0.456,-0.136]
Middle	-1.341**	-0.209**	0.232***	-0.220**
	[-2.531,-0.151]	[-0.404,-0.013]	[0.074,0.391]	[-0.430,-0.010]
Richer	-0.984***	-0.112***	0.054***	-0.064**
	[-1.300,-0.667]	[-0.162,-0.063]	[0.014,0.093]	[-0.125,-0.003]
1999	-1.242	-0.201	0.130	-0.083
	[-2.837,0.354]	[-0.464,0.062]	[-0.048,0.307]	[-0.336,0.170]
2010	-1.129	-0.310**	0.191**	-0.129
	[-2.564,0.306]	[-0.547,-0.073]	[0.018,0.365]	[-0.363,0.105]
2015	-1.002	-0.231**	0.127	-0.013
	[-2.295,0.291]	[-0.447,-0.016]	[-0.025,0.279]	[-0.222,0.196]
Mills^M	-3.903	-0.833*	0.244	-0.771**
	[-8.851,1.045]	[-1.723,0.058]	[-0.459,0.947]	[-1.537,-0.006]
Mills^F	4.930	2.441*	-1.744	1.167
	[-12.035,21.896]	[-0.341,5.223]	[-3.968,0.479]	[-1.602,3.936]
Constant	5.582**	0.013	0.875***	0.618
	[0.687,10.477]	[-0.797,0.823]	[0.254,1.496]	[-0.149,1.385]
$\rho_{(7),(9)}$	0.075	0.004	-0.070	0.369***
	[-0.019,0.170]	[-0.084,0.092]	[-0.161,0.020]	[0.198,0.540]
$\rho_{(8),(9)}$	-0.023	-0.067*	0.017	-0.058
	[-0.096,0.051]	[-0.142,0.009]	[-0.059,0.093]	[-0.130,0.013]
$\rho_{(7),(8)}$	0.415***	0.415***	0.415***	0.406***
	[0.387,0.442]	[0.387,0.442]	[0.387,0.442]	[0.379,0.434]
N	8,242	8,242	10,553	11,612
Control variables Z	YES	YES	YES	YES
Region FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Region × Year FE	YES	YES	YES	YES

Source: Authors' calculations from the Demographic and Health Surveys.
Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 95% confidence intervals in brackets. Robust standard errors clustered at the enumeration area level. Education is number of years. The X control variables are child sex and age, and urban residence and household wealth quintiles. The Z control variables are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage, and the proportions of sampled men who were previously married and of polygamous households in the cluster.

Table B3. Nutrition - The impact of mother's and father's education (analytical sample) (Equation 9)

	(1) Stunted	(2) Severely stunted	(3) Wasted	(4) HAZ	(5) WAZ	(6) WHZ
$Educ^M$	0.012	0.009	-0.002	-0.035	-0.020	-0.012
	[-0.005,0.028]	[-0.004,0.022]	[-0.010,0.007]	[-0.094,0.023]	[-0.065,0.025]	[-0.068,0.044]
$Educ^F$	0.009	-0.000	0.002	0.005	-0.014	-0.015
	[-0.005,0.023]	[-0.011,0.011]	[-0.005,0.008]	[-0.044,0.053]	[-0.050,0.022]	[-0.055,0.025]
$Educ^M \times Educ^F$	-0.001***	-0.000	-0.000	0.002	0.002**	0.001
	[-0.002,-0.000]	[-0.001,0.000]	[-0.000,0.000]	[-0.000,0.005]	[0.001,0.004]	[-0.001,0.004]
Girl	-0.053***	-0.031***	-0.009**	0.149***	0.062***	-0.027
	[-0.071,-0.035]	[-0.044,-0.019]	[-0.018,-0.001]	[0.086,0.212]	[0.017,0.107]	[-0.081,0.027]
Age	0.040**	0.007	-0.009	-0.312***	-0.250***	-0.041
	[0.010,0.071]	[-0.014,0.028]	[-0.024,0.005]	[-0.432,-0.192]	[-0.325,-0.175]	[-0.135,0.053]
Urban	0.113**	0.006	-0.046*	-0.200	0.242**	0.266*
	[0.011,0.214]	[-0.062,0.073]	[-0.098,0.006]	[-0.590,0.190]	[0.006,0.477]	[-0.043,0.574]
Poorest	-0.016	0.018	0.034	0.031	-0.489***	-0.464***
	[-0.108,0.075]	[-0.047,0.082]	[-0.012,0.081]	[-0.311,0.373]	[-0.719,-0.258]	[-0.753,-0.174]
Poorer	-0.118*	-0.011	0.059*	0.231	-0.541***	-0.546***
	[-0.250,0.013]	[-0.103,0.080]	[-0.008,0.127]	[-0.284,0.746]	[-0.869,-0.213]	[-0.956,-0.136]
Middle	-0.232**	-0.043	0.080	0.538	-0.602***	-0.624**
	[-0.419,-0.045]	[-0.172,0.085]	[-0.016,0.176]	[-0.205,1.281]	[-1.058,-0.146]	[-1.198,-0.049]
Richer	-0.007	0.009	0.017	-0.010	-0.221***	-0.182**
	[-0.056,0.041]	[-0.025,0.042]	[-0.007,0.041]	[-0.187,0.168]	[-0.341,-0.100]	[-0.336,-0.028]
1999	-0.419***	-0.153**	0.071	1.190**	-0.144	-0.644*
	[-0.659,-0.178]	[-0.304,-0.002]	[-0.051,0.193]	[0.240,2.140]	[-0.766,0.479]	[-1.394,0.107]
2010	-0.437***	-0.172**	0.031	0.842*	-0.271	-0.557
	[-0.657,-0.216]	[-0.315,-0.029]	[-0.085,0.147]	[-0.039,1.722]	[-0.870,0.328]	[-1.258,0.145]
2015	-0.466***	-0.170***	0.033	1.052**	-0.111	-0.493
	[-0.669,-0.263]	[-0.297,-0.043]	[-0.074,0.141]	[0.247,1.858]	[-0.657,0.434]	[-1.149,0.162]
$Mills^M$	-4.404***	-1.443***	0.413**	15.510***	3.818***	-3.245***
	[-5.172,-3.635]	[-1.947,-0.940]	[0.011,0.816]	[12.811,18.210]	[1.852,5.783]	[-5.590,-0.901]
$Mills^F$	5.807***	1.453	-1.264*	-15.677***	3.303	7.402*
	[3.154,8.460]	[-0.312,3.218]	[-2.636,0.107]	[-26.098,-5.255]	[-3.157,9.762]	[-0.677,15.481]
Constant	-0.455	0.075	0.410**	-0.136	-2.082**	-0.802
	[-1.223,0.312]	[-0.433,0.583]	[0.025,0.795]	[-3.110,2.838]	[-3.960,-0.203]	[-3.142,1.538]
$\rho_{(7),(9)}$	-0.068*	-0.049	0.024	0.054	0.054	0.039
	[-0.147,0.010]	[-0.134,0.036]	[-0.063,0.111]	[-0.030,0.138]	[-0.031,0.138]	[-0.052,0.131]
$\rho_{(8),(9)}$	-0.044	-0.016	0.012	0.007	0.031	0.030
	[-0.115,0.026]	[-0.093,0.061]	[-0.054,0.078]	[-0.065,0.079]	[-0.037,0.098]	[-0.038,0.098]
$\rho_{(7),(8)}$	0.415***	0.415***	0.415***	0.415***	0.415***	0.415***
	[0.387,0.442]	[0.387,0.443]	[0.387,0.442]	[0.387,0.442]	[0.387,0.442]	[0.387,0.442]
N	9,675	9,675	9,607	9,675	9,953	9,607
Control variables Z	YES	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Region × Year FE	YES	YES	YES	YES	YES	YES

Source: Authors' calculations from the Demographic and Health Surveys.
Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 95% confidence intervals in brackets. Robust standard errors clustered at the enumeration area level. Education is number of years. The X control variables are child sex and age, and urban residence and household wealth quintiles. The Z control variables are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage, and the proportions of sampled men who were previously married and of polygamous households in the cluster.

