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Abstract

The consequences of orphanhood have been an important topic on the research agenda in recent years, particularly against the backdrop of the AIDS epidemic in Sub-Saharan Africa. Previous literature has highlighted negative effects on children from prime-age adult deaths in the household. Some authors have however pointed out that the effects are small, possibly as a result of well-functioning coping mechanisms prevailing in the region. In this article, we investigate the links between deaths in the household and subsequent economic outcomes of children by exploiting an unusually rich dataset from Senegal. Along the lines of Case, Paxson and Ableidinger (2004), we test whether impacts on children differ according to the relationship with the deceased. We find evidence that this is the case: deaths in the household are not associated with diminished school presence for those children who are not under the direct responsibility of the deceased. It however has a strong significant negative effect for those children who are. On the basis of our results, which include effects on child labor and fostering, we argue that in large and complex households, household budgetary arrangements are an essential part of the story that may well lead to a heterogeneous absorption of shocks among family members. As such, there seem to be limits to the much lauded African informal safety net.

Keywords: Intra-household resource allocation, Child labor, Senegal.

Résumé

La question des conséquences de l'orphelinage a été longuement traitée dans la littérature économique des dernières années, en particulier dans le contexte de l'épidémie de SIDA. Cette littérature a mis en évidence des impacts négatifs sur les enfants de décès d'adultes en âge de travailler dans le ménage. Certains auteurs ont cependant souligné que l'impact est limité, potentiellement grâce à de bons mécanismes de solidarité œuvrant au sein de la famille élargie. Dans cet article, nous nous intéressons aux liens entre un décès dans les ménages sénégalais et les conséquences sur les enfants des ménages touchés, en nous appuyant sur des données de panel particulièrement riches. En lien avec l'approche de Case, Paxson et Ableidinger (2004), nous testons l'hypothèse d'un impact sur les enfants différencié et dépendant du lien entre l'enfant et l'adulte décédé. Nos résultats sont en faveur de cette hypothèse: le décès d'un adulte n'a pas d'impact sur la scolarisation des enfants qui ne sont pas sous la responsabilité directe du défunt. En revanche, il a un impact négatif fort sur les enfants qui le sont. Sur la base de nos résultats, qui montrent également des effets sur le travail des enfants et le confiage, nous soutenons que dans des ménages élargis, les arrangements budgétaires constituent une information capitale, conditionnant l'absorption de chocs des différents membres du ménage. Ainsi, les mécanismes de solidarité intra-ménages africains semblent avoir de fortes limites.

Mots clés: Allocation des ressources au sein des ménages, travail des enfants, Sénégal.
JEL: D10,D13,J13,O12.

1 Introduction

The Western literature of the nineteenth century is full of novels in which orphans face a terrible destiny. Cosette in Victor Hugo's famous novel *Les Misérables* is entrusted to an innkeeper and his wife, the Thénardiers, who abominably exploit her and treat her no better than a dog. Oliver Twist in Charles Dickens' eponym novel lives in a workhouse where he and other orphaned boys are forced to work and fed very little. Charlotte Brontë's Jane Eyre, following the death of her parents from typhus, lives with her aunt who dislikes her and treats her as a burden. And Charles Perrault's famous fairy tale *Cinderella* tells the story of a young girl who has lost her mother and who is enslaved by her stepmother and her daughters. The western African oral tradition is also full of tales about children who lost their mother and who are abused by their step mother (see Leguy and Diarra (2015)). All these novels convey the idea that the loss of a parent, when it occurs at a young age and in poor households, is likely to be an event with terrible consequences.

In Africa orphanhood has recently received much attention following the spread of the AIDS epidemic and the multiplication of armed conflicts. It is widely assumed that the extended family network provides, in normal times, an efficient safety net where institutions fail to assist people in need (UNICEF 2001; Foster 2000). However, in countries badly struck by the AIDS epidemic, the system may have found its limits, being overwhelmed by the number of people, especially orphans, in need of assistance (see Chirwa (2002) and Kuo and Operario (2010) for opposing views on this issue). Often, adult members of an extended family may share the task of running the day-to-day life of the household, including a shared responsibility for childcare. As such they should be able to expect that their children will be cared for by other adult members, should they not be in a position to do so themselves. Even if this is indeed the case, this does not mean that children are all treated in the same way, and in particular that those who have lost one or both of their parents have the same access to resources as others. Concerning for instance educational investment, it could be that for some reason orphaned children have a lower return to education than others (Case, Paxson, and Ableidinger (2004)), inducing a lower level of schooling attainment. It may also be the case that orphaned children are discriminated against, like Jane Eyre is because her genetic relatedness is too weak with her aunt, who then prefers to reserve her love and caring capacity for her own children. This conforms to the so-called *Hamilton hypothesis* (Hamilton 1964) implying that altruistic behavior between two individuals is closely related to their genetic proximity, so that one prefers one's own children to one's grand-children and nephews or nieces who are in turn preferred to cousins etc.

More generally, the concept of *kin selection* suggests that evolutionary success might not necessarily imply a maximization of the number of offspring of an individual. Instead, investing in other individuals carrying the same genes increases their probability of reproductive success and might thus be the optimal behavior, even at the cost of one's own reproductive success. Since the common genetic endowment of two individuals is related to their genetic proximity, altruistic behavior should be positively associated with the tightness of blood links. [1]

If either of these mechanisms are at play one could expect to observe that in extended families, and outside the context of an epidemic or a civil war that puts a heavy strain on informal social safety nets, children who have lost one or both of their parents are not treated in the same way as other children, receiving a lower level of human capital and being asked to contribute more to the household income or to take on a higher share of domestic chores. This is what we

[1] On a related note, evolutionary psychology speaks of the *Cinderella effect* when referring to the fact that the risk of child abuse is higher when the child lives with a step-parent (Daly and Wilson 1998).

examine in this paper. Using data from an unusually rich household panel survey in Senegal, we examine whether children whose main care giver dies receive a lower level of educational investment, work more or provide more domestic work. We also examine whether these children are more likely to be fostered out. Through this lens, our work also provides an opportunity to examine the extent of intra-household solidarity in the Senegalese context.

Our paper is in line with the work that Case, Paxson, and Ableidinger (2004) have conducted, analysing the impact of a parent's death on children's schooling, using data from eleven DHS surveys. We differ from it in three ways: first, as mentioned, while Case, Paxson and Ableidinger have limited their analysis to school enrollment, we also examine labor market participation, hours of domestic work and the probability of being fostered as outcomes likely to be impacted by the death of a parent ; second, we do not limit our analysis to parents' death and also examine the impact of the death of any member (adult, youth, elderly, men or women) in the household, in order to evaluate the relative importance of the genetic relatedness in the size of the impact ; third, as we have individual panel data, we are able to check that our results are not driven by unobserved heterogeneity, through the use of individual and household fixed effects estimates.

Our main results show negative impacts on school enrollment and positive impacts on market and domestic work and on the probability of being fostered, that are much larger and significant when the adult who dies is the main care giver of the child. The rest of the paper is organized as follows: in the next section we provide a literature review. Section 3 presents the data and our empirical strategy. Section 4 shows some descriptive statistics regarding our main variables of interest. Results are presented in section 5 and section 6 concludes.

2 Linkages between schooling decisions and household income in Sub-Saharan Africa

The seminal model of allocation of educational investment to children was laid out in Becker and Tomes (1976). This model shows that, under a number of strong assumptions - nuclear family, perfect capital markets, parents caring equally about each child and education being valued solely for its future income generative properties - the investment in a child's education is unaffected by income shocks to the household, such as the death of a parent (Gertler, Levine, and Ames 2004). In the context of developing countries, many - if not all - of these assumptions are questionable.

In Sub-Saharan Africa large households and extended family systems often prevail, and multiple spouses often live under the same roof. In a polygamous society, the responsibilities of members extend to children of other partners, even when these do not live in the same household (Lloyd and Blanc 1996). In such a context, allocative theories based on the nuclear family are less pertinent and intra-household decisions must be conceptualized taking this into account. This is not the case in the unitary household model, which assumes one decision maker and the pooling of income from different household members. A result of the unitary model is that a change in the distribution of income between household members does not affect household spending patterns, something that has been strongly questioned in the literature (Hoddinott and Haddad 1995; Hoddinott, Alderman, and Haddad 1997; Vermeulen 2002). In Senegal, polygamy is widespread. According to Tabutin and Schoumaker (2004), 46% of women between 15 and

49 years of age were in polygamous unions in Senegal in 1999. Of the 29 African countries for which they have data, only Guinea and Burkina Faso exceed this rate. More recent data show that 32.4% of women between 15-49 years and who are in some form of union have at least one co-wife[2]. Anthropologists have noted that rivalry exists among wives in polygamous unions, and that this rivalry is primarily related to fecundity. Using the same data as this paper, Lambert and Rossi (2016) explore co-wife rivalry in the Senegalese context, finding evidence of strategic birth behavior among co-wives. Thus, it does not seem a long shot to assume that adjustments to household deaths (in particular maternal deaths) are distributed unequally among remaining members, and attempts to examine the impacts of household shocks on children outcomes should therefore take this into account.

2.1 Household responses to health and income shocks in developing countries

It is well known that households resort to a number of coping mechanisms in the case of income and health shocks. Evidence however also suggests these mechanisms are not always sufficient, and shocks are associated with consumption decreases even in the medium term (Dercon, Hoddinott, and Woldehanna 2005; Beegle, De Weerdt, and Dercon 2008). Income and health shocks constrain households in several ways: first and foremost, through a tightening of the budget constraint, leading households to eventually withdraw children from school (Jacoby and Skoufias 1997) and increase the labor supply of household members. Second, health shocks not only affect income directly, through medical expenses and reduced labor supply, but also since other household members might be mobilized as caregivers. Yamauchi, Buthelezi, and Velia (2008) find support for such coping mechanisms in South Africa, where death of prime-age adults in the household are associated with accelerated transitions from school to work for adolescents. Furthermore, female school attendance drops prior to death, suggesting that girls bear the burden of AIDS care in the household. Beegle, Dehejia, and Gatti (2006), using panel data from Tanzania, find that agricultural shocks are mitigated through an increase in child labor and sales of assets. Guarcello, Mealli, and Rosati (2010) also find that shocks are associated with increased child labor in Guatemala, and Duryea, Lam, and Levison (2007) find that unemployment shocks on male household heads increase child labor in Brazil. However, looking at adult deaths in the Kagera region of northwestern Tanzania, Beegle (2005) does not find any evidence of increased labor supply of surviving members.

