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Community Factors Influencing Contraceptive Use among Married Women in 21 African Countries

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Committee Chair

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Bachelor of Arts
Oberlin College
2006

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An abstract of
A thesis submitted to the Faculty of the
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Abstract

Community Factors Influencing Contraceptive Use among Married Women in 21 African Countries

By K. Miriam Elfström

Contraceptive prevalence is low in the African region despite considerable family planning programmatic efforts. This study investigates community level influences on modern contraceptive use among married women ages 15 – 49 in 21 African countries. The analysis builds on previous studies through an examination of the individual, household and community level factors that shape contraceptive use. The data used in this analysis were from nationally representative Demographic and Health Surveys completed between 2005 and 2009. A separate multi-level logistic model was fitted for the outcome of current modern contraceptive use in each country. After controlling for individual and household level factors, community level factors of demographics and fertility norms, gender norms and inequalities, and health knowledge remain significantly associated with contraceptive use. The results highlight the importance of harnessing community level factors in planning interventions for increasing access to and utilization of modern contraceptive methods.

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In honor of my late grandfather, Dr. Martin H. Smith, Emory MD ’45 who taught me what a commitment to health equity means. I hope I have done you proud.

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CHAPTER 1: INTRODUCTION

Uptake of contraceptive use as part of a broader push to further sexual and reproductive health is an integral part of achieving the Millennium Development Goals (MDGs) and recognized specifically in MDG 5 which pertains to improving maternal health and includes a sub-component focusing on access to reproductive health services (United Nations, 2010). While much focus has been placed on reducing maternal mortality rates (part 1 of MDG 5), ensuring access to reproductive health services has been more difficult to address. The inter-relatedness and complexity of sexual and reproductive health issues have made it difficult to translate goals into action. In addition, the sensitivity of issues surrounding sexual and reproductive health have further complicated efforts to address contraceptive uptake (UN Millennium Project, 2006).

Increasingly, the role of community environments and the impact of cultural norms and attitudes in shaping contraceptive use have been recognized (Cleland et al., 2006, Wellings et al., 2006, WHO Regional Office for Africa and USAID, 2008). Despite programmatic efforts to expand access to family planning in Africa, progress has slowed and significant variations in contraceptive prevalence exist between regions (UN Millennium Project, 2006, Wellings et al., 2006, WHO Regional Office for Africa and USAID, 2008, United Nations, 2010, Cleland et al., 2006). Programmatically, a more nuanced understanding of these factors will contribute to informing funding decisions and strengthening family planning service delivery. With the due date for the MDGs fast approaching, examining factors associated with modern contraceptive use is critical to making progress towards reducing the burden of health and non-health outcomes related to unmet need for contraceptives.

Contraceptive Use

Contraceptive use is important to sexual and reproductive health programming because of both its health and non-health related benefits. On average, contraceptive prevalence has increased from 10% in 1960 to approximately 60% in 2004 in low-resource settings (UN Millennium Project, 2006). While there have been dramatic increases in contraceptive prevalence, these numbers mask regional variation and high unmet need for birth-spacing and limiting (UN Millennium Project, 2006, WHO Regional Office for Africa and USAID, 2008, Cleland et al., 2006, United Nations Population Division, 2007). As a result of greater access to modern contraceptives, investment in family planning programs, and changing norms regarding family size, the total fertility rate (TFR) decreased in the late 20th century resulting in fertility levels below 5 children in many parts of Asia, Latin America, the Caribbean and Oceania (UN Millennium Project, 2006). However, many countries in Africa have not experienced a decline in TFR in recent years. Instead, countries such as Benin, the Democratic Republic of Congo, Ethiopia, Guinea, Kenya, Madagascar, Mali, Senegal, Sierra Leone, Uganda, and Rwanda still have TFRs of greater than 5.4 and high population growth rates (Cleland et al., 2006).

Research and advocacy efforts have often focused on the direct health benefits of contraception and the impact of population growth on the environment and efforts to combat poverty. Population growth estimates from the 1990s predicted that countries in Sub-Saharan Africa would increase by 112% between 1990 and 2000 (Segal, 1993). More recent estimates suggest that populations in some countries in Sub-Saharan Africa will increase by 200% by 2050 (USAID, 2009). Rapid population growth and

urbanization strain already weak health and education systems exacerbating existing health access issues and limiting economic growth (UN Millennium Project, 2006, Cleland et al., 2006). Given that 43% of the population in Sub-Saharan Africa is below the age of fifteen and will soon enter their reproductive years, investing in family planning programming is critical to helping this next generation of women achieve their desired fertility and reducing unintended pregnancies (USAID, 2009).

