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The Impact of Family Planning on Primary School Enrolment in Sub-national Areas within 25 African Countries

Abiba Longwe and Jeroen Smits*

Nijmegen Centre for Economics (NiCE), Institute for Management Research, Radboud University Nijmegen

***For correspondence:** *Email:* a.longwe@fm.ru.nl; j.smits@fm.ru.nl Tel: +31243611436/12319

Abstract

We study how the availability and use of family planning services in African countries influences the family planning situation of households and through this the educational participation of young children. A district panel dataset is used for 441 urban and rural areas within 233 districts of 25 countries. Path analysis shows that a decrease in the number of births is associated with an increase in educational participation in the area. The number of births is negatively associated with acceptance, knowledge and actual use of contraceptives in the area. As reversed causality and selection bias seem unlikely, the identified relationship probably is at least partially causal. Hence, investments in family planning services in poor areas are not only important because they allow women to plan their births better, but also because they may lead to higher primary enrolment rates and thus contribute to the region's future economic growth. (*Afr J Reprod Health 2013; 17[2]: 23-38).*

Résumé

Nous étudions comment la disponibilité et l'utilisation des services de planification familiale dans les pays africains influence la situation de la planification familiale des ménages et ce faisant, nous étudions aussi la participation éducationnelle des jeunes enfants. Nous nous servons d'un ensemble de données pour 441 zones urbaines et rurales au sein de 233 districts de 25 pays. L'analyse du montre que la baisse dans le nombre de naissances est associée à une augmentation de la participation à l'éducation dans la région. Le nombre de naissances est négativement associé à l'utilisation d'acceptation, les connaissances et l'emploi efficace de la contraception dans la région. Comme la causalité inversée et un biais de sélection est peu probable, les relations identifiées semblent être au moins partiellement causalité. Par conséquent, les investissements dans les services de planification familiale dans les régions défavorisées ne sont pas seulement importants parce qu'ils permettent aux femmes de mieux planifier les naissances, mais aussi parce qu'elles peuvent entraîner une augmentation des taux de scolarisation primaire et de contribuer ainsi à l'avenir de la région de la croissance économique. (*Afr J Reprod Health 2013; 17[2]: 23-38).*

Keywords: Fertility; Family Planning ; Path Analysis; District Panel; Children's Schooling; Africa

Introduction

Sexual and reproductive health (SRH) affects the lives of women and men from conception to birth and from adolescence to menopause[1]. It includes the attainment and maintenance of good health as well as the prevention and treatment of ill-health. Poor SRH contributes to high levels of morbidity and mortality for largely preventable problems, particularly in developing countries[2, 3]. This paper focuses on family planning, one of the key areas of the SRH field. Unwanted births are known to have a major influence on maternal and children's health and are associated with negative socio-economic outcomes at the household and the societal level [4, 5].

Poverty and poor family planning (FP) are intrinsically linked; with poverty being both a cause and a consequence of poor FP. High levels of fertility contribute directly to poverty by reducing women's opportunities, diluting expenditure on children's education and health, precluding savings and increasing vulnerability and insecurity[6-8]. Poor family planning exacerbates and perpetuates the cycle of intergenerational poverty. It reduces productivity and earnings,

constrains investments in children and leads to untold private suffering. Poverty also aggravates poor family planning, contributing to risky behaviours, such as unsafe sex for survival, fuelling the spread of HIV/AIDS and other sexually transmitted infections[9]. In order to break this destructive cycle, it seems critical that the poorest are able to access affordable and good quality FP services.

Access to family planning services increases the chances of having healthy children and saves mothers' time for engaging in economic activities. Increased female involvement in these activities may enhance their output and income which improves economic growth. Additional income may be invested in business activities or spent on household consumption. This leads to increased per capita consumption and reduced poverty[10]. Having fewer children might therefore mean more resources for each child, increased educational participation and reduction in child labor[11, 12].

Low levels of investment in education and development of children may translate into poorer outcomes when those children grow up: - reduced employment and lower wages, higher rates of early and non-marital childbearing and lower incomes, with all concomitant risks to family health and well-being. This indicates that improvements in family planning may be linked to economic and social development and are important for reaching sustainable reductions in poverty[13]. However, about the pathways through which family planning investments may eventually lead to societal progress, not yet much knowledge is available.

This paper aims to contribute to the literature by building a theoretical model in which factors related to the use of contraceptives are connected with family planning outcomes at the household level and through these outcomes with the chances of children to enrol in primary education. Contraceptive use is supposed to depend on the knowledge people have of contraceptives and the degree to which it is socially accepted in the region where they live. An increase in contraceptive use is expected to lead to better spacing and a reduction in the number of births. This in turn may increase the chances of older children to go to school. Hence even though reproductive health factors like knowledge and acceptance of contraceptives are not directly related to educational outcomes, they may improve educational participation through their influence on the intermediate variables in our model.

The existence and strength of the hypothesized pathways of our theoretical model are empirically tested by performing path analysis on a newly built database. This database contains information on FP factors and on changes in FP outcomes and educational participation in urban and rural areas of 233 sub-national regions (henceforth called "districts") within 25 African countries. For each district, data is available for two or more points in time, so that changes over time in the central variables can be related to each other. By performing path analysis on this district panel database we aim to answer the following research questions:

(1) To what extent are changes in primary school participation in districts of African countries related to changes in the number of births within those districts?

(2) To what extent are changes in the number of births in districts of African countries related to changes in contraceptive use within those districts?

(3) To what extent are changes in contraceptive use in districts of African countries related to knowledge and acceptance of contraceptives within those districts?

In the following section, we first describe our theoretical framework and discuss the expected effects of the major factors included in it. Thereafter the data and methods used in this study are discussed. The results section starts with descriptive statistics of the district-level variables that are used. After that the estimated coefficients of our path model are presented. Both direct, indirect and total effects of the independent variables on primary school participation are shown. In the final section, the major findings are summarized and arguments for a causal interpretation of the findings are provided.

The Model

Figure 1 presents the theoretical model that we have developed to study the pathways through

which family planning influences school participation in sub-national areas of African countries. The central variables of the model are changes in the acceptance of contraceptive use, in the actual use of contraceptives, in the number of births, and in the primary school participation of children. The model assumes that if acceptance of contraceptives is higher in a district, there will be a boost in actual contraceptive use by women who want to control their pregnancies. This increased use will lead to a better FP situation (lower prevalence of unwanted pregnancies and increased birth spacing; thus a reduction in number of births) in that particular district. This better FP situation will allow couples to invest more in their children's education, which – over time – will contribute positively to poverty reduction and economic growth.