The issue of adult death impacts on child outcomes has received much attention in the aftermath of the AIDS epidemic. Much of the work has focused on children's school enrolment. Ainsworth and Filmer (2006) examine enrollment rates of orphans versus non-orphans in 28 countries, 22 of which are located in Sub-Saharan Africa. They show that the difference in enrollment rates between orphans and non orphans varies considerably across countries. In some countries, orphans are - contrary to common perception - more likely to enroll than non-orphans. Some of the enrollment differentials however seem to be due to household income being endogenous with respect to orphanhood. The heterogeneity of findings is less present when one looks at country-specific studies, a negative effect of orphanhood being found in most studies of African countries. However, attention has been drawn to the magnitude of the effect and its concentration among specific sub-groups of individuals. For example, Bennell (2005) argues that the direct effect of orphanhood on educational outcomes has been overstated, the overwhelming part of the explanation being poverty. Similarly, Ainsworth and Filmer (2002) argue that although enrollment

[2]Enquête Démographique et de Santé Continue, 2014. Agence Nationale de la Statistique et de la Démographie (ANSD), Dakar, Sénégal.

differentials between orphans and non-orphans are statistically significant, they are small compared to those between poor and non poor households. Yamano and Jayne (2005) find adverse school attendance effects from orphanhood in Kenya for the lower half of the income distribution, and Kobiané, Calvès, and Marcoux (2005) find especially strong effects of orphanhood in rural areas of Burkina Faso. It thus seems crucial to account for the household's situation before the occurrence of a death, since unobserved heterogeneity might account for a downward bias on coefficients in cross-sectional regressions. This is noted by Evans and Miguel (2007), who use a large panel data set to study the impact of orphanhood in a high HIV prevalence area in Western Kenya, while holding account of unobserved individual heterogeneity. Their results show that the estimated coefficients of orphanhood increase when individual fixed effects are removed and suggest that parental death does reduce school participation, with maternal death orphans, weak students and young girls being particularly affected. Other panel data studies finding a negative impact on schooling include Yamano and Jayne (2005), Beegle, De Weerdt, and Dercon (2006), and Senne (2014). The latter study distinguishes short-run and long-run impacts, affirming that not only is dropping out of school an immediate and short-term household coping mechanism in case of adult deaths; the effects linger on and translate into lower educational attainment at adulthood.

Gertler et al. (2003) lay out some of the theoretical reasons which might affect educational decisions in case of parental death. Firstly, in developing countries, when credit or insurance markets fail, informal insurance mechanisms prevail, especially within the extended family. Such mechanisms rely on expected reciprocity, which may decline upon the death of a family member. Secondly, the optimal investment in a child might change if there are changes in preferences, or in the educational production function. For example, it has been suggested that mothers value education more than fathers, and stronger effects from maternal deaths are found by Beegle, De Weerdt, and Dercon (2006), Case and Ardington (2006), Evans and Miguel (2007), Ueyama (2007), and Ardington and Leibbrandt (2010). Ardington and Leibbrandt (2010) find support for the preference channel using a series of cross-sectional datasets from South Africa. They find that fathers' deaths are associated with revenue losses and lower enrollment, but that the enrollment impact of mothers' deaths is stronger, while the revenue effect is absent. This suggests that the orphanhood-schooling nexus operates not only through the channels associated with a deterioration of households' economic situation. Finally, parental time might be an input into the educational production function. A decrease in available time might thus modify the optimal educational investment for children.

Child fostering is another possible adjustment mechanism in case of income shocks to the household. The practice is well known in many parts of the world, but according to Isiugo-Abanihe (1985) it is perhaps nowhere as institutionalized as in West Africa, and "unique to West African fostering are both its prevalence and the very early age at which children are boarded out". DHS reports from 11 countries in the region show that the proportion of fostered children younger than 14 years old varies from 7% in Burkina Faso to 16.8% in Liberia, standing at about 10% in Senegal (Beck et al. 2015). Looking only at children between 10 and 14 years of age, Eloundou-Enyegue and Kandiwa (2007) find a fostering prevalence rate of 19.5% for Senegal. Fostering fills several functions: it provides opportunities for educational investment in children when parents are unable to provide it, be it due to financial, geographical or pedagogical reasons; it provides caring possibilities for elderly people in the fostering household; it permits households to cope with financial difficulties. Finally it is a possibility to establish or strengthen ties between households. Vandermeersch and Chimere-Dan (2002) look at fostering of children below the age of 6 in Senegal, and find that mothers likely to out-foster are those who have

experienced the dissolution of a union, or those who have many children. The households likely to receive children are those with older or sub-fecund women, suggesting that fostering of very young children might be a way of adjusting demographic imbalances between households. Beck et al. (2015) find evidence of self-selection among fostered children in Senegal, consistent with several motives for fostering. Fostered boys are relatively more educated than their siblings who are not fostered out, and are being sent to families with a higher propensity to educate their children. Girls are being sent to households where children undertake relatively more domestic work. They however conclude that, on average, fostered children do not seem to be treated differently than the other children of the host family. Earlier empirical evidence of the effects of fostering in West Africa includes Ainsworth (1995) and Akresh (2007).

The strict interpretation of the results we are about to present hinges on the type of behavior adopted by households facing a shock. Currie and Almond (2011) discuss parental behavior in a two period childhood model, where investment in children's human capital is decomposed into a component in the early childhood, and a component in later childhood. Whether or not it is optimal for parents to compensate for a negative shock in early childhood, or on the contrary, reinforce the effects of the negative shock, essentially depends on the substitutability between investment in the two periods. When investments are relatively complementary (such that mitigating a shock to early investment in the second period is hard), it might be optimal for parents to reinforce the impact of shocks and defer resources to personal consumption in the second period. In general, ignoring parental utility or household responses might overstate or understate the true effect of a shock in models with household fixed effects (Currie and Almond (2011)). In the specific case of a death in the household, however, what is being estimated is essentially the parental (or household head) response to a shock that is multi-level in nature, modifying not only resource inputs into the utility function (such as market and domestic work), but the utility function itself. If the polygamous household head's utility function is a nested one, depending on the utility of all other household members, and the utility of co-wives depends on investments made to their children, the household head's marginal utility of investing into the child decreases upon the death of its caregiver.

As previously stated, the nuclear family model is likely to be of little relevance in Sub Saharan Africa. Yet, studies taking into account differential impacts within the household are few, and mainly restricted to the distinction between boys and girls. It seems that generally girls are more affected than boys by a death in the family (Evans and Miguel 2007; Operario et al. 2008; Senne 2014). Perhaps closest in spirit to us, Case, Paxson, and Ableidinger (2004) revisit the *Hamilton* hypothesis from evolutionary biology, namely that altruistic behavior amongst individuals is an increasing function of their genetic proximity. Thus, parents should care more about their children than grand-parents, who should care more than cousins. Using cross-sectional data from 10 countries, they conclude that, within households, orphans are worse off than non orphans in terms of enrollment figures, and find support for the Hamilton hypothesis.

3 Data and empirical specification

3.1 Data

The data come from an original individual panel survey entitled Pauvreté et Structure Familiale (henceforth PSF), conducted in Senegal in 2006-2007 for the first wave and in 2010-2012 for the second. The PSF survey results from cooperation between a team of French researchers

and the National Statistical Office of Senegal (See De Vreyer et al. (2008) for details.)[3]. It is a nationally representative survey covering 1 800 households in the first wave, spread over 150 clusters drawn randomly from the census districts so as to ensure a nationally representative sample (only 1 781 households can be used). This sample will be referred to as the primary sample in what follows. To these households are added 220 supplementary households identified as being households of nonresident spouses of primary sample household heads. They are called secondary households. This special feature results from the observation that in Senegal polygyny is very much widespread and that it sometimes occurs for all spouses in a polygamous marriage to not reside together. Including secondary households in the survey allows us to better study households' living standards and how they adapt to their changing environment. In the second wave, every single individual that was observed in the first wave was tracked and re-interviewed, together with her current household if found in Senegal. A total of 16 152 individuals belonging to primary (14 379 individuals in 1 781 households) and secondary (1 773 individuals in 220 households) households were tracked, 83.6% (13 506 individuals) of whom were found and re-interviewed. They live in 2 964 households, making up a total sample of 28 312 individuals in the second wave.

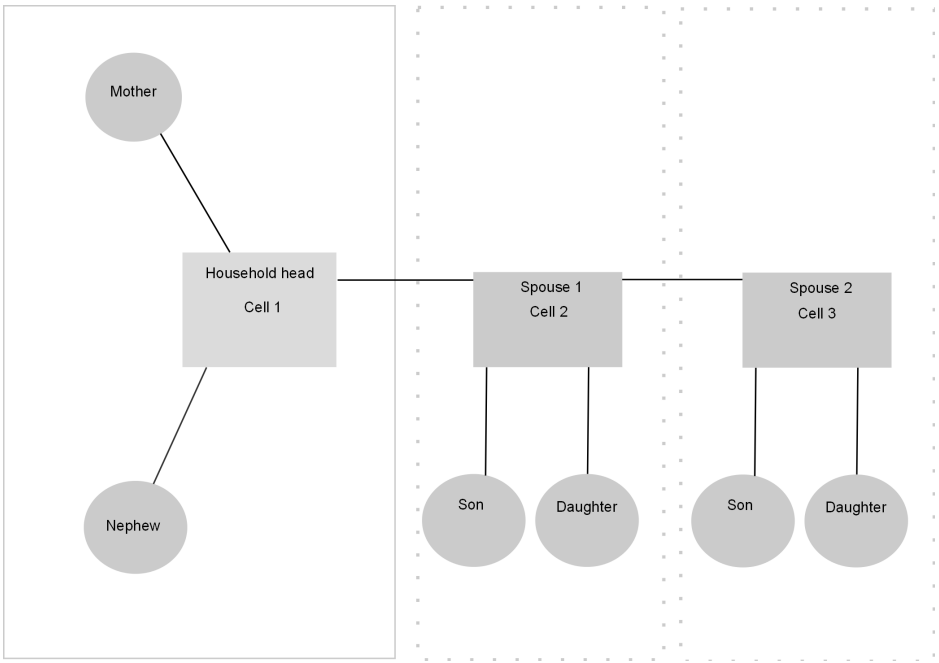
The PSF survey was designed to allow for a more precise measurement of individual access to resources than traditional consumption surveys. Interviews conducted at the early stages of the PSF project showed that within Senegalese households, it is possible to distinguish sub-groups of household members (henceforth referred to as *cells*) that are at least partly autonomous in their budget management. Consumption common to various cells in the household appeared clearly defined, as well as the responsibilities for paying for that consumption, and cells' own resources turned out to be not entirely pooled in the household.

The survey collects the usual information on individual characteristics, as well as a detailed description of the household structure and budgetary arrangements. Households are divided into cells according to the following rule: the head of household (a man most of the time) and unaccompanied dependent members, such as his widowed parent or children whose mother does not live in the same household, are grouped together. Then, each wife and her children and, potentially any other dependent under her care, make up a separate group. Finally, any other family nucleus such as a married child of the household head with his/her spouse and children also form separate groups. Polygamous men other than the household head are treated in the same way as the head, with the husband and each wife in separate cells. This decomposition emerged from field interviews as being the relevant way to split the households into components. It corresponds well to the sociology of households in Senegal and in the field it was never difficult to master, neither by the enumerators who found it fairly natural, nor by the households themselves.

In the PSF sample, more than a third of households contain at least three cells. The grouping of household members in distinct cells allows for the collection of consumption expenditures made to benefit members of a given cell. For children, it also allows us to identify who is taking care of them aside from the household head. This feature will be used to identify within households the differential impacts of adult deaths on children according to their relationship to the deceased person.

[3]Momar Sylla and Matar Gueye of the Agence Nationale de la Statistique et de la Démographie of Senegal (ANSD), and Philippe De Vreyer (University of Paris-Dauphine and IRD-DIAL), Sylvie Lambert (Paris School of Economics-INRA) and Abla Safir (now with the World Bank) designed the survey. The data collection was conducted by the ANSD.

Figure 1: Example of a 3-cell Senegalese household



3.2 Empirical specification

In this paper we estimate the impact of adult deaths on several outcomes pertaining to children: school entry, current school enrollment, current and past labor market work, participation in domestic chores and fostering. The empirical strategy is based on the linear probability model and makes use of the panel dimension of the data and of the grouping of cells within households.