With regard to the direct health benefits of contraception, Cleland et al. (2006) suggest that 90% of abortion related morbidity and mortality as well as 20% of obstetric morbidity and mortality could be avoided if women were able to achieve their desired fertility through effective contraceptive use. In addition to the impact contraceptive use can have on reducing maternal morbidity and mortality, uptake of family planning can help with the prevention of HIV transmission and can support greater birth-spacing leading to better health outcomes for women and their children. By preventing HIV transmission, the risk of mother-to-child transmission of HIV is also reduced and by increasing birth-spacing, the risk of infant and neonatal mortality is also decreased (UN Millennium Project, 2006, WHO Regional Office for Africa and USAID, 2008, Tsui et al., 2010, Glasier et al., 2006, Cleland et al., 2006, Marston and Cleland, 2004).

The impact of contraceptive use on non-health outcomes such as women's empowerment and gender equality is harder to measure but equally important. Access to contraceptive services is a key component of helping women achieve their desired fertility (UN Millennium Project, 2006, Cleland et al., 2006, WHO Regional Office for Africa and USAID, 2008). Studies have shown strong links between contraceptive use and fertility and measures of autonomy, decision-making, and empowerment (Gwako,

1997, Cleland et al., 2006, UN Millennium Project, 2006, Ahmed et al., 2010). Specifically, a study completed by Family Health International showed that women who use a contraceptive method from an earlier age are more likely to work outside the home (Family Health International, 2011). Through greater participation in the labor force, women are exposed to broader social networks and may increase their social status (Castle et al., 1999). Other studies suggest that high fertility rates coincide with more traditional gender roles, which in turn impact whether young girls attend school (Lloyd and Gage-Brandon, 1994, UN Millennium Project, 2006). The relationship between contraceptive use and non-health outcomes such as gender equality and empowerment is complex as greater empowerment and equity are both a pre-requisite of contraceptive use as well as a result of increased uptake of family planning.

In the past decade, family planning programs have been de-prioritized as health sector reforms have decentralized services, funding has decreased, and HIV/AIDS service delivery has taken precedence (Singh et al., 2009, Smith et al., 2009). Refocusing on increasing contraceptive prevalence, through understanding factors associated with uptake and applying those findings to programmatic efforts will have the potential to positively impact health and non-health outcomes for women in low-resource settings.

Aims and Objectives

Objective

- The primary aim of this study is to investigate the associations between community level factors and current modern contraceptive use among married or co-habitating women ages 15 – 49 in 21 African countries with completed Demographic and Health Surveys (DHS) from 2005-2009. Modern contraceptive

will be defined as reporting current use of one of the following methods: pill, IUD, injections, condom, male or female sterilization, Norplant, or diaphragm/foam/jelly.

