

RESEARCH ARTICLE

School Enrollment and Living Arrangements of Children in Sub-Saharan Africa

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School enrollment has increased in many sub-Saharan African countries over recent decades, alongside substantial socioeconomic and demographic transitions. However, gains in educational enrollment have not been equal, raising questions about the determinants of access to and variability in school enrollment. The living arrangements of children constitute one possible factor associated with this variability. We leverage 60 census samples, provided by IPUMS International, to analyze links between living arrangements and school enrollment for 24 African countries between 1976 and 2019, and explore how these associations have changed across countries and over time. The results suggest that school enrollment among children aged 7–14 increased in all countries, but variability in enrollment by children's living arrangement persists. Children living in households without both of their parents or without their mother face a disadvantage compared to those in households with both parents. Among recent samples, living in households with a mother only is associated with higher school enrollment in around two-thirds of countries, even when controlling for individual and household characteristics. The persistent heterogeneity in children's school enrollment across households demands further attention to better understand the links between family and developmental processes, and to inform policies aiming to increase children's school enrollment.

Introduction

This study aims to explore and compare links between school enrollment and children's living arrangements across African countries and over time. The expansion of school enrollment in many sub-Saharan African countries

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has, despite improvements, not been equal (Eloundou-Enyegue, Giroux, and Tenikue 2020; Lewin 2009; Lewin and Sabates 2012; Moja 2020), raising questions about determinants of variability in school enrollment in the context of educational expansion. Research from high-income countries highlights the importance of household and family influences for child outcomes (McLanahan and Percheski 2008; Sweeney 2007). However, in the African context, the household environment and children's living arrangements tend to be more diverse compared to other world regions due to relatively high levels of adult mortality, linked for instance to HIV/AIDS among other things, migration, union dissolution and re-partnering, and well-established foster systems (Adjiwanou, Boco, and Yaya 2021; Cotton 2021; Cotton and Oduor 2024; Evans et al. 2022; Hampshire et al. 2015). Thus, the links between living arrangements and variation in school enrollment demand further research attention.

An existing body of literature focuses on examining links between parental absence, orphanhood, and the educational outcomes of children in sub-Saharan Africa (Akwara et al. 2010; Beegle, De Weerd, and Dercon 2006, 2009; Beegle, Filmer, et al. 2010; Case and Ardington 2006; Case, Paxson, and Ableidinger 2004; Evans and Miguel 2007; Hampshire et al. 2015; Monasch and Boerma 2004), yet less literature has explored associations between children's household environment and school outcomes within changing educational contexts. The studies that have been conducted, tend to focus on individual countries, such as Cameroon (Eloundou-Enyegue and Williams 2006), Burkina Faso (Gnoumou, LeGrand, and Kobiané 2013), Malawi (Carling and Tønnessen 2013; Chae 2016), Senegal (Crespin-Boucaud and Hotte 2021), South Africa (Chuong and Operario 2012; Townsend et al. 2002), and Tanzania (Gaydos 2015, 2017), or on specific dimensions of the household context, such as stepfamilies (Adjiwanou, Boco, and Yaya 2021).

We describe and explore changes in school enrollment within countries and differences across countries based on 60 census samples for 24 African countries, provided by IPUMS-International (Ruggles et al. 2025). We then analyze associations between living arrangements and school enrollment of children aged 7–14 covering four decades, from 1976 to 2019. We further explore how associations between living arrangements and school enrollment have changed over time and differ between countries. We aim to answer the following questions: (1) *What are the links between children's living arrangements and school enrollment in sub-Saharan Africa?*; (2) *How do these links differ across countries?*; and (3) *How have these links changed over time?* We distinguish between four distinct living arrangements of children: living with both parents; living with the biological mother only; living with the biological father only; and living in a household without biological parents.

With this article, we make two core contributions to the literature. The first contribution lies in the scope of the comparative analysis: we cover a

vast number of countries and analyze changes over time, thus adding a long-term comparative perspective to an existing body of literature that tends to focus on individual countries or on the most recent available survey data to study living arrangements and school enrollment. The second contribution is the emphasis on different children's living arrangements, thereby broadening research focusing on the impact of specific groups, such as orphans, or events, such as parental divorce, on school enrollment. While these contributions are relevant from research and policy perspectives, we provide a descriptive overview of links between living arrangements and school enrollment and explore how this relationship might have changed over time, to better understand how living arrangements are associated with the creation of future generations' human capital. Improved understanding of this relationship can contribute to the development of context-specific theories on these associations and form a starting point for further research on the role of living arrangements in the expansion of education in sub-Saharan Africa.

Background

School enrollment in sub-Saharan Africa

In recent decades, the majority of sub-Saharan African countries witnessed a vast educational expansion, alongside socio-economic and demographic transitions. Gains in school enrollment, however, have not been equal, raising questions about variability in school enrollment in African contexts (Eloundou-Enyegue, Giroux, and Tenikue 2020; Lewin 2009; Moja 2020). Changes in school enrollment within countries and over time differ, driven in part by heterogeneity and inequalities in educational opportunities of children (Kakuba and Golaz 2023; Lloyd and Hewett 2009; Temitope, Obayemi, and Rasiah 2019; Tshabangu 2018; Zoch 2015). Among the many children in sub-Saharan Africa who do not attend school, some never enroll in primary education, whereas others do not complete primary school, as expansion in first grade enrollment is not followed by enrollment increases in successive grades (Akyeampong 2009; Lewin 2009). Estimates suggest a low primary adjusted net school enrollment rate of children in sub-Saharan Africa of 79% in 2018 and an even lower primary completion rate of 61% (UNESCO Institute for Statistics 2022). Thus, many African countries are not on track to reach the 2030 Sustainable Development Goals' (SDGs) target of primary education for all children (Fredriksen 2022; UN DESA 2024) and enrollment in secondary education remains low in many countries (UNESCO Institute for Statistics 2019).

Education is necessary for the development of human capital and associated with economic development and productivity (Hannum and Buchmann 2005; Lutz, Cuaresma, and Sanderson 2008; Lutz et al. 2019). Addressing educational inequalities can boost social mobility and access

to opportunities (Azomahou and Yitbarek 2021), whereas the failure to address such inequalities might keep welfare and economic development low (Temitope, Obayemi, and Rasiah 2019). However, despite international initiatives related to the SDGs, countries in sub-Saharan Africa face substantial challenges to reaching universal (primary) education (Bennell 2002). Colonial rule left many countries with low rates of school enrollment, even compared to other developing countries (Fredriksen 2022). Uneven economic growth, persistent poverty, economic crises, political turmoil, rapid population growth, urbanization decoupled from industrialization, and environmental vulnerabilities have added substantial challenges (Cleland and Machiyama 2017; Hoeffler 2019; Juju et al. 2020; Serdeczny et al. 2017; Tabutin and Schoumaker 2004). These challenges, as well as the destruction of public infrastructure and educational systems due to wars and conflicts, can limit educational attendance (Lewin 2009) and exacerbate inequalities in the educational access and attainment of African youths (Moja 2020).

Challenges related to achieving universal school enrollment have been extensively studied from macro-level perspectives, yet less research has focused on exploring how the living arrangements of children are linked to variation in school enrollment over time and between countries. However, household characteristics in low- and middle-income countries are often crucial in determining educational access and opportunities for children (Lewin and Sabates 2012). For instance, public spending on education, which depends on economic factors, tends to be severely constrained in low- and middle-income countries. Consequently, education poses a higher relative economic burden on governmental budgets and on private households, which spend more on education compared to high-income countries (Fredriksen 2022; Lewin 2009). The household environment, and living arrangements in particular, might be an overlooked dimension in the literature exploring variation in school enrollment. Living arrangements and family structures of children might reflect factors that contribute to heterogeneity in school enrollment, such as economic inequalities and social relations (Adjiwanou, Boco, and Yaya 2021; Beegle, De Weerd, and Dercon 2010; Chae 2016; McLanahan and Percheski 2008).

