REPORT

Adolescent Fertility Is Lower than Expected in Rural Areas: Results from 10 African HDSS

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The adolescent birth rate (ABR) is an important indicator of maternal health, adolescent sexual health, and gender equity; it remains high in sub-Saharan Africa. While Demographic and Health Surveys (DHS) are the main source of ABR estimates, Health and Demographic Surveillance Systems (HDSS) also produce ABRs. Studies are lacking, however, to assess the ease of access and accuracy of HDSS ABR measures. In this paper, we use birth and exposure data from 10 HDSS in six African countries to compute local ABRs and compare these rates to DHS regional rates where the HDSS sites are located, standardizing by education and place of residence. In rural HDSS sites, the ABR measure is on average 44 percent lower than the DHS measure, after controlling for education and place of residence. Strong temporary migration of childless young women out of rural areas and different capacities in capturing temporarily absent women in the DHS and HDSS could explain this discrepancy. Further comparisons based on more strictly similar populations and measures seem warranted.

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INTRODUCTION

Addressing adolescent childbearing has been a development priority since the 1994 Cairo Conference. Initially, global discourse framed adolescent childbearing as a maternal health issue. The maternal mortality rate is indeed three times higher among young women (Nove et al. 2012), and young mothers and their children have worse health outcomes (United Nations [UN] 2013). Accordingly, the adolescent birth rate (ABR) (i.e., the fertility rate of women aged 15–19) was introduced as an indicator to measure progress and improvements in maternal health in the Millennium Development Goals in 2000 and was maintained as such in the Sustainable Development Goals in 2015. In recent years, more attention has been given to adolescent fertility as a marker of women's status (Heckert and Fabic 2013); it is used as one component of the latest Gender Inequality Index (UN 2010). In fact, low levels of educational attainment and a lack of job prospects for young women are important drivers of early initiations into unions and childbearing. Simultaneously, early fertility contributes to high rates of school drop-out and poor economic opportunities among young women (Coyne and Onofrio 2012). Over the years, the ABR has also become an indicator of young people's sexual and reproductive health, as it is closely related to adolescents' unmet need for contraception (UN 2013).

Like other developing regions, sub-Saharan Africa (SSA) has witnessed a decline in its ABR over the past 50 years. In 1970–1975, women aged 15–19 in SSA had 152 births per 1000 woman-years. This reduced to 109 per 1000 woman-years by 2010–2015 (UN 2015). These levels of adolescent childbearing, however, remain strikingly higher than in other parts of the word: in 2010–2015, ABR was 16 per 1000 in Europe, 28 in North America, 30 in Asia and Oceania, and 67 in Latin America and the Caribbean.

Since the early 1980s and with over 200 surveys implemented in developing countries worldwide, the Demographic and Health Surveys (DHS) are the main source of data to monitor adolescent fertility in SSA. Given the heavy reliance on these data for fertility and mortality estimates in countries devoid of complete vital statistics, great efforts are devoted to DHS data collection, quality checks, and variable preparation. Attention to quality continues after data collection. Analysts recurrently scrutinize the DHS birth histories for several potential biases: birth omissions, birth displacements (i.e., erroneous birth dates), as well as age misreporting. These periodic assessments show that the quality of the DHS birth histories is excellent or acceptable for most surveys and has been improving over the past 20 years (Pullum and Becker 2014). Reporting of age is often more inaccurate, but since biases tend to be unsystematic this issue is not thought to bear heavily on fertility rates (Pullum and Staveteig 2017). Nevertheless, published fertility rates that are computed from uncorrected birth data collected for the past three years can be quite different from the reconstructed fertility rates that are computed from complete birth histories over successive DHS (Schoumaker 2014). The later procedure corrects for births omissions and displacements that can be numerous in some surveys. Even so, almost all biases that could potentially affect DHS fertility estimates tend to underestimate the fertility rates rather than the opposite (Schoumaker 2014), a tendency to keep in mind as we compare DHS ABRs with ABRs generated in Health and Demographic Surveillance sites (HDSS) below.

The INDEPTH network is comprised of 48 HDSS in low- and middle-income countries, and as of 2012, 37 of them were located in SSA (Sankoh and Byass 2012). All INDEPTH sites conduct prospective monitoring of the population living in the area under surveillance, which often corresponds to a health district. After an initial census, all entries into and out of the population (immigrations, births, deaths, and emigrations) are recorded at least once a year and often several times a year. While INDEPTH HDSS sites are better-known for their mortality-by-cause data (Streatfield et al. 2014), the information on births collected in surveillances sites have been used in different instances. Births are sometimes the object of cohort studies nested on HDSS platforms, as in a prospective study of unintended pregnancies among young women in the Nairobi HDSS (Beguy et al. 2014). HDSS sites also often undertake health interventions, among which family planning or maternal health experiments, as in the Matlab HDSS (Phillips et al. 1984). In such interventions, fertility is an important outcome variable.