Two kinds of regressions are estimated. First, keeping all households with children in age of being affected, the definition of which varies with the outcome of interest, we compare outcomes of children who have experienced a death in their household between the two waves of the survey with outcomes of those who have not. The basic model is a treatment model, so that our estimator is a double difference. Second, we draw benefit from the identification of budgetary independent cells within households to compare outcomes between children of different cells while removing household fixed effects: we thus identify the differential impact of a cell head death between the two waves, depending on whether the children belonged to the impacted cell in the first wave or not. For these regressions, the sample is reduced to households that have experienced a cell head death. Furthermore, since the head of the household (who is also a cell head) plays a specific role in the intra-household allocation of resources between cells, and since the death of

the household head is likely to result in the household breaking up, we choose to restrict the sample to households in which the household head himself did not die. Hence, we compare impacts between cells that are fully comparable.

Estimates of death impacts may be biased by two different sources of unobserved heterogeneity. First, it may be the case that deaths are not random, and that the probability that someone dies in a household is linked to unobserved characteristics correlated with child outcomes, even when controlling for household size, total expenditure, adult education levels and any other pertinent and observable characteristics. Such unobserved heterogeneity would probably upwardly bias estimates of the magnitude of the effects, as those households that *ceteris paribus* are more likely to experience deaths are also more likely to underinvest in children's education and to need their work inputs. To deal with this potential source of endogeneity we use the panel dimension of the data to produce individual fixed effects estimates and check that they are not significantly different from those obtained when fixed effects are not removed. The results from the Random effects and Fixed effects models are remarkably similar, leading us to conclude that the total bias associated with selection of individuals likely to experience death is close to zero. Second, since we evaluate deaths impacts by double differences, that is comparing time changes in outcomes between impacted and non impacted individuals, we need to make the assumption that deaths are unpredictable events, such that adjustments in the allocation of household resources do not precede death. While this might be true when death results from crime or accidents, the majority of recorded deaths among prime-age adults were due to illness, and one might reasonably expect that a share of them were at least partly anticipated at the date of the first survey round. Falling ill might imply loss of labor capacity, and the need for care at home, and adjustment of child labor and schooling are thus likely to set in before death. For our purpose however, it suffices that death was unpredictable at the date of the first survey. This is likely to be all the more true the later the death occurred. Since some deaths probably occurred shortly after the first survey round, we cannot however definitely claim that all recorded deaths were unpredictable events in 2005-2006. When death is anticipated, adjustments are likely to precede actual death and part of the adjustment process might already have begun when individuals were interviewed for the first time. As such, there is a bias towards zero on estimated coefficients which should therefore be considered as lower bounds of the true effect of illness and death on households' allocation of time and resources.

In order to further investigate the assumption regarding predictability of death, we turn to two other sources of information: epidemiological data, and self-assessed health. The global burden of disease survey provides data on causes of death by country and age-range. Table A5 shows the main causes of death in Senegal for individuals between 15 and 49 years of age. While some causes are clearly associated with long-term illnesses (such as HIV and some forms of cancer), the majority are associated with rather abrupt deaths. Furthermore, self-assessed health is known to be a good predictor of mortality (Idler and Benyamini 1997), and by definition an even better predictor of an individual's

belief regarding his or her probability of dying. Looking at self-assessed health in the first round of the PSF survey, by subsequent mortality status in round 2, gives us an idea on whether or not death seemed to be anticipated. Table A6 shows that while individuals who died in between panel rounds did indeed give a worse assessment of their health situation than individuals who survived, some 79% still believed that they were in average or above average health. We interpret this finding as another sign of death being -in the majority of cases -an unanticipated shock to the household.

4 The evolution of Senegalese households between 2006 and 2012

Table 1 shows some characteristics of individuals from the two waves of the PSF survey. It should be noted that although the first wave data are representative of the Senegalese population, the second wave data are not. However, a look at the gender and age composition of our two samples shows that they are not significantly different. Looking at the proportion of children ever enrolled in school for those between 4 and 9 years old [4], or currently in school for those between 4 and 17, it seems that current school enrollment made some progress between the two waves. This is reflected in aggregate data, where the gross primary intake increased from 67.3% to 96.4% in the period 1999-2014 (UNESCO 2016) and mirrors efforts made by the government to increase quantity and quality of schooling in accordance with the millennium development goals. However, at the same time, labor market work increased among children between 6 and 17, while participation in household domestic chores and the hours of domestic work carried out were reduced. The proportion of fostered children rose from 8% to 10%. Thus, school participation and labor market work seem to have increased over the period at the expense of domestic work. This could be good news if those at school or at work accumulate human capital or labor market experience that could increase their incomes in the future. Our data, however, does not allow us to investigate this.

In the next table (Table 2) we examine the same outcomes, but this time only for children that are observed in the two waves. Here we see that amongst children aged between 4 and 9 in the first wave and that were not at school at that time (55%) only 53% ((0.73-0.45)/0.55) entered at school during the four and a half years (on average) separating the two surveys, leaving 27% of these children out of school. As school entry generally occurs before ten (though the official age of entry is 6), one can expect that very few of them will start studying later. Consistent with the previous results we observe that the proportion of children that were between 4 and 17 at the time of the first wave and who are currently at school increases from 51% to 57%. The proportion of children between 6 and 17 who are working or have been working in the past also increases from 26% to 40%, while that of those currently working rises from 18% to 33%.

[4] In Senegal primary school normally starts at 6. Children may however go to pre- or nursery school before that age. On the opposite, a significant number of children delay their entry at school. For those that ever go to school, most of them enter before ten.

Table 1: Evolution of child characteristics in Senegal between 2006 and 2012 (all observations)

Sample selection criteria		All observations				
		Wave 1		Wave 2		
		N	Mean	N	Mean	Diff. (s.e.)
Males	All individuals less than 18	7622	0.5	13373	0.49	-0.01 (0.01)
Age	All individuals less than 18	7622	7.97	13373	7.74	-0.23 (0.07)
Went to school	Children between 4 and 9	2382	0.43	4435	0.44	0.01 (0.01)
Currently at school	Children between 4 and 17	5315	0.49	9488	0.54	0.05 (0.01)***
Ever worked	Children between 6 and 17	4754	0.26	8131	0.28	0.02 (0.01)***
Currently working	Children between 6 and 17	4754	0.18	8131	0.24	0.06 (0.01)***
Is doing domestic work	Children between 6 and 17	4754	0.53	8131	0.48	-0.05 (0.01)***
Hours of domestic work	Children between 6 and 17	4754	8.17	8131	5.7	-2.5 (0.26)***
Fostered	Children less than 15	6319	0.08	11337	0.10	0.012 (0.00)***

Source: PSF survey, waves 1 and 2, authors' calculations

We also observe an increase in the proportion of those doing domestic work and in the number of hours spent working on household chores. Finally, we observe a small increase in the proportion of fostered children. These results are all in line with what could be expected when looking at a sample of children over a four year span: school enrollment increases together with market and domestic work.

Table 2: Evolution of child characteristics in Senegal between 2006 and 2012 (panel observations)

Sample selection criteria		Panel sample			
			Wave 1	Wave 2	
		N	Mean	Mean	Diff. (s.e.)
Males	Children less than 18 in wave 1	6486	0.49	0.49	-
Age	Children less than 18 in wave 1	6486	7.91	12.4	4.44 (0.09)***
Went to school	Children between 4 and 9 in wave 1	2033	0.45	0.73	0.29 (0.01)***
Currently at school	Children between 4 and 9 in wave 1	2033	0.44	0.69	0.25 (0.02)***
Written calculations	Children between 8 and 17 in wave 1	2996	0.58	0.62	0.04 (0.01)***
Ever worked	Children between 6 and 17 in wave 1	4025	0.26	0.4	0.14 (0.01)***
Currently working	Children between 6 and 17 in wave 1	4025	0.18	0.33	0.15 (0.01)***
Is doing domestic work	Children between 6 and 17 in wave 1	4025	0.53	0.64	0.11 (0.01)***
Hours of domestic work	Children between 6 and 17 in wave 1	4025	8.35	10.74	2.40 (0.39)***
Fostered	Children less than 15 in wave 1	5378	0.08	0.12	0.04 (0.01)***

Source: PSF survey, waves 1 and 2, authors' calculations

Table 3 sums up our main explanatory variables, namely deaths occurring in the households. Frequencies given are those of the affected children, and categories are not mutually exclusive. A child who lost both his mother and his younger brother will thus appear both in the "Any young member" and "Any adult female" categories. The affected children are all present in both rounds of the panel, and the deaths occurred sometime between the two waves. The most prevalent cause of death is sickness, followed by old age. Violent crime and accidents account for very few deaths.

Table 3: Identity of the deceased and number of bereaved children, by sex

Deceased	Both genders		Girls		Boys	
	Frequency	% of sample	Frequency	% of sample	Frequency	% of sample
Any member	1293	19.9%	653	19.8%	640	20.0%
Any adult (15-64)	558	8.6%	275	8.4%	283	8.9%
Household head	413	6.4%	211	6.4%	202	6.3%
Any head of cell	742	11.4%	355	10.8%	387	12.1%
Cell head (except HH)	329	5.1%	144	4.4%	185	5.8%
Any young member (<15)	316	4.9%	165	5.0%	151	4.7%
Any old member (>64)	561	8.6%	281	8.5%	280	8.8%
Any adult male (15-64)	278	4.3%	142	4.3%	136	4.3%
Any adult female (15-64)	299	4.6%	137	4.2%	162	5.1%
Individual's cell head	83	1.3%	41	1.2%	42	1.3%
Individual's cell head (except HH)	57	0.9%	25	0.8%	32	1.0%

Source: PSF survey, waves 1 and 2, authors' calculations.
Population: Children less than 18 years old.

5 Consequences of a death in the household

5.1 Impacts by deceased individual

We first set out to investigate the impact of deaths of different members on children in the household, regardless of their relationship to the deceased. This way, we can estimate an average effect of losing a particular household member. All models in this subsection use individual fixed effects[5]. In the next subsection, the division of households into cells is made use of in order to identify the relative effects between children in a given household. The following tables show estimated coefficients from an individual panel regression model. Overall, results show that deaths in the household do not seem to influence schooling significantly when the relationship between members is ignored. Adult male deaths do however influence the decision to send children to work, while we notice an increased participation of children in domestic work, following the death of an adult female.

Two variables capture schooling adjustments: "currently at school", and "ever enrolled". As can be seen from Table 4, being currently at school is not significantly correlated with household deaths. The same holds for "ever enrolled" (not shown). This suggests that households do not respond to deaths neither through having children dropping out from school, nor by preventing younger children from entering school (although, as we shall see, the effect on children is conditional on their relationship to the deceased). Rather, households' losses seem to be mitigated by increases in child labor (tables 5 to 7) ; both current market work and domestic chores of children[6] rise significantly when households lose adult members. In particular, the loss of a male adult is associated with

[5]A random effects model has also been run for each regression, and results remain qualitatively unchanged.

[6]The adjustment takes place both at the extensive and intensive margins; however, only the number of hours of work is reported here.