Aims

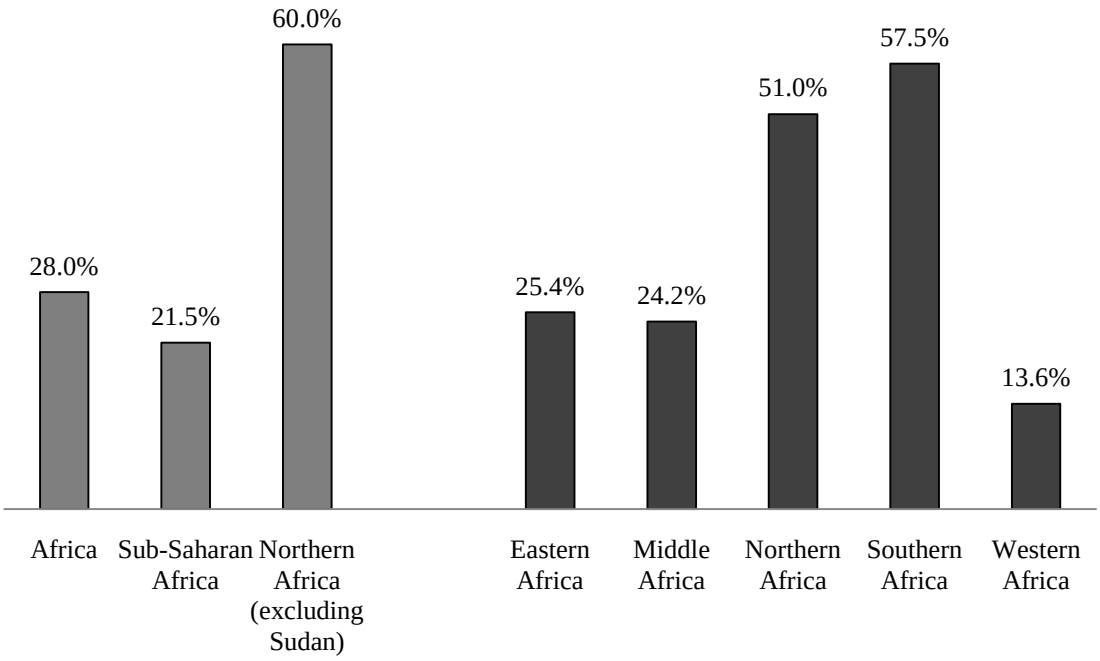
- The analysis will focus on three levels of influence: individual, household, and community and will provide an opportunity to understand how the community environment influences modern contraceptive use.
- The impact of four community level domains will be explored: community demographics and fertility norms, community gender norms and inequalities, community economic prosperity, and community health knowledge and media exposure.
- The findings of this study will contribute to a broader understanding of community level factors associated with modern contraceptive use as well as highlight regional variations in contextual influences.
- The results will be used to inform current family planning programmatic work in the African region and future research in community level determinants of contraceptive use.

Study Setting: Family Planning in Africa

Worldwide estimates of contraceptive prevalence show a dramatic increase in modern contraceptive use in the 2nd half of the 20th century following the introduction of the pill (Segal, 1993). Contraceptive prevalence varies significantly across the African region. Northern Africa (excluding Sudan) and Southern Africa have the highest prevalence rates (51.0% and 57.5% respectively) whereas Western Africa has the lowest

(13.6%) and Middle Africa and Eastern Africa fall in between with 24.2% and 25.4% respectively (United Nations Population Division, 2007) (Figure 1).

Figure 1: Contraceptive Prevalence in the African Region



Source: UNDP 2007

In addition to notable variations in overall prevalence of contraceptive use, method preference differs between countries and regions. Globally, female sterilization and IUDs are the most commonly used methods of contraception; however, looking specifically at African regions, women rely on the pill and injectables rather than sterilization and IUDs (United Nations Population Division, 2007). As expected, in countries where modern contraceptive prevalence is low, reliance on traditional methods is higher and conversely, where contraceptive prevalence is high, use of traditional

methods is lower (United Nations Population Division, 2007). Choice of contraceptive method reflects attitudes and norms of specific cultural contexts as well as method availability (Biddlecom and Fapohunda, 1998, Sullivan et al., 2006).

Previous studies investigating contextual influences on contraceptive use have focused on individual countries, communities, or in some of the more expansive studies, a set of countries in a sub-region of the world has been analyzed (Burgard and Lee-Rife, 2009, Kaggwa et al., 2008, Paek et al., 2008, Magnani et al., 1999, Stephenson et al., 2007, Stephenson et al., 2008b). This study builds on these earlier studies to expand the geographic breadth of countries included and the contextual depth of community level variables examined. To our knowledge, a study of this reach has not been completed previously. Therefore, it offers the first opportunity to characterize, for an entire region, the influence of community level factors on contraceptive use. Given the significant variation in contraceptive prevalence in the African region and the gap remaining to achieve universal access to contraceptives, it is critical to look beyond what has been done previously with regard to examining determinants of contraceptive use and focus on the influence of the environment in which a woman lives.

CHAPTER 2: LITERATURE REVIEW

Determinants of Contraceptive Use

Significant research attention has been devoted to describing trends in contraceptive prevalence and understanding individual determinants of contraceptive use among women of reproductive age. With regard to demographic factors, in general contraceptive prevalence is higher in urban areas, higher among more educated women, and varies by age (Segal, 1993, Magadi and Curtis, 2003, Beekle and McCabe, 2006, Ozumba et al., 2005). Older women are more likely to use contraceptive; however, age-specific prevalence is dependent on differing reasons for use and closely associated with parity (Segal, 1993). Fertility preferences have a considerable influence on contraceptive use with women often reporting desire for more children as a reason for non-use of a method (Weldegerima and Denekew, 2008, Omokhodion et al., 2007). In a study from Ethiopia, while many women reported that using contraceptives was acceptable in their community, women also reported that the cultural and religious beliefs of their community did not condone contraceptive use (Weldegerima and Denekew, 2008). Attitudes towards contraceptives and desired fertility can also be shaped by gender norms and partner beliefs about the benefits of having more children (Izugbara et al., 2010).