Recent births and children's education

We expect that primary school participation in a district is influenced by the FP situation of the households in that district through several pathways: a better spacing of births, less new births, and fewer pregnancies. The presence of young children in the household may negatively influence the chances of older children to attend school, through the higher care needs of the household[14-16]. Using data from Ghana, Lloyd and Gage-Brandon showed that girls are relatively more likely to be withdrawn from school as new siblings are added to the family[17]. Longwe and Smits found negative effects of the presence of young siblings on primary school participation of older children in 30 African countries[18]. Patrinos and Psacharopoulos showed for Peru that the age structure of siblings matter; having a greater number of younger siblings implies less schooling, more age-grade distortion in the classroom and more child labor[19]. Results for India also indicate that the presence of very young siblings in the household worsens the probability of girls to go to school[20]. In China, girls are disadvantaged by having a younger sibling, but more so by the presence of a younger brother than of a younger sister[21].

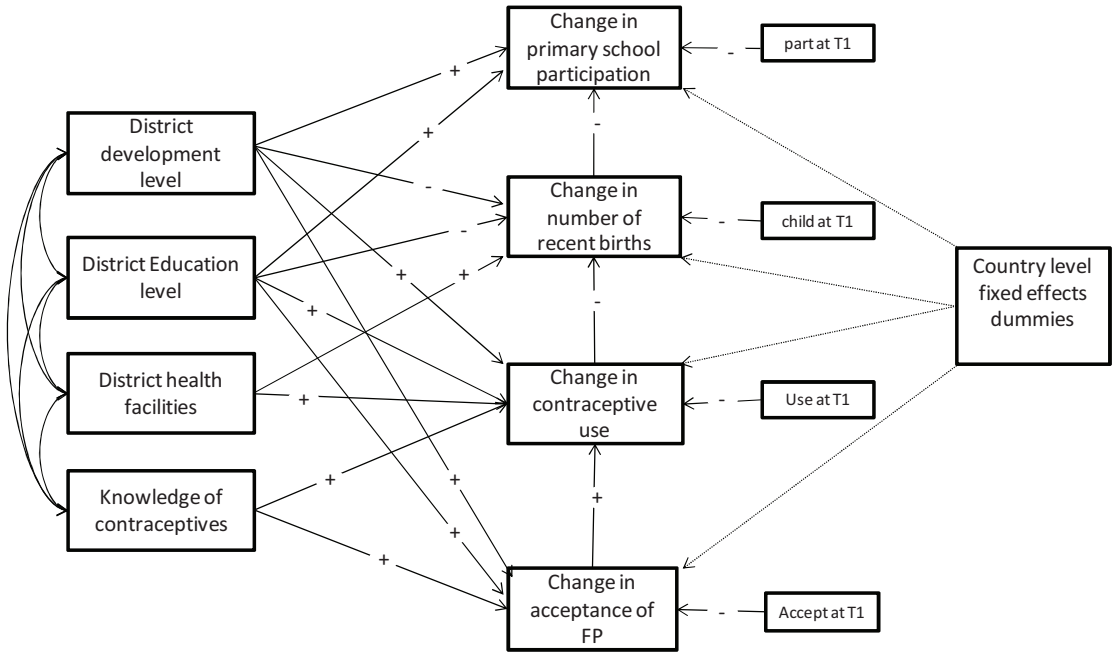

Figure 1: *The input path diagram of the conceptual model*

Birth spacing is also considered important, because there is evidence that it affects health and well-being of both mothers and children. Appropriate birth spacing reduces the risk of child mortality, stunting and being underweight of children[22-27]. Longer birth intervals ease pressures

on the family's finances and give parents more time to spend with each child during their important development years, thereby increasing the children's human capital[28-30]. Short preceding and succeeding birth intervals reduce the odds of being in primary education of African children[18].

Pregnancy of the mother may also reduce older children's chances to be in school, because pregnant women in developing countries are prone to different types of morbidity[31, 18]. It is possible that adverse effects are stronger if the pregnancy is unwanted. Unintended pregnancies are associated with negative social and health outcomes for mothers, children and society as a whole[32-35].

The arguments given above make clear that the major way in which reduction and better spacing of births may increase children's schooling chances is through a removal of restrictions at the household level. Of course also other factors play a role, like parent's willingness to send children to school and availability of educational facilities. However, as these factors are less related to family planning decisions we will not further discuss them.

Contraceptive use and households' FP situation

The FP situation of households, as discussed in the preceding section, is expected to be influenced by the availability and actual use of FP services. If no contraceptives or only less effective traditional methods are used, preferred family planning outcomes are more difficult to achieve.

Family planning has steadily decreased as an international priority in recent years, despite its documented impact on maternal and children's health and on overall development [36]. The benefits of family planning and birth spacing may reach far beyond the individual level for women and their families. Women who can plan the number and timing of the birth of their children enjoy improved health, experience fewer unplanned pregnancies and births, and are less likely to have an abortion[37, 38]. Furthermore, women who have control over their fertility have more educational and employment opportunities, which in turn enhance their social and economic status and improve the well-being of their families[38].

To achieve these health benefits, women and men must have access to a wide range of contraceptive methods at all stages of their reproductive lives, so that they can have the number of children they want when they want them. The situation in Sub-Saharan Africa is still far away from this ideal, with on average about 20 percent of married women actually using family planning—16 percent with a modern method and 5 percent with a traditional method [39]. There are also large disparities among African regions, with as much as 58% using modern methods in Southern Africa versus only 8% in Western Africa. An even larger percentage of women (24 percent on average, ranging from 16% in the South until 23% in the West) report having "unmet need," meaning that they would prefer to use family planning measures to stop having children or delay their next birth, but have no access to contraceptives [40].

Knowledge, acceptance and actual use

The actual use of contraceptives at the household level depends besides on the availability of accessible FP services in the local environment, on the knowledge people have of family planning measures, and their attitudes towards (acceptance of) these services [41-43]. These relationships are indicated at the left bottom corner of our model in Figure 1. It is expected that the more people know about and accept modern contraceptives, the more they will use them to be able to better plan their births.

Knowledge of modern contraceptives is considered one of the essential factors associated with effective use of these methods. Biney observed that lack of knowledge about modern contraceptives among Ghanaian women led to failure of contraceptive use which in turn led to unintended pregnancies and induced abortions[44]. Similarly, Lindstrom and Hernandez found that limited knowledge of modern contraceptives among recent rural-urban migrants in Guatemala was associated with unmet need and with limited choice of contraceptives[45]. There is also evidence that family planning messages through media may play an important role in increasing the acceptance and use of family planning methods, especially in those areas where literacy level is low[46-48].

Knowledge about contraceptives and their side effects may also affect their actual use indirectly, through the attitudes people have regarding contraceptive use[46, 48-50]. Smith found that Nigerian women with positive attitudes towards contraception used contraceptives more than others[51]. Zabin and others further showed that positive attitudes towards contraception among adolescents in Baltimore had a significant effect on their contraceptive use[52]. Davidson and Jaccard also found that married women's attitudes towards birth control were positively correlated to their actual use[53].