Table 4: Death impact on current schooling - Individual fixed effects - Children aged between 4 and 17 in first wave

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Age (years)	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
2nd round	0.13***	0.13***	0.13***	0.13***	0.13***	0.13***	0.13***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Identity of the deceased:							
Household head	0.04						
	(0.028)						
Cell head (not HH)		-0.03					
		(0.045)					
Adult (15-64) member			0.02				
			(0.033)				
Member less than 15				-0.00			
				(0.033)			
Member more than 64					0.00		
					(0.030)		
Male adult (15-64) member						0.06	
						(0.040)	
Female adult (15-64) member							-0.02
							(0.048)
Constant	0.54***	0.54***	0.54***	0.54***	0.54***	0.54***	0.54***
	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
Observations	8,958	8,958	8,958	8,958	8,958	8,958	8,958
R-squared	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Number of individuals	4,479	4,479	4,479	4,479	4,479	4,479	4,479

Standard errors clustered at the household level.
*** p<0.01, ** p<0.05, * p<0.10
Source: PSF survey, waves 1 and 2, authors' calculations

an increase in current market work (table 6), while the loss of a female adult is associated with an increase in the hours of household chores carried out by children (table 7). Distinguishing effects by sex, table A11 in the appendix shows an increased probability of market work for girls upon the death of their cell heads[7].

Table 5: Death impact on the probability of having ever worked on the market - Individual fixed effects - Children aged between 6 and 17 in first wave

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Age (years)	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
2nd round	0.09***	0.09***	0.09***	0.09***	0.09***	0.09***	0.09***
	(0.021)	(0.021)	(0.022)	(0.022)	(0.022)	(0.021)	(0.021)
Identity of the deceased:							
Household head	0.01						
	(0.039)						
Cell head (not HH)		0.05					
		(0.053)					
Adult (15-64) member			0.03				
			(0.036)				
Member less than 15				-0.02			
				(0.046)			
Member more than 64					0.05		
					(0.039)		
Male adult (15-64) member						0.03	
						(0.057)	
Female adult (15-64) member							0.02
							(0.038)
Constant	0.06*	0.06*	0.06*	0.06*	0.06*	0.06*	0.06*
	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)
Observations	8,038	8,038	8,038	8,038	8,038	8,038	8,038
R-squared	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Number of individuals	4,019	4,019	4,019	4,019	4,019	4,019	4,019

Standard errors clustered at the household level.
*** p<0.01, ** p<0.05, * p<0.10

Appendix Table A13 shows that girls carry the load of an increased charge of domestic chores. Regressions run on the extensive margin however suggests that boys' participation in domestic work increases, although their number of hours of help does not. Inversely, girls' participation is not affected. The fact that girls adjust in the intensive margin only might stem from the fact that conventionally girls participate in domestic chores, while boys do not, unless under exceptional circumstances such as the death of an adult woman in the household. In the case of a loss of a female adult, girls need on average to carry out an additional 8.7 hours of domestic work per week. The fact that girls carry out unpaid caregiving work upon maternal deaths was previously

[7]This result is robust to the exclusion of children belonging to the cell whose cell head is deceased, such that girls from all cells in the household are found to increase domestic chores upon the death of a household head.

highlighted in the study of Evans (2014) on deaths among the Serer people in Senegal.

Table 6: Death impact on current market work - Individual fixed effects - Children aged between 6 and 17 in first wave

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Age (years)	0.01**	0.01**	0.01**	0.01**	0.01**	0.01***	0.01***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
2nd round	0.11***	0.11***	0.11***	0.11***	0.11***	0.10***	0.11***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Identity of the deceased:							
Household head	0.04						
	(0.041)						
Cell head (not HH)		0.03					
		(0.062)					
Adult (15-64) member			0.05				
			(0.042)				
Member less than 15				-0.05			
				(0.044)			
Member more than 64					0.06		
					(0.038)		
Male adult (15-64) member						0.11*	
						(0.062)	
Female adult (15-64) member							-0.02
							(0.045)
Constant	-0.04	-0.04	-0.04	-0.04	-0.03	-0.04	-0.04
	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)
Observations	8,038	8,038	8,038	8,038	8,038	8,038	8,038
R-squared	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Number of individuals	4,019	4,019	4,019	4,019	4,019	4,019	4,019

Standard errors clustered at the household level.
*** p<0.01, ** p<0.05, * p<0.10

Concerning fostering, Table 8 shows that a death in the household increases the probability of being fostered, although the effect is only significant for that of the household head. Looking at the breakdown by sex (appendix Table A15) the effect is significant for boys only. There is also a significant association between the death of a young member of the household and girl fostering. The urban-rural breakdown (appendix Table A16) shows that this is a rural phenomenon: the death of any household member (except for adult males where the coefficient is not significant) increases the probability that a child is fostered, whereas in the urban setting coefficients are never significant.

Summing up, no significant impact is found on the average child's schooling following the death of an adult in a household. A small effect, driven by boys, is found for current market work when adult males die. A strong impact is found on girls' hours of domestic work following the death of an adult woman, and fostering out a child is found to be among the preferred coping strategies in rural areas. These results are obtained comparing children in impacted households with children from other households, and individual fixed effects are removed in order to account for unobserved heterogeneity

Table 7: Death impact on hours of household chores - Individual fixed effects - Children aged between 6 and 17 in first wave

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Age (years)	0.52***	0.52***	0.52***	0.53***	0.52***	0.53***	0.52**
	(0.201)	(0.201)	(0.201)	(0.201)	(0.200)	(0.201)	(0.201)
2nd round	-0.00	0.00	-0.07	0.03	-0.02	0.06	-0.02
	(0.923)	(0.923)	(0.919)	(0.931)	(0.929)	(0.921)	(0.921)
Identity of the deceased:							
Household head	1.63						
	(1.326)						
Cell head (not HH)		1.88					
		(1.571)					
Adult (15-64) member			2.10				
			(1.317)				
Member less than 15				0.94			
				(1.566)			
Member more than 64					1.55		
					(1.251)		
Male adult (15-64) member						0.52	
						(1.847)	
Female adult (15-64) member							3.48**
							(1.662)
Constant	2.49	2.50	2.59*	2.38	2.53	2.38	2.60*
	(1.555)	(1.543)	(1.557)	(1.541)	(1.541)	(1.546)	(1.551)
Observations	8,038	8,038	8,038	8,038	8,038	8,038	8,038
R-squared	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Number of individuals	4,019	4,019	4,019	4,019	4,019	4,019	4,019

Standard errors clustered at the household level.
*** p<0.01, ** p<0.05, * p<0.10

Table 8: Death impact on probability to be fostered - Individual fixed effects - Children less than 15, not fostered in first wave

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Age (years)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
2nd round	0.02*	0.02*	0.02*	0.02*	0.02*	0.02*	0.02*
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Identity of the deceased:							
Household head	0.03*						
	(0.020)						
Cell head (not HH)		0.01					
		(0.029)					
Adult (15-64) member			0.02				
			(0.016)				
Member less than 15				0.04			
				(0.026)			
Member more than 64					0.02		
					(0.020)		
Male adult (15-64) member						0.01	
						(0.019)	
Female adult (15-64) member							0.02
							(0.023)
Constant	-0.02*	-0.02**	-0.02*	-0.02*	-0.02*	-0.02**	-0.02*
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Observations	9,518	9,518	9,518	9,518	9,518	9,518	9,518
R-squared	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Number of individuals	4,759	4,759	4,759	4,759	4,759	4,759	4,759

Standard errors clustered at the household level.
*** p<0.01, ** p<0.05, * p<0.10

that could bias the estimates.

Thus far, we have neglected the links between children and deceased individuals. While an adult death does not seem to (much) impact the average child's schooling and market work, it is not unlikely that effects are conditional on the relationship between the deceased and the child, such that children whose main caregiver dies are more impacted than others in the same household. This will be explored in the next section, where we shall focus on the death of a cell head.

5.2 The penalty of losing a cell head

We now turn our attention to the impact of the death of a cell head, focusing on children belonging to the impacted cell. When not taking into account the relationship between the deceased adult and the child, the death of a cell head did not give rise to any significant change in children outcomes in the first set of regressions. In this section, we take this relationship into account: first comparing children who lost their cell head to others who did not, whether or not they live in the same household ; second comparing impacted children to other children of the same household, but belonging to a different cell. Throughout this section, we exclude the first cell of each household, since the household head's cell is a particular one and the death of its head usually leads to the household splitting up.

5.2.1 Individual fixed effects

First, we compare individuals who lost their cell heads to individuals who did not, controlling for individual fixed effects. In these regressions, the control sample is made of children who did not lose their cell head, whether or not they belong to the same household. Results in Table 9 show that being the child of a deceased cell head is significantly and negatively associated with school attendance, positively associated with having worked and with having been fostered. Interestingly, we observe that the effects seem to be limited to children of the impacted cell, since children who leave in a household where a cell head died, but whose own cell head is still alive do not seem to be impacted. The channels of household coping are thus primarily defined within cells, rather than within households, although as previously shown, all children in the household might adjust to some extent in case of death of other members, especially through market and domestic work. This adjustment is likely to be sex-specific, as the previous section showed.

The latter argument finds support from the fact that the coefficients pertaining to domestic work in Table 9 are not significant, suggesting that children under the care of the deceased do not have to help out in the case of death; a look at appendix Table A17 however shows an effect which differs with the sex of the child. As previously, the death of a cell head (usually a woman) implies that all girls in the household need to work more domestic hours. There is also an effect on the boys inside the affected cell.

Table 9: Cell head death impact on various outcomes - Individual fixed effects

	Curr. in school	Ever worked	Curr. working	Doing dom. work	Hours dom. work	Fostered
Age (years)	-0.02***	0.00	0.01	0.01**	0.43*	0.00
	(0.004)	(0.004)	(0.004)	(0.005)	(0.238)	(0.003)
2nd round	0.14***	0.11***	0.12***	0.07**	0.29	0.03*
	(0.021)	(0.024)	(0.025)	(0.028)	(1.096)	(0.015)
Cell head death* 2nd round	0.03	0.04	0.03	-0.01	3.15	0.00
	(0.066)	(0.075)	(0.090)	(0.068)	(2.203)	(0.013)
Own cell head death* 2nd round	-0.25*	0.24**	0.11	0.11	-0.87	0.17
	(0.126)	(0.107)	(0.159)	(0.145)	(4.627)	(0.105)
Constant	0.49***	0.10***	-0.01	0.33***	3.52**	-0.01
	(0.028)	(0.034)	(0.035)	(0.038)	(1.787)	(0.010)
Observations	6,484	5,690	5,690	5,690	5,690	7,948
R-squared	0.03	0.07	0.08	0.04	0.02	0.02
Number of individuals	3,242	2,845	2,845	2,845	2,845	3,974

Standard errors are clustered at the household level.
*** p<0.01, ** p<0.05, * p<0.10
Samples differ from one regression to the other. School enrolment: 4 to 9 years old in first wave ;
Current schooling: 4 to 17; Currently working, Domestic work, Ever worked: 6 to 17;
Fostered: 0 to 14 and not fostered in first wave.

Regarding market work, the non-significant coefficients indicate that cell head deaths are not associated with increased labor for the individuals inside or outside the affected cell. For the probability of having ever worked the coefficient is however significant. It is thus plausible that children whose head of cell dies are more frequently mobilized in the short term but that eventually other coping mechanisms are put in place.

5.2.2 Household fixed effects

In the preceding analysis we were comparing children whose cell head died with children whose cell head stayed alive, regardless of the household they belonged to. Since individual fixed effects are accounted for, we can expect these results to be robust estimates of the impact of a cell head death on children's outcomes in the average population. However, they do not show whether or not, within the affected household, all children are treated equally. In order to answer this question, we now turn to within-household estimates. We run the same regressions with household fixed effects, decomposing results by sex and by area of residence. Results are shown in tables 10 to 14. They show that being the child of the cell head who died has adverse effects larger than those on other children in the household, suggesting that the extended family does not provide as good an insurance as may have been argued.

