

Women's Education and Modern Contraceptive Use in Ethiopia

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Abstract

Women's education and modern contraceptive use are two central issues highlighted in the Ethiopian government's current development strategy. While the link between education and contraceptive use has been widely established in the background literature, there are few quantitative studies that explore how and why education affects the use of contraception. This study investigates the relationship between education and modern contraceptive use among a sample of 1,200 sexually active women from across Ethiopia. It uses secondary analysis of a survey conducted by Marie Stopes International Ethiopia in 2008. Through structural equation modelling it demonstrates that educational effects are fully mediated by attitudes, knowledge and access to health services. Of these, knowledge and access emerge as having the most considerable explanatory power.

Keywords: Education, Contraceptive use, Ethiopia, Structural equation

1. Introduction

Contraceptive use is seen as pivotal to protecting women's health and rights, impacting upon fertility and population growth, and promoting economic development particularly in much of sub-Saharan Africa. Globally, contraceptives help prevent an estimated 2.7 million infant deaths and the loss of 60 million years of healthy life (Darroch, Singh, & Nadeau, 2008).

At the same time, there is a growing call for population policy to shift away from a narrow concern with improving family planning services to also consider the wider social and societal influences regarding the determinants and consequences of women's position in society (Casterline & Sinding, 2000). In this light, a large body of research has emphasized the association between increasing women's education and increasing usage of contraceptives. But why or how education affects the practice of modern contraception remains relatively unexplored in the quantitative literature.

This paper is concerned with one particular question: what factors explain the association between education and contraceptive use? Its focus is a country with one of the highest population growth rates in the world. With an estimated population increase of 2 million people every year (MoEFD, 2006, p165), Ethiopia is grappling with the effects of a population explosion. As part of its population policy the government has set ambitious targets to increase the contraceptive prevalence rate from 15% in 2005 to 60% by 2010 (MoEFD, 2006, p170). This study aims to gain a better understanding of how education may influence contraceptive use amongst a sample of women from Ethiopia.

The Ethiopian government sees the expansion of women's education as instrumental in meeting its plans to ambitiously increase the contraceptive prevalence rate from 15% in 2005 to 60% by 2015 (MoEFD, 2006, p49, p170). It is estimated that currently only 23% of women (15 and over) are literate, compared to 50% of men (UNESCO, 2008, p274). Access to basic education has been rising since the introduction of the first Education Sector Development Plan in 1997, with overall enrolment rapidly increasing from 3.7 million to 12 million in 2007 (UNESCO, 2008, p58). The gender gap in education persists, but this has narrowed significantly over the last decade, particularly at primary level, where the net enrolment rate has risen to 68% for girls and 74% for boys (UNESCO, 2008, p274). With an increasing number of girls going to school and women acquiring education how could these potentially impact upon women's family planning and decision-making regarding contraceptive use?

2. Review of Previous Studies

While the primary focus of the review of previous studies is on modern contraceptive use, the issue of fertility is also discussed. Fertility and modern contraceptive use are two inter-related yet distinct themes. Fertility deals with the number of live births a woman or couple may have, whereas contraceptive use has been identified as a key determinant of fertility (Note 1) Where possible, the literature review focuses on modern contraceptive use (Note 2) but also broadens to studies on fertility. "Contraceptive use" will be used to refer to modern contraceptive use unless otherwise indicated.

2.1 Women's Education, Fertility and Contraceptive Use

Education has long been associated with declining fertility and increasing contraceptive use since the publication of the results of the first World Fertility Survey in the mid-1970's. Findings from across the developing world show that the better educated a woman is, the more likely she is to use contraception (Ainsworth, Beegle, & Nyamete, 1996; Rutenburg, Ayad, Ocho, & Wilkinson, 1991). Similarly in Ethiopia, Beekle and McCabe (2006) and Korra (2002) found strong associations between women's education and contraceptive use whereas Hogan, Berhanu, and Haliemariam (1999) found an association between literacy levels and modern contraceptive use in southern Ethiopia.

The question that presents itself then is: why does education affect contraceptive use? There is much speculation in this area, but often little empirical data to support the arguments, which are highlighted below. The **economic argument** focuses on the trade-off between time spent in education, and thereafter employment, and the time spent raising children (Becker, 1965; Willis, 1973). Child rearing activities are intensive of the mother's time. Education, being time-intensive as well, reduces women's demand for children and increases demand for contraception. Thus, women with high levels of education are likely to delay conception while getting their education. Once women obtain their education and enter into the labor market, those with high levels of education demand less children than women with low levels of education because of the higher cost of foregone income that rearing children entails. Educated women, then, are more likely to use contraceptive methods during their productive years in the labor market than their less educated counterparts. This is the hypothesized channel of educational effects on contraceptive use through the labor market. (Note 3)

Hogan et al. (1999) showed economic status and women's paid employment in Southern Ethiopia to be associated with contraceptive use, with the latter significantly increasing the likelihood of contraceptive use (they did not, however, test its link with education). Heeks (2008) found that the relationship between education and women's contraceptive use was mediated through household wealth. However, she also found her measure of household wealth to be biased towards urban dwelling and consumption of durable goods, and therefore questions the reliability of it in reflecting economic status.

Perhaps the most commonly argued factor explaining the link between education and contraceptive use concerns the idea of **women's autonomy** (Note 4). The link between education and women's autonomy has been assumed to be so strong that studies have often used education and literacy as proxies for women's autonomy (for example Mason, 1984). Autonomy is linked with women's power to make decisions; hence its use may vary depending on the context, such as family or workplace, and the power relations between women and men within these contexts. Often studies of Asia (Bloom, Wypij, & das Gupta, 2001; Saleem & Bobak, 2005) and the Middle East (Riyami, Afifi, & Mabry, 2004) focus on women's involvement in household decision-making and freedom of movement. Yet these indicators rarely fit with the sub-Saharan African cultural context, where it is argued that women tend to have considerable economic independence, access to resources, freedom of movement, and decision-making power with respect to their own land and trading activities

(Jejeebhoy, 1995). Others argue for a closer examination of the power relationships between a wife and her husband and how this affects sexual relationships (Blanc, 2001). For example, qualitative studies from Ethiopia have found that decisions regarding family size and contraceptive use are dominated by husbands and subsequently influence the fertility behavior of their wives and their attitudes towards the use of contraceptives (Hemmings, Wubshet, Lemma, Antoni, & Cherinet, 2008; Mesfin, 2002).

