(When) are Grandfathers Beneficial for Children's Schooling in Sub-Saharan Africa?

(When) are grandfathers beneficial for children's schooling in Sub-Saharan Africa?

Abstract

In recent years, several studies in the social stratification literature have paid attention to the role of grandparents for their grandchildren's life chances in sub Saharan African (SSA). This is important because in SSA, where overall mortality levels are extremely high, it is a very common situation that children come to live with their grandparents. The prolonged survival of women after their fertile age offers them the opportunity to help their own children raise their offspring, and in this way, increase their own reproductive success. The theory is less clear about the role of grandfathers. They have no menopause and tend to be associated with more distant and authoritarian ways of involvement. Nevertheless, their reproductive success is also increased by the survival of their grandchildren. To gain insight into the importance of grandfathers in the Sub-Saharan African context, we study the relationship between grandfathers' co-residence and children's schooling among a broad range of circumstances. Using data on 898,006 children aged 7–15 years old in 33 African countries, we find that children who live with their grandfather have significantly higher odds of being in school than those who do not. This effect increases with the grandfather's educational level, and is particularly strong for older children, for girls, and when the mother is absent or deceased. Grandfathers seem less important if the grandmother is also co-residing.

1. Introduction

In recent years, several studies in the social stratification literature have paid attention to the role of grandmothers for their grandchildren's life chances in sub Saharan African (SSA) (e.g. Lachaud & Kobiané, 2017; Lu & Treiman, 2011; Parker & Short, 2009; Duflo, 2003; Schrijner & Smits, 2018a, 2018b). This is important because in SSA, where overall mortality levels are extremely high, it is a very common situation that children come to live with their grandparents (UNAIDS, 2013). Studies so far have documented that particularly the presence of a grandmother increases the chances of children to go to school (Parker & Short, 2009; Schrijner & Smits, 2018a; Zeng & Xie, 2014). But what about the role of grandfathers? Is there such a thing as a grandfather's version of the grandmother hypothesis? Although the reproductive success of grandfathers is also increased by the survival of their grandchildren, they get less attention in the literature. A few historical studies in Poland, Canada, Germany, and Italy have reported both positive and negative associations between the presence of a grandfather and child survival (Beise, 2005; Derosas, 2002; Kemkes-Grottenthaler, 2005; Tymicki, 2009). However, some more recent studies in Africa examining the association between grandfathers and child survival and stunting found no straightforward effects (Borgerhoff Mulder, 2007; Gibson & Mace, 2005; Schrijner & Smits, 2018b; Sear, 2008; Sear, Mace, & McGregor, 2000). This does not necessarily mean that African grandfathers are not important for their grandchildren, but it suggests that to identify grandparental effects, we may have to look at other outcomes or study these effects under specific circumstances.

It is, for example, possible that grandfathers become important when parents are absent or when there is no grandmother to help their (grand)children. It is also possible that grandfathers become more important when children are older. While (grand)mothers are supposed to be

focused on the feeding and caring of young children, (grand)fathers might be more focused on the societal position of their grandchildren. It might, for example, be possible that the social status and masculinity of African grandfathers is affected by the societal success of their grandchildren to a certain extent. To gain insight into the role of grandfathers, it therefore seems better to look at outcomes that are more directly related to their grandchildren's (future) societal position. In the current study, this is done by looking at children's participation in school.

Given the importance of education for employment opportunities and economic growth (Lutz et al. 2008; UNESCO 2014), gaining insight into the determinants of children's schooling in the Sub-Saharan African (SSA) context has become increasingly important. The current study aims to provide this insight. Using a database with information on almost 900,000 children aged 7–15 years old and living in 33 SSA countries, we determine the strength of the relationship between grandfathers' co-residence and children's schooling in the region, and how this relationship is influenced by the circumstances in which the household is situated. By applying multilevel logistic regression analysis on this database, we aim to answer the following research questions:

- What is the relationship between grandfathers' co-residence and their grandchildren's educational participation in Sub-Saharan Africa?
- To what extent do socio-economic, demographic, and cultural characteristics at the household and context level influence this relationship?

A major step forward of our approach is that we study the influence of contextual factors on the grandfather effect at the level of 1,164 sub-national regions and 29,925 communities within the 33 countries. This means that we have considerable power to study the effects of contextual factors in a multivariate way, and we can answer questions about the role of the context better than in earlier research.

2. Background

Generative grandfathering

Women may live long after their reproductive period, a phenomenon which is not very common in nature. In most species, breeding is possible throughout adult life. Regardless of the actual evolutionary origin of this phenomenon, it offers women (grandmothers) the opportunity to increase their reproductive success by helping their daughters and sons raise their children (Hamilton 1964; Hawkes et al. 1997; Hawkes 2004). But what about men? Men are able to reproduce until their death, which enables them to enhance their inclusive fitness throughout their lives. Does this mean that they are not involved in taking care of their grandchildren?

Theory concerning the relationship between grandfathers and grandchildren in developing countries is scarce. Intuitively, given the supposedly strong bond between mothers and daughters, grandmothers are expected to help their daughters with the care of their children (Coall & Hertwig, 2010; Hawkes, 2003, 2004; Sear & Mace, 2008). Particularly in developing countries, where extended household structures are still pervasive, grandmothers are supposed to play a role of importance in this respect. Regarding grandfathers, this is different as they are much less associated with caring tasks (Bates & Taylor, 2012; Mann, Tarrant, & Leeson, 2015) and, therefore, have received much less theoretical attention in the child survival and health literature. Thus, we cannot draw extensively from the literature in this field. That is why we derive theoretical ideas from studies in other fields, in particular, the gerontological literature on grandparenthood in developed countries, such as the US and the UK (e.g., Bates and Taylor 2012; Creasey and Koblewski 1991; Mann et al. 2015).

A useful framework for studying and understanding the role of grandfathers has been built by Bates (2009). At the heart of his conceptual framework of g*enerative grandfathering* is the developmental stage of "generativity," introduced by Erikson (1963) as one of the eight stages in psychosocial development. In the *generative* stage of life, establishing and guiding the next generation forms a central theme. Grandfathering and generativity are connected by Bates through the generative work of grandfathers, which can be described as the efforts grandfathers put forth when nurturing and caring for their offspring. This involves lineage work, spiritual work, recreation work, family identity work, mentoring and investment work (Bates, 2009).

Some of these forms of generative work may have a direct effect on schooling such as "mentoring work" and "investment work." *Mentoring work* concerns the efforts grandfathers put forth to teach, instruct, and coach their grandchildren. In doing so, grandfathers also transfer a part of their own knowledge to their grandchildren. This implies that the educational level of a grandfather might be important for schooling as well. *Investment work* concerns the ability and willingness of grandfathers to invest in the educational, occupational, and financial needs of their grandchildren. Other forms of generative work, such as "lineage work" and "spiritual work," might help grandchildren develop their own identities and become stable individuals, which is also important for schooling. We hypothesize that the average effect of grandfathers' co-residence through generative work is positive for their grandchildren's schooling. This *positive grandfather hypothesis* is based on the expectation that grandfathers who live with their grandchildren have a low threshold to invest in them. According to Bates and Taylor (2012), contact frequency and participating in activities are key elements of a positive grandfather role, and co-resident grandfathers are best situated to have high frequent contact with their grandchildren and to participate in their activities.

It seems obvious to assume that the degree and quality of the generative work grandfathers put forth to their grandchildren varies and depends on the characteristics of the grandfather. Important characteristics of the grandfather that may play a role are his age and educational level. Higher educated grandfathers have experienced themselves the benefits of good education, which may make them better equipped to teach, instruct, and coach their grandchildren. It might also make them more eager to teach their grandchildren and to stimulate them to go to school than grandfathers with less or no education.