Living arrangements of children in sub-Saharan Africa

Historically, children's living arrangements in Africa are diverse (Adjiwanou, Boco, and Yaya 2021). Households in sub-Saharan Africa are, on average, larger and have a more complex composition than households in other world regions (Esteve et al. 2024), although their characteristics, such as size and composition, differ across and within countries (Pohl, Esteve, and Galeano 2025). Globally, families, households, and living arrangements have undergone substantial changes, reflecting demographic, social, political, and economic developments (Esteve et al. 2024; Esteve and Reher 2024;

Pesando and GFC Team 2019). These developments have been accompanied by shifts in values and behaviors that shape the family environment in which children grow up, such as increases in cohabitation, nonmarital childbearing, and union dissolution (Cherlin 2012; Lesthaeghe 2020; Pesando and GFC Team 2019). Various distinct family systems and historic and socio-economic contexts further contribute to the continued heterogeneity in households and families (Cherlin 2012; Furstenberg 2019; Therborn 2004). In other words, the diversity in household and family characteristics makes it pertinent to examine the implications of this heterogeneity on dimensions of well-being, such as children's human capital accumulation.

The living arrangements of children in Africa are shaped by a well-established fosterage system (Akresh 2009; Bachan 2014; Cotton 2021; Cotton, Clark, and Madhavan 2022; Isiugo-Abanihe 1985; Lloyd and Desai 1992; Madhavan 2004), relatively high prevalence of orphanhood (Beegle, Filmer, et al. 2010; Case, Paxson, and Ableidinger 2004; Chuong and Operario 2012), internal and international migration patterns that might cause parental absence (Cotton and Oduor 2024; Townsend et al. 2002), and by frequent divorce and repartnering (Clark and Brauner-Otto 2015; Crespin-Boucaud and Hotte 2021; Lloyd and Blanc 1996), although these dynamics and their influence on children's living arrangements differ across countries. While aspects of family systems and their links with children's lived realities are context-dependent and can differ over time, existing literature highlights that many children in sub-Saharan Africa do not reside with their biological parents or live in a household with only one biological parent present (Cotton 2021). For instance, an analysis of data from Tanzania suggests that parental absence is common even among children born into two-parent households, with 25% and 40% of these children experiencing maternal or paternal absence, respectively, by age 10. Among children born to single mothers, more than two-thirds experience maternal absence. Parental absences may be driven by marriage patterns, migration, and parental death (Gaydosch 2015).

Many children who reside without their parents, either due to voluntary fostering decisions or familial crises, such as the death of one or both parents, are fostered by kin or nonrelatives. Such fostering arrangements are a longstanding pillar of the African kinship system, yet fostering prevalence varies across countries. A recent analysis of DHS data from 36 countries shows that fostering is most common in Namibia, where 45.7% of mothers report not living with at least one of their children aged 0–15, and with 11.5% being the least common in Burundi (Cotton 2021). Moreover, the analysis suggests that fostering levels have remained stable over time. Similarly, an analysis by Pohl, Batyra, and Esteve (2025) highlights that out-fostering prevalence among Senegalese mothers remained stable over time. Hence, despite broad demographic, social, and economic changes, fostering remains a common practice among mothers and many children are raised

and cared for by people other than their biological parents (Beck et al. 2015; Cotton 2021; Evans et al. 2022; Madhavan 2004).

Children might reside without either or both parents because of parental migration; however, data on the prevalence of children living in migrant families are scarce. It is estimated that these arrangements are quite common, with nongovernmental reports suggesting that in some sub-Saharan African countries around one-quarter of children are part of a transnational family, meaning at least one of their parents resides abroad (Mazzucato and Schans 2011). Caarls et al. (2018) highlight that migration literature tends to focus on men and paternal absence, yet already in the 1960s, female migrants accounted for nearly 50% of international migrants and migration among women has since increased. In addition to international migration, internal migration is common in many African countries (Cebotari and Mazzucato 2016). Migration decisions in the African context are supported by notions of family and kinship extending beyond the household, with shared responsibilities for children (Cebotari and Mazzucato 2016; Mazzucato and Cebotari 2017; Mazzucato et al. 2015).

Parental absence in sub-Saharan African households has also been linked to family systems in which marriage, divorce, and repartnering are relatively common (Clark and Brauner-Otto 2015; Crespin-Boucaud and Hotte 2021), and polygyny is persistently prevalent in some countries (Somefun et al. 2025), thus contributing to fluid or stretched family arrangements across multiple households (Adjiwanou, Boco, and Yaya 2021; Gaydosh 2015; Mazzucato and Schans 2011). An analysis of union dissolution for 33 sub-Saharan African countries suggests that, on average, around 25% of unions will end in divorce and 8% of unions will end due to spousal death 15–19 years after first union (Clark and Brauner-Otto 2015). The analysis further estimates that the vast majority of women—over 85%—experience union dissolution while having a child younger than age 15, hence a substantial number of children will experience a period of coresidence with only one biological parent. This is in line with the finding that up to half of all women in the region might experience single motherhood due to divorce and widowhood (Clark and Hamplová 2013). Living arrangements, family composition, social and legal norms surrounding union formation and dissolution, as well as the meanings of marriage are diverse and differ across countries in the region (Clark and Brauner-Otto 2015; Cotton 2021; Crespin-Boucaud and Hotte 2021). Some partnership practices have been outlined as distinct to the African context (Somefun et al. 2025) and other aspects, such as kinship ties have been identified as a shared feature among family systems across Africa (Therborn 2004).

African kinship systems differ with respect to lineage and locality, with patrilineal kinship prevailing among most ethnic groups, despite matrilineal kinship in parts of sub-Saharan Africa (Grant and Yeatman 2014; Lowes 2022). Historically, matrilineal ethnic groups in Africa are

primarily present in what is sometimes referred to as the “matrilineal belt,” a stretch of matrilineal groups across the region from Angola to Tanzania but is also found in other African countries (Lowes 2022). In patrilineal societies, children belong to their paternal family and patrilocal residence norms prevail for couples, whereas in matrilineal societies residence might be matrilineal, although the boundaries are not always easy to distinguish (Grant and Yeatman 2014; Lowes 2022), different practices might exist within ethnic groups (Clark and Brauner-Otto 2015), and even in some patrilineal societies, children tend to reside with their mother after a divorce (Grant and Yeatman 2014). As divorce is common in most African societies, many children in sub-Saharan Africa might at least temporarily live in a mother-only household. Since divorce might be higher in African matrilineal societies, compared to patrilineal societies, and divorce rates are declining (Clark and Brauner-Otto 2015), such patterns likely vary across countries and over time.

While remarriage in sub-Saharan Africa is generally common, less than 5% of children reside in a household with a stepfather (Adjiwanou, Boco, and Yaya 2021). The low prevalence of step-family arrangements, but also of children residing with only their biological fathers if their mothers are alive (Beegle, Filmer, et al. 2010; McDaniel and Zulu 1996), might be linked to fostering practices and decisions to out-foster children once a new union is formed. Union formation in the African context can be complex (Somefun et al. 2025) and might be a process rather than a point in time (Hertrich 2017; Meekers 1992). Moreover, premarital and nonmarital childbearing are common and can be linked to (temporary) parental absence (Gaydosch 2015). Single motherhood and polygyny in some contexts might be positively associated with out-fostering (Pohl, Batyra, and Esteve 2025). Thus, children who experience the death of a parent, are born into a polygynous union, or to a single or divorced mother might reside in a household without either parent.