Uptake of contraceptives is also associated with knowledge of modern methods and beliefs about side effects (Cleland et al., 2006, Oye-Adeniran et al., 2006, Sedgh et al., 2006, Rutenberg and Watkins, 1997). Source of knowledge about contraceptives varies with women reporting exposure to family planning messages in the media and peer networks as major sources of information (Ozumba et al., 2005, Adeyemi et al., 2008). In a qualitative study examining the impact of informal social interaction on the use of

contraceptive, Rutenberg and Watkins found that women gained much of their knowledge of contraception from their social networks and were deterred from using contraceptives by rumors of various side-effects (1997).

Women are affected by the level of support they receive from their partners in using contraception and acceptance of contraception they perceive at the community level (Cleland et al., 2006, Ozumba et al., 2005, Castle, 2003, Osemwenkha, 2004). Concern over the partner's opposition to using contraception leads many women to use contraceptive clandestinely (Population Council, 1998, Biddlecom and Fapohunda, 1998, Chikovore et al., 2002). Prevalence of covert contraceptive use varies, but Biddlecom and Fapohunda found that it accounted for 6 – 20% of all contraceptive use among women (1998). Some evidence suggests an association between experiencing intimate partner violence and use contraceptive (Diop-Sidibe et al., 2006, Alio et al., 2009). Other studies have taken this further and shown a connection between clandestine use and violence. In one study from Zimbabwe, men expressed concern over women's clandestine use and women reported experiencing violence as a result of being discovered (Chikovore et al., 2002). Women's access to contraception is limited, not only by infrastructure level constraints, but also by the social norms that impact decision-making and autonomy.

In addition to studies examining individual level determinants among women of reproductive age, research has increasingly focused on sub-populations and health outcomes related to contraceptive use. Specifically, studies have investigated determinants of contraceptive use among adolescents, use of barrier methods among sex workers, and condom use as a means to prevent HIV transmission. Results of studies

focusing on adolescents have found similar factors associated with contraceptive use – education, social networks, and contraceptive knowledge surface as important factors (Katz and Nare, 2002, Adedimeji et al., 2008, Amoran and Fawole, 2008). Knowledge and education were also significantly associated with condom use for the prevention of HIV (Ukwuani et al., 2003).

Previous studies exploring contraceptive use in low-resource settings have helped to capture individual level factors associated with contraceptive use and have begun to highlight the impact of social networks and interactions on contraceptive use. While studies have effectively described demographic characteristics associated with contraceptive use and discussed individual barriers to uptake, significant gaps remain in our understanding of how the environment in which a woman lives shapes her decision to use contraception. Increasingly, the role that the community plays in shaping contraceptive uptake has been recognized because of its potential to provide insight into regional variations in contraceptive use and highlight community characteristics associated with differing patterns of contraceptive uptake (Cleland et al., 2006, Wellings et al., 2006, WHO Regional Office for Africa and USAID, 2008). While strong infrastructure and dependable supply chains are key pieces of family planning program implementation, in order to be successful and sustainable, efforts to increase contraceptive prevalence must also consider the influence of the broader context in which a woman lives. Moving beyond individual level studies to focus instead on community level factors allows us to better identify the norms, expectations, and characteristics of communities that shape contraceptive use and tailor interventions to specific community settings.

Multilevel Modeling and the Importance of Community Level Factors

The growth of multilevel modeling in public health reflects the growing recognition of the role that community plays in shaping health outcomes and provides one way to conduct studies demanding a social epidemiological approach (Pickett and Pearl, 2001). Multilevel modeling achieves this through including variables at the individual level as well as the community level. Smith, Littlejohns and Thompson (2001) clearly describe how individuals are influenced by the community in which they live saying, "personal values, beliefs and behaviors are always situated within and shaped by the social context of relationships among people who share the experience of belonging to community" (p. 34). In examining determinants of health outcomes, the trend in epidemiological research has been to individualize risk and through doing so, highlight individual behavior as definitive in shaping health status while ignoring the social context in which an individual lives (Diez-Roux, 2001, Diez-Roux, 1998, Pickett and Pearl, 2001). By using a multilevel analysis technique, value is placed on the societal dimension of health and both micro- and macro-level determinants of health evaluated (Diez-Roux, 1998, Cubbin et al., 2000, DiPrete and Forristal, 1994).