Indicators that have attempted to demonstrate the influence of women's autonomy through the dynamics of marital relationships have focused primarily on spousal communication of family planning and husbands' approval/disapproval of family planning. Spousal communication is considered a strong indicator of power relations between couples (Blanc, 2001) and has also been closely associated with educational background (Blanc & Wolff, 2001). Gage (1995) argues that spousal discussion of family planning could also be a reflection of women's autonomy. It has also been associated with contraceptive use because a sizeable minority of women cite husband disapproval of contraceptive use as a reason of non-use, even though they have never spoken to them about family planning (Bongaarts & Bruce, 1995). Thus, researchers argue that women may actually wrongly perceive that their partner disapproves of family planning (Bongaarts & Bruce, 1995). DHS data from across sub-Saharan Africa, including Ethiopia, have indicated that women who discussed family planning with their spouses were more likely to use contraception (Korra, 2002; Sharan & Valente, 2002). Hogan et al. (1999) and Beekle and McCabe (2006) also report that educated and literate women in Ethiopia were more likely to discuss family size and contraceptive use. In Hogan et al.'s study, however, they also conclude that approaches to contraception are much more likely to be determined by religion than spousal communication. Husbands' disapproval, which is linked to spousal communication, has also been demonstrated to have a significant impact on "unmet need" for family planning – a term used to describe those women wishing to limit or cease child bearing but not using contraceptives – in Ethiopia (Korra, 2002).

Connected with women's power of negotiation in the household, a further factor that has been highlighted is the husband's education level (Blanc, 2001). This is considered particularly important in terms of the relative difference between husband and wife (Wolff, Blanc, & Gage, 2000). In Ethiopia, for example, Korra (2002) found that women who had received less education than their husband were less likely to wish to limit the number of children.

Another potential explanation of the mechanisms behind the education-contraception link is the impact education has on **knowledge of, and access to, family planning services**. Hemmings, Wubshet, Lemma, Antoni, and Cherinet's (2008) qualitative study in Ethiopia suggests that women's education impacts upon their level of knowledge, and through it their contraceptive use. They note the power dimensions relating to access to mass media, particularly the radio, arguing that: "[People lacking information in this community are] those who stay in the house for a long time, those who have never been to school, they only know the local language and don't understand the Amharic on the radio." (Hemmings et al., 2008, p.53). A lack of knowledge of family planning sources and methods is often cited as a key variable in determining contraceptive use (Bongaarts & Bruce, 1995; Casterline & Sinding,

2000; Korra, 2002). Low levels of knowledge of contraceptive methods have also been linked to lower levels of schooling (see for example, Rosenzweig & Schultz, 1989), with Hogan et al. (1999) concluding that knowledge was far lower for illiterate women in their study in Southern Ethiopia.

Being advised on family planning through visits to health clinics has also been considered an important variable for contraceptive use and desire to limit child bearing. In turn, educated women are considered more likely to demand, seek and question service providers and adopt a contraceptive method that is ideally suited to them, and therefore less likely to discontinue it (Jejeebhoy, 1995, p.162). However, while Heeks (2008) and Korra (2002) both found that being advised on family planning related significantly to contraceptive use amongst women and this remained after socio-economic characteristics, including education level, were controlled for in their analyses.

Although it has yet to be directly tested with regards to contraceptive use, education could potentially impact upon **women's attitudes** towards family size and contraceptive use. Studies have shown that the ideal number of children and, related to this, number of living children, are strong determinants of "unmet need" for family planning in Ethiopia (Korra, 2002). Supporting the economic arguments outlined above, it is possible to hypothesise that education influences women's ideal number of children, as studies mainly focusing on developed nations have argued.

A more direct measure of women's attitudes towards contraceptive use is their stated approval or disapproval of family planning. The 2000 DHS data from Ethiopia revealed that there were significantly higher odds of "unmet need" for spacing childbearing, although not for limiting family size, among women who disapproved family planning (Korra, 2002).

In the wider literature regarding attitudes and health the importance of the presence of an internal locus of control has been emphasized. Internal locus of control has been loosely defined as a person's belief in the efficacy of their own behavior, rather than that of others, chance, fate or luck (Laffery & Isenberg, 2003). Women who have a high internal locus of control are more likely to use contraceptives (Lee & Mancini, 1981). It has been argued that educated women tend to employ a more scientific paradigm when dealing with life-course events such as births and marriage, and rely less on superstition and supernatural explanations, which are prevalent in traditional societies (Jejeebhoy, 1995). Blanc and Wolff (2001) using a series of locus of control questions in their study of condom use in Uganda, found a sense of control over fertility had a positive association with condom use. However, the connection between education, locus of control and contraceptive use has received little attention in large scale studies in sub-Saharan Africa.

There are a number of potentially confounding background socio-demographic variables that could affect or override the significance of education and the mediating factors that could explain the link with contraceptive use. For example, urban and rural locations (Hogan, Berhanu, & Haliemariam, 1999; Korra, 2002), age (Heeks, 2008; Hogan et al., 1999), regional differences (Measure DHS, 2007), religion (Hogan et al., 1999), ethnicity (Heeks, 2008; Korra, 2002) and number of children born (Korra, 2002) have all been identified as

factors in Ethiopia that may significantly influence desire to limit childbearing and increase contraceptive use. A further argument has been the significance of the community's level of education on women's fertility and contraceptive use. Although this has not been analyzed in Ethiopia, studies from sub-Saharan Africa and India have shown the importance of the education or literacy of women in the village or district, arguing that it had a substantial influence on a woman's reproductive behavior, above and beyond that of her own education (Kravdal, 2002; McNay, Arokiasamy, & Cassen, 2003).

2.2 Developing Research Questions and a Conceptual Framework

A review of the literature has revealed that there is surprisingly limited quantitative evidence of how education affects contraceptive use. Few quantitative studies have focused on the multiple factors associated with contraceptive use. Many have included education as a factor for analysis, but none have systematically interrogated the reasons behind this link. Moreover, there appears to be no evidence of research that explains the relative influences of the potential pathways for educational effects on contraceptive use. This is the aim of our paper.

In order to inform our empirical analysis, Figure 1 presents a conceptual framework that we put forward to explore the pathways for educational effects on contraceptive use. The development of this framework is based on the results from the review of studies presented above. It is important to highlight that this framework is based on potential mechanisms rather than causal pathways. Hence, the empirical analysis of this paper deals with associations as opposed to causal effects.