As (grand)fathers age, they gain more experience. Their image of leadership and masculinity shifts, and they may become more emotionally expressive and affectionate towards their grandchildren. They may wish to teach their grandchildren interpersonal relationships and transfer their values to them (Fuller-Thomson and Minkler 2001; Waldrop, Weber, Herald, Pruett, Cooper, Juozapavicius 1999). Such a mentoring and teaching role might become a particularly rewarding experience for grandfathers, if their grandchildren's degree of success contributes to the level of respect they gain from their social environment. However, at some point, the grandfather may become too old to take care of his grandchildren, or even himself, and he might become a drain on the household. Grandfathers should also not be too young, because then they are busy with their own work and have to put their energy into caring for their own offspring, lowering the possibility of taking care of their grandchildren. The relationship between the grandfather's age and the role he may play in his grandchildren's lives is thus expected to be parabolic, with his contribution being more important at an intermediate age than when he is very young or old. A similar relationship has been documented for the grandmother's age (Schrijner & Smits, 2018a). This *parabolic age effect hypothesis* will be tested by looking at the nonlinear effects of the grandfather's age in our analysis.

Grandfathers and children's schooling

Although much research has already been done on the determinants of children's schooling in poor countries (e.g. Glick & Sahn, 2006; Huisman & Smits, 2015; Lloyd & Blanc, 1996; Mukherjee & Das, 2008; Schrijner & Smits, 2018a; Smits & Huisman, 2013), the role of the grandfather for children's schooling has received little attention in the literature. Only a few studies have provided some statistical evidence regarding this relationship. For example, Parker and Short (2009) found no effect between living with a grandfather and children's schooling in Lesotho, while for rural China, Zeng and Xie (2014) showed that the educational level of co-resident grandparents was positively associated with the educational attainment of their grandchildren.

Most research studying the role of grandparents in a low-income context is focused on child survival as an outcome variable instead of schooling. A meta-analysis conducted by Sear and Mace (2008) gives a broad overview of the empirical work in this field. Their analysis showed that grandfathers in 4 out of 20 studies were positively associated with child survival, in 3 studies negatively, and in 13 studies, no significant effect at all. For grandmothers, out of 26 studies, these figures were 16 positively, 3 negatively, and 7 no effect at all, respectively. The results indicate that grandfathers are less important than grandmothers when it comes to child survival. Most of the studies included in the analysis concerned pre-modern European, Asian, North American, and South American countries. In the few African studies available (4), no significant connections were reported between grandfather's presence and child survival (Borgerhoff Mulder, 2007; Gibson & Mace, 2005; Sear, 2008; Sear et al., 2000).

The role of the circumstances

Because of the variations in grandfather's effect found in previous research, the main focus of the current paper is on the role of the circumstances. The factors reflecting these circumstances that may moderate the grandfather's effect can be divided into two groups: resource- and gender-related factors. The factors belonging to each of these groups may have effects at the household as well as the context level.

Resource-related factors at the level of the household are income, wealth, education, and employment of the parents. The availability of these resources may influence the grandfather effect in several respects. Children of poor families are less likely to be enrolled in school, are more involved in child labor, and suffer from many other negative outcomes, including high levels of child mortality, disease, and stunting (Basu and Tzannatos 2003; Bourdillon 2006; Duncan and Brooks-Gunn 1997; Hope 2005; Webbink, Smits, de Jong 2012). Their educational enrollment is lower, because the direct and indirect costs of schooling may be a heavy economic burden on their parents (Admassie, 2003; Ananga, 2011). Grandparents can compensate for the opportunity costs of their grandchildren's schooling. They can enable parents to work outside the home or prevent children from taking on work when their parents are working or absent (Schrijner & Smits, 2018a; Smits & Huisman, 2013).

Regarding parental education and the father's occupation, there is broad evidence that children from better educated parents and whose fathers have a non-farm job go to school and stay in school more often (Buchmann and Brakewood 2000; Colclough, Rose, Tembon 2000; Ersado 2005; Mingat 2006; Smits and Gündüz-Hoşgör 2006). Better educated parents experience the benefits of education themselves and are, therefore, expected to weigh the costs and benefits more in favor of schooling than parents with little education (Huisman and Smits 2009;

Piotrowski and Paat 2012). Also, fathers with a non-farm job are expected – and have been found (Breen and Goldthorpe 1997; Huisman and Smits 2015) – to attach more value to schooling than those who work in the agricultural sector. Under such more favorable circumstances, the presence of a grandfather might make less of a difference.

Grandparents might also be a burden to the household resources. The *local resource competition hypothesis* (e.g., Borgerhoff Mulder 2007; Sear and Mace 2008) predicts that altruistic behavior of family members may be reduced when there is a scarcity of local resources. Several studies support this hypothesis. Strassmann (2011) found the co-residence of a grandmother among the Dogon in Mali to be negatively related to child survival and growth. She attributes this to the fact that older grandmothers become net consumers and, therefore, their grandchildren's competitors in the resource-poor society of the Dogon. This might also be applicable to grandfathers. Sear (2008) discovered that among the Chewa in Malawi, child mortality rates are higher in the presence of matrilineal kin. She supposed this negative effect was caused by resource competition between kin. While studying land ownership in Kenya, Borgerhoff Mulder (2007) observed that wealth affects the extent of kin altruism. Paternal relatives (specifically father's brothers) appear to buffer young children from mortality much more effectively in rich than in poor households. The extent to which a grandfather has a positive effect on children's schooling might thus depend on the circumstances, with the effect being weaker when the grandfather is old and/or when the household is living under poor circumstances.

The presence of a grandfather is expected to be particularly important if parents are deceased or absent from the household. Parental death is known to have a negative impact on children's well-being and schooling outcomes (e.g., Case and Ardington 2006; Evans and Miguel 2007;

Nyamukapa and Gregson 2005). Single parenthood is also associated with negative effects on children's schooling (Martin, 2012; Pong & Ju, 2000; Potter, 2010). Schrijner & Smits (2018a) found grandmothers to be particularly important for children's schooling when the mother was deceased or absent from the household for other reasons. It is important to determine the extent to which such a beneficial effect is also present for a co-residing grandfather.

Important resources at the local context are the educational and transport infrastructures, which may both influence the potential for children to attend school. In SSA countries, the availability of (good quality) schools and infrastructures varies considerably according to the overall level of urbanization and development of the region. In more modern and urban areas, infrastructures are generally better and the state's influence stronger, which means that educational laws may be better enforced. The effects of globalization may also be stronger and values that stress the importance of education and equality among sexes more commonly spread. This might put more pressure on parents to send their children to school (Huisman & Smits, 2009; Tansel, 2002). Smits and Gündüz-Hoşgör (2006) found that children living in urban areas in Turkey had significantly higher school attendance, and Fafchamps and Wahba (2006) found that Nepalese children living near towns and cities were more likely to attend school. Hence, the expectation is that, particularly in rural areas, a co-residence grandfather might increase young children's chances to go to school.