But how reliable are HDSS fertility data in general and HDSS ABRs in particular? Over the years, the network has put in place several mechanisms to ensure the quality and comparability of the data collected across its sites. First, the INDEPTH Resource Kit provides standard data collection forms and procedures (INDEPTH 2008). For example, when a site begins (and afterwards when a new person enters the area under study), fieldworkers are requested to ask for an ID or vaccination card to ascertain the date of birth, to minimize age misreporting. Moreover, INDEPTH HDSS sites provide core datasets each year to the network (vital events and entries/exits of residents) and statistics. The network examines these data annually; only sites whose data are of sufficient quality to be included in the online statistics generator INDEPTHStats (http://www.indepth-network.org/data-stats/indepthstats) continue to be a full member of INDEPTH (http://www.indepth-network.org/member-centres/types-membership).

The longitudinal design itself helps to improve the quality of the data collected in HDSS sites. Field agents go into the field for surveillance rounds with the list of household members who were present at the last round; during their visits, they remind the household respondent about the residents listed at the previous round, and check on their current status. They register births and other vital events for all residents, even those who are temporarily absent. They identify errors or gaps left in previous rounds and correct them in the current round. Data managers also perform quality checks between rounds, and inconsistencies are corrected in the next round. In addition, fieldworkers are often part of the community themselves so at times are aware of changes in household structures due to their own residence in the area. Moreover, in some sites, as in the Ouagadougou HDSS (Soura et al. 2019), key informants collect independent lists of births and deaths that are cross-checked with the vital events collected by fieldworkers during household visits. Also, in most sites data collection has now shifted to electronic devices, which has further improved the quality of the data (Mukasa et al. 2017).

For these various reasons, HDSS sites usually outperform other local sources of data. For instance, a recent paper compares the data collected in the Navrongo HDSS in Ghana to the census data and findings indicate that the HDSS indicators are more reliable (Wak et al. 2017). HDSS data also offer a gold standard in diverse experiments. For example, HDSS data have been used to assess the progress of official vital statistics registration in the Agincourt HDSS in South Africa (Garenne et al. 2016) and the completeness of adult mortality counts in demographic surveys in the Senegalese sites (Helleringer et al, 2014). HDSS data are also more complete than health facility statistics, since many births and deaths occur at home in the areas of concern (Byass, de Savigny, and Lopez 2014). In some HDSS sites, fertility or mortality rates have declined following a health or family planning intervention like in the Kisumu HDSS where adult mortality dropped after the introduction of HIV therapy (Gargano et al. 2012). So vital rates monitored in HDSS sites sometimes differ from levels observed in surrounding areas; but these instances are well documented. In the current validation exercise, none of the HDSS sites hosted an intervention that could explain any change in the ABR.

Altogether, given that HDSS data are generally found to be of good quality, it could be expected that HDSS fertility rates align with fertility estimates from the DHS, and other high-quality sources on the topic. The only thorough assessments of HDSS fertility rates done to date reveals a totally different picture however. A comparison between three Senegalese HDSSs (Niakhar, Mlomp, Bandafassi) and the 2002 and 2013 national censuses conducted in the surveillance areas show that HDSS fertility rates are much lower than census rates, especially at younger ages (Ndiaye et al. 2018). In the Niakhar HDSS in 2013, for instance, the ABR was 42/1000 according to HDSS data as opposed to 84/1000 births per women according to the census in the same area. The difference is very large, and goes in the unexpected direction, as censuses are a priori more likely to omit births than HDSS. Further analysis points to the implementation of the definition of residence. In the Senegalese censuses, as in other censuses in the region as well as in the DHS, individuals are counted as "residents" if they usually lived in the household for more than six months or arrived recently and intend to stay longer than six months; people who have left less than six months ago and can be expected to return within that time window are also residents. Several definitions are used in the Senegalese HDSS, one of which matches the census definition. However, after applying the census definition of residence to the HDSS data, Ndiaye et al. (2018) still found HDSS fertility rates to be much lower: not because births were missing, but because more women appeared in the denominator. Indeed, the population counted in the HDSS was higher compared to census counts, even when using the same definition. For example, the population aged 15–59 was 20 percent smaller in the census data than in the HDSS data for Mlomp in 2013. The authors concluded that the longitudinal nature of the HDSS yields larger resident counts, because people who have left since less than six months are counted more systematically. Further, they found that temporary female migrants have very low recent fertility rates compared to sedentary residents, and that (high fertility) sedentary residents are those who are disproportionately captured by the census. The TFR in Mlomp in 2002, for instance, was 4.8 children per woman according to the census but only 3.0 according to the HDSS data for the same year. Once only sedentary women are kept in the Mlomp HDSS database (eliminating all those who were gone for less than six months), age-specific fertility rates computed from HDSS data also amounted to 4.8 children per woman.