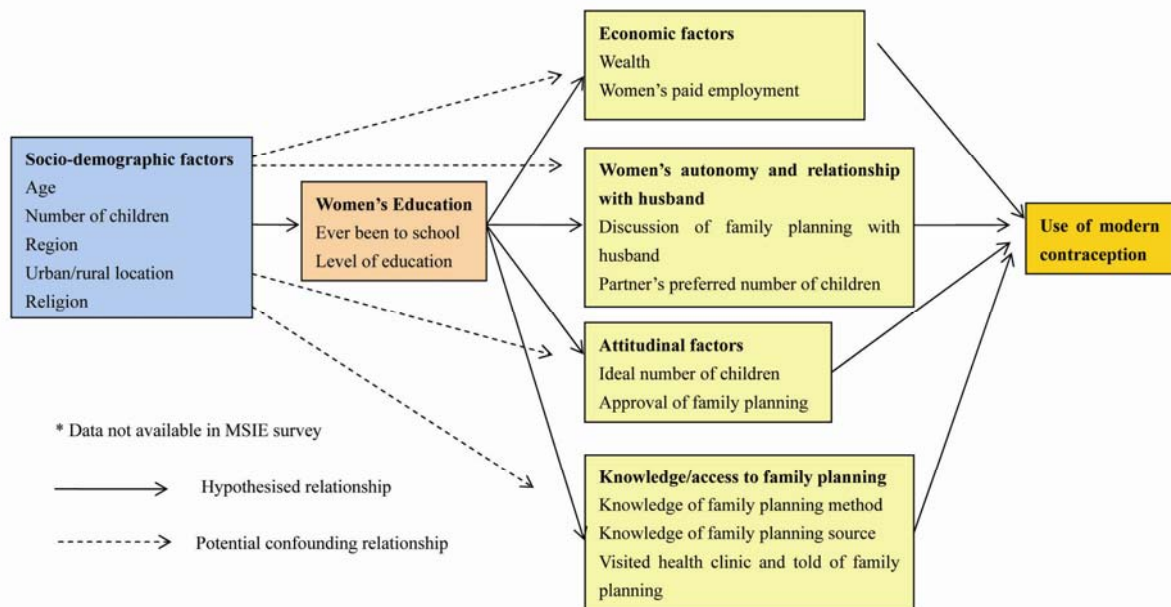


Figure 1. Conceptual Framework of the Possible Mechanisms through which Education Impacts upon Contraception Use

3. Methods

3.1 Data

The analysis for this paper is based on data from a 2008 survey conducted by Marie Stopes International (MSI), a non-profit non-governmental organization working in Ethiopia that specializes in sexual and reproductive health. The primary purpose of the survey was to provide evidence for monitoring and implementation of MSI Ethiopia's (MSIE) Family Planning Program. We utilize information from this survey for our research purposes.

The sampling technique for selecting women to participate followed a multi-stage clustering sample approach. Six regions, out of a total of nine regions in Ethiopia, and two towns within these regions where MSI operates (or plan to operate in the future) were selected. This comprises 330 Woredas (administrative units) of the total 494 Woredas in Ethiopia. From this subsample, 120 Woredas (21 in urban and 99 in rural areas) were selected following a probability proportional to size (PPS) method. From each Woreda, two enumeration areas were selected and ten consecutive households were contacted from each enumeration area. All women of reproductive age (15 to 49) were eligible for the study. The total sample size was 1200 sexually active women aged between 15 and 49 years. The data was collected using a structured questionnaire translated into the local language and pre-tested in Addis Ababa. The final survey was conducted in November and December 2008.

3.2 Defining and Developing the Variables

Outcome variable: Our outcome variable is the use of modern contraceptives. Specifically this refers to condoms, oral pills, Intra Uterine Contraceptive Device (IUCD), injectables, female sterilization and male sterilization. A binary indicator of contraceptive use was obtained from the following information: all women who indicate that they are currently using any method listed above and all women who report that they intend to use a contraceptive method to delay or avoid pregnancy in the future. The total number of women from the sample who are currently using or intending to use contraceptives is 68% (see Table 1 for mean and standard deviation of the key variables outlined in the conceptual framework). Of those, 593 women, or 49% of the total sample, are currently using contraceptives.

This figure is far higher than the latest nationwide figure of 10% for all women who were using a modern contraceptive method in 2005 (Measure DHS, 2007), which indicates that our sample is biased towards women who use or are likely to use modern contraceptive methods. This difference is explained by the purposely selective sample obtained by MSI, which although random, targeted MSI existing and expanding catchment areas which are usually located in urban and semi-urban areas. Therefore, our results cannot be considered as being nationally representative. They are, nevertheless, important as the overrepresentation of women who use modern contraceptive methods enables us to model and measure the pathways for the relationship between education and contraceptive use.

Main explanatory variable: For **women's education** we distinguished between women who had never been to school (49%, $n=590$) from those who had (51%, $n=610$). Of those who had attended school, the vast majority (70%) had at most completed primary schooling. We did

not find that the level of schooling achieved, ranging from incomplete primary to completion of secondary school or higher education, was associated with an incremental increase in the use of contraceptives. Nevertheless, there was a significant difference in contraceptive use between women who attended schooling and those who did not (80% and 56% had used modern contraceptives respectively). In addition, our indicator of literacy revealed that the ability to read and women's schooling were very closely linked. Hence, we believe that our simple binary indicator of education captures the acquisition of some knowledge from the schooling experience.

Mediating variables: Channels for the relationship between education and contraceptive use are divided into economic factors, women's autonomy and relationships with partners, attitudinal factors, and knowledge and access to family planning methods and sources.

Economic factors include wealth and employment status. Wealth was measured by constructing an index, using principal component analysis, as formulated by Filmer and Pritchett (1994). The construction of the index uses a range of assets in each household, such as dwelling characteristics (material of housing, cooking fuels, toilet type, drinking water source etc), consumer items (bicycle, television, bed, electricity etc), and more rural assets such as agricultural land and types of animals. (Note 7) Employment status differentiated between women who are paid in cash for their job from those who are paid in kind or who are not in employment. The control of own finances is seen as indicative of women's opportunity cost of labor and hence a more important differentiation than simply distinguishing between women who work and those who do not.