The role of living arrangements for school enrollment of children in sub-Saharan Africa

The household provides the immediate context of socialization for children and influences the human capital accumulation of children through resource allocation among household members (Esteve, Castro Torres, and Becca 2025). The literature further suggests that living arrangements matter for child outcomes, such as school enrollment (Adjiwanou, Boco, and Yaya 2021; Chae 2016; Esteve, Castro Torres, and Becca 2025; Lewin and Sabates 2012; McLanahan and Percheski 2008). As outlined by Adjiwanou, Boco, and Yaya (2021), different models and theories emphasize various underlying mechanisms to explain differences in child outcomes across family forms and living arrangements. Research from developed countries,

for instance, explores resource availability (McLanahan and Percheski 2008), repartnering of parents (Sweeney 2010), and intrafamily instability and conflicts (Osborne and McLanahan 2007) as explanatory factors. In the African context, a sizable body of research focuses on variability in school outcomes due to orphanhood, child fostering, or parental divorce (Adjiwanou, Boco, and Yaya 2021; Beegle et al. 2010; Chae 2016; Crespin-Boucaud and Hotte 2021; Hampshire et al. 2015). In the following section, we provide an overview of research on determinants of variations in school enrollment and possible individual- and household-level moderators of these relationships. This literature guides our analytical approach, although we do not test for mechanisms or determinants in this study.

Within countries, child outcomes might vary across living arrangements of children due to differences in the availability and distribution of resources within the household (Gaydosch 2017; Lloyd and Desai 1992; Van De Walle 2013). Households with two biological parents often have more resources available than households with single parents. Biological parents might also have more incentives to invest into the human capital accumulation of their children compared to more distant or nonrelatives, as suggested by kin selection theory (Adjiwanou, Boco, and Yaya 2021; Case, Lin, and McLanahan 2001; Lopus 2017). Thus, children living in households with both biological parents present might fare better in terms of educational outcomes, such as school enrollment, compared to those living in a household with only one or neither biological parent. Children living with only one parent, might face lower school enrollment compared to children living with both their parents due to possible negative socio-economic effects of the events that lead to the absence of either parent, such as union dissolution, death of a parent, or parental migration. Nonetheless, the possible links between these events and child outcomes are complex and shaped by individual and contextual factors. Parental separation and repartnering can further contribute to the establishment of blended families, and in the context of many sub-Saharan African countries, might take place within a polygynous family. On the one hand, remarriages might involve living with children from prior relationships, which can increase the overall number of children, dilute the resources available to children, and heighten intrahousehold resource competition (Adjiwanou, Boco, and Yaya 2021). On the other hand, (re)marriage might provide increased resource access (Crespin-Boucaud and Hotte 2021). Households with only one parent present might also be indicative of a migrant parent supporting the family (Carling and Tønnessen 2013) and the educational attainment of children in the household.

Given the well-established fosterage system and the shared social responsibility among kin to rear children, the links between parental absence and educational enrollment in the African context are not straightforward. Children are at times out-fostered to gain access to educational opportuni-

ties or improve well-being (Akresh 2009; Bachan 2014; Serra 2009), thus living in a household without parents could be linked to higher school enrollment compared to other living arrangements. However, children are also out-fostered following crises associated with parental death or union dissolution, which could negatively affect child outcomes. Existing research on the impacts of fostering suggests that the effects on child outcomes are shaped by selection effects among the sending and receiving households, the individual characteristics of children, the fostering arrangement, and the circumstances that motivate fostering decisions (Beck et al. 2015; Bee-gle, Filmer, et al. 2010; Case, Paxson, and Ableidinger 2004; Hedges et al. 2019; Lachaud et al. 2014; Madhavan 2004; Townsend et al. 2002). Since we do not control for selection effects into specific foster arrangements, we expect children living without parents to fare worse in terms of school enrollment compared to children living with both biological parents.

Across countries, variation in school enrollment is linked to a complex interplay of social, economic, demographic, historical, and political factors. However, as education expands and more children are enrolled in school, variation in school enrollment by living arrangement might decline and living arrangements might already be less important for educational outcomes in countries with high school enrollment compared to countries with low school enrollment, where household factors, such as resource availability, play a bigger role. Thus, we anticipate the relationship between living arrangements and school enrollment to vary over time: if enrollment increases, we anticipate lower intracountry variation in school attendance. We further expect to see cross-country variation in the links between children's living arrangements and school enrollment due differences in the prevalence of different household structures. In countries, such as Namibia, where fostering and single-motherhood are common (Cotton 2021; Odimegwu, Mutanda, and Mbanefo 2017), such households are likely to be more socially accepted compared to societies with a strong prevalence of living with both biological parents. Thus, in the latter countries, we anticipate negative selection into single-parent households and households without parents, and increased variation in school enrollment by living arrangement. In other words, we predict greater differences in school enrollment by living arrangement in countries with homogenous household structures.

On the individual level, several factors can moderate the relationship between children's living arrangements and educational outcomes, such as age and gender, and household characteristics, such as size and composition (Adjiwanou, Boco, and Yaya 2021). On the individual-level, we expect that older children are more likely not to attend school, as primary enrollment exceeds secondary enrollment (UNESCO Institute for Statistics 2019). Male school enrollment tends to exceed female enrollment; therefore, gender might moderate the relationship between living arrangements and school enrollment. Additionally, children's place of residence might be linked to

their school enrollment. In urban areas, access to educational opportunities and resources might be higher, which could positively impact school enrollment; however, urban areas might also disconnect vulnerable parents from their rural kin networks and reduce physical, emotional, and financial help they receive, thus negatively impacting parents' ability to enroll children in school (Adjiwanou, Boco, and Yaya 2021).

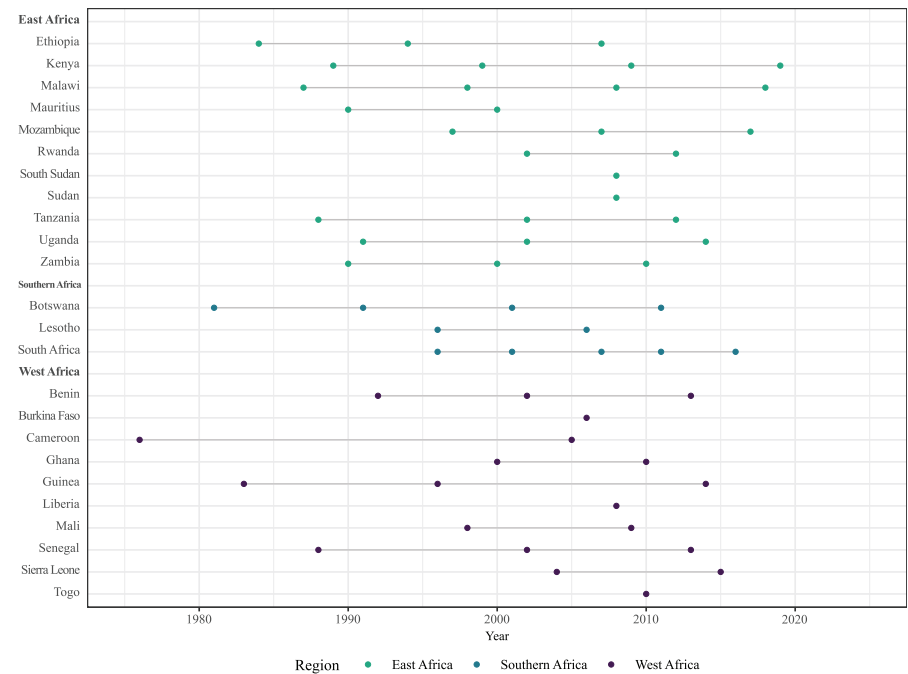
On the household level, household size and composition can impact children's school enrollment. Households with more children might face difficulties in providing educational access to all children due to resource constraints and dilution, although these relationships differ across contexts and over time (Eloundou-Enyegue and Williams 2006). Educational attainment and labor force participation among adults can be indicators of household wealth, especially in many sub-Saharan African countries where educational inequalities among the adult population are high, many people participate in the informal labor market, and parental socioeconomic status is linked to children's social mobility (Leibbrandt et al. 2025). Lastly, the age of the household head can be an indicator of a multigenerational household with an older decision maker, who might not emphasize children's educational attainment. Yet, an older household head can also indicate the presence of a grandparent, which can be positively associated with child outcomes (Schrijner and Smits 2018; Sear et al. 2002).