Altogether, the work by Ndiaye et al. (2018) indicates that HDSS fertility rates could be much lower—especially at young ages—compared to cross-sectional sources in rural African areas. This may be a nontrivial issue as temporary migration of young people is widespread in African rural areas and often essential for rural household survival (Beauchemin and

Bocquier 2004; Delaunay et al 2016; Hampshire 2002; Hertrich and Lesclingand 2013; Konseiga 2007; Lesclingand 2011; Sauvain-Dugerdil 2013), and as having small children has been shown to impede migration especially for women in that context (Pongi 2018). Important temporary migration flows of childfree young women out of rural areas may thus affect greatly the measurement of fertility rates in cross-sectional sources. In urban areas, young migrants away for a few months can also be hypothesized to keep their fertility low; but as nonmobile young city dwellers do the same, the (non)inclusion of temporary migrants will likely not affect fertility rates.

In the current study, we invited INDEPTH sites to a workshop on the model of the INDEPTH cause-of-death analysis (Streatfield et al. 2014) to perform an assessment of adolescent birth rates. The ABR is the focus of this study rather than fertility rates in general because of the particular policy relevance of this indicator. The aim of this effort was not to produce ABRs for INDEPTH sites (they are already available on INDEPTHStats for participating sites), but *standardized* ABRs (using as many socioeconomic variables as possible) in order to compare HDSS ABRs to DHS ABRs for the region of the HDSS. While this comparison strategy has its limitations, which we will discuss, it provides a first test of the hypothesis that HDSS fertility rates measured in rural African sites are substantially lower than DHS estimates, not because of data quality or definitional issues, but because the population entering in the denominator of the rate can be expected to be different.

On another level, publishing a series of African HDSS ABRs will help highlight the diversity in adolescent fertility rates found at the local level. Indeed, high fertility countries are often conceived as uniform wholes: ABRs and other fertility measures produced by the DHS are usually discussed only at the national level, or for different socioeconomic groups within nations. But social inequalities have a strong geographical grounding; at the local level in high fertility countries, ABRs can be expected to extend the entire range from low to very high levels because of the diversity in socioeconomic conditions, a reality that remains seldom depicted.

DATA AND METHODS

We sent a call to all INDEPTH sites to participate in a comparative adolescent fertility analyses workshop. A total of 18 sites, all African, responded and participated in a one-week workshop organized in Accra in May 2016.

Computing Basic HDSS ABRs

At the workshop, we first asked each site to produce basic ABRs for as many years as possible, supplying them with model programs and step-by-step instructions (Bocquier et al. 2017). All HDSS sites collect data on births that take place in the surveillance area and link this information to the mother's and household/dwelling's unique identifiers. Routine core data collected for all births include the date of birth, the sex of the child, the mother's age at the time of birth, and whether the birth was a singleton or a multiple birth. Sites prepared the data in an event-history format by creating a "core residency file" based on a "beginning/end of state" file of women aged 15–49, including their date of birth and unique identifier. Second,

TABLE 1 10 HDSS sites in six African countries, and last DHS in their region

	Starting year	Population 2014	Location	DHS year and region	Year of comparison for HDSS rates*
Senegal				*2014*	
Bandafassi	1970	13,000	Rural	Kedougou	2012
Niakhar	1962	43,000	Rural	Fatick	2012
Mlomp	1985	8,200	Rural	Ziguinchor	2012
Burkina Faso				*2010*	
Nouna	1992	93,000	Rural	Bouche de Mouhoun	2008
Nanoro	2009	54,780	Rural	Center West	2009
Ouagadougou	2009	82,387	Urban	Ouagadougou	2009
Côte d'Ivoire				*2011–2012*	
Taabo	2008	45,766	Rural	Sud sans Abidjan	2009
Ethiopia				*2011*	
Kilite	2009	65,848	Rural	Tigray	2009
Kenya				*2014*	
Nairobi	2003	61,695	Urban	Nairobi	2012
Malawi				*2010*	
Karonga	2002–2004	35,730	Rural	Northern	2008

*The quantities are calculated for DHS year −2 except for Nanoro and Ouagadougou which used year of last DHS −1, because they started data collection in 2009.

births were added as new events to this "core residency file." Using this file, sites computed ABRs by calendar year using events and exposures recorded, for all available years. These rates remain unweighted, since information are collected exhaustively in the sites.