Women's autonomy and relationship with husband was measured by the degree of communication with partner, partner's preferences for family size and partner's approval of family planning. Spousal communication was determined from the level of agreement with one question: "I am unable to discuss the need for family planning with my spouse/partner." The answers were categorized into a 5-point Likert scale of: strongly disagree, disagree somewhat, neither agree nor disagree, agree somewhat and strongly agree. (Note 8) Two questions were used to indicate husband's approval of family planning: "My spouse/partner does not see the need to avoid or delay pregnancy," and: "My spouse/partner does not see the need to use modern family planning methods". The answers, based on 5-point Likert scale (strongly disagree to strongly agree), were added together to create a scale of approval, ranging from a minimum score of 2 to a maximum of 10. (Note 9) These questions have an alpha reliability coefficient of 0.89.

Attitudinal factors included women's own responses to issues around family planning, ideal number of children and locus of control. The ideal number of children was based on a single question that was phrased differently according to whether the woman already had children or not. The wording for those already with children was: "If you could go back to the time you did not have any children and choose exactly the number of children to have in your whole life, how many would that be?" This phrasing attempts to side-step the effect of psychological ex-post rationalization: the tendency for women to deny that their desired family size is smaller than their actual family size. Furthermore, the phrasing "if you could ... choose exactly" aims to prevent answers being influenced by the cost or difficulty of

implementing the choice – for example costs of and access to contraceptives, and spousal preferences. The average ideal number of children was 4.

The respondent's approval of family planning was gauged from the response to three questions concerning their perception of contraception (contraceptive methods are harmful; natural methods are safer; natural methods are convenient). Answers to these questions, which were logged on a 5-point Likert scale (strongly disagree to strongly agree), were added together to create a scale of approval, ranging from a minimum score of 3 to a maximum of 15, indicating a stronger level of approval. The alpha reliability coefficient of this variable was 0.73, just within the acceptable threshold of 0.70. Locus of control was based on the question: "If destiny brings another child, we cannot help, as pregnancy is God's gift". Because of the specific nature of this question, and it being the sole question available, the variable is not used as a general indicator of a woman's locus of control, but explicitly regarding her locus of control of pregnancy. Answers were re-coded, with a higher level of internal locus of control indicated by a higher score (maximum 5).

Knowledge of contraceptive methods and family planning sources, as well as access to clinics or health centers and exposure to the media were indicators of **knowledge and access to family planning**. Contraceptive knowledge was measured on the basis of which family planning methods individuals have heard of. Women were initially asked to name any methods they knew of. These were recorded as spontaneous responses. Then women were given a list of all contraceptive methods and asked whether they have heard of any of them. Responses were recorded as prompted. For this study, both spontaneous and prompted mentions of a modern contraceptive method counted as knowledge. It should be noted that both of these indicators have potential limitations, as argued by Bongaarts and Bruce (1995). For those answering spontaneously, women may mention a method even if they know only its name, rather than how it is used or its potential side-effects. Recognition of methods may be biased in part because some respondents may be embarrassed to admit that they have never heard of a method, and because recognition is an incomplete indicator of knowledge. The level of knowledge was calculated by adding the number of contraceptive methods known, ranging from 0 to 7. (Note 10)

Knowledge of contraceptive source was obtained by asking women where they would get a method if they wanted to use it. Both spontaneous and aided responses were included as knowledge of family planning source (such as government hospital or government health post). Whether or not women had visited a health clinic and been advised or received services related to family planning was created as a binary - yes or no - indicator. Anyone who indicated they had visited at least one from a list of potential sites from within the public medical sector, an NGO, trust hospital or clinic, or the private medical sector, were categorized as having visited a health clinic. 49% of the sample has never visited a health clinic and received family planning advice or services. This variable does not factor a consideration of the quality of the advice or services, which has been raised as an issue for women in qualitative research in Ethiopia (see, Berhane et al, 2001).

Access to media used listening to the radio and watching television as indicators. Frequencies

of television and radio usage were added to create a scale from high to low exposure. This variable is concerned with the broader issue of access and usage of mass media and hence does not offer any insight into the content of the media; specifically whether family planning messages were being broadcast. It is used as a proxy for a potential source of information and influencer of attitudes regarding family planning.

Age, the number of children ever born, the location – whether it is urban (18%) or rural (82%) – the religion – Orthodox Christian (56%), Muslim (23%) and other religions (21%) - and ethnicity – Amhara (37%), Oromo (37%) and other ethnic groups (26%) - were used as **socio-demographic variables** that may confound the relationship between education and contraceptive use, and their relationship with the mediating variables.

3.3 Estimation Method

Our conceptual model is depicted in Figure 1. In terms of proximal determinants, we expect the use of modern contraception to be influenced by the knowledge and beliefs of the women and her partner, as well as her wealth, the number of children she has already given birth to and whether she has visited a health clinic to discuss family planning. These proximal determinants will in turn be influenced by the woman's education, indexed here by whether or not she has attended school. Background variables that are expected to influence schooling and proximal factors are the respondent's age, whether the woman is from an urban or rural background, and her religion and ethnicity. Correlations for these variables are given in Table 1. (Note 11) As Table 1 shows, all variables were significantly correlated with contraceptive use, except for the dummy variable indicating whether or not the respondent was Amhara. The largest correlation was with whether the respondent had attended a health clinic, whereby those who had attended were more likely to use contraception. The next largest correlations were with age and, importantly for our concerns, with having attended school. Younger respondents, and those who had attended school, were more likely to use contraception.

As a first step towards developing a path model, we carried out a probit regression (Note 12) predicting use of modern contraception from the set of proximal factors. The results are given in Table 2 where it can be seen that, although all proximal factors are significantly correlated with the use of contraception, several are not significant independent predictors. These are the woman's wealth, the number of children she desires, whether she can discuss family planning with her partner, and her knowledge of where to obtain contraception. In view of these non-significant relationships, especially in view of the power of the analysis given the large sample size, these variables were dropped from the path model. We also decided to drop the variable assessing the partner's desired number of children. Although it had a significant independent effect, this was the smallest standardized coefficient and we encountered convergence problems in models where this variable was included.