Table B4. Prevention - The impact of mother's and father's education (analytical sample) (Equation 9)

	(1) Number of types of complete vaccines	(2) Complete vaccination	(3) Slept under net last night
Educ^M	-0.054	-0.004	0.008**
	[-0.145,0.038]	[-0.021,0.013]	[0.001,0.015]
Educ^F	0.085***	0.024***	0.003
	[0.027,0.142]	[0.009,0.038]	[-0.007,0.012]
$\text{Educ}^M \times \text{Educ}^F$	-0.003***	-0.000	-0.001***
	[-0.004,-0.001]	[-0.001,0.000]	[-0.001,-0.000]
Girl	-0.031	-0.011	-0.004
	[-0.077,0.015]	[-0.029,0.007]	[-0.017,0.009]
Age	0.080	0.261***	0.009
	[-0.024,0.184]	[0.229,0.292]	[-0.020,0.037]
Urban	0.353**	0.061	-0.013
	[0.056,0.649]	[-0.039,0.161]	[-0.119,0.093]
Poorest	-0.616***	-0.210***	-0.082**
	[-0.913,-0.318]	[-0.301,-0.119]	[-0.158,-0.006]
Poorer	-0.856***	-0.245***	-0.003
	[-1.268,-0.445]	[-0.379,-0.111]	[-0.124,0.118]
Middle	-1.161***	-0.312***	0.058
	[-1.725,-0.598]	[-0.501,-0.123]	[-0.120,0.236]
Richer	-0.291***	-0.123***	-0.018
	[-0.449,-0.133]	[-0.174,-0.073]	[-0.061,0.025]
1999	-0.932***	-0.231*	
	[-1.622,-0.242]	[-0.470,0.008]	
2010	-0.982***	-0.190*	0.268**
	[-1.646,-0.318]	[-0.414,0.034]	[0.041,0.496]
2015	-1.702***	-0.216**	0.265***
	[-2.297,-1.107]	[-0.418,-0.015]	[0.068,0.462]
Mills^M	-15.101***	-8.286***	0.017
	[-17.692,-12.511]	[-9.232,-7.341]	[-0.542,0.575]
Mills^F	19.446***	6.025***	-1.967
	[11.700,27.192]	[3.361,8.688]	[-4.586,0.651]
Constant	-0.096	0.528	0.634*
	[-2.415,2.223]	[-0.228,1.285]	[-0.119,1.387]
$\rho_{(7),(9)}$	0.137*	0.039	0.007
	[-0.026,0.301]	[-0.040,0.118]	[-0.038,0.052]
$\rho_{(8),(9)}$	-0.062*	-0.080**	0.020
	[-0.133,0.008]	[-0.151,-0.009]	[-0.060,0.100]
$\rho_{(7),(8)}$	0.413***	0.415***	0.412***
	[0.385,0.441]	[0.387,0.442]	[0.384,0.439]
N	11,612	9,338	9,285
Control variables Z	YES	YES	YES
Region FE	YES	YES	YES
Year FE	YES	YES	YES
Region × Year FE	YES	YES	YES
Month FE	NO	NO	YES

Source: Authors' calculations from the Demographic and Health Surveys.

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 95% confidence intervals in brackets. Robust standard errors clustered at the enumeration area level. Education is number of years. The X control variables are child sex and age, and urban residence and household wealth quintiles. The Z control variables are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage, and the proportions of sampled men who were previously married and of polygamous households in the cluster.

Table B5. The impact of mother's and father's education without interactions (analytical sample)

Panel A – *Prenatal Care*

	(1) Number of prenatal visits	(2) Prenatal visits ≥ 4	(3) Home birth	(4) Birth assisted by medical staff
Educ^M	-0.059	0.003	-0.011	-0.052***
	[-0.167,0.050]	[-0.015,0.021]	[-0.028,0.005]	[-0.091,-0.014]
Educ^F	0.086**	0.014*	-0.017**	0.051***
	[0.002,0.170]	[-0.000,0.029]	[-0.030,-0.003]	[0.033,0.069]
N	8,242	8,242	10,553	11,612
Control variables X	YES	YES	YES	YES
Control variables Z	YES	YES	YES	YES
Region FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Region × Year FE	YES	YES	YES	YES

Panel B – *Nutrition*

	(1) Stunted	(2) Severely stunted	(3) Wasted	(4) HAZ	(5) WAZ	(6) WHZ
Educ^M	0.007	0.007	-0.002	-0.025	-0.007	-0.006
	[-0.009,0.024]	[-0.006,0.020]	[-0.011,0.006]	[-0.082,0.032]	[-0.051,0.037]	[-0.061,0.049]
Educ^F	0.003	-0.002	0.001	0.019	0.003	-0.006
	[-0.011,0.016]	[-0.013,0.008]	[-0.005,0.007]	[-0.026,0.064]	[-0.030,0.036]	[-0.043,0.031]
N	9,675	9,675	9,607	9,675	9,953	9,607
Control variables X	YES	YES	YES	YES	YES	YES
Control variables Z	YES	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Region × Year FE	YES	YES	YES	YES	YES	YES

Panel C – *Prevention*

	(1) Number of types of complete vaccines	(2) Complete vaccination	(3) Slept under net last night
Educ^M	-0.067	-0.006	0.002
	[-0.164,0.030]	[-0.022,0.011]	[-0.004,0.007]
Educ^F	0.067**	0.021***	-0.002
	[0.011,0.124]	[0.007,0.035]	[-0.012,0.007]
N	11,612	9,338	9,285
Control variables X	YES	YES	YES
Control variables Z	YES	YES	YES
Region FE	YES	YES	YES
Year FE	YES	YES	YES
Region × Year FE	YES	YES	YES
Month FE	NO	NO	YES

Source: Authors' calculations from the Demographic and Health Surveys.
Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 95% confidence intervals in brackets. Robust standard errors clustered at the enumeration area level. Education is number of years. The X control variables are child sex and age, and urban residence and household wealth quintiles. The Z control variables are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage, and the proportions of sampled men who were previously married and of polygamous households in the cluster.