Regarding the gender-related factors, it is important to note that most research on the relationship between grandparents' co-residence and children's well-being has found different effects for boys and girls (e.g. Borgerhoff Mulder, 2007; Gibson & Mace, 2005; Jamison, Cornell, Jamison, & Nakazato, 2002; Schrijner & Smits, 2018a, 2018b; Strassmann, 2011). This suggests that gender cannot be neglected when studying the role of grandfathers. There is, for

instance, evidence that granddaughters are in closer contact with grandmothers and grandsons with grandfathers (Hagestad and Speicher 1981; Mann and Leeson 2013). In line with this finding, we expect boys to benefit more from a co-residing grandfather than girls. There is also evidence that a stronger position of women is associated with higher children's education, health, and well-being (e.g., Hobcraft 1993; Mukherjee and Das 2008). To what extent and in what way the position of women in the region also affects the importance of a co-residing grandfather has not been studied.

Regarding the role of polygamy, Strassmann (2011:1) observed that in polygamous families, child mortality and stunting rates are significantly higher. She attributed this to the fact that polygamy creates conflicts within families associated with asymmetries in genetic relatedness. With more uncertainty about genetic relatedness among family members, the risk of conflict increases. Omariba and Boyle (2007) found that children from polygamous families were more likely to die compared to those from monogamous families. Kandiyoti (1988:277) argues that in the case of polygamy, the continuing obligations of both men and women to their own kin do not foster a notion of the family or household as a corporate entity. To what extent this is also true for grandfathers living in these families is not clear. Hence, whether the effect on schooling is stronger or weaker with the presence of a grandfather in polygamous families compared to monogamous families remains an empirical question to be answered in our analyses.

Other factors

Other factors that may affect the grandfather co-residence effect are the number of children in the household and the birth order of a child. Regarding the number of children, literature indicates that the probability of going to school is smaller for children with more siblings (Booth

& Kee, 2009; Huisman & Smits, 2009). A likely explanation is that children with more brothers and sisters have to share the available resources. With regard to birth order, there is evidence that older children, particularly older girls, have lower schooling rates, probably because they have to work in the household or earn money to supplement household income (Buchmann and Hannum 2001; Emerson and Souza 2008; Webbink et al. 2013). In both cases, the presence of a grandfather may provide additional resources to compensate for these situations. We therefore expect the presence of a grandfather in the household to be more important in high fertility situations and for older daughters.

3. Data and methods

Data

For this study, combined datasets from the Demographic and Health Surveys have been used (DHS; www.dhsprogram.com). The data are derived from the Database Developing World (www.datdevworld.org). DHS are large, nationally representative household surveys. For each survey, non-overlapping area units (often enumeration areas) are randomly selected. These areas (called "clusters" henceforth) are usually communities, villages, or city quarters. In the selected clusters, all households are listed and a random sample of 25–30 households is selected for the interviews. The DHS consists of a household survey in which basic information is collected from all household members, with separate surveys for women and men. In the women's surveys, all usual resident women aged 15 to 49 are invited for an oral interview. In this interview, information is obtained on socioeconomic, demographic, and health-related issues.

To get a maximum discriminatory power, the data of all available DHS surveys for SSA countries held since 2000 have been pooled. For South Africa and Togo, data for 1998 is used, as

no other DHS surveys for these countries were available at the start of the project. To control for the fact that the surveys are held in different years and that for most countries several surveys were brought together, an indicator for survey year is included in the analysis. In Appendix B, additional information about the sample can be found. Response rates are generally very high, over 95% in all but one survey.

Our combined dataset contains information derived from 69 surveys on 917,788 children (467,528 boys and 450,260 girls) aged 7–15 years old and living in 29,925 local communities (sample clusters) within 1,164 sub-national regions (called "districts" henceforth) of 33 SSA countries. The household level data has been supplemented with context information at the level of districts and communities/clusters. To get representative samples of the countries, the household weights provided by DHS are used in all analyses. Because of missing cases on the variables of parental education, (grand)parental age, polygamy, number of brothers and sisters, wealth, and educational participation, and some unrealistic cases for (grand)parental age, a total of 19,782 (2,2%) children have been removed from the dataset. Unrealistic cases are parents aged below 19 or grandparents aged below 31 (as the included children are at least age 7). Our analysis, therefore, covers 898,006 children (457,286 boys and 440,720 girls). Data missing on characteristics of parents and grandparents who were absent from the household (e.g., education or occupation of a deceased father) is addressed using the dummy variable adjustment procedure, which leads to unbiased estimates of these variables (Allison, 2001; Little & Rubin, 2002).

Method and Variables

The dataset is characterized by a hierarchical structure. Households are nested within sample clusters, nested within districts, nested within countries. We use three-level logistic regression

analysis to address the nesting of the households within sample clusters and districts, and include fixed effects dummies at the national level to control for the nesting within countries. This strategy allows us to fully control for clustering and confounding at the national level, while retaining the possibility to study the role of contextual factors at the district and cluster level.

The dependent variable "educational participation" is a dummy variable indicating whether (1) or not (0) children aged 7–15 years of age were attending school at the time of the interview. The upper age limit of 15 is chosen because above that age less children are living with their parents (e.g., because of early marriage, education, or parental death). The lower age limit is set at 7, because in most SSA countries a substantial number of children start schooling at a later than compulsory age (Huisman and Smits 2009). The models are estimated with MLwiN, using second-order penalized quasi-likelihood (PQL2), the recommended estimating technique for multilevel logistic regression analysis (Goldstein and Rasbash 1996).

The major independent variable is a dummy variable indicating whether (1) or not (0) children are living with a grandfather. Children living with their grandfather are identified in the DHS data by using the household roster, which defines the relationship of all household members to the household head. Children are identified as living with a grandfather if: (1) they are grandchildren of a male household head; (2) they are grandchildren of a female household head whose husband is also living in the household; (3) they are children of the household head, and the father or father-in-law of the household head is also living in the household; (4) they are children of a brother or sister of the household head, and the father of the household head is also living in the household. All other children living in the household, including adopted and foster children, are considered as not living with their grandfather. Given the restricted information on the relationships within the households, it cannot be completely precluded that some of these

children still live with a grandfather, for example, if they belong to the categories "Other family members" or "Not related household members." However, given that the number of school-aged children in the data who belong to these categories is very small (3%), the number of them living with a grandfather is expected to be negligible.

Of the other variables, grandparental age and educational level are measured in years. The presence of the father and mother of the child in the household is measured with two dummy variables for each of them: one dummy indicating whether (1) or not (0) the parent is absent from the household, and one dummy indicating whether (1) or not (0) the parent is deceased. The age of the child, "number of sisters," "number of brothers," and "birth order" are interval variables. Because income is lacking in the DHS data, household wealth is measured by the International Wealth Index (IWI; Smits and Steendijk 2015), a comparative asset-based wealth index. Parents' education is measured in years of education completed, ranging from 0 to 16 years. Father's occupation is measured by three dummy variables, indicating whether (1) or not (0) the father was employed in a farm, lower non-farm (sales, services, manual), or upper non-farm (professional, technical, managerial, clerical) occupation. Mother's employment is measured by a dummy variable indicating whether (1) or not (2) the mother, apart from her housework, did any other work the previous week. To indicate the relative position of the mother in the household, we follow earlier research (Blanc and Wolff 2001; Luz and Agadjanian 2015; Spierings et al. 2010) and use the age difference between parents (mother's age minus father's age) measured in three categories with a respective age-difference of up to -6, -6 to 0, and 0 and more, thus indicating a step-by-step strengthening of the relative position of the mother or a weakening of the position of the father.

Of the contextual factors, the level of development is indicated by the mean of the IWI in the region. Given that this index at the national level is highly correlated with the Human Development Index and with GNP per capita (Smits and Steendijk 2015), it is expected to be a good development indicator at the sub-national level as well. Urbanization is measured by a dummy variable indicating whether (1) or not (0) the household is living in a rural area. Education is measured by the mean years of education of people aged 20–40 in the area. The relative position of women in the context where the household lives is indicated by the average age difference between parents as an interval variable and by the percentage of polygamous households in the area. Polygamous households are households where the male household head has more than one wife.