Measuring contextual influences on health outcomes has been described in a range of settings and can be accomplished using a variety of multilevel modeling techniques (DiPrete and Forristal, 1994). In essence, contextual analyses describe macro level effects on individual outcomes that operate in addition to individual level factors. Context in multilevel modeling can be defined as spatial, temporal, organizational, and social, cultural or economic (Duncan et al., 1998, DiPrete and Forristal, 1994). Individuals are then part of a context or a set of contexts depending on the complexity of

the analysis. Multilevel modeling techniques described in the literature differ according to the statistical properties of the model. The basic model can be divided into two main categories: the fixed effects model (an earlier iteration of the multilevel model) and the random effects model. Random effects multilevel models allow for the estimation of within-community variance and between-community variance with regard to the outcome of interest at the individual level (DiPrete and Forristal, 1994). This is important because individuals in the same community are more likely to be similar than individuals in different communities (Pickett and Pearl, 2001, Guo and Zhao, 2000).

For this analysis, Demographic and Health Survey (DHS) data was used. DHS data is collected by a multi-stage sampling design. A multilevel modeling technique was used to account for the hierarchical structure of the DHS data and allow for the estimation of community level influences on current modern contraceptive use. The hierarchical structure of the DHS data violates the assumption of independence as women are clustered within primary sampling units (PSUs) which serve as a proxy for communities. If this clustering is ignored, the standard errors are underestimated. Multilevel modeling corrects the estimated standard errors resulting from this clustering (Guo and Zhao, 2000). Additionally, multilevel modeling estimates the variances of the outcomes between communities. The model used for this study is written:

$$Y_{ij}=\pi_{ij}+\varepsilon_{ij}Z_{ij}$$

where $\log_e(\pi_{ij}/(1-\pi_{ij}))=\alpha+\beta X^T_{ij}+U_j+V_K$, Y_{ij} is a binary outcome for individual *i* in PSU *j*, Y_{ij} are assumed to be independent Bernoulli random variables with the probability of using a modern contraceptive $\pi_{ij}=Pr(Y_{ij}=1)$. Therefore, to correctly specify the binomial variation, Z_{ij} denotes the square root of the expected binomial variance of π_{ij} and the

variance of the individual residual term ε_{ij} is constrained to be one. The outcome variable $\log_e(\pi_{ij}/(1-\pi_{ij}))$ fitted in the model is the $\log_e$ odds of contraceptive use. This constrained the predicted values from the model to be between zero and one. α is a constant while β is the vector of parameters corresponding to the vector of potential explanatory factors defined as X_{ij}. The PSU residual term is defined as $U_j \sim N(0,\sigma_u^2)$.

As Diez-Roux describes, critics of studies that examine community level influences on health outcomes suggest that by including the higher level variables, the results suffer from the ecological fallacy (1998). However, by clearly stating the different levels of influence considered and using a hierarchical modeling technique, these concerns can be overcome and, in the case of the DHS surveys, the impact of cluster sampling addressed. Of more concern in current studies, is the potential to over-simplify analyses and focus solely on individual level influences to explain determinants of health outcomes, ignoring the impact that differences in context can have on individual experience and failing to account for disparities in health outcomes (Diez-Roux, 1998, O'Campo et al., 2008).

Community Level Effects on Health Outcomes

There is a growing body of work addressing community level influences on health outcomes, both here in the U.S. and internationally. These studies represent the increasing attention paid to the influence of context and highlight the utility of multilevel models in addressing a range of health outcomes. Through an examination of what has been done in the past with regard to community level studies, the potential pathways of community factor influence on contraceptive use can be described.