Control factors

Besides the FP variables discussed so far, our model contains several control factors that are known or expected to influence educational participation, fertility regulation and use and acceptance of family planning services. An important factor for which we control is adult educational level in the district. There is ample evidence that children from better educated parents more often go to school and drop out less[54-58]. Parents who have reached a certain educational level may want their children to achieve at least the same level[59].

A second reason why we control for district education level is that there is evidence that women's fertility is besides by their own educational level also affected by the education level of the community they are living in[60]. The education level of other people in the community may play a role through social learning and other indirect effects[61-63]. Our expectation therefore is that uneducated women will have more knowledge of contraceptives if they live in a community where the average education level is high.

Another, closely related, characteristic of the context that may play a role is its level of development. In more developed and urban areas, educational participation levels are generally higher, because of the better educational and transport infrastructure[11, 64, 65]. In those areas, there is also more impact of globalization, including the diffusion of value patterns that stress the importance of education, of smaller families and of equality among sexes.

Studies have shown that women living in rural areas tend to use fewer contraceptives and have more children than their urban counterparts[66, 67]. In the 1990s, urban fertility in Sub-Saharan Africa was almost 30 percent lower than rural fertility [68, 69]. The most recent data from the Demographic and Health Surveys show rural fertility rates to be higher than urban rates almost everywhere in developing countries[70]. A major reason might be that the costs of children are higher in more developed and urban areas than in rural areas[71].

Data and Methods

Data

Our hypotheses are tested on a newly built district panel dataset. The data for this dataset are derived from a harmonized set of (Demographic and Health Surveys-DHS) that were constructed as part of the "Database Developing World" project (www.datdevworld.org), in which household level datasets for many developing countries are connected and harmonized. The division of countries into sub-national regions was made on the basis of the regional codes available in the datasets. These codes often, but not always, follow the major administrative geographic divisions of the countries. For sub-national regions different names may be used (states, provinces, regions, districts, governorates…). Here we use the term 'district'. The districts were for our analyses further subdivided into urban and rural areas, on the basis of the urbanization variable available in the datasets.

The district-level panel dataset was created by aggregating variables from the DHS household datasets to the district level. For each included country, data for two or more years was aggregated so that episodes were created over which changes within districts could be studied. Depending on the years in which the surveys were held, the duration of the episodes varied between three and six years, except for Morocco with an episode of 11 years. The study covers a time period of about two decades covering the last decade of the 20th century and the first decade of the 21st century. The first year is 1992 (Morocco) and last year is 2009 (Madagascar).

The aggregation was done separately for the urban and rural areas of the districts. As some districts were completely urban, the number of areas included in our analyses is lower than twice the number of districts. Only areas were included for which the aggregated values for the main dependent variable was based on aggregation over at least 30 cases. Our district panel dataset therefore included data for 441 rural/urban areas of 233 districts within 25 African countries. For some of the countries, two episodes were available. The total number of cases (episodes) on which the analyses are run is therefore 622. Further information on the included countries, districts, and episodes is presented in Appendix A.

Methods

We use path analysis to estimate the relationships among the variables in our model. Path analysis is a generalization of multiple regressions that allows one to estimate the strength and sign of relationships for complicated causal schemes with multiple dependent variables[72,73]. Our path model contains one final dependent variable – change in educational participation -- and several intermediate dependent variables – changes in number of births, contraceptive use and acceptance of contraceptives.

A path diagram shows the nature and direction of causal relationships and includes estimates of the strength of those relationships, the path coefficients. To obtain the path coefficients, for each dependent variables a separate ordinary least squares (OLS) regression analysis is performed. Path coefficients are the standardized regression coefficients of these models. The standardization acts to remove differences in scale among variables and makes them comparable. The path coefficients of the separate regression models can be combined to compute indirect and total effects of the independent variables on the dependent variable(s) of interest. To address the fact that the districts are nested within countries, all regression analyses are controlled for country level fixed effects by incorporating country dummies in the model. In this way also the clustering of more than one episode in some of the countries is controlled for.

Measurement

The central variables in our model are primary school participation, number of recent births, contraceptive use, acceptance of contraceptives and knowledge about contraceptives. All these variables are measured at the district level. Primary school participation is indicated by the district's percentage of children aged 8-12 attending school at time of the survey. The upper age limit of 12 was chosen to restrict the analysis to primary education while the lower age limit was put at 8 because compulsory entry ages differ per country and not all children start schooling at the compulsory age. Number of recent births is the average number of children under age six that women aged 15-49 in the district had at time of survey. Age below six was chosen because of the high care need of this group. Contraceptive use is the district's percentage of women using modern contraceptives among all women aged 25-40 in the district who are sexually active and would like to use contraceptives. Acceptance of contraceptives is the district's percentage of women who stated they are not opposed to using contraceptives, among all women aged 25-40 in the district for whom contraceptives might be relevant (hence excluding those who never had sex, who did not want sex, who desired a birth, who were infecund or in menopause). Knowledge of contraceptives is the percentage of women aged 25-40 in the district who reported that they knew at least one method of modern contraceptives.

Of the control factors, district level of development is indicated by the percentage of households with a television set (TV) in the district. This measure has been found in earlier research to give a good indication of national level of development for low income countries[74]. We have tested whether urbanization should also be in the models. However as this variable was not significant in most models and level of development was already controlled for, we decided not to include it in our analyses. District educational level is indicated by the average number of completed years of education of individuals aged 20 and over in the district. The availability of health facilities in the districts is indicated by an index created by taking the mean of the standardized version of two variables: (a)

the percentage of hospital births among all births in the district in the last five years, and (b) the percentage of children under age five who received a vaccination for diphtheria-tetanus-pertussis (DTP3).

For our dynamic variables -- primary school participation, number of recent births, contraceptive use and acceptance of contraceptives -- both their value in the first year of the episode (referred to here as time period one-T1) and their value in the last year of the episode (time period two – T2) was computed. To measure the degree of change in these variables, the value at T1 is subtracted from the value at T2. Because the episodes differ in length, we divide the outcome of the subtraction by the number of years between T1 and T2, to get the average annual change in the variables. For the dynamic variables also their value at T1 is included in the models, to control for convergence effects (regions with low educational attendance have more room for improvement than regions with high attendance levels, etc.). For the non-dynamic variables only the value at T1 is included.