Appendix C: Robustness check using a different education variable

Table C1. Prenatal Care - Complete Primary at least

	(1) Number of prenatal visits	(2) Prenatal visits ≥ 4	(3) Home birth	(4) Birth assisted by medical staff
Education variable: Having completed Primary at least				
Educ^M	-0.801*	-0.032	-0.042	-0.678***
	[-1.696,0.094]	[-0.183,0.120]	[-0.188,0.104]	[-0.874,-0.482]
Educ^F	0.788**	0.124*	-0.167***	0.509***
	[0.029,1.546]	[-0.009,0.256]	[-0.291,-0.044]	[0.391,0.626]
Educ^M $\times$ Educ^F	0.269*	0.059**	-0.039	0.010
	[-0.013,0.551]	[0.005,0.113]	[-0.096,0.018]	[-0.047,0.066]
Mills^M	-4.103	-0.855*	0.263	-0.901**
	[-9.121,0.914]	[-1.749,0.038]	[-0.443,0.968]	[-1.726,-0.075]
Mills^F	6.524	2.541*	-1.827	2.600*
	[-10.835,23.883]	[-0.278,5.361]	[-4.088,0.434]	[-0.366,5.566]
$\rho_{(7),(9)}$	0.124**	0.013	-0.011	0.581***
	[0.002,0.246]	[-0.105,0.131]	[-0.134,0.112]	[0.438,0.724]
$\rho_{(8),(9)}$	-0.087**	-0.114**	0.105**	-0.181***
	[-0.170,-0.003]	[-0.202,-0.026]	[0.017,0.193]	[-0.258,-0.104]
$\rho_{(7),(8)}$	0.205***	0.205***	0.204***	0.202***
	[0.173,0.236]	[0.173,0.236]	[0.173,0.236]	[0.171,0.232]
N	8,260	8,260	10,576	11,641
Control variables X	YES	YES	YES	YES
Control variables Z	YES	YES	YES	YES
Region FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Region $\times$ Year FE	YES	YES	YES	YES

Source: Authors' calculations from the Demographic and Health Surveys.
Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 95% confidence intervals in brackets. Robust standard errors clustered at the enumeration area level. Education is number of years. The X control variables are child sex and age, and urban residence and household wealth quintiles. The Z control variables are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage, and the proportions of sampled men who were previously married and of polygamous households in the cluster.

Table C2. Nutrition - Complete Primary at least

	(1) Stunted	(2) Severely stunted	(3) Wasted	(4) HAZ	(5) WAZ	(6) WHZ
Education variable: Having completed Primary at least						
Educ^M	0.048	0.063	-0.016	-0.220	-0.077	-0.083
	[-0.090,0.185]	[-0.045,0.170]	[-0.086,0.055]	[-0.706,0.267]	[-0.448,0.294]	[-0.563,0.397]
Educ^F	0.023	-0.024	0.018	0.192	0.005	-0.089
	[-0.093,0.139]	[-0.118,0.071]	[-0.033,0.070]	[-0.207,0.591]	[-0.294,0.304]	[-0.423,0.245]
$\text{Educ}^M \times \text{Educ}^F$	-0.011	-0.001	-0.014	0.022	0.075	0.095
	[-0.065,0.043]	[-0.040,0.037]	[-0.040,0.013]	[-0.157,0.202]	[-0.057,0.207]	[-0.071,0.260]
Mills^M	-4.396***	-1.437***	0.403**	15.482***	3.795***	-3.299***
	[-5.164,-3.627]	[-1.942,-0.932]	[0.002,0.805]	[12.769,18.195]	[1.828,5.762]	[-5.641,-0.956]
Mills^F	5.857***	1.343	-1.263*	-15.236***	3.511	7.556*
	[3.180,8.534]	[-0.454,3.139]	[-2.647,0.122]	[-25.778,-4.693]	[-3.044,10.067]	[-0.630,15.742]
$\rho_{(7),(9)}$	-0.053	-0.071	0.049	0.062	0.033	0.017
	[-0.159,0.052]	[-0.189,0.046]	[-0.066,0.163]	[-0.049,0.173]	[-0.077,0.144]	[-0.103,0.138]
$\rho_{(8),(9)}$	-0.025	0.003	0.008	-0.024	-0.002	0.016
	[-0.103,0.053]	[-0.085,0.092]	[-0.063,0.079]	[-0.103,0.055]	[-0.078,0.073]	[-0.059,0.090]
$\rho_{(7),(8)}$	0.205***	0.205***	0.205***	0.205***	0.205***	0.205***
	[0.173,0.236]	[0.173,0.236]	[0.173,0.236]	[0.173,0.236]	[0.173,0.236]	[0.173,0.236]
N	9,695	9,695	9,627	9,695	9,974	9,627
Control variables X	YES	YES	YES	YES	YES	YES
Control variables Z	YES	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Region × Year FE	YES	YES	YES	YES	YES	YES

Source: Authors' calculations from the Demographic and Health Surveys.
Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 95% confidence intervals in brackets. Robust standard errors clustered at the enumeration area level. Education is number of years. The X control variables are child sex and age, and urban residence and household wealth quintiles. The Z control variables are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage, and the proportions of sampled men who were previously married and of polygamous households in the cluster.

Table C3. Prevention - Complete Primary at least

	(1) Number of types of complete vaccines	(2) Complete vaccination	(3) Slept under net last night
Education variable: Having completed Primary at least			
Educ^M	-1.317***	-0.082	0.028
	[-1.931,-0.703]	[-0.224,0.060]	[-0.013,0.070]
Educ^F	0.962***	0.179***	-0.019
	[0.574,1.350]	[0.055,0.303]	[-0.096,0.059]
$\text{Educ}^M \times \text{Educ}^F$	-0.026	0.025	-0.023
	[-0.166,0.113]	[-0.027,0.078]	[-0.059,0.013]
Mills^M	-15.445***	-8.290***	0.018
	[-18.123,-12.767]	[-9.237,-7.342]	[-0.540,0.575]
Mills^F	22.721***	6.279***	-2.020
	[14.847,30.594]	[3.634,8.925]	[-4.641,0.601]
$\rho_{(7),(9)}$	0.384***	0.064	0.012
	[0.216,0.552]	[-0.044,0.173]	[-0.028,0.052]
$\rho_{(8),(9)}$	-0.153***	-0.125***	0.042
	[-0.229,-0.078]	[-0.206,-0.044]	[-0.044,0.128]
$\rho_{(7),(8)}$	0.205***	0.205***	0.202***
	[0.174,0.236]	[0.173,0.236]	[0.171,0.233]
N	11,641	9,362	9,298
Control variables X	YES	YES	YES
Control variables Z	YES	YES	YES
Region FE	YES	YES	YES
Year FE	YES	YES	YES
Region × Year FE	YES	YES	YES
Month FE	NO	NO	YES

Source: Authors' calculations from the Demographic and Health Surveys.
Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 95% confidence intervals in brackets. Robust standard errors clustered at the enumeration area level. Education is number of years. The X control variables are child sex and age, and urban residence and household wealth quintiles. The Z control variables are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage, and the proportions of sampled men who were previously married and of polygamous households in the cluster.

Appendix D: Robustness checks with sample restrictions

Three types of checks are carried out for the sample: (i) the sample is restricted to the waves collected in 1999 and 2005 (D1 - D2); (ii) the cohorts born in 1966-1970 are removed from the core analysis (D3 - D4); and (iii) the cohorts born in 1961-1965 are removed from the core analysis (D5 - D6).