Data and methods

We use 60 census samples obtained from the Integrated Public Use of Microdata Series (IPUMS International) for 24 African countries, covering the time span from 1976 to 2019. Figure 1 provides an overview of samples included in the analysis, by country and continental subregion. Countries are grouped according to the geoscheme of the United Nations, with the exception of Cameroon (Central Africa) and Sudan (North Africa), which were included in the geographically closest available group. For Burkina Faso, Liberia, Togo, Sudan, and South Sudan only one census sample was available for analysis.

We included samples in the analysis for which information on children's school enrollment was collected in the census and that provided comparable information about individual-level and household-level characteristics that would be needed as controls in the analysis. In addition to school enrollment, samples needed to provide information about age, sex, and parental line numbers, educational attainment, labor force participation, and urban–rural status. However, for Botswana (1981, 2001, 2011), Cameroon (1976), Senegal (1988), Tanzania (1988), and Zambia (2010), no distinction could be made between urban and rural areas. For Botswana (1981), Ethiopia (1984, 1994), and South Africa (2016) information about household residents' labor market participation was not avail-

FIGURE 1 Overview of census samples included in the analysis



able. For Ethiopia (2007), only respondents who provided answers to the long form census questionnaire were included in the analysis. Most census samples included in the analysis are self-weighting with an expansion factor of 10; however, others require the use of weights. To account for weights and expansion factors, we conducted the analysis using the survey package in R (Lumley 2023).

We restrict the analysis to households with at least one child aged 7–14. We deliberately set a relatively high lower bound (7 years) because the mandatory starting age for children in sub-Saharan Africa varies across countries and subsequently, the comparability of enrollment levels could be affected when including younger children. We set the upper limit at age 14 to avoid heterogeneity arising from cross-country differences in the timing of school leaving and in the transition to work and adulthood. Table 1 provides an overview of the available sample of children aged 7–14 in each country, grouped by continental regions. The table further shows the proportion of children enrolled in school among the sample. A full sample overview can be found in Appendices A1–A4 in the Supporting Information.

For each child, we categorize the living arrangement based on the information about parental survival and the parental location in the household roster or their absence from the household. We grouped children

TABLE 1 Sample overview

Country	Year	Number of children	School enrollment (%)	Country	Year	Number of children	School enrollment (%)
East Africa							
Ethiopia	2007	285,513	38.4	Botswana	2011	32,326	95.2
	1994	1,159,544	15.1		2001	33,378	90.8
Kenya	1984	714,126	32.2	Lesotho	1991	29,661	83.2
	2019	994,345	89.8		1981	16,289	71.7
	2009	813,130	88.1		2006	32,872	89.3
Malawi	1999	315,330	81.5	South Africa	1996	39,252	74.0
	1989	249,190	80.9		2016	499,381	96.8
	2018	408,405	81.1		2011	608,276	94.6
	2008	273,862	74.6		2007	160,232	95.7
Mauritius	1998	198,039	71.5	West Africa	2001	661,492	93.9
	1987	171,749	38.1		1996	538,840	88.9
	2000	16,149	94.8		Benin	2013	212,985
Mozambique	1990	17,947	85.7				
	2017	590,846	62.4	Burkina Faso	2002	125,813	59.8
	2007	410,924	72.1		1992	99,657	36.2
	1997	296,433	47.3		2006	274,506	43.4

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TABLE 1 (Continued)

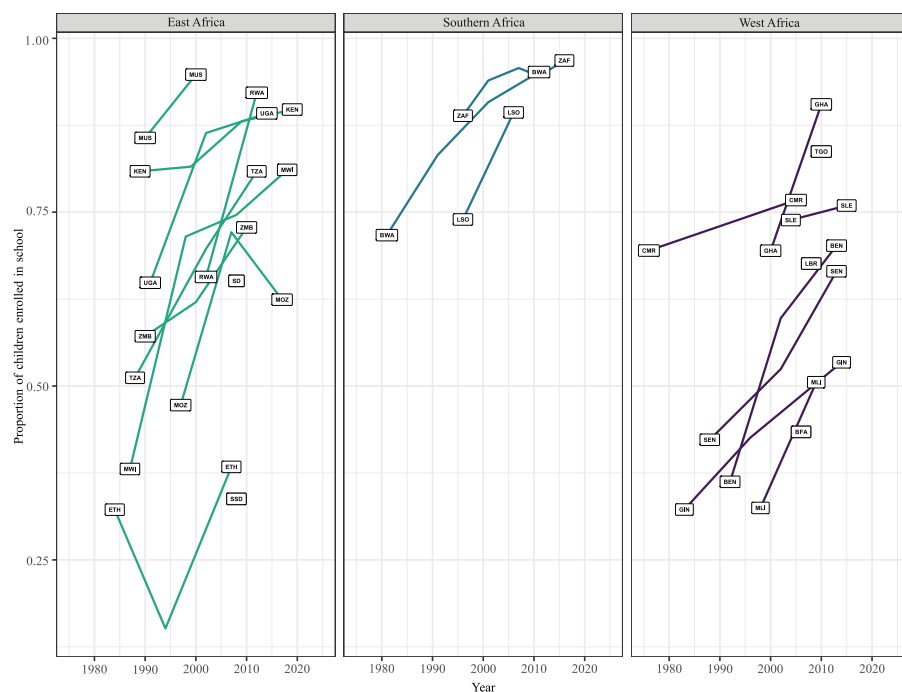
Country	Year	Number of children	School enrollment (%)	Country	Year	Number of children	School enrollment (%)
Rwanda	2012	210,822	92.2	Cameroon	2005	334,984	76.7
	2002	167,071	65.7		1976	121,769	69.5
South Sudan	2008	120,767	33.8	Ghana	2010	448,729	90.5
Sudan	2008	1,070,934	65.1		2000	384,856	69.5
Tanzania	2012	982,589	80.9	Guinea	2014	205,246	53.4
	2002	791,312	69.7		1996	138,325	42.6
Uganda	1988	498,270	51.2	Liberia	1983	75,142	32.2
	2014	783,270	89.2		2008	68,587	67.6
Zambia	2002	569,205	86.4	Mali	2009	295,787	50.6
	1991	325,197	64.9		1998	190,303	32.5
	2010	283,252	72.8	Senegal	2013	242,225	66.5
	2000	171,524	62.1		2002	209,336	52.4
	1990	170,409	57.2	Sierra Leone	1988	143,897	42.3
					2015	147,317	76.0
				2004	95,454	73.9	
				2010	119,717	83.7	

NOTE: School enrollment estimates are weighted using person weights provided by IPUMS. Countries are grouped according to the geoscheme of the United Nations, except Cameroon (Central Africa) and Sudan (North Africa), which were included in the geographically closest available group.

into four living arrangements: (1) living with both biological parents, (2) living with the biological mother only, (3) living with the biological father only, and (4) living with neither parent. Other household members may or may not be present but are not considered for the categorization of living arrangements, which focuses on the presence or absence of biological parents. The four living arrangements form the basis for the analysis of living arrangements of children by country and over time. We further created a binary variable coded 0 for children not enrolled and 1 for children enrolled in school.