The 10 sites out of 18 that produced basic ABRs during the workshop are listed in Table 1. They are located in six African countries: Senegal (Bandafassi, Niakhar, Mlomp), Burkina Faso (Nouna, Nanoro, Ouagadougou), Ethiopia (Kilite), Kenya (Nairobi), Côte d'Ivoire (Taabo), and Malawi (Karonga) (Beguy et al. 2015; Crampin et al. 2012; Delaunay et al., 2013; Derra et al. 2012; Kone et al. 2014; Pison et al. 2014, 2018; Rossier et al. 2012; Sié et al. 2010). The average population under surveillance in these sites (all ages) is estimated at 55,000 individuals, ranging from a low of 8,000 in Mlomp to a high of 93,000 in Nouna. The sites in Senegal have long historical data series, having begun data collection in the 1960s, 1970s, and 1980s. Nouna, in northern Burkina Faso, began the surveillance program back in 1992; all other sites are relatively recent.

Computing ABRs for the DHS Region

The next step was to compute the DHS ABRs for the region in which each of the 10 sites are located. We first matched each site with its DHS region. All six countries had had a DHS recently (between 2010 and 2014); Table 1 shows the year of the most recent DHS survey at the time, and the DHS region in which the HDSS is located.

When compared to the sample of the corresponding DHS region, the number of women aged 15–19 is larger even in the smallest HDSS site (Table 2). While we were interested in adolescent births reported at each age and especially in births to very young women (before aged 16), DHS sample sizes at the regional level were too small to allow for this distinction. Moreover, the level of fertility before aged 15 was found to be negligible in the HDSS sites. We therefore focused on the ABR computed for the 15–19 age group as a whole in the two data sources.

We computed the DHS ABRs for the 10 regions using tfr2, a Stata program designed to compute fertility rates from the DHS using all births reported in the last five years

TABLE 2 Adolescent birth rates in HDSS sites and in the corresponding region at the time of last DHS, basic and standardized to DHS region by educational level and urban residence

	Number 15–19		Ratio 15–19 to 15–49		ABR				TFR	
HDSS sites	HDSS Year of comparison* (in person years)*	DHS Last survey* (unweighted)	HDSS Year of comparison	DHS Last survey	HDSS Year of comparison	DHS (5 last years) and 95% confidence interval	HDSS corrected with DHS educational distribution	HDSS corrected with DHS urban distribution	HDSS Year of comparison	DHS (5 last years)
Bandafassi	696	90	0.24	0.22	0.113	0.194 (0.1415–0.248)		Only rural	5.07	6.52
Niakhar	2121	146	0.23	0.25	0.065	0.081 (0.0575–0.105)	0.035	Only rural	6.11	6.43
Mlomp	510	103	0.23	0.23	0.026	0.083 (0.0535–0.114)		Only rural	3.24	4.66
Nouna	3862	230	0.21	0.16	0.138	0.165 (0.1455–0.186)	0.138	Only rural	5.47	6.77
Nanoro	2266	304	0.23	0.19	0.088	0.134 (0.1085–0.160)	0.067	Only rural	4.83	6.54
Ouagadougou	4148	317	0.23	0.24	0.055	0.050 (0.0365–0.065)	0.043	Only urban	3.13	3.26
Taabo	886	137	0.13	0.20	0.213	0.134 (0.1065–0.162)	0.096	0.202	5.51	4.74
Kilite	4526	458	0.28	0.26	0.027	0.098 (0.0735–0.122	0.027	0.025	2.91	2.03
Nairobi	2786.6	125	0.15	0.12	0.098	0.081 (0.0585–0.104)		Only urban	2.75	2.90
Karonga	1765.2	968	0.23	0.23	0.146	0.171 (0.157—0.188)	0.105	Only rural	5.11	5.74

*See Table 1.

*The quantities are calculated for DHS year −2 except for Nanoro and Ouagadougou which used year of last DHS −1, because they started data collection in 2009). Nouna and Niakhar also provided their computation only for year −1.