Results

Table 1 presents values for the central variables in our model at T1 and the annual percentage change between T1 and T2. School participation at T1 was highest in Egypt and Zimbabwe at a rate of 95% and 96%, while Chad and Guinea had the lowest rates with 42% and 36%. There is a general increase in primary school participation over time, except for Zimbabwe which shows a slight decrease. Noteworthy is the annual increase in school participation of 4.65%, 3.13% and 2.06% for Guinea, Tanzania and Morocco, respectively. Number of recent births at initial period was highest in Niger and lowest in Lesotho. In many countries the number of births has decreased in the period under study. Only four countries, Cameroon, Cotedivoire, Nigeria and Rwanda, showed an increase in recent births. Contraceptive use among the relevant group was highest in Egypt with a rate of 90%; it was lowest in Chad with 26%. The percentage of women using modern contraceptives shows an increase in all countries under study. This increase was highest in Lesotho, Mozambique, Tanzania and Ethiopia. The percentage of women accepting FP was highest in Morocco and Egypt and lowest in Mali and Nigeria. Regarding the change in acceptance of contraceptives among women eligible to their use, we observe a mixed trend, with diminishing acceptance in some of the poorest countries (e.g. Chad, Burkina Faso, Eritrea, Guinea and Niger).

Path Analysis

Table 2 presents the results for the different regressions that were performed as part of our path analysis. The obtained path coefficients are shown in Figure 2. The coefficients are standardized, which means that we can directly compare their effect sizes with each other.

The regression results reveal that a decrease in the number of births in a district is associated with an increase in educational participation of children aged 8-12 in that district. This result is in line with our expectation that better spacing of births would increase the chances of children to go to school. It implies that educational investments of households in a district increase as the number of children declines.

We also find that in districts where the use of modern contraceptives increases, the number of births shows a decrease. Other factors being held constant, for each standard deviation increase in contraceptive use in a district, the number of recent births in the district shows a yearly decrease of 0.115. This finding is consistent with the results of other studies which indicate that where contraceptive use is widespread, fertility is low[75].

Knowledge and acceptance of modern contraceptives are very important for women, because both their own and their family's health and well-being may depend on their ability to plan their first birth and space subsequent births[50, 76]. Our study reveals that increasing acceptance of modern contraceptives in a district is associated

Table 1: Average values at T1 and annual percentage change of the central variables in the model

Country	School participation at T1 (%)	Annual % change in school participation	Recent births at T1	Annual % change in recent births	Contra-ceptive use at T1 (%)	Annual % change in contra-ceptive use	Acceptance of contra-ceptives at T1 (%)	Annual % change in acceptance of contraceptives
Benin	60.33	1.73	0.88	-0.08	28.88	1.33	73.18	1.00
BurkinaFaso	45.76	0.61	0.90	-1.81	34.42	0.76	94.39	-1.17
Cameroon	82.72	0.84	0.73	1.01	51.78	0.40	75.40	0.51
Chad	42.30	1.20	0.99	-1.05	26.45	0.70	70.81	-2.47
Cotedivoire	54.75	0.48	0.51	5.09	27.80	1.93	75.34	1.17
Egypt	94.83	0.39	0.71	-1.26	90.43	0.25	97.64	0.14
Eritrea	60.95	1.53	0.81	-1.59	34.42	1.56	84.53	-2.35
Ethiopia	52.93	1.44	0.67	-0.34	47.46	3.29	73.53	1.10
Ghana	77.65	0.91	0.64	-0.46	52.29	0.25	83.49	0.12
Guinea	35.99	4.65	0.82	-1.52	30.38	1.93	74.59	-2.78
Kenya	92.57	0.67	0.68	-0.27	75.88	0.61	86.65	0.53
Lesotho	94.31	0.31	0.48	-0.18	72.48	4.59	91.83	1.36
Madagascar	78.66	1.35	0.80	-1.95	60.34	2.81	86.97	0.48
Malawi	89.41	0.70	0.86	-0.19	61.88	0.65	92.75	0.74
Mali	46.02	1.11	0.99	-0.56	36.92	1.61	61.92	-0.56
Morocco	67.46	2.06	0.57	-1.84	75.87	1.33	100.00	-0.15
Mozambique	67.39	1.60	0.88	-0.56	38.57	5.00	76.60	1.81
Namibia	89.53	0.30	0.59	-0.64	82.49	0.29	94.21	0.62
Niger	45.27	0.93	1.02	-0.23	46.08	0.50	76.64	-2.86
Nigeria	74.28	0.91	0.71	2.53	60.41	0.56	62.20	-0.73
Rwanda	81.92	1.94	0.75	0.21	34.82	1.64	74.51	1.35
Tanzania	59.03	3.13	0.76	-0.81	77.64	4.13	88.84	2.02
Uganda	85.27	1.33	0.95	-0.74	51.65	1.03	89.39	0.49
Zambia	74.00	1.38	0.87	-0.06	51.01	1.87	94.69	0.33
Zimbabwe	96.30	-0.03	0.58	-0.35	85.69	0.59	96.68	0.21
Total	**72.92**	**1.11**	**0.76**	**-0.42**	**57.43**	**1.45**	**85.26**	**0.20**

with increasing use. Acceptance of modern contraceptives also increases more strongly in districts where at T1 more knowledge of modern contraceptive methods was present. This means that the outcomes of our path analysis are also for the FP part of our model in line with expectations. Promotion of a healthy reproductive lifestyle by providing appropriate knowledge to bring about behavioral change with regard to contraceptive use seems very important.

All variables indicating the starting level of our dynamic variables show significant negative 5effects, thus confirming the existence of convergence effects: regions with higher starting levels have less remaining possibilities for an increase. The effect of the district's educational level is also largely in line with expectations. Districts with a more highly educated population at T1 show a stronger increase in acceptance and use of contraceptives and a larger reduction in the number of new births. The last finding indicates that FP is more effective in regions with a more highly educated population. We did not find a direct effect of district education on the change in

changes in use of contraceptive turn out to be marginally. This is not surprising given that primary school participation at T1 was also in the model with educational participation as dependent variable.

The effects of district level of development at T1 on the changes in use of contraceptives turn out to be marginally at the $p<0.05$ level. The effect on contraceptive use is marginally significant at the $p<0.1$ level, but this effect is negative. Given the significant positive effects of the region's education at T1 on acceptance and use of contraceptives, it seems
likely that the overall higher levels of contraceptive use in more developed regions are related to the higher educational level of the population in these regions. Hence human capital improvements seem important for the spread of FP.

Availability of general health facilities does not directly influence contraceptive use, but -- just as with education – we see a stronger reduction in number of births in regions with more of these facilities. Hence even though no direct association between health facilities and educational participation of children could be expected, these facilities still seem to affect educational participation positively through their effect on acceptance and use of contraceptives.