Table 10 shows results for current school attendance.[8] The effects are very large indeed: being under the care of the individual who died reduces the probability of going to school by 24% to 33%, compared to the average school attendance in the household, which one can assume to be close to the population average in the second wave, that is 69%. Surprisingly, the impact is only significant for boys, though the coefficient for girls has the same size. Tables 11 and 12 show that the reduction in school attendance is mirrored in the increase in labor market work. Once again compared to the household mean, the probability of working increases by 31% in urban areas for children whose cell head died (Table 11). Larger effects are found for the probability of ever having worked, which suggests, as already mentioned, that following the death of their main caregiver, children are temporarily put to work (Table 12). However no impact is found on domestic work (Table 13), suggesting along the previous results that when an adult dies her load of household chores is redistributed among all children. Finally, Table 14 shows that fostering is another way of adjusting to the death of an adult, particularly for girls.

To sum up, when it comes to children of deceased cell heads, the negative impacts seen in the previous regressions are confirmed. In a given household that has seen the death of a cell head, the boys under the care of the person are less likely to go to school, and more likely to work, while the girls are more likely to be fostered. Dropping out of school seems to be the main channel of adjustment in rural areas, whereas child labor seems to be dominant in urban areas.

Table 10: Cell head death impact on current schooling - Household fixed effects - Children between 4 and 17 in first wave

	Full sample	Girls	Boys	Urban	Rural
Male	-0.06			-0.14	-0.03
	(0.065)			(0.139)	(0.076)
Age (years)	-0.01*	-0.03**	0.00	-0.01	-0.02*
	(0.007)	(0.012)	(0.013)	(0.017)	(0.008)
Death of own cell head	0.14*	0.15	0.19	0.17	0.15
	(0.086)	(0.215)	(0.135)	(0.174)	(0.089)
2^{nd} round	0.15**	0.27***	0.06	0.03	0.22**
	(0.063)	(0.081)	(0.081)	(0.071)	(0.082)
Own cell head death*2^{nd} round	-0.27**	-0.26	-0.29**	-0.13	-0.36*
	(0.124)	(0.212)	(0.133)	(0.134)	(0.177)
Constant	0.58***	0.64***	0.43**	0.83***	0.42**
	(0.125)	(0.103)	(0.212)	(0.141)	(0.180)
Observations	368	164	204	138	230
R-squared	0.42	0.46	0.53	0.34	0.43

Standard errors are clustered at the household level.
*** p<0.01, ** p<0.05, * p<0.10

[8]Sample size in tables 10 to 14 is reduced since households in which no cell head died do not contribute to the estimation. Keeping them in the sample does not significantly change the results

Comparing the results of the "Full sample" column from the household fixed effects regressions shown in tables 10-14 to the results in the individual fixed effects regressions shown in table 9 shows qualitatively similar results (the coefficients for schooling and fostering are slightly bigger, and the one associated with ever having done market work smaller). This confirms our previous results on schooling, where we found that belonging to a household that experienced a death had no significant impact. Rather, it is being in a cell that experiences a death that matters. Finally, running the regressions on school presence by consumption quartile (not shown) shows that our effects are driven by the lower half of the income distribution, in line with results from previous literature (Yamano and Jayne 2005).

Table 11: Own cell head death impact on current market work - Household fixed effects - Children between 6 and 17 in first wave

	Full sample	Girls	Boys	Urban	Rural
Male	0.08*			0.14*	0.05
	(0.046)			(0.069)	(0.060)
Age (years)	0.02***	0.02	0.03**	0.03**	0.02**
	(0.008)	(0.014)	(0.011)	(0.010)	(0.010)
Death of cell head	-0.00	-0.03	0.04	-0.17	0.08
	(0.103)	(0.242)	(0.138)	(0.128)	(0.136)
2^{nd} round	0.08	0.12	0.06	-0.07	0.17
	(0.111)	(0.137)	(0.130)	(0.044)	(0.158)
Own cell head death* 2^{nd} round	0.06	0.04	0.07	0.31**	-0.07
	(0.173)	(0.159)	(0.232)	(0.120)	(0.254)
Constant	-0.25	-0.20	-0.21	-0.19	-0.26
	(0.149)	(0.184)	(0.207)	(0.150)	(0.208)
Observations	336	144	192	120	216
R-squared	0.42	0.37	0.52	0.58	0.36

Standard errors are clustered at the household level.
*** p<0.01, ** p<0.05, * p<0.10

Table 12: Own cell head death impact on the probability of having ever worked on the market - Household fixed effects - Children between 6 and 17 in first wave

	Full sample	Girls	Boys	Urban	Rural
Male	0.06			0.08	0.09
	(0.046)			(0.080)	(0.056)
Age (years)	0.04***	0.04***	0.06***	0.02	0.05***
	(0.008)	(0.014)	(0.012)	(0.011)	(0.009)
Death of cell head	-0.06	0.07	-0.03	-0.19	-0.02
	(0.086)	(0.127)	(0.100)	(0.132)	(0.108)
2^{nd} round	-0.01	-0.02	-0.04	-0.01	0.01
	(0.077)	(0.106)	(0.096)	(0.049)	(0.114)
Own cell head death*2^{nd} round	0.20	0.16	0.21	0.29**	0.16
	(0.121)	(0.163)	(0.141)	(0.119)	(0.172)
Constant	-0.21	-0.18	-0.29*	-0.12	-0.24
	(0.142)	(0.216)	(0.145)	(0.137)	(0.180)
Observations	336	144	192	120	216
R-squared	0.58	0.57	0.65	0.49	0.54

Standard errors are clustered at the household level.
*** p<0.01, ** p<0.05, * p<0.10

Table 13: Own cell head death impact on hours of domestic work - Household fixed effects - Children between 6 and 17 in first wave

	Full sample	Girls	Boys	Urban	Rural
Male	-13.21***			-13.17**	-13.36***
	(2.300)			(4.990)	(2.808)
Age (years)	1.64***	3.10***	0.33	1.66**	1.63***
	(0.290)	(0.794)	(0.299)	(0.724)	(0.320)
Death of cell head	-2.88	-9.89	-2.23	1.83	-4.69
	(2.535)	(9.991)	(1.655)	(2.110)	(3.226)
2^{nd} round	-1.88	-0.97	-3.01	-2.43	-1.58
	(2.175)	(3.281)	(3.314)	(3.300)	(2.978)
Own cell head death*2^{nd} round	-0.25	-1.38	3.96	-3.27	1.44
	(4.761)	(10.576)	(2.754)	(3.680)	(7.168)
Constant	-3.22	-24.36***	3.63	-7.53	-0.97
	(3.272)	(8.268)	(2.557)	(5.618)	(4.469)
Observations	336	144	192	120	216
R-squared	0.37	0.54	0.33	0.39	0.35

Standard errors are clustered at the household level.
*** p<0.01, ** p<0.05, * p<0.10

Table 14: Own cell head death impact on probability of being fostered - Household fixed effects - Children less than 15 not fostered in first wave

	Full sample	Girls	Boys	Urban	Rural
Male	0.01			-0.00	0.02
	(0.019)			(0.023)	(0.024)
Age (years)	-0.00	0.00	-0.00	0.00	-0.00
	(0.002)	(0.003)	(0.004)	(0.003)	(0.004)
Death of cell head	0.06	0.01	0.19	0.04	0.07
	(0.042)	(0.046)	(0.117)	(0.071)	(0.050)
2^{nd} round	0.04**	0.02	0.06**	0.03	0.05*
	(0.016)	(0.028)	(0.026)	(0.017)	(0.026)
Own cell head death*2^{nd} round	0.18	0.27*	0.11	0.15	0.21
	(0.120)	(0.155)	(0.120)	(0.148)	(0.181)
Constant	-0.04	-0.03	-0.05	-0.04	-0.04
	(0.025)	(0.032)	(0.044)	(0.040)	(0.034)
Observations	384	174	210	150	234
R-squared	0.23	0.33	0.22	0.27	0.22

Standard errors are clustered at the household level.
*** p<0.01, ** p<0.05, * p<0.10

5.3 Robustness checks

The previous models have all used individual or household fixed effects in order to establish a relationship between bereaved children and various outcomes. In particular, we have shown that when a cell head dies, the children belonging to this cell suffer heavy adjustments. Household fixed effects ensures that this result is not driven by selection at the household level. However, it could be that within a household, cells differ on some observable or unobservable characteristic which leads to be more exposed to death while also having children at a higher risk of dropping out of school, being fostered or joining the labor market. Appendix Tables A2-A4 show that the affected cells are indeed different on some sociodemographic characteristics, such as the average age and sexe of the cell head. However, it is unclear if this would lead to a bias in the results, and what direction the bias would take. A first test for cell selection is to estimate the same regressions that we did in tables 4 to 9, but this time not removing individual fixed effects. If estimates are unchanged, this supports the hypothesis that cell fixed effects are not explaining our results. This is what we did (results not shown) and indeed, keeping or removing individual fixed effects from the regressions yields very similar results in terms of coefficients size, sign, and significance. The second test is to keep the same samples as in tables 10 to 14, that is households who experienced the death of a cell head, but this time removing individual instead of household fixed effects. As shown in the table below, this hardly modifies the coefficients obtained in the household fixed effects regressions.

Table 15: Cell head death impact on various outcomes - Individual fixed effects - Impacted households only

	Curr. in school	Ever worked	Curr. working	Doing dom. work	Hours dom. work	Fostered
Age (years)	-0.02	0.00	-0.01	0.05*	3.18*	-0.02
	(0.030)	(0.023)	(0.033)	(0.024)	(1.754)	(0.011)
2nd round	0.20	0.17	0.23*	-0.10	-8.93	0.10*
	(0.127)	(0.108)	(0.137)	(0.150)	(7.795)	(0.055)
Own cell head death* 2nd round	-0.27**	0.20*	0.06	0.13	-0.11	0.18
	(0.113)	(0.115)	(0.161)	(0.128)	(4.330)	(0.113)
Constant	0.63***	0.07	0.03	0.04	-21.88*	0.00
	(0.228)	(0.208)	(0.302)	(0.151)	(12.771)	(0.022)
Observations	368	336	336	336	336	384
R-squared	0.05	0.20	0.13	0.06	0.14	0.16
Number of indpsf2	184	168	168	168	168	192

Standard errors are clustered at the household level.
*** p<0.01, ** p<0.05, * p<0.10
Samples differ from one regression to the other. School enrolment: 4 to 9 years old in first wave ;
Current schooling: 4 to 17; Everworked, Currently working; Domestic work: 6 to 17;
Fostered: 0 to 14 and not fostered in first wave.

6 Concluding remarks

In this article, we have attempted to shed light on the linkages between death and children outcomes in Senegal. Our dataset allows to take into account the complex structure of extended and polygamous households. Within households, relatively independent budgetary units, cells, can be identified, and children assigned to these cells. We look at the impacts of adult death shocks on children, paying special attention to the relationship between the child and the deceased. First, we find that for the average child in the household, a death does not lead to a decrease in schooling, but does lead to an increased probability of doing market work as well as domestic chores, depending on the sex and age of the deceased. Second, when we zoom in on heads of cells, most commonly co-wives in a polygamous household, we find that their death is associated with strong and significant adverse effects on schooling for the children belonging to that cell. These adverse effects do not concern other children in the household. We also find that girls who lose their head of cell are significantly more likely to be fostered out, whereas boys are more likely than other children in the household to have had to do market work.