Table D1. First-Stage estimates for mothers and fathers (sample: 1999 - 2005)

	(1) Education^M	(2) Education^F
Exposed	1.053**	0.677***
	(0.481)	(0.251)
Pre-reform trend	0.352**	0.231***
	(0.159)	(0.029)
Pre-reform trend^2	0.015	0.003***
	(0.011)	(0.001)
Post-reform trend	0.172***	-0.050
	(0.038)	(0.032)
Post-reform trend^2	-0.007***	0.001
	(0.002)	(0.002)
Number of mother's siblings	0.007	
	(0.019)	
Mills^M	-4.111	-4.734
	(3.243)	(3.317)
Mills^F	32.832***	17.537
	(11.793)	(12.444)
Constant	-8.610	5.358
	(5.991)	(4.944)
N	4,619	5,028
Adjusted R^2	0.40	0.39
F	44.87	47.78
p-value (F)	0.000	0.000
F (excluded instruments)	66.86	125.39
pvalue (excluded instruments)	0.000	0.000
Control variables X	YES	YES
Control variables Z	YES	YES
Region FE	YES	YES
Year FE	YES	YES
Region × Year FE	YES	YES

Source: Authors' calculations from the Demographic and Health Surveys.
Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors clustered at the enumeration area level in parentheses. Education is number of years. The X control variables are child sex and age, and urban residence and household wealth quintiles. The Z control variables are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage, and the proportions of sampled men who were previously married and of polygamous households in the cluster. The F-statistic of the excluded instrument comes from the estimation of Equations (7) and (8) (with correction for selection into coresidence).

Table D2. The impact of mother's and father's education (sample: 1999 and 2005)

Panel A – *Prenatal Care*

	(1) Number of prenatal visits	(2) Prenatal visits ≥ 4	(3) Home birth	(4) Birth assisted by medical staff
$Educ^M$	-0.134**	0.002	-0.012	-0.007
	[-0.256,-0.012]	[-0.019,0.024]	[-0.032,0.007]	[-0.046,0.031]
$Educ^F$	-0.046	0.009	-0.025***	0.054***
	[-0.176,0.085]	[-0.011,0.029]	[-0.044,-0.007]	[0.026,0.081]
$Educ^M \times Educ^F$	0.017***	0.001*	0.001	-0.002***
	[0.008,0.026]	[-0.000,0.002]	[-0.000,0.002]	[-0.003,-0.001]
N	3,344	3,344	4,466	5,024
Control variables X	YES	YES	YES	YES
Control variables Z	YES	YES	YES	YES
Region FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Region × Year FE	YES	YES	YES	YES

Panel B – *Nutrition*

	(1) Stunted	(2) Severely stunted	(3) Wasted	(4) HAZ	(5) WAZ	(6) WHZ
$Educ^M$	0.016*	0.007	-0.000	-0.022	-0.028	-0.024
	[-0.002,0.034]	[-0.008,0.021]	[-0.011,0.010]	[-0.087,0.044]	[-0.079,0.024]	[-0.089,0.040]
$Educ^F$	0.014	0.002	0.004	0.009	-0.013	-0.015
	[-0.005,0.032]	[-0.012,0.017]	[-0.006,0.014]	[-0.057,0.075]	[-0.063,0.037]	[-0.072,0.041]
$Educ^M \times Educ^F$	-0.002***	-0.000	-0.001*	0.000	0.003	0.003
	[-0.003,-0.001]	[-0.001,0.001]	[-0.001,0.000]	[-0.004,0.005]	[-0.001,0.006]	[-0.001,0.007]
N	4,009	4,009	3,971	4,009	4,210	3,971
Control variables X	YES	YES	YES	YES	YES	YES
Control variables Z	YES	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Region × Year FE	YES	YES	YES	YES	YES	YES

Panel C – *Prevention*

	(1) Number of types of complete vaccines	(2) Complete vaccination	(3) Slept under net last night
$Educ^M$	-0.010	-0.010	-0.006
	[-0.218,0.198]	[-0.029,0.009]	[-0.015,0.002]
$Educ^F$	0.088	0.015	-0.006
	[-0.054,0.230]	[-0.004,0.033]	[-0.018,0.007]
$Educ^M \times Educ^F$	-0.002	0.000	0.001**
	[-0.006,0.001]	[-0.001,0.001]	[0.000,0.002]
N	5,024	4,508	2,993
Control variables X	YES	YES	YES
Control variables Z	YES	YES	YES
Region FE	YES	YES	YES
Year FE	YES	YES	YES
Region × Year FE	YES	YES	YES
Month FE	NO	NO	YES

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Source: Authors' calculations from the Demographic and Health Surveys.

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 95% confidence intervals in brackets. Robust standard errors clustered at the enumeration area level. Education is number of years. The X control variables are child sex and age, and urban residence and household wealth quintiles. The Z control variables are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage, and the proportions of sampled men who were previously married and of polygamous households in the cluster.

Table D3. First-Stage estimates for mothers and fathers without cohorts 1966-1970

	(1) Education^M	(2) Education^F
Exposed	1.224***	0.144
	(0.488)	(0.271)
Pre-reform trend	0.295*	0.231***
	(0.158)	(0.029)
Pre-reform trend^2	0.012	0.003***
	(0.011)	(0.001)
Post-reform trend	0.127***	0.081***
	(0.030)	(0.028)
Post-reform trend^2	-0.004***	-0.004***
	(0.001)	(0.001)
Number of mother's siblings	-0.003	
	(0.012)	
Mills^M	-2.582	0.654
	(1.879)	(1.979)
Mills^F	22.851**	14.523*
	(9.012)	(8.622)
Constant	-0.162	5.009
	(3.720)	(4.153)
N	8,845	9,497
Adjusted R^2	0.42	0.43
F	56.79	66.14
p-value (F)	0.000	0.000
F (excluded instruments)	69.52	135.71
pvalue (excluded instruments)	0.000	0.000
Control variables X	YES	YES
Control variables Z	YES	YES
Region FE	YES	YES
Year FE	YES	YES
Region × Year FE	YES	YES

Source: Authors' calculations from the Demographic and Health Surveys.

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors clustered at the enumeration area level in parentheses. Education is number of years. The X control variables are child sex and age, and urban residence and household wealth quintiles. The Z control variables are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage, and the proportions of sampled men who were previously married and of polygamous households in the cluster. The F-statistic of the excluded instrument comes from the estimation of Equations (7) and (8) (with correction for selection into coresidence).