Indirect and total effects

Figure 2 only shows the direct effects of the independent variables on the outcome variables. Path analysis also offers the possibility to compute the indirect and total effects of the variables. These effects are very useful, because they show

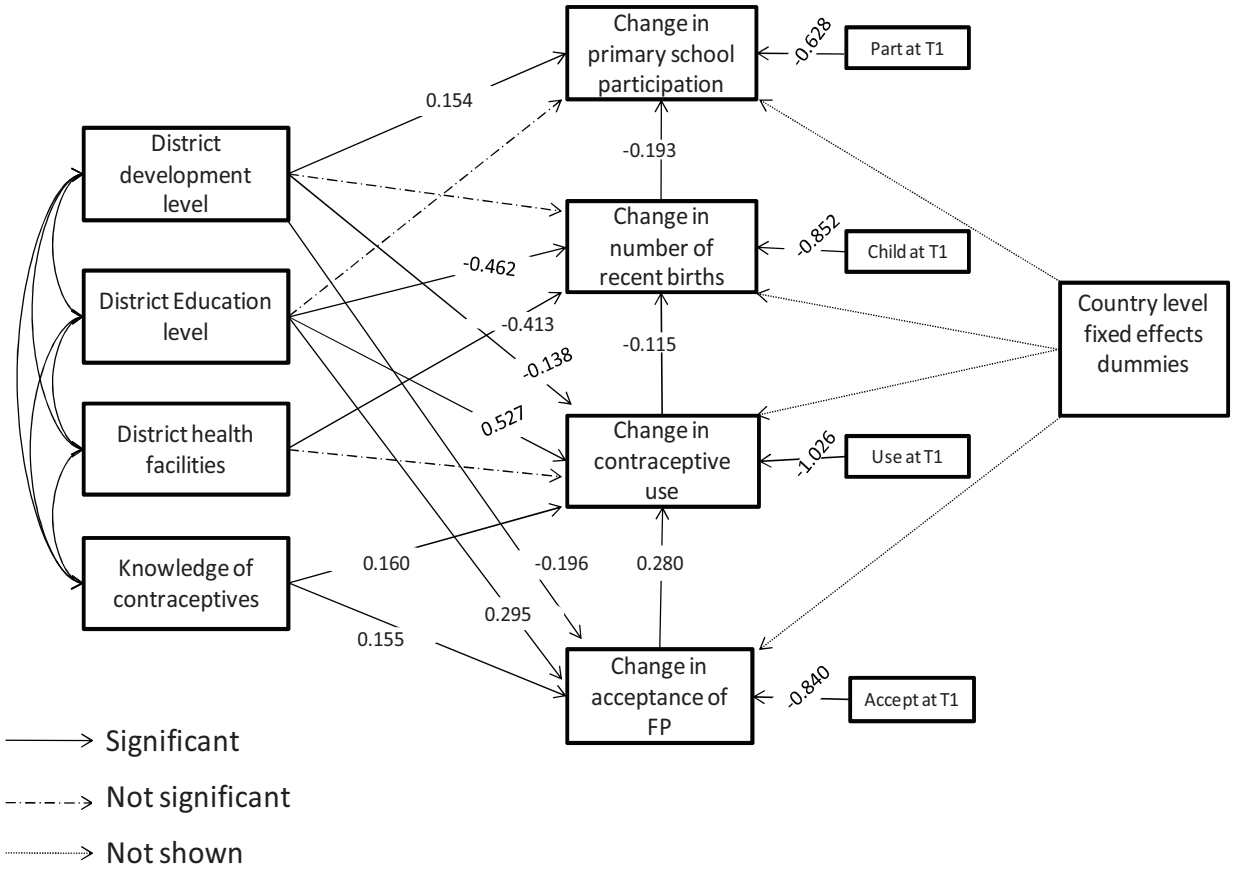

Figure 2: *A path model of FP service availability, contraceptive use and primary school participation*

Table 2: Standardized linear regression coefficients for the major dependent variables in the Path model (N=622)

	Coefficient	SE	Sig.
Change in primary school participation			
Change in average number of births in the district	-0.193	0.038	0.000
% of children attending primary school in the district at T1	-0.628	0.069	0.000
District development level at T1	0.154	0.088	0.079
District education level at T1	-0.008	0.085	0.923
Change in number of births in the district			
Change in % of women using modern contraceptives	-0.115	0.033	0.000
Health facilities availability at T1	-0.413	0.064	0.000
Average number of recent births in the district at T1	-0.852	0.061	0.000
District development level at T1	0.013	0.085	0.882
District education level at T1	-0.462	0.084	0.000
Change in % of women using modern contraceptives			
Change in % women accepting FP	0.280	0.032	0.000
Knowledge of modern contraceptive methods at T1	0.160	0.048	0.001
Health facilities availability at T1	0.031	0.067	0.644
% of women using modern contraceptives T1	-1.026	0.055	0.000
District development level at T1	-0.138	0.079	0.082
District education level at T1	0.527	0.072	0.000
Change in % women accepting FP			
Knowledge of modern contraceptive methods at T1	0.155	0.044	0.000
% women accepting FP at T1	-0.840	0.043	0.000
District development level at T1	-0.196	0.077	0.011
District education level at T1	0.295	0.065	0.000

how our outcomes of interest might be indirectly affected by the FP variables in our model, which at first glance seem to have little to do with the decisions of parents regarding sending their children to school.

Table 3 shows the regression coefficients for the direct, indirect and total effects. The coefficients are again standardized, which means

Table 3: Direct, indirect and total effects of focus variables at district level on the annual change in district primary school participation (N=622)

Change in primary school participation in the district			
	Direct	***Indirect***	***Total***
Change in number of births in the district	-0.193	-	-0.193
Change in % of women using modern contraceptives	-	0.022	0.022
Change in % women accepting FP	-	0.006	0.006
Knowledge of modern contraceptive methods at T1	-	0.005	0.005
Health facilities availability at T1	-	0.080	0.080
District development level at T1	0.154	-0.007	0.147
District education level at T1	-0.008	0.103	0.095
% of children attending primary school at T1	-0.628	-	-0.628
Average number of recent births in the district at T1	-	0.164	0.164
% of women using modern contraceptives at T1	-	-0.023	-0.023
% women accepting FP at T1	-	-0.005	-0.005

that they are directly comparable. Of the FP variables, only the change in the number of births in the district is directly related to the change in educational participation. All other FP variables exert their influence indirectly, through their effect on the change in the number of births. These indirect influences of the FP variables are all positive; hence an increase in modern contraceptive use, an increase in acceptance of modern contraceptives and more knowledge of

modern contraceptives at T1 are all associated with a larger increase in educational participation in the district.

Two of the static control variables -- availability of health facilities and the district's educational level at T1 -- show positive total effects on the change in educational participation. Hence the lack of a direct effect of district education on educational participation is more than compensated by the positive effects of this variable through other pathways. So a higher education level in a district increases children's school participation through other mediating factors, namely reduced fertility and increased acceptance and use of modern contraceptives.

For level of development the total effect is also positive. However, as two of its three coefficients were marginally significant (only at $p<0.1$ level), and the third one was not significant at all, it is difficult to show conclusions regarding this effect.