To analyze the association between school enrollment and living arrangements of children, we estimate two sets of logistic regression models: one set of models separately for each sample and one set of models pooling samples for each country. Within the models, we include the categories of children's living arrangement as the main predictor variable, with living with both biological parents forming the reference category. On the individual level, we control for age in 2-year age groups (7–8, 9–10, 11–12, 13–14) and sex (male, female). We further control for additional household characteristics. We consider the urban–rural status; the mean-centered number of children aged 0–14 in the household, the educational attainment of the household head as a categorical variable (low/unknown, medium, high); the number of adults participating in the labor force as a categorical variable (0, 1, 2, 3+); and the age of the household head as a binary variable (<60, 60+). For the second set of models, we choose countries with at least two samples available and include a categorical control for the decade of the census sample (1970, 1980, 1990, 2000, 2010) and an interaction between time and living arrangement.

In addition to clustering at the household level when estimating standard errors, we conducted robustness checks to account for the fact that multiple children from the same household can be included in the analysis. We estimated models using only individual-level characteristics and models randomly selecting one child per household (Appendices A5 and A6 in the Supporting Information). However, the robustness checks did not reveal any substantial issues including several children from one household. We conducted checks using alternative control variables, such as mean-centered household size rather than the number of children in the household, and the highest education of the household head rather than any household member but this did not improve the model fit. We further estimated models for the most recent sample of each country for children residing only with the biological mother to control by maternal marital status and to examine links between remarriage or a potential migrant father on school enrollment (Appendix A9 in the Supporting Information).

FIGURE 2 School enrollment of children aged 7–14 over time by country and continental region

NOTE: Countries with only one observation are not shown in the figure but the proportion of children enrolled in school can be found in Tables A1 and A2 in the Supporting Information. Colors indicate sub-continental regions: East Africa (green), South Africa (blue), and West Africa (purple).

Results

School enrollment

Figure 2 highlights increasing school enrollment of children over time; however, differences emerge across countries. School enrollment is highest among Southern African countries with school enrollment differences of around 8 percentage points in the most recent sample. Among East African countries, school enrollment is highest in the 2000 sample for Mauritius, with 95% of children aged 7–14 being enrolled in school, followed by Rwanda (92%, 2012) and Kenya (90%, 2019). In Mauritius, school enrollment among children exceeded 85% in 1990, while only 66% of Rwandan children and 81% of Kenyan children were enrolled in school in 2002 and 1989, respectively. For earlier East African samples, school enrollment was lowest in Ethiopia, Mozambique, and Malawi.

Among the most recent samples, Ethiopia continues to remain at the bottom of the distribution of countries, with a 6-percentage point increase between the 1984 and 2007 census samples, from 32% to 38% of children

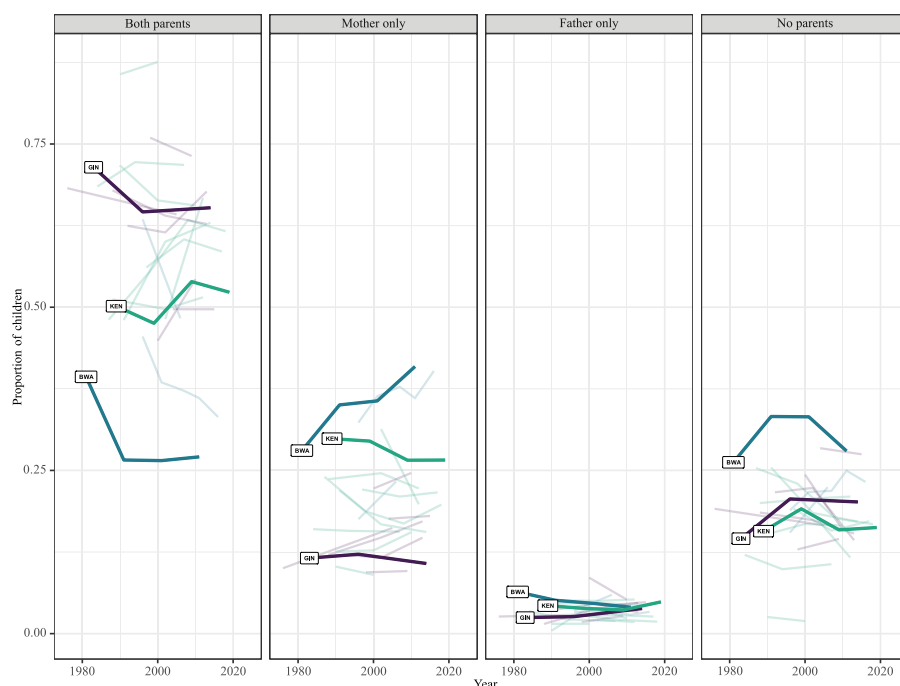
enrolled in school. The increase was more pronounced in Mozambique, with a 15 percentage points increase over 20 years, from less than 50% of children enrolled in school in 1997 to 62% in 2017. Yet, school enrollment in Mozambique remains comparatively low. Malawi, however, witnessed one of the largest expansions in school enrollment, with an increase of 43 percentage points, from 38% of children to 81% between 1987 and 2018.

In West Africa, school enrollment of children aged 7–14 remains lower on average compared to countries in East and Southern Africa. In this group, school enrollment is highest in Ghana (2010), with 90% of children enrolled in school, representing an increase of 21 percentage points over one decade. However, in all other West African countries, recent school enrollment remains below 80% and below 60% in Guinea (2014) and Mali (2008). Benin, Senegal, Guinea, and Mali witnessed increases in school enrollment of 34, 24, 21, and 18 percentage points between the earliest and latest samples, respectively. Overall, significant gains in enrollment were made in several countries with low enrollment rates in earlier samples, while others experienced minor enrollment increases. Yet, given the population growth over the observed time periods, achieving rather modest increases in the proportion of children enrolled in school represents vast increases in enrollment in absolute numbers of children.

Living arrangements of children

Figure 3 provides an overview of living arrangements of children aged 7–14 by country. We focus on four distinct types of living arrangements: (1) living with both biological parents, (2) living with the biological mother only, (3) living in households with the biological father only, and (4) living in households without biological parents. For each continental group, we highlight one country for which we observe at least 30 years: Kenya in East Africa, Botswana in Southern Africa, and Guinea in West Africa.