Given that for African countries hardly any indicator is available at the sub-national level, contextual factors are created by aggregating household level variables to the sample cluster and district level. Sample clusters are villages or neighborhoods and, therefore, reflect the nearby community in which the household lives very well. Thus, using context variables at the cluster level seems preferable over using such variables at the more distant district level. However, the sample clusters in our data are rather small (at most 30 households and often much less). This means that there is little variation at that level and measurement is less precise. At the district level, sample sizes are much larger. There is evidence that context effects can be caught rather well with more distant variables (Smits, Keij-Deerenberg, & Westert, 2005), although education at the cluster level forms an exception. Kravdal (2006) found that the context level of education works well at the cluster level. We therefore include education context in the cluster level and the other contextual factors in the district level. To determine whether and in which ways the effect of a co-residing grandfather differs across circumstances, interactions between the grandfather

dummy variable and other variables at the household and context levels are tested. In the interaction analysis, centered versions of the involved variables are used, so that the main effects can be interpreted as average effects. Only the significant results of our interaction analysis are reported.

4. Results

Descriptive statistics of the variables used in our models revealed that 6.8% of the children aged 7–15 years old in our sample were living with at least one grandfather and 16.2% were living with at least one grandmother (Table 1).

-- Table 1 about here --

Almost 73% of the children were attending school at the time of interview. The average age of the grandfathers in the sample was almost 68 years against nearly 63 years for grandmothers. There were more children living with a missing father than with a missing mother. In 23.4% of the cases, the mother was absent or deceased, and for 35.5% of the children, the father was absent or deceased. Most of the children in our population were living in a rural area (71%). On average, grandfathers had obtained more years of education (2.7 years) than grandmothers (1.5 years) and parents in general were better educated than grandparents.

Multilevel analysis

Table 2 shows the coefficients and odds ratios of our multilevel logistic regression model for the effect of grandfather's co-residence on the educational participation of children aged 7–15

years old. Besides the factors shown in Table 2, the model contains controls for socio-economic, demographic, and cultural factors at the cluster and district levels. The complete model is presented in Appendix A.

-- Table 2 about here --

The co-residence of a grandfather is positively associated with the educational participation of his grandchildren. This effect is significant and substantial. When controlling for confounding factors at the household and context levels, the odds of being in school are about 16% higher for children living with a grandfather. This finding is in line with the *positive grandfather hypothesis*, which predicts the presence of a grandfather to be beneficial for his grandchildren's schooling. For comparison reasons, we also include the grandmother effect in Table 2. This effect is substantially stronger than the grandfather effect. Children with a co-residing grandmother have 39% higher odds of being in school than those without a grandmother in the household.

Table 2 shows that the educational level of the grandfather is also important. If the grandfather has completed more years of education, the likelihood that his grandchildren are in school is higher. The positive effect of grandfather's education is in line with the idea that grandfathers with more education are more motivated and have more potential to get and keep their grandchildren in school. Regarding grandfather's age no significant effect was found.

The role of the context

There are a substantial number of significant interactions between grandfather's co-residence and variables at the household level. A first important interaction concerns the presence of a

grandmother, which in almost all cases is the grandfather's wife. If the grandmother is present, the grandfather effect is substantially weaker. This interaction effect is so strong that in households where both the grandfather and the grandmother are present, the grandfather effect becomes significantly negative (β = -.076, SE = 0.032). Hence, when the grandfather is the only grandparent in the household, he seems to behave responsibly and contribute to the household. However, when his wife, the grandmother, is also present, it seems that he leans on her, and even to such an extent that he may become a burden instead of a resource to the household. This is particularly the case if the grandmother is young, as there is also a significant positive interaction between the grandfather effect and grandmother's age. However, if the grandmother is older, the contribution of the grandfather increases and he becomes more important for the school attendance of his grandchildren.

Important interactions also exist between the grandfather effect and the age and sex of the child. As grandchildren grow older, the importance of a co-residing grandfather increases. For each year the child is older than six, the grandfather effect increases by 3%. The grandfather is also more important for girls than for boys. For girls, the odds of being in school increase by 25% ($P < 0.01$ not shown in the table) in households with a co-residing grandfather; however, for boys, this increase is only 7%.

The presence of a grandfather is particularly important if the mother is deceased or absent from the household. In those situations, a co-residing grandfather increases the odds of being in school by 27% to 41%, respectively. Interestingly, there is no evidence that in the case of a deceased or absent father, it has an effect on children's schooling whether or not a grandfather is present. Hence, it seems that grandfathers may replace a missing mother, but less so a missing father.

There are no significant interactions with characteristics of the context in which the household is situated. Whether or not the household lives in a more or less educated or developed area, in an urban versus a rural area, in an area where the age difference between spouses is larger or smaller, or where there is more or less polygamy, in all these cases, the effect of a co-residing grandfather is more or less the same. There is also no significant interaction with the year in which the survey was held, thus indicating that the importance of a co-residing grandfather has remained more or less stable since the turn of the century.

5. Conclusion and discussion

On the basis of the data on almost 900,000 children aged 7–15 years old, living in 33 SSA countries, we find evidence that children who live with their grandfather have higher odds of attending school than children who are not living with their grandfather. Children with a co-residing grandfather have 16% higher odds of attending school on average. This effect is rather substantial, even though it is weaker than that of a co-residing grandmother, which increases the odds of attending school by 39%. The finding of a positive grandfather effect is in line with the *generative grandfathering* framework of Bates (2009), which supposes that grandfathers in their *generative* stage of life actively support and guide the next generation.

We expected the degree and quality of the generative work grandfathers put forth to their grandchildren to vary and to depend upon their characteristics, and in particular, their educational level and age. Regarding their educational level, we argued that grandfathers who had experienced the benefits of good education might be better equipped to teach, instruct, and coach their grandchildren. It might also make them more eager to stimulate their grandchildren to go to school than grandfathers with less or no education. This expectation is supported by our results.

The level of education of co-residing grandfathers is positively associated with the schooling of their grandchildren. For grandfather's age, we hypothesized that when grandfathers get older, they become more emotionally expressive and affectionate towards their grandchildren and may wish to teach them about interpersonal relationships and transfer their values to them (Fuller-Thomson & Minkler, 2001; Waldrop et al., 1999). This hypothesis is not confirmed by our results.

To gain insight into the circumstances under which a grandfather is more or less important for children's schooling, an interaction analysis was conducted. An important finding of this analysis is that there is a significant positive interaction between grandfathers' co-residence and their grandchildren's age. Hence, the presence of a grandfather is more positive for the schooling of older grandchildren. This finding supports our hypothesis that grandfathers might be particularly focused on the societal position of their grandchildren, because the level of respect they gain in society might depend on the success of their grandchildren. Because this success of the grandchildren is related to the level of schooling they obtain, grandfathers have an incentive to keep their children in school and to help them to move on from primary to secondary education.

Based on previous studies in which granddaughters tend to report closer contact with grandmothers and grandsons with grandfathers, we expected boys to benefit more from a co-residing grandfather than girls (Hagestad & Speicher, 1981; Mann et al., 2013). However, our results show the opposite effect. Girls profit more from a co-residing grandfather than boys. This might indicate that grandfathers also take over (household)tasks that otherwise would have been done by girls. It might also have to do with the overall weaker position of girls compared to boys in African households, which implies that more improvement is possible for girls than for boys and that additional resources (in this case, the support given by the grandfather) might benefit

them more (convergence). This explanation is supported by earlier research indicating that girls also tend to profit more than boys from a co-residing grandmother (Schrijner & Smits, 2018a).