Through these results we contribute to the literature on adult mortality and children's welfare, showing along the lines of Case, Paxson, and Ableidinger (2004) that the burden of adult deaths is not homogeneously shared among children in affected households. In particular, we show that in Senegal, a West African country with frequent polygamy and large extended households, withdrawal from school or fostering is a very

likely outcome for children whose main care giver dies. Policies targeting orphans at the household level are therefore likely to be inefficient.

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7 Appendix

Table A1: Household composition

	Mean	St. Dev.	Min	Max
Number of cells	2.63	1.31	1	11
HH Size	9.41	6.81	1	47
No of men	4.31	3.46	0	26
No of women	5.11	3.97	0	24
No of children	3.91	3.43	0	21
No of adults	5.13	3.89	0	26
No of old age	0.38	0.64	0	4
Female head	0.25	0.44	0	1
Head can read	0.48	0.50	0	1
Head can write	0.91	0.29	0	1

Population: 1726 households from the first wave of PSF.

Table A2: Descriptive statistics by cell status (cells in affected households)

	No death of cell head	Death of cell head	Difference	
Cell size	3.7	2.1	1.6	***
Cell head can write	0.34	0.40	-.06	
Cell head can read	0.66	0.71	-.05	
Cell head age	43.3	55.7	-12.4	***
Cell head woman	0.684	0.476	0.21	***
Cell head education: *none*	0.49	0.39	0.1	
Cell head education: *primary 1-3*	0.04	0.01	0.03	
Cell head education: *primary 4-5*	0.13	0.18	-0.05	
Cell head education: *secondary 1-4*	0.04	0.04	0	
Cell head education: *high school or above*	0.03	0.06	-0.03	
Cell head education: *islamic*	0.20	0.27	-0.07	
Percentage of children 6-12 in school	0.61	0.80	-0.19	**
Percentage of children 13-15 in school	0.59	0.75	-0.16	
Cell has lowest consumption in HH	0.30	0.37	-0.07	
Cell has highest consumption in HH	0.29	0.45	-0.16	***
Per capita spending (total, excluding rent)	315 971	381 805	-65 834	
Per capita spending on food	144 169	158 387	-14 218	
Increasing expenditure on food	0.19	0.15	0.04	
Decreasing investment expenditure	0.10	0.12	-0.02	
Member permanently left for work	0.02	0.01	0.01	
Frequency	341	91		

Population: All cells in households where at least one cell head died between panel rounds and containing at least one panel individual. Information was gathered from the first wave of PSF.
*** p<0.01, ** p<0.05, * p<0.10

Table A3: Descriptive statistics by cell status (all cells)

	No death of cell head	Death of cell head	Difference	
Cell size	3.2	2.1	-1.1	***
Cell head can read	0.386	0.405	-0.02	
Cell head can write	0.613	0.714	-0.1	*
Cell head age	43.0	55.7	-12.8	***
Cell head woman	0.587	0.476	0.111	***
Cell head education: *none*	0.44	0.39	0.05	
Cell head education: *primary 1-3*	0.04	0.01	0.03	
Cell head education: *primary 4-5*	0.11	0.18	-0.07	*
Cell head education: *secondary 1-4*	0.06	0.04	0.02	
Cell head education: *high school or above*	0.06	0.06	0	
Cell head education: *islamic*	0.22	0.27	-0.05	
Percentage of children 6-12 in school	0.64	0.80	-0.16	*
Percentage of children 13-15 in school	0.58	0.75	-0.17	
Cell has lowest consumption in HH	0.41	0.37	0.04	
Cell has highest consumption in HH	0.41	0.45	-0.04	
Per capita spending (total, excluding rent)	392 405	381 805	10 600	
Per capita spending on food	171 753	158 387	13 366	
Increasing expenditure on food	0.16	0.15	0.01	
Decreasing investment expenditure	0.10	0.12	-0.02	
Member permanently left for work	0.02	0.01	0.01	
Frequency	4104	91		

Population: All cells in the first round of PSF containing at least one panel individual.
*** p<0.01, ** p<0.05, * p<0.10

Table A4: Descriptive statistics by household status

	No death of CH in HH	Death of CH in HH	Difference	
Household size	7.58	9.27	-1.69	***
Household head can read	0.48	0.45	-.03	
Household head can write	0.45	0.45	0	
Household head age	50.5	59.4	-8.9	***
Household head female	0.25	0.18	0.07	*
Household head education: *none*	0.36	0.36	0	
Household head education: *primary 1-3*	0.04	0.01	0.03	
Household head education: *primary 4-5*	0.10	0.13	-0.03	
Household head education: *secondary 1-4*	0.07	0.09	-0.02	
Household head education: *high school and above*	0.08	0.03	0.05	**
Household head education: *islamic*	0.28	0.31	-0.03	
Percentage of children 6-12 in school	0.65	0.62	0.03	
Percentage of children 13-15 in school	0.58	0.62	-0.04	
Per capita spending (tota, excluding rent)	434 656	367 134	67 521	
Per capita spending on food	189 260	177 056	12 204	
Increasing expenditure on food	0.14	0.16	-0.02	
Decreasing investment expenditure	0.10	0.10	0	
Member permanently left for work	0.16	0.13	0.03	
Frequency	1570	156		

Population: All cells in the first round of PSF containing at least one panel individual.
*** p<0.01, ** p<0.05, * p<0.10

Table A5: Causes of death, male and female, 15-49 y.o., Senegal, 2010

Cause of death or injury	%
Accidents (including drug use, self-harm)	13.1
Maternity- related deaths	12.2
Tuberculosis	11.3
Cancer	7.7
HIV/AIDS	8.3
Malaria	5.4
Lower respiratory infections	4.9
Diarrheal diseases	4.5
Cerebrovascular diseas	3.8
Meningitis	3.6
Ischemic heart disease	2.7
Other causes	22.5

Source: Global Burden of Disease Study, 2015.

Table A6: Inter-wave mortality and self-assessed health in PSF1

Self-assessed health status	Frequency			Percentage	
	Survivors	Deceased	Total	Survivors	Deceased
Both sexes					
Very good health	2 025	24	2 049	15%	8%
Good health	9 180	157	9 337	67%	54%
Average health	2 067	50	2 117	15%	17%
Bad health	358	52	410	3%	18%
Very bad health	38	8	46	0%	3%
Total	13 668	291	13 959	100%	100%
Male					
Very good health	1 035	15	1 050	16%	10%
Good health	4 367	89	4 456	67%	57%
Average health	924	23	947	14%	15%
Bad health	143	24	167	2%	15%
Very bad health	25	5	30	0%	3%
Total	6 494	156	6 650	100%	100%
Female					
Very good health	990	9	999	14%	7%
Good health	4 813	68	4 881	67%	50%
Average health	1 143	27	1 170	16%	20%
Bad health	215	28	243	3%	21%
Very bad health	13	3	16	0%	2%
Total	7 174	135	7 309	100%	100%

Source: Authors' calculations using observations from PSF1 with nonmissing health and mortality status.

Table A7: Death impact on current schooling - Individual fixed effects - Children aged between 4 and 17 in first wave - by sex

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Age (years)	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
2nd round	0.16***	0.12***	0.17***	0.13***	0.17***	0.12***	0.17***	0.12***	0.16***	0.12***	0.16***	0.12***	0.17***	0.12***
	(0.025)	(0.026)	(0.025)	(0.026)	(0.025)	(0.026)	(0.025)	(0.026)	(0.025)	(0.026)	(0.025)	(0.026)	(0.025)	(0.026)
Identify of the deceased:														
Household head	0.07*	0.02												
	(0.043)	(0.047)												
Cell head (not HH)			0.01	-0.07										
			(0.050)	(0.047)										
Adult (15-64) member					-0.00	0.04								
					(0.038)	(0.040)								
Member less than 15							-0.03	0.08						
							(0.049)	(0.056)						
Member more than 64									0.03	-0.02				
									(0.039)	(0.040)				
Male adult (15-64) member											0.08	0.04		
											(0.050)	(0.056)		
Female adult (15-64) member													-0.08	0.02
													(0.054)	(0.052)
Constant	0.55***	0.58***	0.55***	0.57***	0.55***	0.58***	0.54***	0.57***	0.55***	0.57***	0.55***	0.57***	0.54***	0.57***
	(0.033)	(0.037)	(0.033)	(0.037)	(0.033)	(0.037)	(0.033)	(0.037)	(0.033)	(0.037)	(0.033)	(0.037)	(0.033)	(0.037)
Observations	4,402	4,234	4,402	4,234	4,402	4,234	4,402	4,234	4,402	4,234	4,402	4,234	4,402	4,234
R-squared	0.03	0.02	0.03	0.02	0.03	0.02	0.03	0.02	0.03	0.02	0.03	0.02	0.03	0.02
Number of individuals	2,201	2,117	2,201	2,117	2,201	2,117	2,201	2,117	2,201	2,117	2,201	2,117	2,201	2,117

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Table A8: Death impact on current schooling - Individual fixed effects - Children between 4 and 17 in first wave - by urban/rural

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Age (years)	-0.03***	-0.01**	-0.03***	-0.01*	-0.03***	-0.01**	-0.03***	-0.01*	-0.03***	-0.01*	-0.03***	-0.01*	-0.03***	-0.01*
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
2nd round	0.17***	0.11***	0.18***	0.12***	0.18***	0.12***	0.17***	0.12***	0.17***	0.12***	0.17***	0.11***	0.18***	0.12***
	(0.026)	(0.025)	(0.026)	(0.025)	(0.026)	(0.025)	(0.026)	(0.025)	(0.026)	(0.025)	(0.026)	(0.025)	(0.026)	(0.025)
Identify of the deceased:														
Household head	0.01	0.06												
	(0.053)	(0.040)												
Cell head (not HH)			-0.06	-0.02										
			(0.049)	(0.047)										
Adult (15-64) member					-0.03	0.04								
					(0.042)	(0.036)								
Member less than 15							0.02	0.01						
							(0.057)	(0.049)						
Member more than 64									-0.00	0.02				
									(0.039)	(0.040)				
Male adult (15-64) member											0.02	0.08*		
											(0.062)	(0.047)		
Female adult (15-64) member													-0.06	-0.01
													(0.054)	(0.051)
Constant	0.77***	0.39***	0.76***	0.38***	0.77***	0.39***	0.77***	0.38***	0.77***	0.38***	0.77***	0.39***	0.77***	0.38***
	(0.037)	(0.033)	(0.037)	(0.033)	(0.037)	(0.033)	(0.037)	(0.033)	(0.038)	(0.033)	(0.037)	(0.033)	(0.037)	(0.033)
Observations	4,018	4,618	4,018	4,618	4,018	4,618	4,018	4,618	4,018	4,618	4,018	4,618	4,018	4,618
R-squared	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Number of individuals	2,009	2,309	2,009	2,309	2,009	2,309	2,009	2,309	2,009	2,309	2,009	2,309	2,009	2,309

Standard errors are clustered at the household level.
*** p<0.01, ** p<0.05, * p<0.10

Table A9: Death impact on the probability of having ever worked on the market - Individual fixed effects - Children aged between 6 and 17 in first wave - by sex