(Schoumaker 2013). DHS regional samples were weighted. We used the entire DHS regional sample for Nairobi and Ouagadougou, and the rural sample for the remaining regions. Indeed, the Nairobi and Ouagadougou HDSS sites are located in capital cities and are completely urban (the regions are also almost entirely urban); six HDSS sites are completely rural (the three Senegalese sites, and Nouna, Nanoro, Karonga); and the two remaining sites (Kilite and Taabo) are rural but include an urban area. HDSS and DHS define "urban" by their respective national statistical offices, which varies by country.

Because we compute DHS ABRs with data pertaining to the five years preceding the survey, we placed the year of comparison for HDSS rates in the middle of the five-year period preceding the last DHS. In practice, we choose to work with the year of the last DHS-2 (except for two sites which started data collected the year of the last DHS-1) (Table 1, last column).

Standardized HDSS ABRs

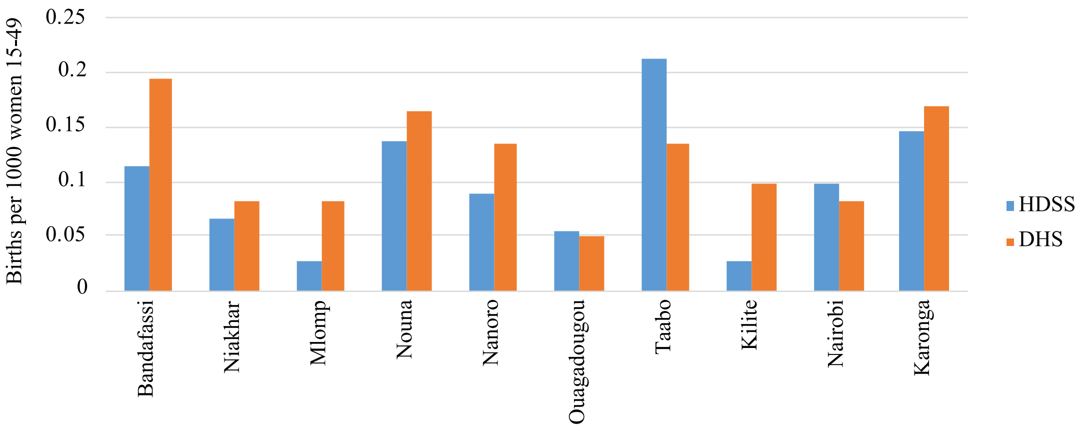
Because the structure of the population of adolescents in HDSS sites likely differs from that in the entire region, even after restricting the DHS sample to the appropriate place of residence (urban or rural), we searched for socioeconomic variables present in both datasets to standardize the HDSS ABRs. The only socioeconomic indicator collected in most HDSS sites was educational level. However, not all sites monitor educational level *continuously* (every year or at least periodically); in fact three HDSS sites out of the 10 had no or incomplete data on educational attainment (Bandafassi, Mlomp, Nairobi). In the seven remaining sites, we added this information to the core residency files. We then produced the distribution of women 15–19 by educational level in the two sources (none, some primary, some secondary or more), and recalculate the ABRs for the HDSS, applying to the HDSS the educational distribution found at the regional level in the DHS. In the two HDSS sites that were rural but with a town qualifying as urban, we also weighted in a separate analysis the initial HDSS population according to the urban/rural distribution in the DHS region, before computing HDSS one more time.

Temporary Migrants' Counts and Their Effect on Fertility Rates in the Two Data Sources

Finally, to test whether a mismatch between the two sources in rural sites could possibly be due to less fertile temporary migrants being more often captured by HDSS, as seen in the Senegalese HDSS-census comparison, we conducted an additional analysis. However, as the workshop was over by the time this interrogation arose, it was not possible to extend this analysis to all seven sites. We worked with the two sites closest to the workshop organizers, one urban site in Ouagadougou (Burkina Faso) and one rural site in Niakhar (Senegal), to compare the fertility of sedentary adolescents to the fertility of mobile ones.