Table D4. The impact of mother's and father's education (analytical sample, without cohorts 1966-1970)

Panel A – *Prenatal Care*

	(1) Number of prenatal visits	(2) Prenatal visits ≥ 4	(3) Home birth	(4) Birth assisted by medical staff
$Educ^M$	-0.128**	0.003	-0.019**	-0.031*
	[-0.241,-0.015]	[-0.017,0.024]	[-0.038,-0.001]	[-0.065,0.004]
$Educ^F$	-0.039	0.005	-0.028***	0.066***
	[-0.143,0.065]	[-0.013,0.022]	[-0.044,-0.011]	[0.044,0.088]
$Educ^M \times Educ^F$	0.016***	0.001	0.002***	-0.002***
	[0.010,0.022]	[-0.000,0.001]	[0.001,0.002]	[-0.003,-0.001]
N	6,778	6,778	8,621	9,471
Control variables X	YES	YES	YES	YES
Control variables Z	YES	YES	YES	YES
Region FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Region $\times$ Year FE	YES	YES	YES	YES

Panel B – *Nutrition*

	(1) Stunted	(2) Severely stunted	(3) Wasted	(4) HAZ	(5) WAZ	(6) WHZ
$Educ^M$	0.013	0.013*	-0.001	-0.037	-0.021	-0.000
	[-0.005,0.032]	[-0.001,0.028]	[-0.010,0.009]	[-0.101,0.027]	[-0.071,0.029]	[-0.061,0.061]
$Educ^F$	0.003	-0.008	0.003	0.032	-0.015	-0.047**
	[-0.013,0.019]	[-0.021,0.005]	[-0.005,0.010]	[-0.024,0.089]	[-0.057,0.027]	[-0.093,-0.001]
$Educ^M \times Educ^F$	-0.001*	-0.000	-0.000	0.002	0.002*	0.000
	[-0.002,0.000]	[-0.001,0.000]	[-0.001,0.000]	[-0.001,0.005]	[-0.000,0.004]	[-0.002,0.003]
N	7,914	7,914	7,860	7,914	8,125	7,860
Control variables X	YES	YES	YES	YES	YES	YES
Control variables Z	YES	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Region $\times$ Year FE	YES	YES	YES	YES	YES	YES

Panel C – *Prevention*

	(1) Number of types of complete vaccines	(2) Complete vaccination	(3) Slept under net last night
$Educ^M$	-0.060	-0.005	0.010**
	[-0.145,0.025]	[-0.024,0.013]	[0.002,0.017]
$Educ^F$	0.073**	0.018**	0.003
	[0.013,0.133]	[0.001,0.035]	[-0.008,0.014]
$Educ^M \times Educ^F$	-0.003***	-0.000	-0.001***
	[-0.005,-0.001]	[-0.001,0.000]	[-0.002,-0.001]
N	9,471	7,533	7,932
Control variables X	YES	YES	YES
Control variables Z	YES	YES	YES
Region FE	YES	YES	YES
Year FE	YES	YES	YES
Region $\times$ Year FE	YES	YES	YES
Month FE	NO .	NO	YES

Source: Authors' calculations from the Demographic and Health Surveys.
Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 95% confidence intervals in brackets. Robust standard errors clustered at the enumeration area level. Education is number of years. The X control variables are child sex and age, and urban residence and household wealth quintiles. The Z control variables are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage, and the proportions of sampled men who were previously married and of polygamous households in the cluster.

Table D5. First-Stage estimates for mothers and fathers without cohorts 1961-1965

	(1) Education^M	(2) Education^F
Exposed	6.677***	1.604***
	(2.252)	(0.501)
Pre-reform trend	-0.938*	0.137***
	(0.519)	(0.051)
Pre-reform trend^2	-0.051**	0.001
	(0.025)	(0.001)
Post-reform trend	0.136***	0.015
	(0.020)	(0.017)
Post-reform trend^2	-0.004***	-0.002**
	(0.001)	(0.001)
Number of mother's siblings	-0.011	
	(0.011)	
Mills^M	-2.346	-0.422
	(1.836)	(1.923)
Mills^F	19.600**	11.852
	(7.920)	(7.888)
Constant	-4.740	6.508**
	(3.883)	(2.949)
N	9,684	10,402
Adjusted R^2	0.37	0.42
F	51.64	63.54
p-value (F)	0.000	0.000
F (excluded instruments)	47.11	145.54
pvalue (excluded instruments)	0.000	0.000
Control variables X	YES	YES
Control variables Z	YES	YES
Region FE	YES	YES
Year FE	YES	YES
Region × Year FE	YES	YES

Source: Authors' calculations from the Demographic and Health Surveys.

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors clustered at the enumeration area level in parentheses. Education is number of years. The X control variables are child sex and age, and urban residence and household wealth quintiles. The Z control variables are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage, and the proportions of sampled men who were previously married and of polygamous households in the cluster. The F-statistic of the excluded instrument comes from the estimation of Equations (7) and (8) (with correction for selection into coresidence).

Table D6. The impact of mother's and father's education (analytical sample, without cohorts 1961-1965)

Panel A – *Prenatal Care*

	(1) Number of prenatal visits	(2) Prenatal visits ≥ 4	(3) Home birth	(4) Birth assisted by medical staff
Educ^{M}	-0.063	0.012	-0.018	-0.045*
	[-0.195,0.069]	[-0.012,0.035]	[-0.041,0.005]	[-0.093,0.002]
Educ^{F}	-0.029	0.005	-0.025***	0.060***
	[-0.121,0.063]	[-0.010,0.021]	[-0.040,-0.011]	[0.042,0.078]
Educ^{M} $\times$ Educ^{F}	0.015***	0.001	0.001***	-0.002***
	[0.010,0.021]	[-0.000,0.001]	[0.001,0.002]	[-0.003,-0.002]
N	7,412	7,412	9,443	10,373
Control variables X	YES	YES	YES	YES
Control variables Z	YES	YES	YES	YES
Region FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Region $\times$ Year FE	YES	YES	YES	YES

Panel B – *Nutrition*

	(1) Stunted	(2) Severely stunted	(3) Wasted	(4) HAZ	(5) WAZ	(6) WHZ
Educ^{M}	-0.003	0.005	0.001	0.005	0.001	-0.014
	[-0.026,0.020]	[-0.012,0.022]	[-0.009,0.012]	[-0.070,0.079]	[-0.062,0.064]	[-0.082,0.055]
Educ^{F}	0.009	-0.001	0.000	0.001	-0.016	-0.013
	[-0.006,0.024]	[-0.012,0.011]	[-0.007,0.007]	[-0.049,0.052]	[-0.054,0.023]	[-0.055,0.028]
Educ^{M} $\times$ Educ^{F}	-0.001*	-0.000	-0.000	0.002	0.002**	0.001
	[-0.001,0.000]	[-0.001,0.000]	[-0.000,0.000]	[-0.001,0.005]	[0.000,0.005]	[-0.001,0.004]
N	8,656	8,656	8,594	8,656	8,902	8,594
Control variables X	YES	YES	YES	YES	YES	YES
Control variables Z	YES	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Region $\times$ Year FE	YES	YES	YES	YES	YES	YES

Panel C – *Prevention*

	(1) Number of types of complete vaccines	(2) Complete vaccination	(3) Slept under net last night
Educ^{M}	0.003	-0.013	0.008**
	[-0.107,0.113]	[-0.032,0.007]	[0.001,0.016]
Educ^{F}	0.072**	0.027***	0.004
	[0.011,0.133]	[0.012,0.043]	[-0.006,0.014]
Educ^{M} $\times$ Educ^{F}	-0.003***	-0.000	-0.001***
	[-0.005,-0.001]	[-0.001,0.000]	[-0.001,-0.000]
N	10,373	8,263	8,592
Control variables X	YES	YES	YES
Control variables Z	YES	YES	YES
Region FE	YES	YES	YES
Year FE	YES	YES	YES
Region $\times$ Year FE	YES	YES	YES
Month FE	NO .	NO	YES

Source: Authors' calculations from the Demographic and Health Surveys.
Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 95% confidence intervals in brackets. Robust standard errors clustered at the enumeration area level. Education is number of years. The X control variables are child sex and age, and urban residence and household wealth quintiles. The Z control variables are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage, and the proportions of sampled men who were previously married and of polygamous households in the cluster.