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Age (years)	0.01***	0.01***	0.01***	0.01**	0.01***	0.01**	0.01***	0.01**	0.01***	0.01**	0.01***	0.01**	0.01***	0.01**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
2nd round	0.03	0.12***	0.03	0.11***	0.03	0.12***	0.04	0.11***	0.03	0.11***	0.03	0.11***	0.03	0.11***
	(0.025)	(0.026)	(0.025)	(0.026)	(0.025)	(0.027)	(0.025)	(0.027)	(0.025)	(0.026)	(0.025)	(0.027)	(0.025)	(0.026)
Identify of the deceased:														
Household head	0.06	-0.06												
	(0.047)	(0.048)												
Cell head (not HH)			0.09	0.02										
			(0.054)	(0.048)										
Adult (15-64) member					0.05	-0.01								
					(0.041)	(0.041)								
Member less than 15							-0.04	0.00						
							(0.054)	(0.058)						
Member more than 64									0.09**	0.01				
									(0.042)	(0.041)				
Male adult (15-64) member											0.05	-0.01		
											(0.055)	(0.057)		
Female adult (15-64) member													0.05	-0.01
													(0.057)	(0.055)
Constant	0.03	0.05	0.03	0.06	0.03	0.05	0.03	0.05	0.04	0.06	0.03	0.05	0.03	0.05
	(0.038)	(0.042)	(0.038)	(0.042)	(0.038)	(0.042)	(0.038)	(0.042)	(0.038)	(0.042)	(0.038)	(0.042)	(0.038)	(0.042)
Observations	3,956	3,786	3,956	3,786	3,956	3,786	3,956	3,786	3,956	3,786	3,956	3,786	3,956	3,786
R-squared	0.04	0.11	0.04	0.11	0.04	0.11	0.04	0.11	0.04	0.11	0.04	0.11	0.04	0.11
Number of individuals	1,978	1,893	1,978	1,893	1,978	1,893	1,978	1,893	1,978	1,893	1,978	1,893	1,978	1,893

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Table A10: Death impact on the probability of having ever worked on the market - Individual fixed effects - Children between 6 and 17 in first wave - by urban/rural

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Age (years)	0.02***	0.01	0.02***	0.01	0.02***	0.01	0.02***	0.01	0.02***	0.01	0.02***	0.01	0.02***	0.01
	(0.004)	(0.006)	(0.004)	(0.006)	(0.004)	(0.006)	(0.004)	(0.006)	(0.004)	(0.006)	(0.004)	(0.006)	(0.004)	(0.006)
2nd round	0.05**	0.10***	0.05**	0.10***	0.05**	0.10***	0.05**	0.10***	0.04**	0.10***	0.05**	0.10***	0.04**	0.10***
	(0.022)	(0.029)	(0.022)	(0.029)	(0.022)	(0.029)	(0.022)	(0.029)	(0.022)	(0.029)	(0.022)	(0.029)	(0.022)	(0.029)
Identify of the deceased:														
Household head	0.01	0.00												
	(0.044)	(0.049)												
Cell head (not HH)			-0.03	0.13**										
			(0.043)	(0.055)										
Adult (15-64) member					-0.00	0.04								
					(0.037)	(0.043)								
Member less than 15							-0.07	0.01						
							(0.051)	(0.059)						
Member more than 64									0.03	0.07				
									(0.033)	(0.049)				
Male adult (15-64) member											-0.02	0.05		
											(0.052)	(0.058)		
Female adult (15-64) member													0.01	0.03
													(0.048)	(0.061)
Constant	-0.16***	0.22***	-0.16***	0.23***	-0.16***	0.23***	-0.16***	0.22***	-0.15***	0.23***	-0.16***	0.23***	-0.16***	0.23***
	(0.035)	(0.043)	(0.035)	(0.043)	(0.035)	(0.043)	(0.035)	(0.043)	(0.035)	(0.043)	(0.035)	(0.043)	(0.035)	(0.043)
Observations	3,622	4,120	3,622	4,120	3,622	4,120	3,622	4,120	3,622	4,120	3,622	4,120	3,622	4,120
R-squared	0.10	0.05	0.10	0.05	0.10	0.05	0.10	0.05	0.10	0.05	0.10	0.05	0.10	0.05
Number of individuals	1,811	2,060	1,811	2,060	1,811	2,060	1,811	2,060	1,811	2,060	1,811	2,060	1,811	2,060

Standard errors are clustered at the household level.
*** p<0.01, ** p<0.05, * p<0.10

Table A11: Death impact on current market work - Individual fixed effects - Children aged between 6 and 17 in first wave - by sex

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Age (years)	0.01**	0.02***	0.01**	0.02***	0.01**	0.02***	0.01**	0.02***	0.01**	0.02***	0.01**	0.02***	0.01**	0.02***
	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)
2nd round	0.04	0.14***	0.04	0.14***	0.04	0.14***	0.04*	0.14***	0.03	0.14***	0.04	0.13***	0.04	0.14***
	(0.024)	(0.027)	(0.024)	(0.027)	(0.024)	(0.027)	(0.024)	(0.027)	(0.024)	(0.027)	(0.024)	(0.027)	(0.024)	(0.027)
Identify of the deceased:														
Household head	0.04	0.03												
	(0.046)	(0.049)												
Cell head (not HH)			0.12**	-0.05										
			(0.052)	(0.049)										
Adult (15-64) member					0.07*	0.02								
					(0.039)	(0.042)								
Member less than 15							-0.03	-0.08						
							(0.052)	(0.060)						
Member more than 64									0.10**	0.03				
									(0.041)	(0.042)				
Male adult (15-64) member											0.08	0.13**		
											(0.053)	(0.059)		
Female adult (15-64) member													0.04	-0.09
													(0.055)	(0.056)
Constant	0.00	-0.13***	0.01	-0.13***	0.01	-0.13***	-0.00	-0.13***	0.01	-0.13***	0.00	-0.12***	0.00	-0.14***
	(0.037)	(0.043)	(0.037)	(0.043)	(0.037)	(0.043)	(0.037)	(0.043)	(0.037)	(0.043)	(0.037)	(0.043)	(0.037)	(0.043)
Observations	3,956	3,786	3,956	3,786	3,956	3,786	3,956	3,786	3,956	3,786	3,956	3,786	3,956	3,786
R-squared	0.03	0.15	0.03	0.15	0.03	0.15	0.03	0.15	0.03	0.15	0.03	0.15	0.03	0.15
Number of individuals	1,978	1,893	1,978	1,893	1,978	1,893	1,978	1,893	1,978	1,893	1,978	1,893	1,978	1,893

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Table A12: Death impact on current market work - Individual fixed effects - Children between 6 and 17 in first wave - by urban/rural

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Age (years)	0.02***	0.01	0.02***	0.01	0.02***	0.01	0.02***	0.01	0.02***	0.01	0.02***	0.01	0.02***	0.01
	(0.004)	(0.006)	(0.004)	(0.006)	(0.004)	(0.006)	(0.004)	(0.006)	(0.004)	(0.006)	(0.004)	(0.006)	(0.004)	(0.006)
2nd round	0.04*	0.14***	0.04*	0.14***	0.04*	0.14***	0.04*	0.15***	0.04*	0.14***	0.04*	0.14***	0.04*	0.15***
	(0.021)	(0.029)	(0.021)	(0.029)	(0.021)	(0.029)	(0.021)	(0.029)	(0.021)	(0.029)	(0.021)	(0.029)	(0.021)	(0.029)
Identify of the deceased:														
Household head	0.02	0.05												
	(0.043)	(0.049)												
Cell head (not HH)			-0.03	0.09*										
			(0.042)	(0.056)										
Adult (15-64) member					-0.00	0.08*								
					(0.035)	(0.044)								
Member less than 15							-0.04	-0.08						
							(0.049)	(0.059)						
Member more than 64									0.04	0.11**				
									(0.032)	(0.049)				
Male adult (15-64) member											-0.02	0.18***		
											(0.051)	(0.058)		
Female adult (15-64) member													0.01	-0.04
													(0.047)	(0.061)
Constant	-0.16***	0.04	-0.16***	0.05	-0.16***	0.05	-0.16***	0.04	-0.16***	0.05	-0.16***	0.05	-0.16***	0.03
	(0.033)	(0.044)	(0.033)	(0.044)	(0.033)	(0.044)	(0.033)	(0.043)	(0.034)	(0.044)	(0.033)	(0.043)	(0.033)	(0.044)
Observations	3,622	4,120	3,622	4,120	3,622	4,120	3,622	4,120	3,622	4,120	3,622	4,120	3,622	4,120
R-squared	0.09	0.08	0.09	0.08	0.09	0.08	0.09	0.08	0.09	0.08	0.09	0.08	0.09	0.08
Number of individuals	1,811	2,060	1,811	2,060	1,811	2,060	1,811	2,060	1,811	2,060	1,811	2,060	1,811	2,060

Standard errors are clustered at the household level.
*** p<0.01, ** p<0.05, * p<0.10

Table A13: Death impact on hours of domestic work - Individual fixed effects - Children aged between 6 and 17 in first wave - by sex

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Age (years)	0.78***	0.20	0.77***	0.21	0.76***	0.21	0.79***	0.20	0.78***	0.20	0.79***	0.20	0.76***	0.20
	(0.229)	(0.143)	(0.229)	(0.143)	(0.228)	(0.143)	(0.229)	(0.143)	(0.229)	(0.143)	(0.229)	(0.143)	(0.228)	(0.143)
2nd round	1.32	-1.09	1.25	-1.07	1.11	-1.05	1.39	-1.07	1.22	-1.09	1.40	-1.00	1.27	-1.12
	(1.165)	(0.696)	(1.162)	(0.697)	(1.164)	(0.699)	(1.169)	(0.700)	(1.167)	(0.697)	(1.165)	(0.697)	(1.159)	(0.696)
Identify of the deceased:														
Household head	3.34	0.09												
	(2.175)	(1.256)												
Cell head (not HH)			6.24**	-0.43										
			(2.470)	(1.264)										
Adult (15-64) member					5.55***	-0.51								
					(1.883)	(1.082)								
Member less than 15							1.78	-0.26						
							(2.473)	(1.536)						
Member more than 64									3.92**	0.04				
									(1.953)	(1.087)				
Male adult (15-64) member											2.13	-1.95		
											(2.536)	(1.509)		
Female adult (15-64) member													8.71***	0.92
													(2.646)	(1.440)
Constant	2.17	3.30***	2.29	3.25***	2.54	3.23***	1.96	3.29***	2.28	3.30***	2.00	3.21***	2.47	3.36***
	(1.758)	(1.114)	(1.755)	(1.112)	(1.760)	(1.113)	(1.752)	(1.106)	(1.759)	(1.117)	(1.755)	(1.107)	(1.754)	(1.111)
Observations	3,956	3,786	3,956	3,786	3,956	3,786	3,956	3,786	3,956	3,786	3,956	3,786	3,956	3,786
R-squared	0.05	0.00	0.05	0.00	0.05	0.00	0.05	0.00	0.05	0.00	0.05	0.00	0.05	0.00
Number of individuals	1,978	1,893	1,978	1,893	1,978	1,893	1,978	1,893	1,978	1,893	1,978	1,893	1,978	1,893

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Table A14: Death impact on hours of domestic work - Individual fixed effects - Children between 6 and 17 in first wave - by urban/rural