Our interaction analysis further reveals that the grandfather effect is stronger when the mother is deceased or absent from the household. However, it is hardly affected by the absence or death of the father. This might be due to the fact that African mothers are more important for children's schooling than African fathers. The effect of an absent mother on African children's schooling is stronger than that of an absent father (e.g., Case and Ardington 2006; Evans and Miguel 2007; Lloyd and Blanc 1996; Parker and Short 2009). Therefore, households with an absent mother might be in more need of a helping grandfather than households with an absent father, at least, when there is no grandmother in the household. Our interaction analysis shows that the effect of a co-residing grandfather is less strong if there is also a grandmother present. Hence, grandfathers and grandmothers are to a certain extent substitutes for each other. Either of them can take over household tasks or contribute in other ways that increase the possibilities of children attending school. When the grandfather and grandmother are together in the household, their individual contributions decrease. However, this also depends on the grandmother's age, as the importance of grandfathers for children's schooling increases significantly if the grandmother is older. Thus, African grandfathers and grandmothers also supplement each other to a certain extent.

No significant interactions are found between the grandfather effect and socio-economic factors at the household or context levels. Our expectation that grandfathers would be more important under difficult circumstances or in situations of scarcity are thus not confirmed by our data. Also, our ideas regarding the role of cultural factors are not confirmed by the data. Given the negative effects of polygamy on child survival documented in earlier research (e.g., Omariba and Boyle 2007; Strassmann 2011), we were wondering whether the grandfather effect on

schooling would be affected by polygamy. This turns out not to be the case. Neither at the household level nor at the community level did polygamy have a significant effect. Regarding the strength of the relative position of fathers versus mothers in the household, we found that only in the rather unusual situation where the mother of the child is older than the father, having a co-residing grandfather is less important for children's schooling. Hence, a weak position of the father seems to go together with a weaker position of the grandfather.

Our study is the first to document a positive effect of the presence of a grandfather on the well-being of children in Sub-Saharan Africa. Earlier studies for this region did not find any grandfather effect, neither on young children's survival chances (Borgerhoff Mulder, 2007; Gibson & Mace, 2005; Sear, 2008; Sear et al., 2000) nor on children's schooling (Parker and Short 2009). This might have to do with the relatively small scale of these studies, the focus on very young children, or the fact that those studies did not control for all relevant socio-demographic factors. The fact that the grandfather effect is substantially weaker than the grandmother effect probably also plays a role. A large database and powerful design are needed to make it visible against the background of confounding factors.

Some caution is required regarding our conclusions, as our study has several limitations. First, it is based on cross-sectional data. Hence, although important new information is obtained on the association between grandfathers' co-residence and children's schooling and on the variations of this relationship across circumstances, no strict conclusions in terms of causal relations can be drawn. Second, as our data does not contain information on non-residing grandfathers, it is not possible to say something about the distance gradient in grandfather support. Grandfathers who live in the vicinity of their (grand)children are probably better able to support them than grandfathers who live farther away. Insight into the nature of this relationship is essential for

policymakers and social agents who want to strengthen existing family ties in order to improve the position of children. Further research is, therefore, needed on this distant gradient, as well as on some other missing factors, such as the lineage of the grandfather and the role played by local organizations, such as schools, governmental services, and NGOs.

In sum, we found evidence in favor of the existence of a positive grandfather effect on children's schooling across a broad range of circumstances in the SSA context. The effect is particularly strong for older children, girls, and when the grandfather is older. Grandfathers and grandmothers are to a certain extent substitutes for each other. However, if both a grandfather and a grandmother are present in the household, the grandfather effect may become negative. This suggests that grandfathers tend to lean on their wives to a certain extent when they are old and that grandmothers have less energy left for their grandchildren if their husband is also present. Compared to earlier research, our study is a major step forward, as it provides – for the first time – a broad comparative analysis of the role played by contextual factors for the relationship between a grandfather's co-residence and a child's well-being, and in particular, children's schooling. Our findings clarify that grandfathers should not be overlooked when designing policies aimed at strengthening the position of children in the SSA context.

REFERENCES

Admassie, A. (2003). Child labour and schooling in the context of a subsistence rural economy: can they be compatible? *International Journal of Educational Development, 23*(2), 167–185. http://doi.org/10.1016/S0738-0593(02)00012-3

Allison, P. D. (2001). *Missing data*. *Quantitative applications in the social sciences* (Vol. 07-136). Thousand Oaks, London: Sage Publications, Inc.

Ananga, E. D. (2011). Typology of school dropout: The dimensions and dynamics of dropout in Ghana. *International Journal of Educational Development, 31*(4), 374–381.

http://doi.org/10.1016/j.ijedudev.2011.01.006

Basu, K., & Tzannatos, Z. (2003). The Global Child Labor Problem: What Do We Know and What Can We Do? *The World Bank Economic Review*, *17*(2), 147–173. http://doi.org/10.1093/wber/lhg021

Bates, J. S. (2009). Generative Grandfathering: A Conceptual Framework for Nurturing Grandchildren. *Marriage & Family Review*, *45*(4), 331–352. http://doi.org/10.1080/01494920802537548

Bates, J. S., & Taylor, A. C. (2012). Grandfather Involvement and aging men's mental health. *American Journal of Men's Health*, *6*(3), 229–39. http://doi.org/10.1177/1557988311430249

Beise, J. (2005). The helping grandmother and the helpful grandmother: The role of maternal and paternal grandmothers in child mortality in the 17th and 18th century population of French settlers in Quebec, Canada. In E. Voland, A. Chasiotis, & W. Schiefenhövel (Eds.), *Grandmotherhood: The Evolutionary Significance of the Second Half of Female Life* (pp. 215–238). New Brunswick: Rutgers University Press.

Blanc, A. K., & Wolff, B. (2001). Gender and decision-making over condom use in two districts in Uganda. *African Journal of Reproductive Health*, *5*(3), 15–28. http://doi.org/10.2307/3583320

Booth, A. L., & Kee, H. J. (2009). *Birth order matters: The effect of family size and birth order on educational attainment*. *Journal of Population Economics* (Vol. 22). http://doi.org/10.1007/s00148-007-0181-4

Borgerhoff Mulder, M. (2007). Hamilton's rule and kin competition: the Kipsigis case. *Evolution and Human Behavior*, *28*(5), 299–312. http://doi.org/10.1016/j.evolhumbehav.2007.05.009

Bourdillon, M. (2006). Children and Work: A Review of Current Literature and Debates. *Development and Change*, *37*(6), 1201–1226. http://doi.org/10.1111/j.1467-7660.2006.00519.x

Breen, R., & Goldthorpe, J. H. (1997). Explaining educational differentials: Towards a formal rational action theory. *Rationality and Society*, *9*(3), 275–305. http://doi.org/10.1177/104346397009003002

Brooks-Gunn, J., & Duncan, G. J. (1997). The Effects of Poverty on Children. *The Future of Children*, *7*(2), 55–71.

Buchmann, C., & Brakewood, D. (2000). Labor Structures and School Enrollments in Developing Societies : Thailand and Kenya Compared. *Comparative Education Review*, *44*(2), 175–204.

Buchmann, C., & Hannum, E. (2001). Education and Stratification in Developing Countries: A Review of Theories and Research. *Annual Review of Sociology*, *27*(2001), 77–102.