Appendix E: Robustness checks using additional control variables

Table E1. Descriptive statistics

	(1) All	(2) Analytical sample	(3) Mother exposed	(4) Mother not exposed	(5) Father exposed	(6) Father not exposed
Panel A – *Macro indicators during child's year of birth*						
GDP per capita (thousands US$, constant 2010)	0.95	0.94	0.93	1.19	0.90	1.09
Life expectancy at birth	50.31	50.51	50.62	47.60	51.13	48.06
Urbanization rate	33.32	33.31	33.34	32.99	33.33	33.25
Under-5 mortality rate	89.44	88.96	88.76	94.53	87.77	93.73
Panel B – *Household composition*						
Number of other adult women	0.77	0.42	0.61	0.67	0.42	0.54
Number of other adult men	0.58	0.35	0.46	0.65	0.32	0.48
Number of other exposed adult women	0.45	0.30	0.37	0.54	0.28	0.42
Number of other exposed adult men	0.41	0.29	0.34	0.60	0.25	0.45
N	21,976	11,754	17,411	1,232	9,521	2,512

Source: Authors' calculations from the World Development Indicators (Panel A) and the Demographic and Health Surveys (1999, 2005, 2010 and 2015) (Panel B).

Notes: Unweighted statistics. The analytical sample refers to the sample of children aged 0-4 who currently live with both parents.

Table E2. Prenatal Care - The impact of mother's and father's education with macro indicators (analytical sample)

	(1) Number of prenatal visits	(2) Prenatal visits ≥ 4	(3) Home birth	(4) Birth assisted by medical staff
Educ^M	-0.135**	-0.001	-0.020**	-0.042**
	[-0.242,-0.028]	[-0.020,0.018]	[-0.037,-0.002]	[-0.076,-0.007]
Educ^F	-0.022	0.009	-0.027***	0.066***
	[-0.116,0.073]	[-0.006,0.025]	[-0.041,-0.013]	[0.048,0.084]
Educ^M $\times$ Educ^F	0.015***	0.001**	0.001***	-0.002***
	[0.010,0.020]	[0.000,0.001]	[0.001,0.002]	[-0.003,-0.001]
GDP per capita	-0.481	0.086	-0.039	-0.078
(thousands US$)	[-1.589,0.627]	[-0.099,0.272]	[-0.181,0.102]	[-0.245,0.090]
Life expectancy at birth	-0.206***	-0.036***	0.006	-0.003
	[-0.356,-0.057]	[-0.062,-0.010]	[-0.015,0.027]	[-0.027,0.020]
Urbanization rate	-0.350	-0.116**	-0.024	0.079
	[-1.020,0.321]	[-0.227,-0.005]	[-0.107,0.058]	[-0.017,0.175]
Under-5 mortality rate	-0.054**	-0.005	0.007**	-0.010**
	[-0.103,-0.004]	[-0.013,0.003]	[0.001,0.014]	[-0.018,-0.002]
Mills^M	-4.761*	-1.056**	0.175	-0.308
	[-9.571,0.049]	[-1.917,-0.195]	[-0.505,0.855]	[-1.064,0.447]
Mills^F	6.937	2.806**	-0.945	0.182
	[-9.637,23.511]	[0.128,5.485]	[-3.147,1.257]	[-2.579,2.944]
Constant	32.168**	5.983***	0.596	-0.756
	[6.460,57.875]	[1.492,10.474]	[-2.805,3.997]	[-4.581,3.070]
$\rho_{(7),(9)}$	0.078	0.004	-0.059	0.382***
	[-0.017,0.173]	[-0.085,0.092]	[-0.150,0.032]	[0.203,0.562]
$\rho_{(8),(9)}$	-0.022	-0.068*	0.026	-0.067*
	[-0.096,0.052]	[-0.144,0.007]	[-0.050,0.102]	[-0.140,0.005]
$\rho_{(7),(8)}$	0.414***	0.414***	0.414***	0.405***
	[0.386,0.442]	[0.386,0.442]	[0.386,0.442]	[0.377,0.433]
N	8,241	8,241	10,552	11,522
Control variables X	YES	YES	YES	YES
Control variables Z	YES	YES	YES	YES
Region FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Region $\times$ Year FE	YES	YES	YES	YES

Source: Authors' calculations from the Demographic and Health Surveys.
Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 95% confidence intervals in brackets. Robust standard errors clustered at the enumeration area level. Education is number of years. The X control variables are child sex and age, and urban residence and household wealth quintiles. The Z control variables are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage, and the proportions of sampled men who were previously married and of polygamous households in the cluster. GDP per capita is in constant 2010 US dollars.

Table E3. Nutrition - The impact of mother's and father's education with macro indicators (analytical sample)

	(1) Stunted	(2) Severely stunted	(3) Wasted	(4) HAZ	(5) WAZ	(6) WHZ
Educ^M	0.012	0.008	-0.002	-0.035	-0.018	-0.007
	[-0.005,0.028]	[-0.005,0.021]	[-0.011,0.007]	[-0.094,0.023]	[-0.063,0.028]	[-0.064,0.049]
Educ^F	0.008	-0.000	0.002	0.005	-0.014	-0.015
	[-0.006,0.022]	[-0.011,0.011]	[-0.005,0.008]	[-0.043,0.054]	[-0.050,0.022]	[-0.055,0.026]
$\text{Educ}^M \times \text{Educ}^F$	-0.001***	-0.000	-0.000	0.002*	0.002**	0.001
	[-0.002,-0.000]	[-0.001,0.000]	[-0.000,0.000]	[-0.000,0.005]	[0.001,0.004]	[-0.001,0.004]
GDP per capita *(thousands US$)*	-0.276***	-0.118*	-0.064	0.713**	0.251	-0.243
	[-0.452,-0.100]	[-0.236,0.001]	[-0.148,0.020]	[0.085,1.340]	[-0.161,0.663]	[-0.739,0.254]
Life expectancy at birth	0.025**	0.011	-0.009	-0.058	0.026	0.050
	[0.002,0.047]	[-0.004,0.026]	[-0.021,0.003]	[-0.139,0.024]	[-0.032,0.083]	[-0.023,0.124]
Urbanization rate	0.142***	0.091**	0.004	-0.447**	-0.130	0.229
	[0.040,0.245]	[0.021,0.160]	[-0.051,0.059]	[-0.820,-0.074]	[-0.400,0.141]	[-0.102,0.560]
Under-5 mortality rate	-0.003	-0.002	-0.003	0.016	0.014	-0.007
	[-0.010,0.004]	[-0.007,0.003]	[-0.007,0.001]	[-0.013,0.045]	[-0.004,0.032]	[-0.031,0.016]
Mills^M	-3.983***	-1.152***	0.377*	14.195***	3.620***	-2.479**
	[-4.728,-3.239]	[-1.641,-0.664]	[-0.005,0.758]	[11.597,16.792]	[1.717,5.524]	[-4.718,-0.241]
Mills^F	4.557***	0.824	-1.311*	-11.769**	3.066	4.328
	[2.007,7.107]	[-0.847,2.495]	[-2.684,0.062]	[-22.014,-1.524]	[-3.244,9.377]	[-3.579,12.236]
Constant	-5.623***	-3.077**	1.068	14.766**	-0.292	-9.336
	[-9.628,-1.618]	[-5.753,-0.401]	[-1.094,3.230]	[0.832,28.701]	[-10.792,10.207]	[-22.496,3.824]
$\rho_{(7),(9)}$	-0.064	-0.044	0.028	0.052	0.049	0.031
	[-0.143,0.016]	[-0.129,0.042]	[-0.060,0.116]	[-0.032,0.136]	[-0.036,0.134]	[-0.061,0.123]
$\rho_{(8),(9)}$	-0.038	-0.011	0.015	0.004	0.029	0.027
	[-0.109,0.033]	[-0.089,0.067]	[-0.052,0.081]	[-0.068,0.076]	[-0.039,0.097]	[-0.041,0.095]
$\rho_{(7),(8)}$	0.414***	0.414***	0.414***	0.414***	0.414***	0.414***
	[0.386,0.442]	[0.386,0.442]	[0.386,0.442]	[0.386,0.442]	[0.386,0.442]	[0.386,0.442]
N	9,675	9,675	9,607	9,675	9,953	9,607
Control variables X	YES	YES	YES	YES	YES	YES
Control variables Z	YES	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES	YES
Region × Year FE	YES	YES	YES	YES	YES	YES