Table 1. Correlations, means and standard deviations for study variables (asterisks *, ** indicates statistical significance at 0.05 and 0.01)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	
1. Use MC	1																			
2. Wealth	.15**	1																		
3. Discuss FP with partner	.19**	.13**	1																	
4. Partner's # chld.	.14**	.06*	.23**	1																
5. Partner's approval	.24**	.14**	.66**	.19**	1															
6. Preferred # chld.	-.16**	-.22**	-.09**	-.03	-.05	1														
7. Approval of FP	.21**	.11	.23**	.10**	.30**	-.09**	1													
8. Locus of control	.21**	.05	.17**	.08**	.15**	-.20**	.26**	1												
9. Knowledge	.27**	.39**	.14**	.13**	.14**	-.17**	-.01	.14**	1											
10. Source	.14**	.08**	.07*	.05	.05	-.00	.02	.09**	.33**	1										
11. Visited clinic	.40**	.12**	.25**	.15**	.20**	-.11**	.02	.17**	.28**	.09**	1									
12. # of chld. born	-.18**	-.19**	-.04	.06	-.05	.44**	-.13**	-.11**	-.15**	.02	-.04	1								
13. Attended school	.26**	.37**	.17**	.08**	.14**	-.26**	.14**	.16**	.34**	.20**	.21**	-.33**	1							
14. Age (divided by 10)	-.32**	-.06*	-.12**	.00	-.15**	.34**	-.13**	-.12**	-.13**	-.05	-.09**	.72**	-.28**	1						
15. Urban vs rural	.09**	.74**	.14**	-.02	.13**	-.25**	.07	.08**	.35**	.04	.13**	-.22**	.30**	-.04	1					
16. Amhara vs other	.01	-.05	-.20**	-.04	-.15**	.12**	.06*	.07*	-.10**	.10**	-.12**	-.01	-.05	-.06*	-.11**	1				
17. Oromo vs other ethnic	.06*	.18**	.09**	.03	.09**	-.05	.13**	-.07*	.11**	-.10**	.10**	-.15**	.12**	-.03	.10**	-.59**	1			
18. Christian vs other rel.	-.06*	-.14**	-.14**	-.06*	-.11**	.18**	-.01	.05	-.14**	-.10**	.02	.02	-.15**	.01	-.16**	.35**	-.23**	1		
19. Muslim vs other rel.	.12**	.16**	-.01	.07*	.01	-.07*	.01	.00	.19**	.13**	.10**	-.08**	.24**	-.05	.11**	-.10**	.25**	-.62**	1	
Mean	0.7	0.0	3.6	0.5	7.2	4.2	9.4	2.6	3.2	2.7	0.5	3.4	0.5	29.9	0.2	1.6	1.6	1.4	1.7	
Standard Deviation	0.5	2.7	1.3	0.5	2.5	2.1	2.8	1.3	1.7	1.2	0.5	2.4	0.5	7.7	0.4	0.5	0.5	0.5	0.4	

Table 2. Probit regression analysis of proximal predictors of contraceptive use

Variable	Unstandardised estimate	s.e.	z	Standardised estimate
Wealth	0.01	(0.02)	0.17	0.01
Discuss FP with partner	-0.07	(0.05)	-1.56	-0.08
Partner's preferred # of chld.	0.20	(0.09)	2.25*	0.08
Partner's approval of FP	0.08	(0.02)	3.14**	0.15
Preferred n of children	-0.02	(0.02)	-0.81	-0.03
Approval of FP	0.08	(0.02)	4.76**	0.17
Locus of control	0.09	(0.04)	2.68**	0.10
Contraceptive knowledge	0.09	(0.03)	3.22**	0.12
Source of contraception	0.06	(0.04)	1.67	0.06
Visited health clinic	0.97	(0.10)	10.22**	0.38
No. of children born	-0.07	(0.02)	-3.46**	-0.13
Threshold	1.42			1.12
R ²	0.38			

Notes. s.e. stands for standard errors and shown in parenthesis. Asterisks *, ** indicate statistical significance at 5 and 1% level, respectively. FP = family planning

3.4 Developing a Path Model

We developed a path model using *Mplus* (Muthén & Muthén, 1998-2007). The dataset

comprises both continuous variables and binary endogenous variables. The use of modern contraception, whether the respondent had accessed a health clinic, and whether the respondent had attended school were binary variables, whereas the remaining variables were treated as continuous variables. We chose to use Muthén's Categorical Variable Methodology (CVM) (Muthén, 1983; Muthén, 1984) using weighted least squares mean and variance adjusted (WLSMV) estimator. In CVM, each categorical variable is assumed to be an indicator of a normally distributed continuous latent variable. Values on this latent variable are related to the observed categorical variable by establishing thresholds. The analysis then proceeds by computing a matrix of polychoric correlations that estimate the relationships between observed continuous variables and the latent variables indicated by the categorical variables. WLSMV provides robust estimates of standard errors and chi-square test of overall model fit. Simulation studies using WLSMV have provided positive results (Bandalos, 2008; Flora & Curran, 2004; Muthén & Asparouhov, 2002).

We first fitted a model (Model A) in line with our hypothesized framework depicted in Figure 1, except that, as described above, five proximal determinants had been removed because they did not have a significant independent association with contraceptive use. The six proximal determinants that were included in the model were approval of family planning, locus of control, contraceptive knowledge, partner's approval of family planning, whether they had accessed a health clinic, and number of children born. In this initial model, it was assumed that these fully mediated the effect of schooling and the background variables on contraceptive use. Model fit statistics for this model (and for subsequent models) are given in Table 3. Although the fit of the model is reasonable, the chi-square statistic is significant and the RMSEA value is barely acceptable (Brown & Cudeck, 1993). Inspection of modification indices indicated that model fit would be significantly improved by adding a direct path from age to the use of contraception. As indicated in Table 3, the fit of this model (Model B) is much improved. Although chi-square is still significant, it is much reduced and RMSEA now indicates a good fit.

Table 3. Model fit statistics for path models

	χ^2	df	CFI	RMSEA	R^2
Model A	46.51	5	.98	.08	.56
Model B	15.32	4	.99	.05	.54
Model C	14.06	4	.99	.05	.53
Model D	21.40	17	.99	.02	.54

Notes: CFI = Comparative Fit Index, RMSEA = Root Mean Square Error of Approximation. R^2 is the variance in the use of contraception accounted for by the model.