Conclusions

The central aim of this study was to develop and test a model for analyzing effects of FP services and outcomes on the educational participation of children in Africa. To fulfill this aim, we have built a path-analysis model with the change in primary school participation at district level as major dependent variable. The variation in district primary participation was supposed to depend on family planning outcomes, which were measured by changes in the number of births in the district's households. We expected educational participation to increase in districts with a decreasing number of births, because less births means less child care needs, less competition between (too closely spaced) children, healthier mothers and children, and more resources available to invest in older children's education. The number of births was expected to decrease more strongly in districts that showed an increase in the use of modern contraceptives. This increase in use of modern contraceptives, in turn, was expected to be stronger in districts with better knowledge and increasing acceptance of such contraceptives.

Our model was empirically tested on a newly built district-level panel database, with data on changes over time within urban and rural areas of 233 districts of 25 African countries. As hypothesized, the changes in the number of births in the districts were negatively related to changes in the percentage of young children attending education in the districts. Hence, a decrease in the number of births between two points in time was associated with an increase in the school participation rate over the same period.

With regard to the family planning part of our model, we found that districts where the use of modern contraceptives increased indeed showed a larger reduction in the number of births. The districts where the use of modern contraceptives increased were those that at the same time showed increasing acceptance of modern contraceptive methods. Moreover, both acceptance and use of modern contraceptives were found to increase more strongly in districts where women had better knowledge of family planning methods.

Hence we found evidence for the existence of an associational chain, in which increases in acceptance of modern contraceptives were associated with increases in use of those contraceptives, which were associated with decreases in the number of births in the area, which were associated with increasing primary school attendance. These results are very relevant from a policy perspective. They indicate that investments in family planning services are not only important because they allow women to plan their births better, but also because they lead to higher primary enrolment rates in the area and thus may contribute to future economic growth.

Of course such a conclusion is only justified if the associations identified in this study are at least partly causal effects. In our vision there are good arguments in favor of the idea that this is indeed the case. Regarding the direction of the effects we can largely rule out the possibility of reversed causality: an increase in educational participation of young children in a district cannot be responsible for a simultaneous reduction in the number of births in that district. Even though we know that the girls who now get the opportunity to go to school most likely will get less children later in their lives, this is a lagged effect that cannot reduce the number of births at this moment. In the same way, it is difficult to imagine how a decrease of birth rates might lead to an increase in

contraceptive use, or how the use and acceptance of contraceptives could increase if there would be no knowledge of contraceptives.

Only regarding the association between acceptance and use of contraceptives we can be less certain of the direction of causality, as it is difficult for women who use contraceptives to answer that they do not accept them. Still even here it seems likely that the effect at least partly runs from acceptance towards use. If women who do not use hear from users in their environment that it is acceptable to use, they may change their attitude towards using in a more favorable direction and more easily make the step towards using themselves.

Given these arguments, it seems that, as far as the direction of causality is concerned, there are no serious problems with our findings. However, besides by reversed causality, a causal interpretation of our results might also be jeopardized by selectivity problems. It is possible that women who get fewer children are a selective group, who reduce their births because they want to be able to invest more in each child. If so, an increase in these kinds of women in a district would cause both a reduction in the number of births and an increase in children's educational participation, without there being a causal relationship between them.

Still, even if this would be the case, this would not rule out the existence of a causal relationship between contraceptive use and educational participation. Without using contraceptives it is very difficult for these women to fulfill their aim of getting fewer children and without getting fewer children it becomes very difficult for them to invest more in each child. The effective use of contraceptives in turn is causally affected by the available stock of knowledge about them and the degree to which they are accepted; without knowledge and acceptance there is no use. Taken together, these arguments strongly suggest that at least part of the identified associations between the family planning factors in our model and educational participation of children are causal effects.

Our study provides several important practical implications for policy makers in African countries. First, our findings make clear that FP services do more than only reducing and spacing births; they also increase educational participation of children and in this way foster a region's future economic growth. Hence an investment in FP services is an investment in the economic and social development of the country. Second, the positive effects of the districts educational level on acceptance, use and effectiveness of contraceptives indicates that by investing in FP services a positive feedback loop can be started, in which more effective use of these services may increase the chances of children to get education. These educated children will be better able to effectively use FP services than their less educated parents, which increases the chances of their children to get educated, etc. Third, our results stress the importance of knowledge of contraceptives for achieving positive FP outcomes. In regions where women at T1 had more knowledge on contraceptives, the increase in their acceptance and use in the subsequent years was larger than in regions with less knowledge. Hence, information campaigns should not be forgotten when making investments in FP services.

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Contribution of Authors

Both authors contributed equally to all aspects of the research.

Appendix A: List of countries, districts, and episodes included in the study

Country	Number of Districts	Number of rural/urban areas [a]	DHS Years
Benin	6	12	1996, 2001, 2006
Burkina Faso	13	23	1993, 1998, 2003
Cameroon	10	19	1998, 2004
Chad	8	14	1997, 2004
Cote d'voire	10	19	1994, 1999
Egypt	22	40	2000, 2005, 2008
Eritrea	6	12	1995, 2002
Ethiopia	11	21	2000, 2005
Ghana	10	20	1998, 2003, 2008
Guinea	5	9	1999, 2005
Kenya	8	14	1998, 2003, 2008
Lesotho	10	20	2004, 2010
Madagascar	6	12	1997, 2004, 2009
Malawi	13	26	2000, 2004
Mali	8	15	1995, 2001, 2006
Morocco	7	14	1992, 2003
Mozambique	11	21	1997, 2003
Namibia	13	23	2000, 2006
Niger	7	13	1998, 2006
Nigeria	6	12	1999, 2003, 2008
Rwanda	12	22	2000, 2005
Tanzania	8	16	1996, 1999, 2004
Uganda	4	8	1995, 2001, 2006
Zambia	9	18	1996, 2002, 2007
Zimbabwe	10	18	1999, 2006
Total	**233**	**441**	-

[a] The number of rural/urban areas is not always the double of the number of districts, as some districts may be completely urban or rural

References

1. Population Action International. How family planning and reproductive health services affect the lives of women, men and children. Factsheet. 2001.
2. Griffin, S. Literature review on sexual and family planning rights: Universal access to services, focussing on East and Southern Africa and South Asia. Literature review commissioned by Panos, London as part of the Relay: Communicating research through the media programme. 2006.
3. Bernstein, S. and Hansen, CJ. Public Choices, Private Decisions: Sexual and Reproductive Health and the Millennium Development Goals. New York: United Nations Millennium Project. 2006.
4. Eastwood R. and Lipton, M. Demographic transition and poverty: Effects via economic growth, distribution, and conversion. In: Birdcall, N, Kelley, AC and Sanding, SW (Eds.). *Population Matters: Demographic Change, Economic Growth, and Poverty in the Developing World.* Oxford: Oxford University Press. 2001.
5. Peas de Barros R, Faro S, Barrett RG, and Elite PG. Demographic changes and poverty in Brazil. In: Birdcall, N, Kelley, AC and Sanding, SW (Eds.). *Population Matters: Demographic Change, Economic Growth, and Poverty in the Developing World.* Oxford: Oxford University Press. 2001.
6. Greene, M., and Merrick, T. Poverty reduction: does family planning matter? Washington, DC: The World Bank. HNP Discussion Paper. 2005.