Across countries, we observe that in the majority of countries around or above 50% of children reside with both biological parents. In Kenya, the proportion of children in the group has remained relatively stable, but a few East African countries exhibit slight increases. In 1989, 50% of children in Kenya resided in a household with both biological parents, compared to 52% in 2019. In Botswana, 39% of children resided with both biological parents in 1981, compared to 27% in the most recent sample. This decrease is in line with a decline in the proportion of children residing in households with both biological parents across all Southern African countries over time. In Guinea, the share of children residing with both parents declined from 71% in 1983 to 65% in 2014. However, while there is stability in living with both parents among most countries in East and West Africa, we observe substantial heterogeneity in the proportion of children

FIGURE 3 Living arrangements of children aged 7–14 by country and continental region

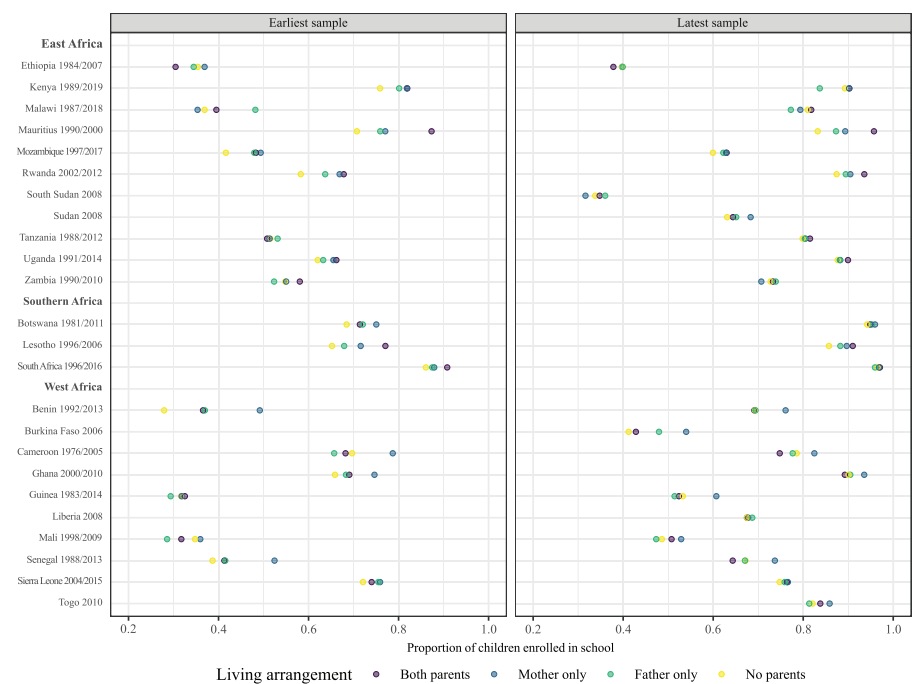
NOTE: Countries with only one observation are not shown in the figure but the proportion of children in each living arrangement can be found in Tables A1 and A2 in the Supporting Information. Colors indicate sub-continental regions: East Africa (green), South Africa (blue), and West Africa (purple).

in this living arrangement, ranging from 0.88 (Mauritius, 2000) to around 0.27 (Botswana, 2001).

The share of children in Kenya living with their mother only, their father only, or without either parent is 27%, 5%, and 16% in 2019, respectively, with little or no change compared to the earliest available sample. For the most part, the proportion of children in each of these living arrangements has remained remarkably stable over time. Fewer than or equal to 5% of children in any East African country reside in households with only their biological father present. We do not observe an increase in children residing only with their mother but emphasize the stability of children residing without either parent over time. In all three Southern African countries, the proportion of children living with their mother only or without parents increased, reaching 41% in Botswana in 2011. Similar to East African countries, few children in Southern African countries reside in households with only their biological father.

All countries in West Africa experience slight increases or stability in the proportion of children residing with the mother only, as exemplified by Guinea where 11% of children in 2014 and 12% in 1983 resided only

FIGURE 4 School enrollment by living arrangement, earliest and latest available samples



NOTE: For several countries (South Sudan, Sudan, Burkina Faso, Liberia, Togo), we only have one sample available. Countries are grouped alphabetically within their subcontinental regions.

with their mother. Children not residing with either parent are common in many West African countries. Several countries experienced an increase in this living arrangement, as highlighted by the 5-percentage point increase in Guinea between 1983 and 2014, although increases are not uniform and some West African countries experienced decreases in the proportion of children not residing with either parent. We note substantial differences in the living arrangements of children between countries but on the country-level, we observe stability in the prevalence of different living arrangements for children, despite vast demographic and socio-economic transformations. Given the educational expansion witnessed in many of the countries included in the analysis, the associations between living arrangements and educational enrollment might have changed over time.

Links between school enrollment and living arrangements of children

Figure 4 shows the school enrollment of children aged 7–14 in the latest (right) and earliest (left) available samples for each country by children’s living arrangements. The distribution of the dots highlights the heterogeneity in school enrollment across countries in both panels but also the diversity in change in enrollment and variation across living arrangements. For

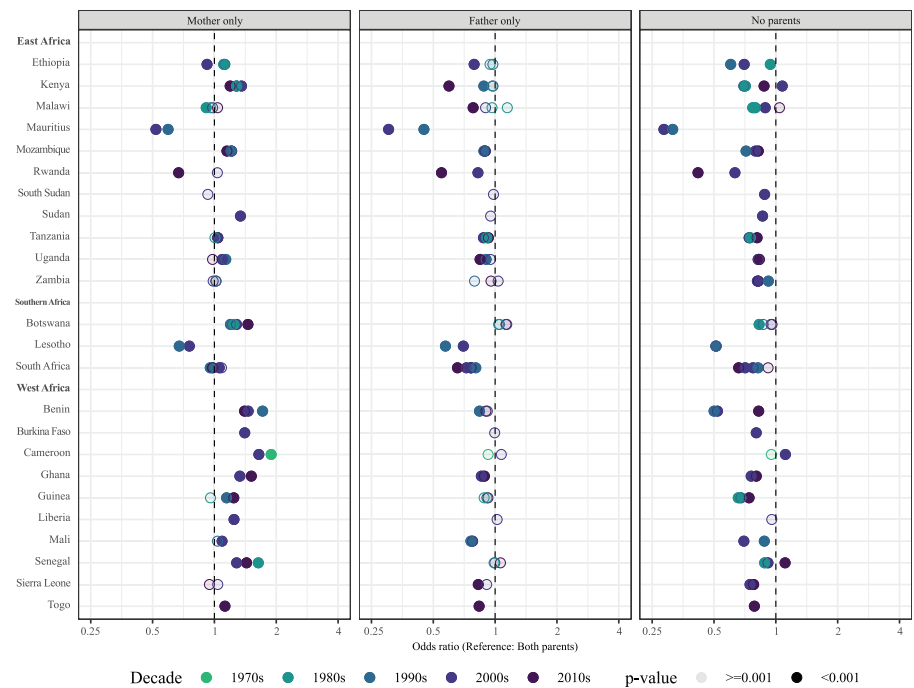
some countries, such as Kenya, more children are enrolled in school across all living arrangements. Differences by living arrangements persist but the underlying dynamics appear to change—in the earliest sample, enrollment was lowest among children living without parents, whereas enrollment in the most recent sample is lowest among children living with only their father. In Botswana, enrollment increased for all children and differences in the proportion of children enrolled in school disappeared over time. Lastly, in the 1983 sample for Guinea, enrollment was low for all children, with slightly lower enrollment for children living only with the father. Over time, enrollment for children in this living arrangement remains lower compared to other groups: In the latest sample enrollment increased for all groups but a nearly 10-percentage point difference emerged between children living only with the mother compared to those living only with the father.

No clear pattern emerges, suggesting that the link between children's school enrollment and living arrangements differs between countries and over time. Increases in school enrollment appear to contribute to a decline in these differences between children across living arrangements in some countries (e.g., Botswana, Ghana, Uganda) but differences persist or even emerge in other countries (e.g., Benin, Guinea, Mauritius). In several countries, children residing without parents appear to have gained access to education (e.g., Benin, Kenya, Rwanda), although enrollment among them remains lower than for children living with both biological parents. Living only with the father, in many countries, is associated with lower school enrollment. Surprisingly, enrollment is highest for children living with only the biological mother for over one-third of countries, most of which are located in West Africa.