Health infrastructure quality and the availability and affordability of services in a community have been the focus of numerous studies examining contextual influences on reproductive health outcomes; however, the effect of health infrastructure measures has been mixed. Weeks et al. (2010) found a strong association between use of female condoms and receiving them for free at clinics in their study of women in an urban setting in the U.S. However, given the lack of variance between the communities chosen in for their analysis, no other health infrastructure factors were found to be significant. In Tajikistan, Habibov and Fan (2008) determined that women who had a negative view of the quality of the existing health infrastructure and had to travel further to a health facility were less likely to seek antenatal care. Similarly, the quality and availability of services offered at the village-level health facilities in West Bengal, India was significantly associated with contraceptive use (Chacko, 2001). The presence of a health facility in communities positively impacted contraceptive use, even though women also had access to outreach workers who could have provide them with services (Chacko, 2001). Interestingly, Stephenson et al. (2008b) found that very few community level measures of health infrastructure were significant after controlling for other individual and household level variables. They found an inverse relationship between distance to a health care facility and contraceptive use: women who lived further from away were more likely to use contraceptives (Stephenson et al., 2008b). While this may have been because they were unable to account for private sector services, it does highlight regional variations in the impact of health infrastructure on contraceptive use.

Norms held in the community about fertility and childbearing help to shape individual fertility desires by providing a set of social expectations. Fertility norms and

patterns of marriage, childbearing, and intercourse in the community have an impact on reproductive health outcomes (Kaggwa et al., 2008, Weldegerima and Denekew, 2008, Mace and Colleran, 2009, Omokhodion et al., 2007, Babalola and Fatusi, 2009). In their study of determinants of antenatal care seeking behavior in Nigeria, Babalola and Fatusi found that in communities where preference for a small family (defined as less than four children) was the norm, women were more likely to seek care (2009). Looking specifically at contraceptive use, Kaggwa et al. found that women in communities with a higher mean number of births were less likely to use a contraceptive method (2008). This is confirmed by the work of Family Health International and as Barnett describes, cultural norms that preference larger families and place greater value on sons negatively influence women's use of contraceptives (Barnett, 1999).

Measures of community socioeconomic status and economic prosperity have been examined as they relate to health outcomes in a variety of settings. The association between wealth and improved health outcomes assumes that increases in wealth translate into stronger health infrastructure and greater ability invest scarce resources in health. In a study of determinants of adolescent condom use in South Africa, Robinson and Seiber found that after adjusting for community clustering, the association between wealth and condom use was significant for females and not males (2008). Poor and extremely poor females compared to non-poor females were significantly less likely to use condoms at first sex however the same comparison was not significant for males (Robinson and Seiber, 2008). A similar study of sexual initiation and condom use found that higher levels of community level economic disadvantage were associated with increased odds of unprotected sex (Burgard and Lee-Rife, 2009). Using mean household amenities index in

the community as a measure for socioeconomic status and wealth, socioeconomic status was found to be significantly associated with modern contraceptive use in Burkina Faso (Stephenson et al., 2007).

Interestingly, Kaggwa et al. found no association between the proportion of women in the community with piped water and contraceptive use in Mali (2008). The authors do not provide a rationale for why this variable was chosen, but assuming that piped water was used a measure of socioeconomic status, these results contradict the other studies reviewed here and highlight the how measurement of indicators may impact results. The association between community wealth is somewhat inconsistent across study results. This demonstrates that while wealth can be a significant predictor of health outcomes, in some instances, once other community demographic information was controlled for, the association between wealth and the outcome of interest diminished.

Gender norms and inequalities in the community impact the level of decision-making autonomy experienced by women and shape health care seeking behavior and outcomes (Paek et al., 2008). Specifically, educational attainment, employment status, and attitudes towards intimate partner violence at the community level have been associated with contraceptive use in previous studies (Stephenson et al., 2007, Cammack and Heaton, 2001, Entwisle et al., 1989). In an early study from Egypt examining village level effects on contraceptive use, Entwisle et al. found that the likelihood of using contraception increases with the proportion of the village population who had primary school education or higher (1989). Stephenson et al. found that in communities in the Eastern Cape of South Africa women were less likely to use a contraceptive method if there was a greater ratio of men than women had a primary education in the community

(2007). Cammack and Heaton found that after controlling for individual level education of wives and husbands, only the proportion of women with at least a primary school education was significantly associated with contraceptive use at the regional level (2001). Educational attainment is an important indicator of gender dynamics in a community as it is associated with increased decision-making power and increased access to social networks (Bloom et al., 2001, Habibov and Fan, 2008, Oye-Adeniran et al., 2006, Hogan et al., 1999).