Nevertheless, a number of the paths in Model B are not significant and therefore we decided to remove non-significant paths in order to provide a more parsimonious model. Most notably, locus of control, partner's approval of family planning and number of children born were no longer significant predictors of the use of contraception, and we therefore decided to remove these three variables from the model. As Table 3 shows, this model (Model C) fits as well as Model B, and results in only a small reduction in R^2 indicating that the removal of these three

variables did not worsen prediction of use of contraception. Although all proximal determinants of use of contraception are significant in Model C, not all direct paths from the background variables to the proximal variables were significant and therefore a fourth model was tested with these non-significant paths removed. This final model (Model D) provides an excellent fit to the data, as shown in Table 3. Chi-square is not significant, and both CFI and RMSEA indicate excellent fit (Hu & Bentler, 1999).

4. Results

The final path model is depicted in Figure 2 and details of parameter estimates and their standard errors are given in Table 4.

Direct predictors of contraceptive use: The variable with the greatest impact was whether the respondent had visited a health clinic and received family planning advice and services. If we set the other predictors of contraceptive use at their mean value, visiting a health clinic increased the probability of using contraception by 27%. The second largest direct predictor was the age of the respondent indicating that younger respondents were more likely to use contraception than older respondents. At mean levels of other predictors, those aged 20 were 21% more likely to use contraception than those aged 30, and 40% more likely than those aged 40. Not surprisingly, approval of family planning also had a direct association. Those who were one standard deviation above the mean on this scale were 14% more likely to use modern contraception than those at the mean. Likewise, knowledge of available contraceptive methods was a direct predictor, although it had a small association with contraceptive use. Those who were one standard deviation above the mean on this scale were 8% more likely to use contraception than those at the mean.

The relationship of attending school on contraceptive use was mediated by three direct predictors, approval of family planning, knowledge of contraceptive methods, and whether the respondent had visited a health clinic, of which the largest association was through attending a clinic. Those who had attended school were more likely to attend a health clinic and, as we have described above, attending a clinic was the single largest predictor of contraceptive use. (Note 13) So, the total magnitude of the indirect relationship of education on contraceptive use via attending a health clinic is 0.17 ($z = 5.83, p < 0.01$). (Note 14) Those who had attended school were also more likely to approve of family planning and through this use contraceptive methods (standardized indirect magnitude = 0.04, $z = 3.41, p < 0.01$). Attending school was also associated with knowledge about contraceptive methods and the total magnitude of this indirect relationship was 0.04 ($z = 3.70, p < 0.01$). (Note 15)

The role of background variables: In terms of background variables, age, in addition to having a direct association with contraceptive use, also has significant indirect relationships, as younger respondents were more likely to have attended school and also to approve of family planning. Age had the largest total impact of all background variables. Those living in urban areas compared to rural areas were more likely to use contraception because they were more likely to approve of family planning and to know about contraceptive methods. In addition, women living in urban areas were more likely to have attended school and through schooling more likely to attend a health clinic. Through these mechanisms, urban women had

higher use of contraceptive methods than women living in rural areas.

Table 4. Parameter estimates for the final path model

	Standardised estimate	Unstandardised estimate	s.e.	z	
Modern contraceptive use ON					
Age	-0.28	-0.53	(0.06)	-8.23	**
Approval of FP	0.24	0.12	(0.02)	6.31	**
Contraceptive knowledge	0.14	0.12	(0.03)	4.07	**
Visited health clinic	0.52	0.71	(0.07)	10.29	**
Approval of FP ON					
Whether attended school	0.17	0.38	(0.09)	4.20	**
Age	-0.06	-0.22	(0.12)	-1.91	
Christian vs other rel.	0.10	0.55	(0.21)	-2.67	**
Muslim vs other rel.	0.16	1.04	(0.24)	-4.28	**
Amhara vs other ethnic	-0.25	-1.45	(0.21)	6.79	**
Oromo vs other ethnic	-0.27	-1.56	(0.20)	7.89	**
Contraceptive knowledge ON					
Whether attended school	0.32	0.45	(0.05)	8.46	**
Muslim vs other rel.	-0.09	-0.38	(0.15)	2.55	*
Urban vs rural	0.21	0.95	(0.13)	7.37	**
Visited health clinic ON					
Whether attended school	0.32	0.29	(0.04)	6.73	**
Christian vs other rel.	-0.24	-0.52	(0.10)	5.03	**
Muslim vs other rel.	-0.18	-0.46	(0.12)	3.73	**
Amhara vs other ethnic	0.17	0.38	(0.11)	-3.60	**
Whether attended school ON					
Age	-0.32	-0.50	(0.05)	-9.73	**
Muslim vs other rel.	-0.24	-0.70	(0.12)	5.69	**
Urban vs rural	0.36	1.15	(0.11)	10.13	**
Residual covariances					
Approval of FP with					
Contraceptive knowledge	-0.10	-0.40	(0.11)	-3.48	**
Visited health clinic	-0.02	-0.06	(0.10)	-0.52	
Contraceptive knowledge WITH					
Visited health clinic	0.23	0.35	(0.06)	6.27	**

Notes. s.e. stands for standard errors and shown in parenthesis. Asterisks *, ** indicate statistical significance at 5 and 1% level, respectively. FP = family planning

Christians, relative to those of other religions, were less likely to use contraception overall (as indicated by a significant total magnitude of -0.10, $p < 0.01$), due to the fact that they were less likely to attend a clinic, which in turn was positively related to use of contraception (indirect estimated magnitude of -0.12, $p < 0.01$). This negative relationship was somewhat offset, however, by Christians being more likely to approve of family planning, which had a positive

effect on use of contraception (indirect estimated magnitude of 0.02, $p < 0.01$). Similarly, Muslims, relative to those of other religions, were less likely to use contraception overall (total estimated magnitude of -0.13, $p < 0.01$), mostly due to being less likely to attend a clinic (indirect estimated magnitude of 0.09, $p < 0.01$) and, to a lesser extent, indirect associations via lesser contraceptive knowledge, and lesser likelihood of having attended school. As with Christians, these negative indirect associations were offset somewhat by Muslims being more likely to approve of family planning, which had a positive association with the use of contraception.

In terms of ethnic background, the Amhara, compared to other ethnic groups, were less likely to approve of family planning, which in turn has a negative association with the use of contraception, but were more likely to attend a clinic, which has a positive association with the use of contraception. Overall, the net total impact on contraceptive use was positive but not significant (total estimated magnitude of 0.03, but this result was not statistically significant at 5 percent level). The Oromo were less likely to use contraception because they were less likely to approve of family planning (total estimated magnitude of -0.06, $p < 0.01$).