Source: Authors' calculations from the Demographic and Health Surveys.
Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 95% confidence intervals in brackets. Robust standard errors clustered at the enumeration area level. Education is number of years. The X control variables are child sex and age, and urban residence and household wealth quintiles. The Z control variables are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage, and the proportions of sampled men who were previously married and of polygamous households in the cluster. GDP per capita is in constant 2010 US dollars.

Table E4. Prevention - The impact of mother's and father's education with macro indicators (analytical sample)

	(1) Number of types of complete vaccines	(2) Complete vaccination	(3) Slept under net last night
$Educ^M$	-0.094	-0.007	0.008**
	[-0.270,0.083]	[-0.024,0.010]	[0.002,0.015]
$Educ^F$	0.134***	0.021***	0.003
	[0.045,0.223]	[0.006,0.035]	[-0.007,0.013]
$Educ^M \times Educ^F$	-0.003***	-0.000	-0.001***
	[-0.005,-0.001]	[-0.001,0.001]	[-0.001,-0.000]
GDP per capita *(thousands US\$)*	-1.074***	-0.367***	-0.212**
	[-1.540,-0.608]	[-0.544,-0.190]	[-0.377,-0.048]
Life expectancy at birth	-0.452***	0.090***	0.006
	[-0.517,-0.387]	[0.065,0.115]	[-0.010,0.022]
Urbanization rate	-1.141***	0.159***	0.105***
	[-1.426,-0.856]	[0.051,0.268]	[0.033,0.176]
Under-5 mortality rate	-0.165***	0.041***	-0.008**
	[-0.186,-0.144]	[0.033,0.050]	[-0.015,-0.001]
$Mills^M$	-16.201***	-5.828***	0.147
	[-18.172,-14.231]	[-6.766,-4.889]	[-0.405,0.700]
$Mills^F$	16.702***	4.521***	-2.424*
	[9.482,23.923]	[1.975,7.067]	[-4.931,0.083]
Constant	77.328***	-12.826***	-2.175*
	[66.096,88.559]	[-17.277,-8.376]	[-4.614,0.263]
$\rho_{(7),(9)}$	0.211	0.061	0.003
	[-0.130,0.553]	[-0.019,0.142]	[-0.042,0.048]
$\rho_{(8),(9)}$	-0.129***	-0.063*	0.017
	[-0.200,-0.057]	[-0.135,0.009]	[-0.064,0.097]
$\rho_{(7),(8)}$	0.410***	0.414***	0.411***
	[0.382,0.438]	[0.386,0.442]	[0.383,0.438]
N	11,522	9,338	9,250
Control variables X	YES	YES	YES
Control variables Z	YES	YES	YES
Region FE	YES	YES	YES
Region × Year FE	YES	YES	YES
Month FE	NO	NO	YES

Source: Authors' calculations from the Demographic and Health Surveys.
Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 95% confidence intervals in brackets. Robust standard errors clustered at the enumeration area level. Education is number of years. The X control variables are child sex and age, and urban residence and household wealth quintiles. The Z control variables are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage, and the proportions of sampled men who were previously married and of polygamous households in the cluster. GDP per capita is in constant 2010 US dollars.

Table E5. Prenatal Care - The impact of mother's and father's education with additional control variables (HH composition) (analytical sample)

	(1) Number of prenatal visits	(2) Prenatal visits ≥ 4	(3) Home birth	(4) Birth assisted by medical staff
Educ^M	-0.122**	-0.001	-0.017*	-0.045***
	[-0.231,-0.013]	[-0.020,0.018]	[-0.035,0.001]	[-0.078,-0.012]
Educ^F	-0.021	0.009	-0.025***	0.061***
	[-0.115,0.074]	[-0.007,0.024]	[-0.039,-0.011]	[0.044,0.078]
$\text{Educ}^M \times \text{Educ}^F$	0.015***	0.001**	0.001***	-0.002***
	[0.010,0.020]	[0.000,0.002]	[0.001,0.002]	[-0.003,-0.001]
No. of adult men	0.053	-0.007	0.019	0.031
	[-0.525,0.631]	[-0.107,0.093]	[-0.066,0.105]	[-0.054,0.116]
No. of adult women	0.408	0.060	0.020	0.037
	[-0.272,1.089]	[-0.059,0.178]	[-0.078,0.118]	[-0.059,0.132]
No. of exposed adult men	0.035	0.030	-0.015	-0.051
	[-0.494,0.564]	[-0.061,0.122]	[-0.092,0.063]	[-0.131,0.028]
No. of exposed adult women	-0.321	-0.071	-0.007	-0.044
	[-0.816,0.175]	[-0.157,0.015]	[-0.080,0.065]	[-0.115,0.027]
Mills^M	-1.877	-0.310	0.303*	-0.580***
	[-4.506,0.752]	[-0.737,0.118]	[-0.028,0.634]	[-0.974,-0.185]
Mills^F	-1.771	-0.190	-0.396	0.175
	[-6.891,3.349]	[-1.077,0.698]	[-1.163,0.371]	[-0.544,0.894]
Constant	6.838***	0.673***	0.410***	0.950***
	[4.916,8.760]	[0.353,0.994]	[0.152,0.668]	[0.603,1.298]
$\rho_{(7),(9)}$	0.065	0.003	-0.076	0.396***
	[-0.032,0.162]	[-0.088,0.093]	[-0.169,0.016]	[0.225,0.567]
$\rho_{(8),(9)}$	-0.029	-0.068*	0.013	-0.044
	[-0.103,0.045]	[-0.144,0.007]	[-0.063,0.090]	[-0.116,0.029]
$\rho_{(7),(8)}$	0.414***	0.414***	0.414***	0.406***
	[0.386,0.442]	[0.386,0.442]	[0.386,0.442]	[0.378,0.433]
N	8,242	8,242	10,553	11,612
Control variables X	YES	YES	YES	YES
Control variables Z	YES	YES	YES	YES
Region FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Region × Year FE	YES	YES	YES	YES

Source: Authors' calculations from the Demographic and Health Surveys.