While the impact that women's employment and economic independence have on reproductive health outcomes has been examined at the individual level and results suggest a positive relationship, studies exploring the community level influence of employment on reproductive health outcomes are few (Miles-Doan and Brewster, 1998, Estrin, 1999). Looking at household and community level data from the Philippines, DeGraff et al. (1997) found that in communities where women's wages were higher, women were more likely to use a contraceptive method. As a woman's earning potential increases, her role in the labor market is solidified and her decision-making autonomy strengthened (DeGraff et al., 1997).

Evidence describing the association between experiencing intimate partner violence (IPV) and contraceptive use is mixed at the individual level. In Rural India, women who experienced IPV were less likely to start using a contraceptive method (Stephenson et al., 2008c) whereas in Sub-Saharan Africa, Alio et al. (Alio et al., 2009) found that women were more likely to use a method if they experience violence. Similarly, women in Egypt who reported having been beaten by their current husband were less likely to use a female contraceptive method (Diop-Sidibe et al., 2006). Little

evidence exists at the community level to describe the relationship between violence and reproductive health outcomes. However, qualitative evidence from India suggests an association between community attitudes towards violence and contraceptive use although the directionality of the association was not clear (violence could either be a pre-cursor to adopting a method or the result of using a method without permission) (Wilson-Williams et al., 2008).

Levels of community health knowledge and exposure to family planning messages in the media have been positively associated with reproductive health outcomes. This is perhaps because exposure to health messages and increased health knowledge are indicative of greater willingness to address potentially sensitive topics and stronger presence of health infrastructure and service provision. In a study examining regional variation in acceptance of the government family planning program in Indonesia, Cammack and Heaton found that media exposure surfaced as a significant predictor of contraceptive use (2001). Controlling for individual level media exposure, they found that community level media exposure was associated with greater family planning program success (Cammack and Heaton, 2001). Similarly, Kaggwa et al. found that women who resided in communities with a higher proportion of women reporting exposure to a family planning message in the past six months had greater odds of using a modern contraceptive method (2008). Finally, Paek et al. found that exposure to mass media at the community was significantly associated with family planning behavior in Uganda. The authors hypothesized that mass media facilitates greater inter-personal communication and allows for increased dissemination of information (Paek et al., 2008).

The association between community level health knowledge and reproductive health outcomes is less well-documented. However, some evidence suggests that knowledge of reproductive health translates into increased care-seeking behavior. For example, in a study looking at prenatal health care utilization in Tajikistan, Habibov and Fan found that women who had limited knowledge of sexual health were less likely to seek prenatal care compared to women who had more knowledge (2008). In this case, knowledge was defined based on the source of information: women who noted that they received most of their information about sexual health from their parents or husband were categorized as having limited knowledge, implying that women who had more sexual health knowledge had accessed sources of information outside of their immediate family (Habibov and Fan, 2008). One study examining community level influences on condom use among upper primary school students in Nyanza, Kenya used church leader attitudes towards condoms as a proxy for community health knowledge (Maticka-Tyndale and Tenkorang, 2010). However, the association between this measure of knowledge in the community and condom use was not found to be significant. Finally, a qualitative study conducted in the same province of Kenya found that women's knowledge of contraception was based largely on conversations with other women and therefore dependent on the general level of knowledge in a social network (Rutenberg and Watkins, 1997). Greater health knowledge in the community may be evidence of stronger health system educational programming and more effective communication of information on the part of health workers.

Through reviewing the literature regarding factors associated with reproductive health outcomes, it is clear that controlling for individual and household level factors,

significant community level influences remain. However, as demonstrated in this literature review, previous studies examining community level influences have focused on a limited geographic range of countries (either one single country or a sub-set of countries in a particular region) and a select number of community level factors. This study seeks to expand the range of countries included and incorporate a broader set of contextual factors. In doing so, this study will fill a gap in the research and will contribute to a deeper understanding of determinants of contraceptive use in the African region. By capturing the impact of a variety of community level factors on contraceptive use, we can better tailor family planning programming to address barriers to contraceptive uptake and inform the allocation of scarce reproductive health funding.

CHAPTER 3: MANUSCRIPT

Community Factors Influencing Contraceptive Use among Married Women in 21 African Countries

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Abstract

Contraceptive prevalence is low in the African region despite considerable family planning programmatic efforts. This study investigates community level influences on modern contraceptive use among married women ages 15 – 49 in 21 African countries. The analysis builds on previous studies through an examination of the individual, household and community level factors that shape contraceptive use. The data used in this analysis were from nationally representative Demographic and Health Surveys completed between 2005 and 2009. A separate multi-level logistic model was fitted for the outcome of current modern contraceptive use in each country. After controlling for individual and household level factors, community level factors of demographics and fertility norms, gender norms and inequalities, and health knowledge remain significantly associated with contraceptive use. The results highlight the importance of harnessing community level factors in planning interventions for increasing access to and utilization of modern contraceptive methods.