Case, A., & Ardington, C. (2006). The Impact of Parental Death on School Outcomes: Longitudinal Evidence from South Africa. *Demography*, *43*(3), 401–420. http://doi.org/10.2307/4137241

Coall, D. a, & Hertwig, R. (2010). Grandparental investment: past, present, and future. *Behavioral and Brain Sciences*, *33*(1), 1-19; discussion 19-40. http://doi.org/10.1017/S0140525X09991105

Colclough, C., Rose, P., & Tembon, M. (2000). Gender inequalities in primary schooling: The roles of poverty and adverse cultural practice. *International Journal of Educational Development*, *20*(1), 5–27.

Creasey, G. L., & Koblewski, P. J. (1991). Adolescent grandchildren's relationships with maternal and paternal grandmothers and grandfathers. *Journal of Adolescence*, *14*(4), 373–387. http://doi.org/10.1016/0140-1971(91)90005-C

Derosas, R. (2002). Fatherless families in 19th century Venice. In R. Derosas, & M. Oris. (Eds.), When dad died: Individuals and families coping with distress in past societies. Bern: Peter Lang.

Duflo, E. (2003). Grandmothers and Granddaughters: Old-Age Pensions and Intrahousehold Allocation in South Africa. *The World Bank Economic Review*, *17*(>1), 1–25. http://doi.org/10.1093/wber/lhg013

Emerson, P. M., & Souza, A. P. (2008). Birth Order, Child Labor, and School Attendance in Brazil. *World Development*, *36*(9), 1647–1664. http://doi.org/10.1016/j.worlddev.2007.09.004

Erikson, E. H. (1963). Childhood and society. (Rev. ed.).

Ersado, L. (2005). Child Labor and Schooling Decisions in Urban and Rural Areas: Comparative Evidence from Nepal, Peru, and Zimbabwe. *World Development*, *33*(3), 455–480. http://doi.org/10.1016/j.worlddev.2004.09.009

Evans, D. K., & Miguel, E. (2007). Orphans and Schooling in Africa: A Longitudinal Analysis. *Demography*, *44*(1), 35–57. http://doi.org/10.2307/4137220

Fafchamps, M., & Wahba, J. (2006). Child labor, urban proximity, and household composition. *Journal of Development Economics*, *79*(2), 374–397. http://doi.org/http://dx.doi.org/10.1016/j.jdeveco.2006.01.005

Fuller-Thomson, E., & Minkler, M. (2001). American grandparents providing extensive child care to their grandchildren: prevalence and profile. *The Gerontologist*, *41*(2), 201–209.

Gibson, M., & Mace, R. (2005). Helpful grandmothers in rural Ethiopia: A study of the effect of kin on child survival and growth. *Evolution and Human Behavior*, *26*(6), 469–482. http://doi.org/10.1016/j.evolhumbehav.2005.03.004

Glick, P., & Sahn, D. E. (2006). The demand for primary schooling in Madagascar: Price, quality, and the choice between public and private providers. *Journal of Development Economics*, *79*(1), 118–145. http://doi.org/http://dx.doi.org/10.1016/j.jdeveco.2005.01.001

Goldstein, H., & Rasbash, J. (1996). Improved Approximations for Multilevel Models with Binary Responses. *Journal of the Royal Statistical Society*, *159*(3), 505–513.

Hagestad, G. O., & Speicher, J. L. (1981). Grandparents and family influence: Views of three

generations. In *biennial meeting of the Society for Research in Child Development, Boston*.

Hamilton, W. D. (1964). The genetical evolution of social behaviour. II. *Journal of Theoretical Biology*, *7*(1), 17–52.

Hawkes, K. (2003). Grandmothers and the evolution of human longevity. *American Journal of Human Biology*, *15*(3), 380–400. http://doi.org/10.1002/ajhb.10156

Hawkes, K. (2004). The grandmother effect. *Nature*, *428*(March), 128–129.

Hawkes, K., O'Connell, J. F., & Blurton Jones, N. G. (1997). Hadza Women ' s Time Allocation , Offspring Provisioning , and the Evolution of Long Postmenopausal Life Spans. *Current Anthropology*, *38*(4), 551–577.

Hobcraft, J. (1993). Women ' s education, child welfare and child survival: a review of the evidence. *Health Transition Review*, *3*(2), 159–175.

Hope, S. K. R. (2005). Child survival, poverty, and labor in Africa. *Journal of Children and Poverty*, *11*(1), 19–42. http://doi.org/10.1080/1079612042000333036

Huisman, J., & Smits, J. (2009). Effects of Household- and District-Level Factors on Primary School Enrollment in 30 Developing Countries. *World Development*, *37*(1), 179–193. http://doi.org/10.1016/j.worlddev.2008.01.007

Huisman, J., & Smits, J. (2015). Keeping Children in School : Household and District-level Determinants of School Dropout in 363 Districts of 30 Developing Countries. *Sage Open*, *2015*(October), 1–38. http://doi.org/10.1177/2158244015609666

Jamison, C. S., Cornell, L. L., Jamison, P. L., & Nakazato, H. (2002). Are all grandmothers equal? A review and a preliminary test of the "grandmother hypothesis" in Tokugawa Japan. *American Journal of Physical Anthropology*, *119*(1), 67–76. http://doi.org/10.1002/ajpa.10070

Kandiyoti, D. (1988). Bargaining with Patriarchy. *Gender and Society*, *2*(3), 274–290. http://doi.org/10.2307/190357

Kemkes-Grottenthaler. (2005). Of Grandmothers, Grandfathers and Wicked Step-Grandparents. Differential Impact of Paternal Grandparents on Grandoffspring Survival. *Historical Social Research / Historische Sozialforschung*, *30*(3 (113)), 219–239. http://doi.org/Retrieved from http://www.jstor.org/stable/20762061

Kravdal, Ø. (2006). A simulation-based assessment of the bias produced when using averages from small DHS clusters as contextual variables in multilevel models. *Demographic Research*, *15*(1), 1–20. http://doi.org/10.4054/DemRes.2006.15.1

Lachaud, J., LeGrand, T. K., & Kobiané, J.-F. (2017). Intergenerational Transmission of Educational Disadvantage in the Context of the Decline of Family Size in Urban Africa. *Population Review*, *56*(1). http://doi.org/10.1353/prv.2017.0004

Little, R. J. H., & Rubin, D. B. (2002). *Statistical Analysis with Missing Data*. New Jersey: John Wiley & Sons, Inc.

Lloyd, C. B., & Blanc, A. K. (1996). Children's Schooling in sub-Saharan Africa: The Role of

Fathers, Mothers, and Others. *Population and Development Review*, *22*(2), 265–298. http://doi.org/10.2307/2137435

Lu, Y., & Treiman, D. J. (2011). Migration, Remittances and Educational Stratification among Blacks in Apartheid and Post-Apartheid South Africa Migration. *Social Forces*, *89*(4), 1119–1143. http://doi.org/10.1353/sof.2011.0063

Lutz, W., Cuaresma, J. C., & Sanderson, W. (2008). Economics. The demography of educational attainment and economic growth. *Science*, *319*(5866), 1047–1048. http://doi.org/10.1126/science.1151753

Luz, L., & Agadjanian, V. (2015). Women's decision-making autonomy and children's schooling in rural Mozambique. *Demographic Research*, *32*, 775–796. http://doi.org/10.1530/ERC-14-0411.Persistent

Mann, R., Khan, H. T. A., & Leeson, G. W. (2013). Variations in grandchildren's perceptions of their grandfathers and grandmothers: Dynamics of age and gender. *Journal of Intergenerational Relationships*, *11*(4), 380–395. http://doi.org/10.1080/15350770.2013.839326