5. Discussion

This study follows in the footsteps of a wide body of literature by demonstrating that women's schooling and contraceptive use are strongly associated (Ainsworth et al., 1996; Beekle & McCabe, 2006; Hogan et al., 1999; Korra, 2002; Rutenburg et al., 1991). We found that the association of attending school and contraceptive use is fully mediated by knowledge, access to health services and attitudinal factors. Of these variables, factors relating to knowledge and access are the most important channels for how education may impact on contraceptive use. Educated women are more likely to know of contraceptive methods, as supported by previous literature (Hogan et al., 1999; Rosenzweig & Schultz, 1989), which then increases the odds of them using contraception. Likewise, women who have been to school are more likely to visit a health clinic and receive advice or services on family planning, and go on to use contraception, than women who have not been to school (Jejeebhoy, 1995). While this may be expected, the magnitude of its relative importance is surprising, with women who have visited a clinic having over 27% higher probability of contraceptive use.

One could argue that visiting a health clinic is strongly related to the use of contraceptives if contraceptive methods can only be obtained in a clinic. However, a secondary analysis of the data confirms that, while there is a strong association, the use of contraception and visiting a clinic are not overly correlated. For women using injectables, which comprise the majority of current users ($n = 408$), 19% have never visited a clinic and received family planning advice or services. For pill users 12% have never visited a clinic and for implants 29% have never visited (the second and third most commonly used contraceptives respectively). Using contraception by no means equates to having visited a clinic in our sample. These results thus indicate that, for the women in the sample, the health clinic and the advice and services they supply on family planning play a remarkably important role in the uptake of contraceptives, even after a number of background characteristics are modeled.

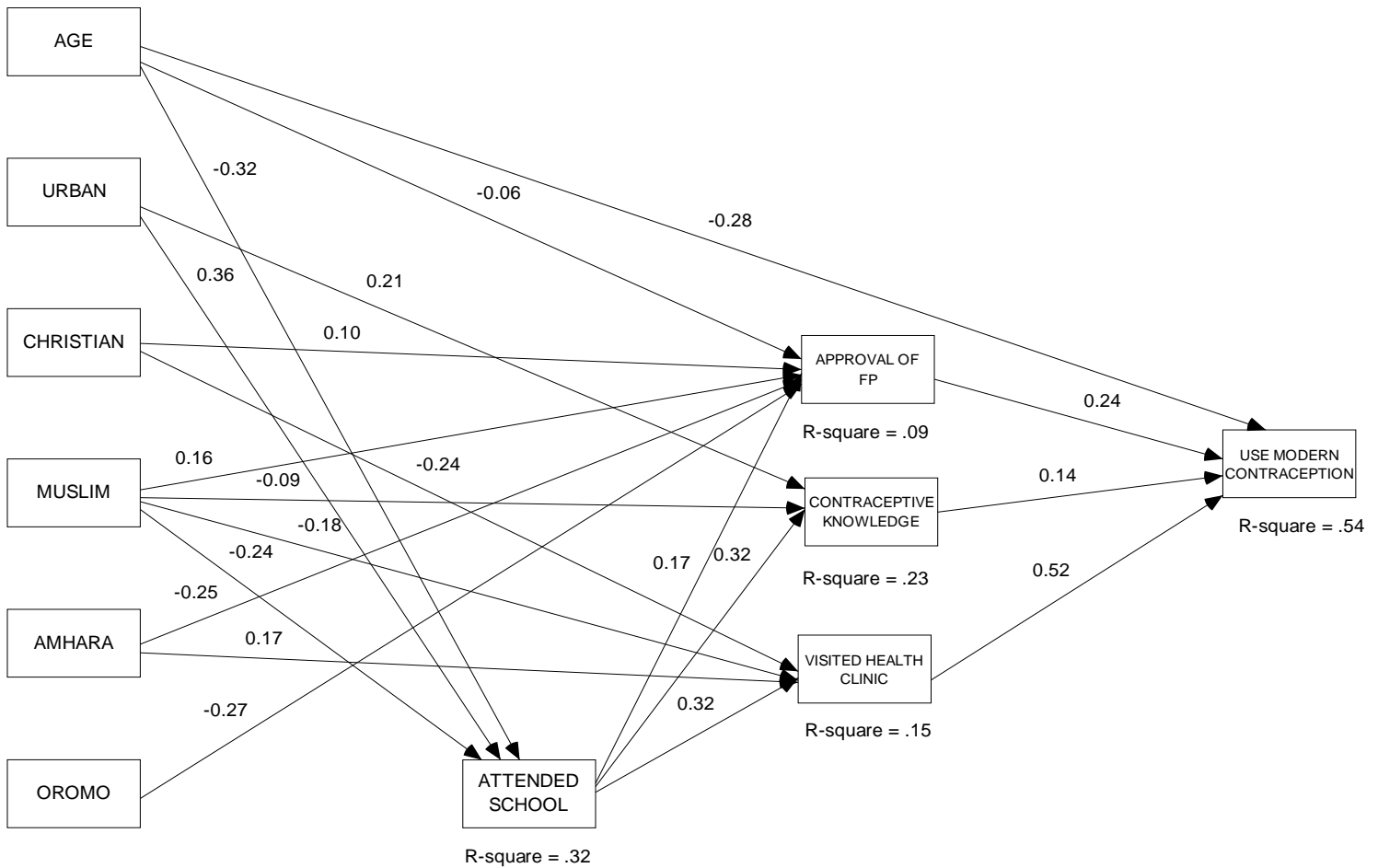


Figure 2. Final path model predicting the use of modern contraception

Notes: The residuals and covariances between exogenous variables and between residuals are included in the model but not shown in the diagram; values are standardized path coefficients. All coefficients are significant at $p < .01$; FP = family planning.

We did not find that the relationship between education and contraceptive use is mediated by economic factors. This is contrary to the result found by Heeks (2008) in Ethiopia; the association of education and contraceptive use disappeared once wealth was factored in the model. There are two possible explanations here. First, the use of wealth in the model by Heeks may be acting as background factor for educational effects. It is possible that household wealth or economic status is related to schooling choices and these in turn are associated with use of contraceptive. In this case, our structural model should have included household wealth measured at the woman's school age as a potential predictor of education. Unfortunately, this information was not available in our survey to model this properly. Secondly, we need to differentiate between wealth and labor market income. Wealth can be associated with higher fertility and hence lower use of contraceptive methods. But the economic channel of education suggests greater contraceptive use because of the higher opportunity cost of time in the labor market. It is possible that wealth may not be a good proxy variable to measure this opportunity cost, but income generated from the labor market may be more closely related to this issue. However information from labor market income was not available in the survey.