In the rural site, adolescent fertility was compared for those who stayed in the surveillance site during the year of interest and those who migrated out of the surveillance site (typically to the city) and later returned. In the urban site, adolescent fertility was compared between those who entered the city migrating (typically from rural areas) during the year of interest, and those who remained urban residents, and those who left temporarily. We also compared

FIGURE 1 ABR in HDSS sites and DHS region without adjustments, SSA, 2009–2012



the share of "absent resident" (i.e., residents who did not sleep in the structure the night before) in these two sites and in the DHS at the regional level. We hypothesize that the share of temporary migrant (= absent resident) is notably larger in the two HDSS compared to the DHS region. We also hypothesize that the level of fertility among adolescent women migrating out of rural areas and those migrating in urban areas is lower than that of nonmigrant rural women, and that DHS ABRs will be close to that of nonmigrating women in the rural HDSS. Migration status is not supposed to make a difference in the urban site.

RESULTS

Large Differences in ABR Levels and Rates of ABR Decline at the Local Level

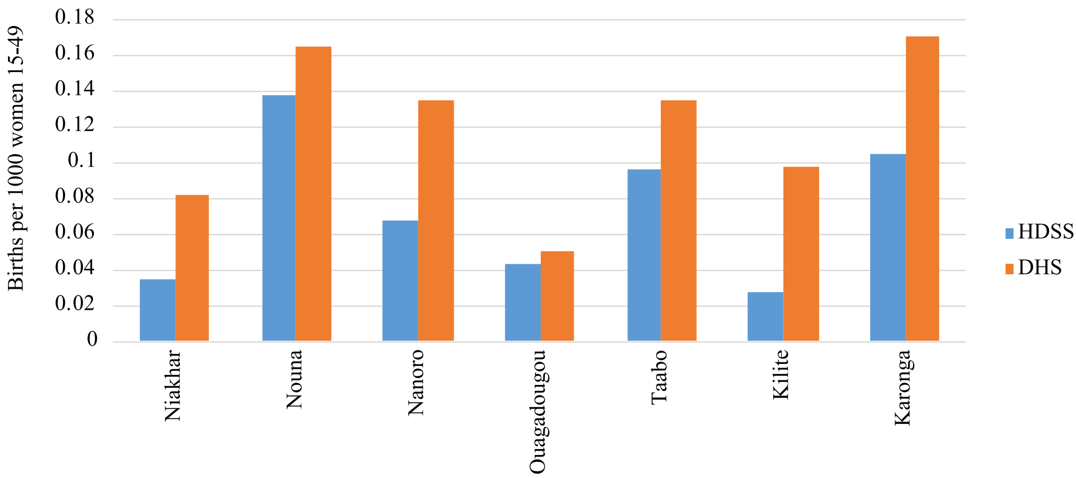
There are large differences in ABRs across the 10 HDSS sites. ABRs range from a low of 26 births per 1000 women aged 15–19 old in Mlomp in Senegal and 27 per 1000 in Kilite, Ethiopia (i.e., close to the North American average in 2010–2015) to a high of 213 in Taabo in Côte d'Ivoire (i.e., higher than the average for SSA in the early 1970s) (Table 2). As expected, these differences are strongly linked to the share of young women who reached secondary level of education (correlation = −0.60).

Standardized ABRs Measured in the Rural HDSS Are Lower Than in the Corresponding DHS Region

When comparing the basic ABRs calculated in the HDSS sites to those from the region of the DHS where the HDSS exists, no clear pattern emerged (Figure 1, Table 2). While ABRs are lower in most HDSS sites compared to the DHS region, ABRs are similar (within DHS confidence intervals) in Ouagadougou, Nairobi, and Niakhar, and ABR is much higher in the Taabo HDSS site.

As mentioned, this first comparison is relatively uninformative, since the majority of women in most HDSS sites are less educated relative to the average woman residing in the DHS region, although women in some HDSS are relatively close to the regional average in

FIGURE 2 ABR in HDSS sites and DHS region SSA, 2009–2012, standardizing foreducation and residence



terms of education or even fare better than the region (Kilite) (data not shown). To account for these differences in educational levels, for seven HDSS sites with continuous data on women's education, we weighted the HDSS 15–19 population according to the educational distribution at the regional level and calculated standardized birth counts, and ABRs. At equivalent educational structure with the DHS region, Figure 2 and Table 2 show that the HDSS feature lower rates of adolescent childbearing in all rural sites (i.e., they are lower than the lower bound of the confidence interval around the DHS estimate). There is only one exception to this pattern: Ouagadougou, which is the only urban site remaining in this analysis, where the ABR calculated from the HDSS data is very close to that of the DHS.

Controlling for the educational distribution and residence in the HDSS across the seven sites, we find that the ABR is 39 percent lower in the HDSS than in its DHS region on average. When excluding Ouagadougou, the ABR in the six rural HDSS is 44 percent lower than in the corresponding DHS region on average, still controlling for education.