Mann, R., Tarrant, A., & Leeson, G. W. (2015). Grandfatherhood : Shifting Masculinities in Later Life. *Sociology*, *50*(3), 594–610. http://doi.org/10.1177/0038038515572586

Martin, M. A. (2012). Family structure and the intergenerational transmission of educational advantage. *Social Science Research*, *41*(1), 33–47. http://doi.org/10.1016/j.ssresearch.2011.07.005

Mingat, A. (2007). Social Disparities in Education in Sub-Saharan African Countries. In *International Studies in Educational Inequality, Theory and Policy* (pp. 223–255). Springer Netherlands. http://doi.org/10.1007/978-1-4020-5916-2_10

Mukherjee, D., & Das, S. (2008). Role of Parental Education in Schooling and Child Labour Decision: Urban India in the Last Decade. *Social Indicators Research*, *89*(2), 305–322. http://doi.org/10.1007/s11205-007-9233-0

Nyamukapa, C., & Gregson, S. (2005). Extended family's and women's roles in safeguarding orphans' education in AIDS-afflicted rural Zimbabwe. *Social Science & Medicine*, *60*(10), 2155–2167. http://doi.org/http://dx.doi.org/10.1016/j.socscimed.2004.10.005

Omariba, D. W. R., & Boyle, M. H. (2007). Family structure and child mortality in sub-Saharan Africa: Cross-national effects of polygyny. *Journal of Marriage and Family*, *69*(2), 528–543. http://doi.org/10.1111/j.1741-3737.2007.00381.x

Parker, E. M., & Short, S. E. (2009). Grandmother Coresidence, Maternal Orphans, and School Enrollment in Sub-Saharan Africa. *Journal of Family Issues*, *30*(6), 813–836.

Piotrowski, M., & Paat, Y.-F. (2012). Determinants of Educational Attainment in Rural Thailand: A Life Course Approach. *Population Research and Policy Review*, *31*(6), 907–934. http://doi.org/10.1007/s11113-012-9242-9

Pong, S.-L., & Ju, D.-B. (2000). from the SAGE Social Science Collections . All Rights Reserved . *Journal of Family Issues*, *21*(10), 147–169. http://doi.org/0803973233

Potter, D. (2010). Psychosocial well-being and the relationship between divorce and children's academic achievement. *Journal of Marriage and Family*, *72*(4), 933–946. http://doi.org/10.1111/j.1741-3737.2010.00740.x

Schrijner, S., & Smits, J. (2018a). Grandmothers and children's schooling in Sub-Saharan Africa. *Human Nature*, *29*(1), 65–89. http://doi.org/https://doi.org/10.1007/s12110-017-9306-y

Schrijner, S., & Smits, J. (2018b). Grandparents and Children's stunting in sub-Saharan Africa. *Social Science and Medicine*, *205*(March), 90–98. http://doi.org/10.1016/j.socscimed.2018.03.037

Sear, R. (2008). Kin and Child Survival in Rural Malawi. *Human Nature*, *19*(3), 277–293. http://doi.org/10.1007/s12110-008-9042-4

Sear, R., & Mace, R. (2008). Who keeps children alive ? a review of the effects of kin on child survival. *Evolution and Human Behavior*, *29*(1), 1–18. http://doi.org/10.1016/j.evolhumbehav.2007.10.001

Sear, R., Mace, R., & McGregor, I. A. (2000). Maternal grandmothers improve nutritional status and survival of children in rural Gambia. *Proceedings of the Royal Society B Biological Sciences*, *267*(1453), 1641–1647. http://doi.org/10.1098/rspb.2000.1190

Smits, J., & Gündüz-Hoşgör, A. (2006). Effects of family background characteristics on educational participation in Turkey. *International Journal of Educational Development*, *26*(5), 545–560. http://doi.org/10.1016/j.ijedudev.2006.02.002

Smits, J., & Huisman, J. (2013). Determinants of educational participation and gender differences in education in six Arab countries. *Acta Sociologica*, *56*(4), 325–346. http://doi.org/10.1177/0001699313496259

Smits, J., Keij-Deerenberg, I., & Westert, G. (2005). Effects of socio-economic status on mortality: Separating the nearby from the farther away. *Health Economics*, *14*(6), 595–608. http://doi.org/10.1002/hec.950

Smits, J., & Steendijk, R. (2015). The International Wealth Index (IWI). *Social Indicators Research*, *122*(1), 65–85. http://doi.org/10.1007/s11205-014-0683-x

Spierings, N., Smits, J., & Verloo, M. (2010). Micro- and Macrolevel Determinants of Women's Employment in Six Arab Countries. *Journal of Marriage and Family*, *72*(5), 1391–1407. http://doi.org/10.1111/j.1741-3737.2010.00772.x

Strassmann, B. I. (2011). Cooperation and competition in a cliff-dwelling people. *Proceedings of the National Academy of Sciences of the United States of America*, *108*(Supplement 2), 10894–10901. http://doi.org/10.1073/pnas.1100306108

Tansel, A. (2002). Determinants of school attainment of boys and girls in Turkey: individual, household and community factors. *Economics of Education Review*, *21*(5), 455–470. http://doi.org/http://dx.doi.org/10.1016/S0272-7757(01)00028-0

Tymicki, K. (2009). Correlates of infant and childhood mortality: A theoretical overview and new evidence from the analysis of longitudinal data of the Bejsce (Poland) parish register reconstitution study of the 18th-20th centuries. *Demographic Research*, *20*, 559–594.

http://doi.org/10.4054/DemRes.2009.20.23

UNAIDS. (2013). *Towards an AIDS-free Generation*. New York.

UNESCO. (2007). *Education for All by 2015 Will we make it? Education for All by 2015 Will we make it?*

Waldrop, D. P., Weber, J. A., Herald, S. L., Pruett, J., Cooper, K., & Juozapavicius, K. (1999). Wisdom and life experience: How grandfathers mentor their grandchildren. *Journal of Aging and Identity*, *4*(1), 33–46.

Webbink, E., Smits, J., & de Jong, E. (2012). Hidden Child Labor: Determinants of Housework and Family Business Work of Children in 16 Developing Countries. *World Development*, *40*(3), 631–642. http://doi.org/10.1016/j.worlddev.2011.07.005

Webbink, E., Smits, J., & de Jong, E. (2013). Household and Context Determinants of Child Labor in 221 Districts of 18 Developing Countries. *Social Indicators Research*, *110*(2), 819–836. http://doi.org/10.1007/s11205-011-9960-0

Zeng, Z., & Xie, Y. (2014). The effects of grandparents on children's schooling: evidence from rural China. *Demography*, *51*(2), 599–617. http://doi.org/10.1007/s13524-013-0275-4

Table 1. *Descriptive statistics: Percentages, means of characteristics of children aged 7–15*