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 95% confidence intervals in brackets. Robust standard errors clustered at the enumeration area level. Education is number of years. The X control variables are child sex and age, and urban residence and household wealth quintiles. The Z control variables are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage, and the proportions of sampled men who were previously married and of polygamous households in the cluster.

Table E6. Nutrition - The impact of mother's and father's education with additional control variables (HH composition) (analytical sample)

	(1)	(2)	(3)	(4)	(5)	(6)
	Stunted	Severely stunted	Wasted	HAZ	WAZ	WHZ
Educ^M	0.015*	0.009	-0.003	-0.042	-0.019	-0.005
	[-0.002,0.031]	[-0.004,0.022]	[-0.012,0.006]	[-0.102,0.018]	[-0.066,0.027]	[-0.063,0.052]
Educ^F	0.008	-0.001	0.001	0.003	-0.015	-0.014
	[-0.006,0.022]	[-0.012,0.010]	[-0.005,0.008]	[-0.045,0.052]	[-0.051,0.022]	[-0.055,0.026]
$\text{Educ}^M \times \text{Educ}^F$	-0.001***	-0.000	-0.000	0.002*	0.003**	0.001
	[-0.002,-0.000]	[-0.001,0.000]	[-0.000,0.000]	[-0.000,0.005]	[0.001,0.005]	[-0.001,0.003]
No. of adult men	0.019	0.008	0.021	-0.275*	-0.202*	-0.019
	[-0.070,0.108]	[-0.048,0.064]	[-0.027,0.069]	[-0.591,0.041]	[-0.421,0.018]	[-0.287,0.249]
No. of adult women	-0.018	-0.009	0.023	-0.405**	-0.293**	-0.058
	[-0.123,0.087]	[-0.072,0.055]	[-0.038,0.083]	[-0.765,-0.044]	[-0.557,-0.029]	[-0.367,0.251]
No. of exposed adult men	-0.030	-0.017	-0.024	0.249	0.189*	0.024
	[-0.112,0.052]	[-0.070,0.036]	[-0.069,0.021]	[-0.049,0.546]	[-0.015,0.394]	[-0.227,0.275]
No. of exposed adult women	0.034	0.011	-0.026	0.253*	0.203**	0.084
	[-0.044,0.111]	[-0.036,0.058]	[-0.069,0.017]	[-0.010,0.516]	[0.010,0.396]	[-0.145,0.312]
Mills^M	-0.832***	-0.394***	0.029	3.679***	1.159**	-0.796
	[-1.223,-0.441]	[-0.641,-0.148]	[-0.152,0.210]	[2.340,5.017]	[0.173,2.144]	[-1.973,0.382]
Mills^F	0.272	0.204	-0.098	1.611	1.778*	0.532
	[-0.507,1.051]	[-0.262,0.669]	[-0.557,0.360]	[-1.057,4.278]	[-0.164,3.721]	[-1.682,2.746]
Constant	0.311**	0.200**	0.168**	-2.156***	-0.798*	0.611
	[0.012,0.610]	[0.014,0.387]	[0.015,0.322]	[-3.202,-1.111]	[-1.611,0.015]	[-0.324,1.546]
$\rho_{(7),(9)}$	-0.074*	-0.048	0.041	0.058	0.052	0.029
	[-0.155,0.006]	[-0.135,0.039]	[-0.048,0.130]	[-0.027,0.144]	[-0.035,0.139]	[-0.064,0.123]
$\rho_{(8),(9)}$	-0.040	-0.010	0.021	0.008	0.031	0.026
	[-0.111,0.031]	[-0.087,0.067]	[-0.046,0.087]	[-0.065,0.080]	[-0.038,0.099]	[-0.042,0.094]
$\rho_{(7),(8)}$	0.414***	0.414***	0.414***	0.414***	0.414***	0.414***
	[0.386,0.442]	[0.386,0.442]	[0.386,0.442]	[0.386,0.442]	[0.386,0.442]	[0.386,0.442]
N	9,675	9,675	9,607	9,675	9,953	9,607
Control variables X	YES	YES	YES	YES	YES	YES
Control variables Z	YES	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Region × Year FE	YES	YES	YES	YES	YES	YES

Source: Authors' calculations from the Demographic and Health Surveys.
Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 95% confidence intervals in brackets. Robust standard errors clustered at the enumeration area level. Education is number of years. The X control variables are child sex and age, and urban residence and household wealth quintiles. The Z control variables are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage, and the proportions of sampled men who were previously married and of polygamous households in the cluster.

Table E7. Prevention - The impact of mother's and father's education with additional control variables (HH composition) (analytical sample)

	(1) Number of types of complete vaccines	(2) Complete vaccination	(3) Slept under net last night
$Educ^M$	-0.057	-0.000	0.007**
	[-0.144,0.031]	[-0.018,0.017]	[0.000,0.014]
$Educ^F$	0.079***	0.025***	0.002
	[0.024,0.133]	[0.010,0.040]	[-0.008,0.011]
$Educ^M \times Educ^F$	-0.002***	-0.000	-0.001***
	[-0.004,-0.001]	[-0.001,0.000]	[-0.001,-0.000]
No. of adult men	0.321***	0.091*	-0.009
	[0.087,0.555]	[-0.007,0.189]	[-0.079,0.061]
No. of adult women	0.508***	0.189***	0.008
	[0.239,0.777]	[0.073,0.305]	[-0.072,0.088]
No. of exposed adult men	-0.330***	-0.077*	0.010
	[-0.548,-0.112]	[-0.168,0.014]	[-0.052,0.072]
No. of exposed adult women	-0.406***	-0.141***	-0.017
	[-0.605,-0.207]	[-0.227,-0.055]	[-0.073,0.039]
$Mills^M$	-4.216***	-1.330***	-0.023
	[-5.428,-3.004]	[-1.780,-0.880]	[-0.257,0.211]
$Mills^F$	-1.677*	-0.702	-0.188
	[-3.637,0.283]	[-1.565,0.161]	[-0.786,0.409]
Constant	3.533***	0.594***	0.109
	[2.637,4.428]	[0.279,0.908]	[-0.121,0.339]
$\rho_{(7),(9)}$	0.145*	0.023	0.012
	[-0.010,0.300]	[-0.059,0.104]	[-0.033,0.056]
$\rho_{(8),(9)}$	-0.050	-0.089**	0.025
	[-0.120,0.019]	[-0.159,-0.019]	[-0.055,0.105]
$\rho_{(7),(8)}$	0.412***	0.414***	0.411***
	[0.385,0.440]	[0.386,0.442]	[0.383,0.438]
N	11,612	9,338	9,285
Control variables X	YES	YES	YES
Control variables Z	YES	YES	YES
Region FE	YES	YES	YES
Year FE	YES	YES	YES
Region × Year FE	YES	YES	YES
Month FE	NO	NO	YES

Source: Authors' calculations from the Demographic and Health Surveys.

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 95% confidence intervals in brackets. Robust standard errors clustered at the enumeration area level. Education is number of years. The X control variables are child sex and age, and urban residence and household wealth quintiles. The Z control variables are the proportions of sampled women who were previously married and who gave birth to their first child outside of marriage, and the proportions of sampled men who were previously married and of polygamous households in the cluster.