In line with our expectation, we observe small differences in enrollment by living arrangement in countries where school enrollment is already approaching universal levels. In some countries, such as Kenya, enrollment continues to differ by living arrangement, although the underlying dynamics appear to change. The figure further suggests that in countries, such as Mauritius, where the overwhelming majority of children reside with both biological parents, enrollment variations by living arrangement are high, while in countries with diverse living arrangements, such as Botswana, variation in school enrollment appears to be only weakly linked to living arrangements. This supports our expectation that in societies with homogeneous family structures, selection effects might amplify negative school outcomes for children in households without one or both parents.

We estimate logistic regression models for each sample to further analyze the observed pattern and the association between children's school enrollment and living arrangements. Figure 5 shows the results of these models based on the exponentiated coefficients for each model by country and living arrangement. Predicted probabilities of school enrollment by living arrangement for all models can be found in Appendices A6 and A7 in

FIGURE 5 Exponentiated logistic regression coefficients (odds ratios) for children’s school enrollment by living arrangement



NOTE: Models were specified for each sample separately. Controls not shown age, sex, urban/rural, number of children in the household, educational attainment of the household head, number of adults participating in the labor force, age of the household head. Dependent variable: school enrollment (0 = no, 1 = yes). For Botswana 1981, 2001, and 2011, Cameroon 1976, Senegal 1988, Tanzania 1988, and Zambia 2010, no distinction could be made between urban and rural areas. For Botswana 1981, Ethiopia 1984 and 1994, and South Africa 2016 information about household residents’ labor market participation was not available.

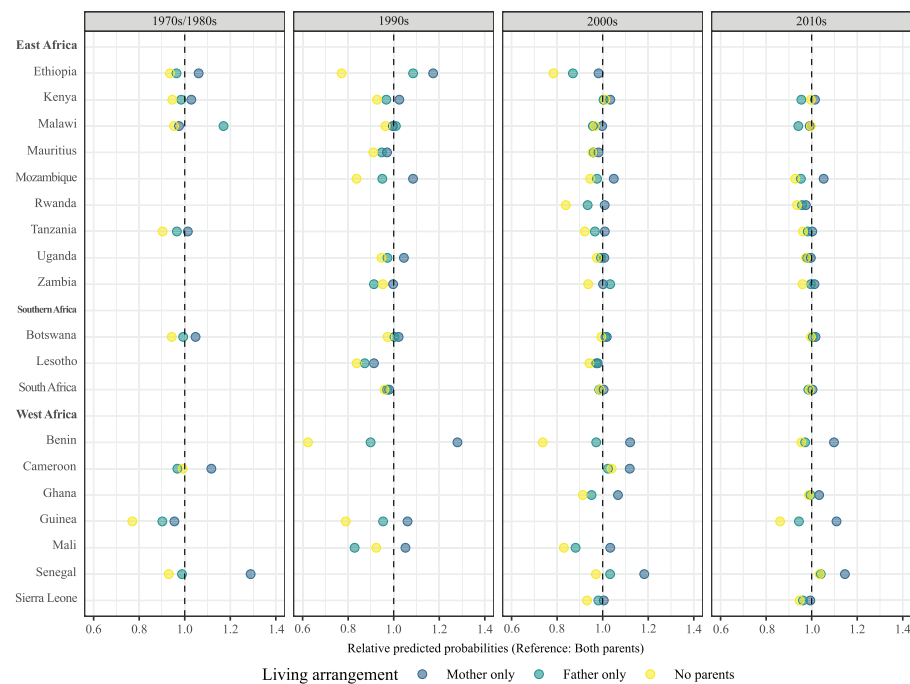
the Supporting Information. We estimate models separately for each sample to obtain estimates that account for differences in enrollment and the prevalence of living arrangements across samples. For all models, living with both biological parents forms the reference category. The aim is to highlight school enrollment differences relative to living with both parents, the prevailing living arrangement in nearly all analyzed countries. The models are not intended to compare differences in the magnitude of associations but rather to explore whether school enrollment varies by living arrangements, while controlling for the individual and household characteristics of children. Dots that are filled out represent coefficients that are statistically significantly different from zero (p -values < 0.001), whereas empty circles represent coefficients that are not statistically significantly different from zero (p -values $\geq$ 0.001). Colors of dots represent the decade in which the census was conducted. Countries are ordered alphabetically and grouped by continental regions.

In nearly all countries, the odds of being enrolled in school among children living with only the biological father (middle panel) or without the biological parents (right panel) are lower compared to children living with both biological parents, as in these panels the dots are nearly all placed to the left of the horizontal dashed bar ($OR = 1$). We further observe that for children living without parents, these differences are statistically significant for most samples, while for children residing only with the father, fewer differences between this group and the reference group are statistically significant, potentially due to the small share of children in this group across samples. Still, for children in the majority of countries, this living arrangement is associated with lower odds of school enrollment. For children in several East African countries, living with the mother only is associated with lower odds of enrollment compared to the reference, but in other countries the results suggest small or no statistically significant differences among these two living arrangements. Among South African countries, this relationship varies: in Botswana, children living only with the biological mother have higher odds of being enrolled in school compared to the reference group, in Lesotho the opposite is the case, and in South Africa, we do not observe differences across these living arrangements. For children in most West African countries living with the mother only is linked to a statistically significant enrollment advantage relative to the reference group.

We further estimate a second set of models to observe patterns in school enrollment over time. We estimate models separately for each country, pooling all samples by country and controlling for time and we include an interaction between time and living arrangement in each model. Figure 6 shows the results as relative predicted probabilities of school enrollment to allow for direct comparisons. The predicted probability of school enrollment for children living with both parents is scaled to one and serves as a reference. Since the descriptive results highlight that school enrollment increased over time in all countries, dots moving closer to center across panels indicate decreases in the variability across living arrangements over time.

In Kenya, we observe small but persistent differences in the probability of being enrolled in school relative to the reference group, whereas in Botswana, differences over time completely diminish. In Guinea, variability in the probability of being enrolled in school for children by living arrangement persists, although the pattern changes. In the earliest sample, children across living arrangements faced a lower predicted probability of being enrolled in school compared to the reference group. However, in the most recent sample, children living with the mother only have a higher probability of being enrolled in school compared to the reference group. The patterns for Kenya and Botswana are similar to those of other countries from East and Southern Africa. The case of Guinea resembles that of other West African countries, where an advantage for children residing in a household only with their mother emerges.

FIGURE 6 Relative predicted probabilities for children’s school enrollment by living arrangement and time



NOTE: Models were specified separately by country, controlling for time of the census and they include an interaction between time and living arrangement. Predicted probabilities were estimated and then scaled relative to the predicted probability of being enrolled in school for children living with both parents (=1). Other controls included are the same as in prior set of models (Figure 5).

Overall, the regression results suggest that after controlling for various individual and household characteristics, persistent differences in school enrollment by children’s living arrangements can be observed. In particular, living in a household without either biological parent or with the biological father only, compared to living in a household with both biological parents present, is associated with lower odds of school enrollment for children. Children living with the mother only appear to not face this disadvantage in most countries, and even an advantage in some countries. In line with our expectations, we find evidence that the associations between school enrollment and living arrangements differ across countries and over time for individual countries. We observe that as school enrollment increases, differences in enrollment across living arrangements decrease in many, but not all countries.