We tested another standardization by considering women's place of residence in the two sites, which were rural but contained a town. This standardization was irrelevant in the eight other sites, which were either fully rural or urban (given that we use the regional sample corresponding to that place of residence). In the two cases (Taabo in Côte d'Ivoire and Kilite in Ethiopia), the HDSS adolescent fertility rates computed when standardized by place of residence of the DHS region did not vary from the original measure. In other words, only a small share of the population is urban in these two HDSS areas.

Do Fertility Rates Vary According to Migration Status? Results from One Rural and One Urban HDSS

To test whether these differences could be linked to disproportionate out-migration of nonchildbearing women in rural areas, we first computed the fertility rates of temporarily outmigrating and nonmigrating adolescents in the rural HDSS of Niakhar in Senegal (in 2012).

TABLE 3 Fertility rates of adolescent women who are visitors, present residents and absent resident in the Niakhar HDSS (2012) and the Ouagadougou HDSS (2009)

	Niakhar HDSS (2012)				Ouagadougou HDSS (2009)			
Women aged 15–19	**Visitors***	**Present resident**	**Absent resident****	**Total**	**Visitors#**	**Resident**	**Absent resident##**	**Total**
Distribution January 1st	-	92.0%	8.0%	100%	5.6%	84.7%	9.7%	100%
		2081	182	2263	283	4284	488	5055
Distribution July 1st	-	82.5%	17.5%	100%	20.3%	69.3%	10.4%	100%
		1840	389	2229	1169	3988	597	5754
ABR	-	93.3	18.01	58.57		5.62	4.93	5.54

*Not monitored in Niakhar.
**Who were gone for more than one month that year and returned # who have resided for less than 6 months ## gone for less than six month and returned.

Table 3 shows that between 8 percent and 17.5 percent of adolescent were temporarily absent (for more than one month) in the Niakhar HDSS in 2012, depending on the month. The number of temporary migrants varies by season with young women leaving more often in the summer (long vacation) (Delaunay et al, 2016). In contrast, only 7.6 percent of women aged 15 to 19 did not sleep in the household the night before according to the DHS regional data (the DHS data collection went from the end of January to the end of October 2014). The fertility rate of young women in the HDSS who did not move in 2012 (93 per 1000) is much higher than the fertility rate of mobile adolescents (18 per 1000). The ABR of sedentary adolescents in the Niakhar HDSS is in fact close to the ABR measured in the DHS for the entire region for that period (81 per 1000).

To test whether in and out migration of young women do not alter local fertility rates in cities, we conducted a similar analysis for the Ouagadougou urban HDSS in Burkina Faso. It shows that the proportion of adolescents who are temporary out-migrants (in this case defined as members who did not sleep in the dwelling the night before but were absent for less than six months) is about 10 percent; this proportion does not vary by season. In the DHS data for that region and in 2010, the share of women 15 to 19 who did not sleep in the sampled dwelling structure the night before was 2.4 percent. Among recent in-migrants (who have not been sleeping in the dwelling for more than six months) in this site, young women who visit (mainly from rural areas) peak for the summer. We also observe that nonmobile adolescents and temporary out-migrants have comparable—and very low—birth rates. In addition, adolescents who arrived during that year and stayed for more than six months (the only visitors for which fertility is collected retrospectively) had similarly low fertility rates in their first six months of stay (result not shown).

DISCUSSION

In this study, we experimented with a collective workshop format, on the model of the INDEPTH cause-of-death analysis, to produce a series of standardized ABRs for African HDSS and compare them with DHS estimates. Ten out of 18 sites produced ABRs, and 7 out of 18 produced ABRs standardized by educational level and place of residence. The results confirmed the surprising finding from a recent HDSS-census comparison in Senegal: we found rural HDSS ABRs to be much lower than DHS estimates in the region (after controlling for the educational distribution), by 44 percent on average. But how robust is this result? The DHS recently published guidelines to assist analysts in comparing DHS fertility and mortality estimates with other data sources (Pullum, Assaf, and Staveteig, 2017). According to these guidelines, the two compared estimates need to cover the same territory and identical calculation method such as births in the last two years or last three years. Even when these conditions are met, random variations as well as differences in the sampling strategy or questionnaire wording could lead to differences in the estimates. In the present study, none of these conditions are met. The respondent is a household referent in the HDSS (also reporting on temporarily absent household members), the respondent is the woman herself in the DHS; the questionnaire is different (although both collect birth histories). The methods of calculation diverge: births to all resident women divided by women-years of all resident women, present or absent in the HDSS; retrospective rates over the last five years for present residents interviewed in the DHS. The period is not exactly the same (five years preceding the DHS and the year in the middle of this five-year period for the HDSS).