7. Gillespie D, Ahmed S, Tsui A, and Radloff S. Unwanted fertility among the poor: an inequity? *Bull World Health Organ* 2007; 85(2): 100-7.
8. Channon AA, Falkingham J, and Matthews Z. Sexual and family planning and poverty. In Malarcher, S. (Ed.). *Social determinants of sexual and reproductive health: informing future research and programme implementation* (Chapter5). World Health Organization. 2010.
9. World Bank. A Review of Population, Family planning, and Adolescent Health and Development in Poverty Reduction Strategies. The Population and Family planning Cluster Health, Nutrition and Population Central Unit, The World Bank, Washington, DC. 2004.
10. Adeoti AI, Oni OA, Alonge SK, and Akintunde OO. Demand for family planning, poverty and economic growth in Nigeria. Paper presented at the conference of Centre for the Study of African Economics, Department of economics, Oxford University. 2009.
11. Huisman J and Smits J. Effects of household- and district-level factors on primary school enrolment in 30 developing countries. *World Dev* 2009; 37(1), 179-193.
12. Webbink E, Smits J and De Jong E. Hidden Child Labor: Determinants of Housework and Family Business Work of Children in 16 Developing Countries. *World Dev* 2012; 40, 631-642.
13. Blakeslee, J. (Ed.) *Focus* 19(1). Institute for Research on Poverty , University of Wisconsin Madison, Wisconsin 53706 . 1997.
14. Liu AYC. Children's participation behaviour in Vietnam: Combined Activities. Asia Pacific School of Economics and Management. 2004. http://hdl.handle.net/1885/40298
15. Levison D. Children's Labour force activity and Schooling in Brazil. Unpublished PhD Thesis. University of Michigan. Michigan. 1991.
16. Chernichovsky D. Socioeconomic and demographic aspects of school enrolment and attendance in rural Botswana. *Econ Dev Cult Change* 1995; 33(2), 319-332.
17. Lloyd C. and Gage-Brandon A. Does Sib size Matter? The Implications of Family Size for Children's Education in Ghana. In C. Lloyd (Ed.). *Fertility, Family Size and Structure: Consequences for Families and Children.* New York: Population Council, 1993, 481-519. Proceedings of a Population Council Seminar New York, 9-10 June 1992.
18. Longwe A and Smits J. Family Planning Outcomes and Primary School Attendance in Sub-Saharan Africa. *Stud Family Plann*, 2012; 43(2):127-134.
19. Patrinos H A, and Psacharopoulos G. Family size, schooling and child labor in Peru – An empirical analysis. *J Popul Econ,* 1997; 10, 387–405.
20. Kambhampati US and Rajan R. The 'Nowhere' children: Girls in India's rural economy. *J Dev Stud* 2008; 44(9), 1309-1341.
21. Connelly A and Zheng Z. Determinants of school enrolment and completion of 10 to 18 year olds in China. *Econ Educ Rev* 2003; 22, 379–388.
22. Yigzaw M and Enquselassie F. Birth spacing and risk of child mortality at Kalu district South Wollo Zone of Amhara region, Ethiopia. *Ethiopian Med J* 2010; 48(2), 105-15.
23. Maitra P and Pal S. Birth spacing, fertility selection and child survival: Analysis using a correlated hazard model. *J Health Econ* 2008; 27, 690–705.
24. Whitworth A and Stephenson R. Birth spacing, sibling rivalry and child mortality in India. *Soc Sci Med* 2002; 55(12), 2107-19.
25. Alam N. Birth spacing and infant and early childhood mortality in a high fertility area of Bangladesh: age-dependent and interactive effects. *J Biosoc Sci* 1995; 27, 393-404.
26. Ronsmans C. Birth spacing and child survival in rural Senegal. *Int J Epidemiol* 1996; 25, 989-997.
27. Rutstein SO. Effects of preceding birth intervals on neonatal, infant, and under-five years' mortality and nutritional status in developing countries: Evidence from the demographic and health surveys. *Int J Gynecol Obstet* 2005; 89 (Suppl 1), S7–S24.
28. Seligman B, Kress D, Winfrey W, Feranil I and Agarwal K. Reproductive health and human capital: a framework for expanding policy dialogue. POLICY Occasional Papers No.1. 1997. Washington, DC: POLICY Project, Futures Group.
29. USAID. Healthier Mothers and Children through Birth Spacing. Issue Brief. 2006. http://www.usaid.gov/our_work/global_health/pop/news/issue_briefs/healthy_birthspacing.pdf
30. Shrestha, C. and Manandhar B. How to Say 'birth spacing' in Kathmandu: A public/private partnership to promote contraception for family health in Nepal. Nepal: World Education, Inc. 2003. (Reproduced from the PATH Web site at http://path.org).
31. UNFPA. 2005. The Millennium Development Goals: Why Every Woman Counts?
32. Gipson JD, Koenig MA and Hindin MJ. The Effects of Unintended Pregnancy on Infant, Child, and Parental Health: A Review of the Literature. *Stud Family Plann* 2008; 39(1), 18–38.
33. Chalasani S, Casterline JB and Koenig MA. Consequences of unwanted childbearing: A study of child outcomes in Bangladesh. 2007. Paper presented at the Annual Meeting of the Population Association of America, New York, 29–31 March.
34. Ronsmans C and Graham WJ. Maternal mortality: Who, when, where, and why. *Lancet.* 2006; 368(9,542): 1,189–1,200.
35. Montgomery MR, Lloyd CB, Hewett PC and Heuveline P. The consequences of imperfect fertility control for children's curvival, health, and schooling. Demographic and Health Surveys Analytical Reports No.7. 1997. Calverton, MD: Macro International.
36. World Bank. World Development Indicators. Washington, DC: World Bank. 2008.