Discussion and conclusions

In this article, we provide a systematic overview of school enrollment and living arrangements of children using census data for 24 African countries,

covering the time period from 1976 to 2019. We investigate links between children's living arrangements and school enrollment and examine how these associations differ across countries and have changed over time. The analysis focuses on four distinct living arrangements of children: living with both biological parents; living with the biological mother; living with the biological father; and living without biological parents. This work contributes to existing research that focuses on how living arrangements might be linked to variation in school enrollment in sub-Saharan Africa (Adjiwanou, Boco, and Yaya 2021; Akwara et al. 2010; Beegle, De Weerd, and Dercon 2009; Case and Ardington 2006; Case, Paxson, and Ableidinger 2004; Chuong and Operario 2012; Eloundou-Enyegue and Williams 2006; Evans and Miguel 2007; Monasch and Boerma 2004) and other countries undergoing demographic and socio-economic transitions (Esteve, Castro Torres, and Becca 2025). The paper provides the basis for further comparative research on living arrangements and child outcomes, such as education.

One key result of this study is that the links between school enrollment and living arrangements of children are context-dependent. Across countries, school enrollment tends to be highest among children who reside with both biological parents, but we find that in several countries enrollment is highest among children living in households with their mother only. Given the literature on poverty and vulnerability in the context of single motherhood and potential negative outcomes for children (Adjiwanou, Boco, and Yaya 2021; Carling and Tønnessen 2013; Clark and Hamplová 2013; Gnoumou, LeGrand, and Kobiané 2013), this is to some extent a surprising finding. A possible underlying explanation for a potential "mother-advantage" is that some of these mothers might have partners who migrated and are able to support their children through remittances (Carling and Tønnessen 2013). Another explanation might be that some of these mothers re-partnered to increase their resources, and are thus able to support their children's school enrollment (Crespin-Boucaud and Hotte 2021), although Adjiwanou, Boco, and Yaya (2021) find lower school enrollment for children living with stepfathers compared to those residing with both biological parents or single mothers. However, when we conducted robustness checks among the group of children residing in a household with only their mother and controlled by maternal marital status (Appendix A9 in the Supporting Information), we found that differences by maternal marital status are overwhelmingly small and not statistically significant. Children living with a stepfather or having a married mother and migrant father do not appear to be systematically advantaged when it comes to school enrollment, compared to other children in the mother only group. Women might generally have a stronger preference for children's education (Crespin-Boucaud and Hotte 2021) and mothers who raise their children alone might have higher decision-making autonomy to act on the preference of school enrollment for daughters (Luz and Agadjanian 2015), thus contributing to

higher enrollment. This is in line with family research suggesting that matrilineal kinship is associated with benefits for child outcomes, as women have greater decision-making power and autonomy to invest in their children's education (Lowes 2022). Future research exploring the emergence of a potential "mother-advantage" could reveal opportunities for policy-makers.

The second key result of the study is that children living with only their biological father or without biological parents are consistently less likely to be enrolled in school, compared to those living with both biological parents. While these differences are in many cases not statistically significant for father-only children, possibly due to smaller case counts, they suggest that children in the African context who reside only with their father are often worse off compared to other children, especially if they are maternal orphans (Case and Ardington 2006). The disadvantage of children living without either parent is noticeable across most countries and persists over time, albeit differences in the predicted probabilities across living arrangements (Appendices A7 and A8 in the Supporting Information) are less pronounced if enrollment is higher. The descriptive results show that the prevalence of different living arrangements of children in many countries have remained stable, but enrollment levels have increased. This is in line with our expectation that the living arrangements of children will become less relevant in explaining variation in school enrollment within a country as enrollment increases. Thus, advances in school enrollment, for instance through the implementation of universal free primary education, could potentially decrease inequalities faced by children in different living arrangements. However, the relationship between school enrollment and living arrangements is shaped by the prevalence of different living arrangements: in countries with homogenous living arrangements where a two-parent household is the norm, such as Mauritius, variation in enrollment by living arrangement remains statistically significant. This observation suggests that prevailing norms and negative selection effects into different household structures can limit the positive effects of educational expansion. To reach universal access to education, policies should seek to counteract disadvantages children face based on their living arrangement.

The group of children living without both parents includes children who live in a foster household because one or both of their parents have died but also children whose parents are alive. In many instances, living without both parents in a foster family might provide educational access and many fostering decisions are motivated by the families' wish to provide educational opportunities to their children (Akresh 2009; Bachan 2014; Serra 2009). This could explain why the differences in enrollment between children in households with both or no biological parents are somewhat small or statistically insignificant in some countries, especially in those with a higher prevalence of foster arrangements such as Malawi, Botswana, or Senegal (Cotton 2021). As a direction for future research, a

nuanced analysis of school enrollment over time and across countries for children living in foster families could provide insights into the underlying dynamics and also test assumptions related to kin selection theory and resource allocation in the household (Adjiwanou, Boco, and Yaya 2021; Case, Paxson, and Ableidinger 2004; Lopus 2017). Additional analyses could also focus on possible differences in the observed associations across individual characteristics of children, such as age and sex.

On a positive note, the educational disadvantages of children living without both parents compared to those living with both parents are less pronounced among recent samples, which supports our expectation that increases in enrollment might be linked to lower variation by living arrangement. Additionally, nonparental living arrangements of children have remained quite stable in many countries (Cotton 2021), yet differences in school enrollment by living arrangements appear to decrease. Thus, school enrollment expansion in some sub-Saharan African countries seems to reach children in all living arrangements and could potentially contribute to decreases in intra-country variation in human capital creation. Further research that considers country-specific historic, economic, social, and policy contexts might provide a better understanding of the associations between educational expansion, educational outcomes, and children's living arrangements.

We acknowledge several limitations that should be considered when interpreting the results of our analysis. Census data are cross-sectional and can only reflect circumstances for a point in time. We are not able to know how long children have been living in a specific living arrangement and we also do not know how long children have been enrolled in school for. While we can analyze country-level trends over time, longitudinal data would be better suited to understand the educational trajectories of children in different living arrangements. Other household characteristics, such as wealth, are potentially strong predictors of school enrollment of children. However, census data do not provide such information and while we considered building a proxy indicator for household wealth based on dimensions such as ownership of the residence, electricity, and water access, we were unable to do so in this comparative framework as many samples lack the information in part or entirely. Several other factors could have strengthened the analysis but were not available within the data: We do not have information about parents of children who are alive but do not reside in the household, such as migrant parents who might support their children through remittances. Additionally, we cannot control for the survival status of the parents and marital status of the mother or father in our models as they are highly correlated with the primary predictor. The presence and characteristics of other household members, such as grandparents, might also be relevant for educational outcomes. Future research investigating these aspects could provide insights into links between family contexts and school enrollment

in sub-Saharan Africa. Lastly, our exploratory analysis is descriptive in nature and cannot identify causal relationships.

Overall, this study highlights the importance of living arrangements in explaining variation in school enrollment in sub-Saharan Africa across countries and over time. We provide an overview of links between children's living arrangements and one of the key developmental outcomes, that can serve as a starting point for further research on the complex links between children's well-being outcomes and their family context. Children living in households without parents or with their biological father only, appear to be disadvantaged in terms of educational opportunities compared to children living with both biological parents. While we find that the importance of family contexts generally decreases if school enrollment increases, children living with only one or neither parent might be particularly at risk of facing barriers to educational participation and human capital creation.

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Data availability statement

The data used in this study was provided by and can be accessed via IPUMS-International: <https://international.ipums.org/international/index.shtml>

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