To tackle the difference in the area covered, and to render the two populations more comparable, we standardized by educational level (in three groups) and residence (urban vs. rural). Even after these controls, there is no guarantee that the population of teenagers in the HDSS is similar to those in the entire region, due to the possible presence in the site of a local industry, a road heavily used for transportation, circumscribed migration flows, or localized norms linked to specific religious group for example. However, the HDSS researchers know their areas well and did not highlight any specificities of that sort; also, none of the sites hosted a health experiment which could have impacted fertility rates. While the comparison undertaken here is certainly only an approximation, it is striking that fertility rates measured in the HDSS and in the DHS region were found to be very close (much closer than the large confidence intervals would allow) in a number of instances, namely for the two urban areas and for nonmigrating residents in one rural site, as hypothesized.

CONCLUSION

The present study makes three contributions. First, the collective workshop format did not prove to be ideal for conducting comparative secondary analysis with INDEPTH's fertility data; the number of participating sites trickled from 18 to 10 to 7 to 2 during the process of analysis. Research visits at sites and the development of links with specific sites remains a workable alternative, but this approach limits the comparison to a few sites. Our work also highlights an important structural weakness of INDEPTH data, which diminishes interest in using it in fertility studies: the lack of continuous and "core" (mandatory) socioeconomic indicators. INDEPTH sites need to make an effort to continuously capture data on education in all sites; they also need to collect data on other basic socioeconomic indicators, such as household assets. Demographic indicators on marital status and parity and more specifically, the rank of each birth, are also missing from most sites. As there is a great deal of socioeconomic inequality within low-income countries, studies of vital rates—including in HDSS sites—cannot be undertaken without a consideration for this diversity. The Sustainable

Development Goals indicators, at any rate, call for a systematic disaggregation of indicators by socioeconomic status.

Second, we show that adolescent fertility rates measured in six rural HDSS are 44 percent lower than the ABRs measured in their DHS regions, controlling for education and residence. We exclude the idea of widespread births omissions in the HDSSs, given that this source of data has been shown to be of good quality in all documented comparisons. The difference seems linked rather, as suggested by a recent census-HDSS comparison in Senegal (Ndiaye et al. 2018), to the inclusion of nonsedentary young women and of their lower fertility in the HDSS databases. We supposed this would make a difference in rural sites (where child-free young women temporarily move to the city and the other stay to have children) but not in urban sites (where temporary out-migrant have the same low reproductive behaviors than sedentary urban dwellers): we were able to check this point for two sites.

While the comparison strategy used here is rough and needs to be improved on, and while many more rural INDEPTH sites need to compute their fertility rates by migratory status before we can conclude, these first results, following Ndiaye et al. (2018), definitely open a possibility. They suggest that the DHS—and other cross-sectional data collection operations—may give a somewhat exaggerated picture of adolescent fertility levels in African rural areas where temporary migration is widespread. By omitting some childfree young women who are gone temporarily from their calculations, adolescent fertility may appear larger in cross-sectional sources than it is in reality. The DHS (or other cross-sectional) measures are not wrong per se, as they amount to a measure a fertility rates in a population that is closer to the "de facto" population (who slept the night before in the housing unit). National measures of fertility rates in the DHS in particular are not affected by the possible bias discussed here, related to temporary internal migration flows. However, our results raise the question of the description of rural levels and rural–urban fertility differentials in African countries where populations are highly mobile. In other words, retrospective ABRs that will be measured in a few years from women at the end of their reproductive time may be lower than expected given contemporary period fertility rates in rural Africa.

The third and last take-home messages from these results is that adolescent childbearing, like the unmet sexual and reproductive health needs of adolescents and overall development levels, are tremendously uneven in sub-Saharan Africa today at lower geographic levels. HDSS sites in the INDEPTH network represent this diversity and are therefore great places not only to study it, but also to test interventions aimed at bettering youth sexual and reproductive health in a variety of African contexts.

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ACKNOWLEDGMENTS

This work was supported by INDEPTH, the European Union under Grant Marie Skłodowska-Curie n°690984 (project DEMOSTAF), and USAID under Grant no AID-OAA-A-13-00087 (Evidence Project). We would like to render homage to Véronique Hertrich who left us in 2019, and who gave us the original idea for this paper.