Variables	%, mean	Min	Max	SD
School attendance (dependent variable)	72.9%	0	1	0.44
Household factors				
Grandfather in the household	6.8%	0	1	0.25
Age grandfather	67.7	31	98	2.74
Education grandfather (years)	2.7	0	16	1.02
Grandmother in household	16.2%	0	1	0.37
Age grandmother	62.9	31	98	4.37
Education grandmother (years)	1.48	0	16	1.14
Sex is girl	49.1%	0	1	0.50
Age child	10.7	7	15	2.54
Age mother	38.0	19	98	7.39
Age father	46.9	19	98	8.80
Birth order	3.30	1	18	1.94
Number of sisters	1.92	0	10	1.65
Number of brothers	2.04	0	10	1.74
Mother alive, not in household	19.0%	0	1	0.39
Father alive, not in household	25.9%	0	1	0.44
Mother deceased	4.4%	0	1	0.20
Father deceased	9.6%	0	1	0.29
Household wealth (IWI)	27.0	0	100	22.73
Education father (years)	4.13	0	16	3.79
Education mother (years)	2.99	0	16	3.47
Mother employed	69.3%	0	1	0.46
Occupation father:				
Farm (reference category)	60.4%	0	1	0.33
Lower non-farm	29.5%	0	1	0.24
Upper non-farm	10.1%	0	1	0.14
Relative position mother (age mother-age father):				
Father ≥ 6 years older than mother (reference category)	64.8%	0	1	0.37
Father 6–0 years older than mother	31.8%	0	1	0.36
Father younger than mother	3.3%	0	1	0.14
Polygamous household	12.9%	0	1	0.33
Contextual factors				
Living in rural area	70.7%	0	1	0.46
Level of development (district)	27.22	0.99	88.96	16.93
Relative position women (district)	-8.99	-27.1	0.04	2.64
Educational level (years, cluster)	2.93	0	12.5	1.30
Polygamy (district)	29.0%	0	1	0.19

Source: DHS (1998-2013).

Table 2. *Logistic regression coefficients, standard errors, and odds ratios of grandfather's co-residence on the educational participation of children aged 7–15 in 33 SSA countries†*

Grandparental factors	β	S.E.	Odds Ratio
Intercept	1.291***	0.153	
Grandfather in household	.145***	0.040	1.16
Age grandfather	.003	0.002	1.00
Education grandfather (years)	.048***	0.006	1.05
Grandmother in household	.329***	0.017	1.39
Interaction effects with presence grandfather			
Gf * Grandmother in the household	-.264***	0.052	0.77
Gf * Age grandmother	.007*	0.003	1.01
Gf * Age child	.027***	0.007	1.03
Gf * Sex is girl	.148***	0.028	1.16
Gf * Mother alive, not in household	.340***	0.038	1.41
Gf * Mother deceased	.240***	0.056	1.27
Gf * Father younger than mother	-.187*	0.078	0.83

*******P < 0.001 **P < 0.01 *P < 0.05 (n = 898,006 of which 61,281 are living with a grandfather and 655,783 are attending school)

†The model includes socio-economic, demographic, and cultural control factors at the household and context levels, plus country-level fixed effects dummies (coefficients of the full model are presented in Appendix A).

APPENDIX A. *Full model of Table 2.*

Grandparental factors	β	S.E.	Exp(β)
Intercept	1.29***	0.153	
Grandfather in household	.145***	0.040	1.16
Grandmother in household	.329***	0.017	1.39
Age grandfather	.003	0.001	1.00
Age grandmother	.031***	0.009	1.03
Age grandmother square	-.0002***	0.000	1.00
Education grandfather (years)	.048***	0.006	1.05
Education grandmother (years)	.075***	0.006	1.08
Household factors			
Age child	.029***	0.001	1.03
Sex of child (0 = boy; 1 = girl)	-.247***	0.020	0.78
Birth order child	-.024***	0.003	0.98
Age mother	.042***	0.005	1.04
Age mother square	-.0004***	0.000	1.00
Number of sisters	.008**	0.003	1.01
Number of brothers	-.026***	0.003	0.97
Mother alive, not in household	-.518**	0.166	0.60
Father alive, not in household	-.312	0.170	0.73
Mother deceased	-.581**	0.165	0.56
Father deceased	-.347*	0.165	0.71
Household wealth (IWI)	.026***	0.001	1.03
Education father (years)	.079***	0.002	1.08
Education mother (years)	.087***	0.003	1.09
Mother employed	.143***	0.015	1.15
Occupation father (ref = farm)			
- Lower non-farm	.116***	0.024	1.12
- Upper non-farm	.224***	0.047	1.25
Position mother (ref = father > 6 years older)			
- Father 0–6 years older than mother	-.056***	0.013	0.95
- Father younger than mother	-.199***	0.029	0.82
Polygamous household	-.116***	0.015	0.89
Uncle in household	-.060*	0.024	0.94
Aunt in household	.009	0.024	1.01
Contextual factors			
Living in rural area	-.525***	0.082	0.59
Level of development (district)	-.014***	0.003	0.99
Educational level (cluster)	.148***	0.014	1.16
Position women (district)	.026	0.021	1.03
Polygamy (district)	-1.80***	0.355	0.16
Year	.050***	0.008	1.05
Interaction effects with presence grandfather			
Gf * Grandmother in the household	-.264***	0.052	0.77
Gf * Age grandmother	.007*	0.003	1.01
Gf * Age child	.027***	0.007	1.03
Gf * Sex is girl	.148***	0.028	1.16
Gf * Mother alive, not in household	.340***	0.038	1.41
Gf * Mother deceased	.240***	0.056	1.27
Gf * Father younger than mother	-.187*	0.078	0.83
Variance components			
District level (3)			
- Variance intercept schooling	.438***	0.027	
- Random effect covariance Gf	.042***	0.013	
- Random effect variance Gf	.040***	0.010	
Cluster level (2)			
- Variance intercept schooling	.766***	0.031	
- Random effect covariance Gf	-.050***	0.015	
- Random effect variance Gf	.662***	0.040	

*******P < 0.001 **P < 0.01 *P < 0.05 (n = 898,006 of which 61,281 are living with a grandfather and 655,783 are attending school) †The model includes the full set of country-level fixed effects dummies to control for confounding and clustering at the national level.

APPENDIX B. *DHS country data, year of survey(s), and household response rates*

Country	**Year(s)**	**HH Resp. rate (%)**
Benin	2001, 2006, 2011	97.0, 99.1, 98.6
Burkina Faso	2003, 2010	99.4, 99.2
Burundi	2010	99.1
Cameroon	2004, 2011	97.6, 99.0
Chad	2004	99.4
Cote d'Ivoire	2005, 2011	95.5, 98.1
Congo DR	2007, 2013	99.3, 99.9
Congo Brazzaville	2005, 2011	99.2, 99.8
Ethiopia	2000, 2005, 2011	99.3, 98.5, 98.1
Gabon	2000, 2012	97.6, 99.3
Ghana	2003, 2008	98.7, 98.9
Guinea	2005, 2012	99.2, 99.5
Kenya	2003, 2008	96.3, 97.7
Lesotho	2004, 2010	95.2, 97.6
Liberia	2007, 2013	97.2, 99.4
Madagascar	2004, 2009	97.8, 98.8
Malawi	2000, 2004, 2010	99.0, 97.8, 98.1
Mali	2001, 2006, 2013	97.9, 98.8, 98.4
Mauritania	2001	98.4
Mozambique	2003, 2011	80.6, 99.8
Namibia	2000, 2006, 2013	96.9, 97.8, 96.9
Niger	2006, 2012	98.0, 98.0
Nigeria	2003, 2008, 2013	98.6, 98.3, 99.0
Rwanda	2000, 2005, 2010	99.7, 99.7, 99.8
Senegal	2005, 2011, 2012	98.5, 98.4, 98.7
Sierra Leone	2008, 2013	97.6, 99.3
South Africa	1998	97.0
Swaziland	2006	95.2
Tanzania	2004, 2010	98.8, 98.8
Togo	1998	98.6
Uganda	2001, 2006, 2011	95.8, 95.3, 97.5
Zambia	2002, 2007	98.2, 97.8
Zimbabwe	2006, 2011	95.0, 96.0