37. Barnett B and Stein J. Women's Voices, Women's Lives: The Impact of Family Planning, Research Triangle Park, NC, USA: Family Health International (FHI). 1998.
38. Singh S, Darroch JE, Vlassof M and Nadeau J. Adding it up: the benefits of investing in sexual and family planning care. 2004. New York: The Alan Guttmacher Institute/UNFPA.
39. Gribble J. and Haffey J. Family planning in Sub-Saharan Africa. Population reference Bureau. BRIDGE. 2008.
40. Sedgh G, Hussain R, Bankole A and Singh S. Women with an unmet need for contraception in developing countries and their reasons for not using a method, Occasional Report, 2007. New York: Guttmacher Institute, 2007, No. 37.
41. Emens A. Perceived fertility regulation costs and contraceptive use in Nepal. 2008. Population Studies Centre Research Report 08-644. University of Michigan.
42. Pebley AR and Brackett JW. The Relationship of contraceptive availability to contraceptive use. *Int Fam Plan Perspec* 1982; 8(3), 84-92.
43. Mahmood N and Ringheim A. Factors affecting contraceptive use in Pakistan. *Pakistan. Dev Rev* 1996 ; 35(1), 1-22.
44. Biney AAE. Exploring Contraceptive Knowledge and Use among Women Experiencing Induced Abortion in the Greater Accra Region, Ghana. *African J Reprod Health,* 2011; 15(1): 37-46.
45. Lindstrom DP and Hernández CH. Internal Migration and Contraceptive Knowledge and Use in Guatemala. *Int Fam Plan Perspec* 2006; 32(3):146–153.
46. Easterlin, R.A. and Crimmins, E. 1985. Theoretical Framework. The Fertility Revolution. Chicago, University of Chicago Press.
47. Saluja N, Sharma S, Choudhary S, Gaur D, and Pandey S. Contraceptive Knowledge, Attitude and Practice Among Eligible Couples of Rural Haryana. *Internet J Health*, 2011; 12(1).
48. Fikree FF, Khan A, Kadir MM, Sajan F, Rahbar MH. What influences contraceptive use among young women in urban squatter settlements of Karachi, Pakistan? *Int Fam Plan Perspec 2001;* 27:130-6. 55.
49. Chipeta EK, Chimwaza W and Kalilani-Phiri L. Contraceptive knowledge, beliefs and attitudes in rural Malawi: misinformation, misbeliefs and misperceptions. *Malawi Med J* 2011; 22(2) 38-41.
50. Smith EJ. Protecting fertility Network, 2002; 22.1:14-18
51. Odimegwu CO. Family Planning Attitudes and Use in Nigeria: A Factor Analysis. *Int Fam Plan Perspec* 1999; 25(2):86-91.
52. Zabin L, Astone NM and Emerson MR. Do adolescents want babies? The relationship between attitudes and behaviour. *J Res Adolescence* 1993; 3(1):67-86.
53. Davidson AR and Jaccard JJ. Variables that moderate the attitude-behaviour relation: results of a longitudinal survey. *J Pers Soc Psychol* 1979; 37; 1364-76.
54. Buchmann Cand Brakewood D. Labor structure and school enrollments in developing societies: Thailand and Kenya compared. *Comp Educ Rev* 2000; 44(2), 175–204
55. Colclough, C Rose P and Tembon M. Gender inequalities in primary schooling: The roles of poverty and adverse cultural practice. *Int J Educ* Dev 2000; 20, 5–27.
56. Ersado L. Child labor and schooling decisions in urban and rural areas: Comparative evidence from Nepal, Peru and Zimbabwe. *World Dev* 2005; 33(3), 455–480.
57. Smits J and Gündüz- Hoşgör A. Effects of family background characteristics on educational participation in Turkey. *Int J Educ Dev* 2006; 26, 545-560.
58. United Nations Educational, Scientific and Cultural Organization. 2005. Education for all: Literacy for life. Paris: United Nations Educational, Scientific and Cultural organization.
59. Breen R and Goldthorpe JH. Explaining educational differentials: Towards a formal rational action theory. *Ration Soc* 1997; 9(3), 275–305.
60. Kravdal O. Education and fertility in sub-Saharan Africa: Individual and community effects. *Demography* 2002; 39:233-250.
61. Bongaarts J and Watkins SC. Social Interactions and Contemporary Fertility Transitions. Popul Dev Rev 1996; 22:639-82.
62. Kohler HP, Behrman JR and Watkins, SC. The Density of Social Networks and Fertility Decisions: Evidence from South Nyanza District, Kenya. *Demography* 2001; 38:43-58.
63. Montgomery MR and Casterline JB. Social Learning, Social Influence and New Models of Fertility. *Popul Dev Rev* 1996; 22(Suppl.): 151-75.
64. Mugisha F. School enrollment among urban non-slum, slum and rural children in Kenya: Is the urban advantage eroding? *Int J Educ Dev,* 2002; 26(5), 471–482.
65. Kırdar MG, Dayıoglu M. and Tansel A. Impact of sibship size, birth order and sex composition on school enrollment in urban turkey, Middle East. 2007.
66. Rutstein SO. Effects of preceding birth intervals on neonatal, infant and under-five years' mortality and nutritional status in developing countries: evidence from the demographic and health surveys. *Int J Gynaecol Obstet,* 2005; 89(Suppl 1):S7-S24.
67. Conde-Agudelo A. and Balizan JM. Maternal morbidity and mortality associated with interpregnancy interval: cross sectional study. *BMJ* 2000, 321:1255-1259.
68. Shapiro D and Tambashe BO. Fertility transition in urban and rural areas of Sub-Saharan Africa. Revised version of paper presented at the 1999 Chaire Quetelet Symposium in Demography, Catholic University of Louvain, Louvain-la-Neuve, Belgium. 2000. University Park, Pa: Department of Economics Working Paper, Pennsylvania State University.
69. Dudley K and Pillet B. Fertility Levels, Trends, and Differentials in Sub-Saharan Africa in the 1980s and 1990s. *Stud Family Plann,* 1998; 29 (1): 1–22.

70. International Food Policy Research Institute. Urbanization and Fertility Rates in Ethiopia. Ethiopia Strategy Support Program II (ESSP II) Working Paper 35. Development Strategy and Governance Division, International Food Policy Research Institute, Ethiopia. 2012.
71. Child Care Aware of America. Parents and the high cost of child care. 2012.
72. Wright S. The relative importance of heredity and environment in determining the piebald pattern of guinea pigs. *Proc. Nat. Acad. Sci.* (U.S.A.) 1920; 6: 320-332.
73. Li CC. 1975. Path Analysis. A Primer. The Boxwood Press, Pacific Grove, California.
74. Monden C and Smits J. Maternal height and child mortality in 42 developing countries. *Am J Hum Biol* 2009; 21, 305-311.
75. Rajaretnam T. How delaying marriage and spacing births contribute to population control: An explanation with illustrations. *J Fam Welfare*, 1990; 34:3-13.
76. Nazar-Beutelspacher, A, Matina-Rosales, D, Salvatierra-Ilzaba, B. Zapata-Martelo, E and Halperrin, D. Education and non-use of contraceptives among poor women in Chiapas, Mexico. *Int Fam Plann Perspect* 1999; 25:3: 132-138