Also differing from the findings of this study, Hogan et al. (1999) found that employment for cash significantly increased the likelihood of contraceptive use. However they did not factor a number of variables, including being advised or receiving services from a clinic and the partner's attitudes towards family planning, and also had literacy as the sole indicator of a woman's education. Ultimately our study supports the claim that women's work and wealth may be overemphasized as a possible channel through which education operates (Cleland & Jejeebhoy, 1996). Nevertheless we acknowledge the limitation of wealth and being in paid employment as proxy measures of the opportunity cost of time for women in the labor market who are opting between having children or not and hence when the decision to use contraceptive methods is relevant.

Although many of the attitudinal variables were dropped from the analysis because they did not have significant independent associations with contraceptive use, this is not to say that these variables are not relevant. Rather, they probably mediate, and are mediated by, the other proximal indicators. Thus, the zero-order correlations of spousal communication, partner's approval of family planning, locus of control, own and partner's desired number of children were all significant, but they were dropped from the analysis. It is likely, for example, that these variables contribute to, and are affected by, whether women decide to attend a health clinic, and it was attendance at the health clinic that came out as the best independent predictor.

In addition, the model does not account for the possible interrelations between the different channels suggested here (economic, autonomy, attitudinal and knowledge/access). It is possible that these proximal factors of contraceptive use are interrelated. For example, approval of family planning may be related to an increased likelihood of visiting a clinic, or the other way around, or there may be influences in both directions. We have not explored the possible dynamic interrelationships in this model (in part because reciprocal relationships would not be identified) but have simply allowed the residuals to be correlated. Table 4 indicates that the inter-correlation between the residuals for contraceptive knowledge and visiting a health clinic was quite high (0.23); between visiting a health clinic and approval of family planning was small and not significant (-0.02); between contraceptive knowledge and approval of family planning was also small (-0.10) but statistically significant. This would, though, be an interesting avenue for further research.

As a concluding remark, women who have more education are more likely to hold positive attitudes towards family planning, have greater knowledge of contraceptive use, are more likely to visit health clinics and, as a result, are more likely to use contraceptives. The impact of background factors such as age, location and religion are mediated by education, as well as these other proximal mechanisms. Only age is likely to have a direct independent association with contraceptive use, indicating the shift of new generations towards use of modern contraceptive methods. Attitudes, knowledge and access to health services play a larger role in explaining the link between education and contraceptive use than both economic factors and women's autonomy. Our findings not only help paint a better understanding of the means through which education may influence contraceptive use, but also provide further evidence of the potential wider benefits of schooling for women.

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Notes

Note 1. The other determinants are: the proportion of reproductive years not living in union, duration of postpartum nonsusceptible period, and incidence of pathological sterility (Bongaarts, 1984). Of these determinants, an urban study from Ethiopia suggests that contraceptive use and a decrease in the proportion of women who are married are the most important mechanisms by which fertility has declined (Sibanda, Woubalem, Hogan, & Lindstrom, 2003).

Note 2. Modern contraceptive use refers specifically to condoms, oral pills, Intra Uterine Contraceptive Device (IUCD), injectables, female sterilization and male sterilization. These are considered the most effective forms of contraception, although this depends on their correct usage (Bongaarts, 1984).

Note 3. We would like to thank anonymous referees for making this channel more explicit.

Note 4. Previously, the term 'women's status' was used. However, it has been criticized for its over emphasis on the division of labor, and for failing to deal adequately with issues of power and conflict (Jeffery & Basu, 1996) and is now more commonly replaced with the broad concept of autonomy.

Note 5. This was not included in the most recent 2005 DHS survey for Ethiopia

Note 6. Incidentally, here the contentiousness of the concept of "unmet need" is emphasized: there is an apparent contradiction that the women who disapprove of family planning are identified as having an unmet need for the very service they disapprove of. As suggested by Casterline and Sindling (2000), the concept of "unmet need" is thus not a condition highlighted by women themselves but an externally imposed label constructed through inference.

Note 7. There are undoubtedly limitations with this indicator of wealth. The resulting index revealed a much finer differentiation of wealth amongst the richest 25%, than the poorest 25%. This would suggest that the characteristics and items used to identify wealth are biased towards those factors attributed to richer households. There is also a correlation between the wealth index and location. This suggests that the index favors those assets more likely to be found in urban areas, and downplays more rural assets such as land tenure and livestock. Nevertheless the index has a good reliability, with an alpha coefficient of 0.84.

Note 8. This measure is perhaps more informative than the frequency of discussion with partner employed in most DHS, yet it is still limited by failing to clarify the nature, content or quality of communication. In addition, the focus of this variable is also narrowly on the verbal dimension of communication, without consideration of other possible mediums of communication.

Note 9. The survey does not incorporate questions about the husband's education level, and therefore these have not been included, although they are indicated as an important indicator of women's relationship with partners.

Note 10. Injectables which, as highlighted above, are the most well-used form of contraception, unsurprisingly are also the most well known method of contraceptives, with 91% (n = 1081) mentioning it or knowing about it, followed closely by the pill (83%, n = 999). These figures are supported by similar national figures of women's contraceptive knowledge, with 84% of women having knowledge of pills and 83% of injectables (DHS Measure, 2007, p58).

Note 11. In this, and all subsequent analyses, age was divided by 10 in order that its variance was broadly in line with the other variables. The largest to smallest variance should not differ by more than a factor of 10 otherwise problems of convergence can arise in fitting path models (Kline, 2005).

Note 12. We used probit regression rather than logistic regression to be consistent with the path analyses described below. Path coefficients predicting binary variables are equivalent to probit regression coefficients.

Note 13. Mplus uses the Delta method for estimating standard errors of indirect tests and hence significance tests are equivalent to a Sobel test (Sobel, 1982).

Note 14. The magnitude of the pathway is obtained by the product of the intervening variables. In the case of education on contraceptive use via health services it is the product of education on health services (0.32) and health service on use of contraceptive (0.52).

Note 15. We also estimated the total magnitude on use of contraception for attending school and for the other background variables. The standardized total magnitude of attending school was significant, and we calculated that the independent relationship was that those who had attended school were 11% more likely to use contraception than those who did not. Results are available from the authors upon request.

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