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Age (years)	0.66***	0.45**	0.66***	0.46**	0.66***	0.46**	0.66***	0.48**	0.65***	0.47**	0.66***	0.47**	0.65***	0.46**
	(0.177)	(0.211)	(0.177)	(0.211)	(0.177)	(0.211)	(0.177)	(0.211)	(0.177)	(0.211)	(0.177)	(0.211)	(0.177)	(0.211)
2nd round	-1.25	0.99	-1.37	1.02	-1.50*	0.99	-1.35	1.06	-1.46*	1.06	-1.25	1.09	-1.53*	1.07
	(0.885)	(1.046)	(0.886)	(1.046)	(0.889)	(1.048)	(0.888)	(1.052)	(0.886)	(1.049)	(0.886)	(1.048)	(0.883)	(1.044)
Identify of the deceased:														
Household head	-1.60	3.33*												
	(1.819)	(1.775)												
Cell head (not HH)			0.90	2.98										
			(1.776)	(2.008)										
Adult (15-64) member					2.22	2.43								
					(1.505)	(1.579)								
Member less than 15							0.39	1.24						
							(2.081)	(2.127)						
Member more than 64									2.05	1.42				
									(1.374)	(1.769)				
Male adult (15-64) member											-1.78	1.18		
											(2.154)	(2.100)		
Female adult (15-64) member													5.37***	3.47
													(1.984)	(2.210)
Constant	-0.31	4.54***	-0.15	4.40***	-0.04	4.51***	-0.20	4.19***	0.08	4.29***	-0.25	4.22***	0.07	4.44***
	(1.426)	(1.571)	(1.427)	(1.567)	(1.426)	(1.575)	(1.422)	(1.559)	(1.434)	(1.568)	(1.423)	(1.563)	(1.423)	(1.568)
Observations	3,622	4,120	3,622	4,120	3,622	4,120	3,622	4,120	3,622	4,120	3,622	4,120	3,622	4,120
R-squared	0.02	0.03	0.02	0.03	0.02	0.03	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.03
Number of individuals	1,811	2,060	1,811	2,060	1,811	2,060	1,811	2,060	1,811	2,060	1,811	2,060	1,811	2,060

Standard errors are clustered at the household level.
*** p<0.01, ** p<0.05, * p<0.10

Table A15: Death impact on probability of being fostered - Individual fixed effects - Children less than 15 not fostered in first wave - by sex

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)		
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Age (years)	-0.00	0.00	-0.00	0.00	-0.00	0.00	-0.00	0.00	-0.00	0.00	-0.00	0.00	-0.00	0.00
	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)
2nd round	0.05***	0.02	0.05***	0.02	0.05***	0.02	0.05***	0.02	0.05***	0.02	0.05***	0.02	0.05***	0.02
	(0.014)	(0.012)	(0.014)	(0.012)	(0.014)	(0.012)	(0.014)	(0.012)	(0.014)	(0.012)	(0.014)	(0.012)	(0.014)	(0.012)
Identify of the deceased:														
Household head	0.03	0.04**												
	(0.022)	(0.021)												
Cell head (not HH)			0.02	0.00										
			(0.027)	(0.022)										
Adult (15-64) member					0.03	0.01								
					(0.020)	(0.018)								
Member less than 15							0.04*	0.03						
							(0.024)	(0.023)						
Member more than 64									0.02	0.03				
									(0.019)	(0.018)				
Male adult (15-64) member											0.02	-0.00		
											(0.027)	(0.025)		
Female adult (15-64) member													0.04	0.01
													(0.027)	(0.023)
Constant	-0.00	-0.02**	-0.00	-0.02**	-0.00	-0.02**	-0.00	-0.02**	-0.00	-0.02**	-0.00	-0.02***	-0.00	-0.02**
	(0.010)	(0.009)	(0.010)	(0.009)	(0.010)	(0.009)	(0.010)	(0.009)	(0.010)	(0.009)	(0.010)	(0.009)	(0.010)	(0.009)
Observations	4,616	4,526	4,616	4,526	4,616	4,526	4,616	4,526	4,616	4,526	4,616	4,526	4,616	4,526
R-squared	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Number of individuals	2,308	2,263	2,308	2,263	2,308	2,263	2,308	2,263	2,308	2,263	2,308	2,263	2,308	2,263

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Table A16: Death impact on probability of being fostered - Individual fixed effects - Children less than 15 not fostered in first wave - by urban/rural

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Age (years)	0.00	-0.00	0.00	-0.00	0.00	-0.00	0.00	-0.00	0.00	-0.00	0.00	-0.00	0.00	-0.00
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
2nd round	0.01	0.06***	0.01	0.06***	0.01	0.06***	0.00	0.05***	0.00	0.06***	0.01	0.06***	0.01	0.06***
	(0.012)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.012)	(0.013)
Identify of the deceased:														
Household head	-0.00	0.06***												
	(0.025)	(0.019)												
Cell head (not HH)			-0.01	0.03										
			(0.026)	(0.024)										
Adult (15-64) member					-0.00	0.03*								
					(0.021)	(0.017)								
Member less than 15							0.02	0.04**						
							(0.026)	(0.022)						
Member more than 64									0.01	0.05**				
									(0.018)	(0.020)				
Male adult (15-64) member											-0.01	0.02		
											(0.029)	(0.024)		
Female adult (15-64) member													0.00	0.04*
													(0.028)	(0.023)
Constant	-0.01	-0.02*	-0.01	-0.02**	-0.01	-0.02*	-0.01	-0.02**	-0.01	-0.02*	-0.01	-0.02**	-0.01	-0.02**
	(0.010)	(0.009)	(0.010)	(0.009)	(0.010)	(0.009)	(0.010)	(0.009)	(0.011)	(0.009)	(0.010)	(0.009)	(0.010)	(0.009)
Observations	4,018	5,124	4,018	5,124	4,018	5,124	4,018	5,124	4,018	5,124	4,018	5,124	4,018	5,124
R-squared	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03
Number of individuals	2,009	2,562	2,009	2,562	2,009	2,562	2,009	2,562	2,009	2,562	2,009	2,562	2,009	2,562

Standard errors are clustered at the household level.
*** p<0.01, ** p<0.05, * p<0.10

Table A17: Cell head death impact on various outcomes - Individual fixed effects - by sex

	(1) Enrolment	(2)	(3) Current schooling	(4)	(5) Ever worked	(6)	(7) Currently working	(8)	(9) Doing dom. work	(10)	(11) Hours dom. work	(12)	(13) Fostered	(14)
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Age (years)	-0.02**	-0.01	-0.02***	-0.02**	0.01	0.01	0.01	0.01*	0.01	0.01*	0.48	0.30*	0.00	0.00
	(0.006)	(0.013)	(0.006)	(0.007)	(0.005)	(0.007)	(0.006)	(0.006)	(0.006)	(0.008)	(0.452)	(0.179)	(0.002)	(0.001)
2^{nd} round	0.35***	0.31***	0.17***	0.14***	0.05*	0.14***	0.04	0.17***	0.13***	-0.00	2.06	-1.33	0.01	0.01***
	(0.037)	(0.060)	(0.029)	(0.035)	(0.031)	(0.037)	(0.032)	(0.034)	(0.031)	(0.044)	(2.100)	(0.862)	(0.008)	(0.004)
Cell head death*2^{nd} round	0.06	0.02	0.04	0.01	0.09	0.02	0.13	-0.03	0.14	-0.12	9.79***	-1.56	-0.01	-0.01
	(0.086)	(0.103)	(0.054)	(0.091)	(0.101)	(0.073)	(0.103)	(0.112)	(0.095)	(0.095)	(3.563)	(2.080)	(0.015)	(0.012)
Own cell head death*2^{nd} round	0.04	-0.30***	-0.25	-0.28**	0.14	0.22*	0.03	0.08	-0.22	0.36**	-3.13	3.97	0.16	0.09
	(0.222)	(0.102)	(0.186)	(0.117)	(0.142)	(0.124)	(0.133)	(0.205)	(0.197)	(0.149)	(10.107)	(2.457)	(0.121)	(0.096)
Constant	0.18***	0.16***	0.50***	0.53***	0.10**	0.07	0.04	-0.10**	0.44***	0.24***	4.99	2.60*	-0.02***	-0.02***
	(0.028)	(0.040)	(0.038)	(0.048)	(0.044)	(0.057)	(0.048)	(0.050)	(0.043)	(0.066)	(3.240)	(1.483)	(0.007)	(0.006)
Observations	1,570	1,466	3,248	2,994	2,864	2,604	2,864	2,604	2,864	2,604	2,864	2,604	3,862	3,764
R-squared	0.27	0.26	0.03	0.02	0.03	0.12	0.03	0.15	0.09	0.01	0.05	0.00	0.03	0.02
Number of individuals	785	733	1,624	1,497	1,432	1,302	1,432	1,302	1,432	1,302	1,432	1,302	1,931	1,882

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10
Samples differ from one regression to the other. School enrolment: 4 to 9 years old in first wave ; Current schooling: 4 to 17;
Everworked - Currently working and Domestic work: 6 to 17; Fostered: 0 to 14 and not fostered in first wave.

Table A18: Cell head death impact on various outcomes - Individual fixed effects - by urban/rural

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
	Enrolment		Current schooling		Ever worked		Currently working		Doing dom. work		Hours dom. work		Fostered	
Age (years)	-0.02	-0.00	-0.03***	-0.01*	0.01**	-0.00	0.02***	0.00	0.02**	0.01	0.39	0.50	-0.00	0.00*
	(0.011)	(0.006)	(0.007)	(0.004)	(0.007)	(0.005)	(0.005)	(0.006)	(0.008)	(0.007)	(0.314)	(0.425)	(0.001)	(0.002)
2^{nd} round	0.37***	0.29***	0.21***	0.12***	0.06*	0.13***	0.04	0.17***	0.08*	0.05	-0.34	0.72	0.02***	0.01
	(0.054)	(0.035)	(0.035)	(0.025)	(0.030)	(0.036)	(0.026)	(0.039)	(0.046)	(0.038)	(1.417)	(1.957)	(0.006)	(0.007)
Cell head death*2^{nd} round	-0.11	0.13	-0.07	0.07	-0.05	0.12	-0.07	0.11	-0.09	0.05	3.34	3.10	-0.02***	-0.00
	(0.075)	(0.109)	(0.056)	(0.091)	(0.049)	(0.104)	(0.049)	(0.130)	(0.138)	(0.070)	(3.030)	(2.953)	(0.004)	(0.014)
Own cell head death*2^{nd} round	0.15	-0.29*	-0.14	-0.35**	0.29***	0.15	0.31***	-0.08	0.00	0.19	-3.09	1.18	0.00	0.22
	(0.258)	(0.151)	(0.117)	(0.165)	(0.104)	(0.162)	(0.105)	(0.232)	(0.185)	(0.166)	(3.210)	(6.763)	(0.000)	(0.169)
Constant	0.35***	0.04	0.74***	0.34***	-0.13**	0.27***	-0.16***	0.09	0.15**	0.48***	1.96	4.66	-0.01**	-0.03***
	(0.039)	(0.029)	(0.051)	(0.029)	(0.054)	(0.048)	(0.042)	(0.055)	(0.064)	(0.051)	(2.482)	(2.999)	(0.005)	(0.008)
Observations	1,242	1,794	2,756	3,486	2,396	3,072	2,396	3,072	2,396	3,072	2,396	3,072	3,272	4,354
R-squared	0.28	0.26	0.04	0.03	0.10	0.06	0.09	0.08	0.06	0.03	0.01	0.02	0.02	0.04
Number of individuals	621	897	1,378	1,743	1,198	1,536	1,198	1,536	1,198	1,536	1,198	1,536	1,636	2,177

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10
Samples differ from one regression to the other. School enrolment: 4 to 9 years old in first wave ; Current schooling: 4 to 17;
Everworked - Currently working and Domestic work: 6 to 17; Fostered: 0 to 14 and not fostered in first wave.