Introduction

Significant variations in contraceptive prevalence exist in the African region. In Sub-Saharan Africa, between 13 - 22% of women who are married or in a union use a method of family planning whereas in Northern Africa, prevalence is closer to 60% (United Nations Population Division, 2007, World Health Organization Regional Office for Africa, 2009). This variation in prevalence also reflects significant differences in method profiles between countries (United Nations Population Division, 2007). While contraceptive prevalence has increased steadily by 1 – 2% in some countries, others continue to lag behind. Contraceptive prevalence in Benin, Guinea, Mali, Niger, Nigeria, Rwanda, Senegal, and Sierra Leone has increased by less than 0.5% per year since 1997 (United Nations Population Division, 2007). Contraceptive uptake has been positively associated with both health and non-health related outcomes. However, despite the impact that family planning can have on preventing HIV transmission, helping women achieve their desired fertility, and increasing women's empowerment, contraceptive prevalence remains uneven (Cleland et al., 2006, Smith et al., 2009, UN Millennium Project, 2006). Programmatic efforts to increase uptake have not successfully reached all segments of the population, leaving women in rural areas and in lower wealth quintiles behind (Creanga et al., 2011).

Previous research has explored modern contraceptive use in resource-poor settings and some studies have examined the impact of community level factors on contraceptive use. However, studies have been narrow in their geographic reach as they have focused on a limited number of countries or communities (Paek et al., 2008, Oye-Adeniran et al., 2006, Kaggwa et al., 2008, Burgard and Lee-Rife, 2009). Studies have

concentrated on fewer community level variables and have taken a particular interest in examining the impact of socio-economic status, supply environment, and quality of care (Dinkelman et al., 2007, Hong et al., 2006). This paper investigates the associations between community level factors and current modern contraceptive use in all 21 African countries with completed Demographic and Health Surveys (DHS) from 2005 - 2009. Community level variables included in this analysis move beyond factors explored in the past such as health infrastructure and socio-economic influences to focus on community demographics and fertility norms, economic prosperity, gender norms and inequalities, and health knowledge and media exposure. This is the first study to examine community level influences on contraceptive use for an entire region. Identifying community level factors associated with contraceptive use is critical to informing family planning programmatic efforts and understanding how community environments shape contraceptive uptake.

Background

There has been a growing interest in examining how community level factors shape health outcomes in recent years (Duncan et al., 1998, DiPrete and Forristal, 1994, Diez-Roux, 2001). The emergence of multi-level modeling as a technique for capturing the effect of community level factors allows for analyzing hierarchically clustered data and estimating variation between communities (Diez-Roux, 2001, Guo and Zhao, 2000, Pickett and Pearl, 2001, Duncan et al., 1998, DiPrete and Forristal, 1994). This is important because individuals in the same community are more likely to be similar than individuals in different communities (Pickett and Pearl, 2001, Guo and Zhao, 2000). If this clustering is ignored, the standard errors are underestimated. Multilevel modeling

corrects the estimated standard errors resulting from this clustering (Guo and Zhao, 2000). By including contextual influences, risk factors for adverse health outcomes associated with specific community characteristics can be determined and public health interventions developed that are adapted to community level needs (Pickett and Pearl, 2001).

The connection between community level factors and reproductive health outcomes has been demonstrated in previous studies. In the past, research has emphasized the presence and quality of the health infrastructure in a community and the socio-economic status of the community as influential community level factors (Stephenson and Tsui, 2002, Stephenson and Tsui, 2003, Magnani et al., 1999, Pebley et al., 1996). Women in communities with stronger health service presence were more likely to seek reproductive health care services (Stephenson and Tsui, 2002). Additionally, women's decisions are influenced by the accessibility of health services in the community and by the general socio-economic status of the community as stronger health infrastructure and higher socio-economic status decrease logistical barriers to seeking services (Stephenson et al., 2008b, Dinkelman et al., 2007, Burgard and Lee-Rife, 2009, Stephenson et al., 2007). Stronger health system level presence in a community translates into more opportunities to build awareness of family planning and confidence in services provided (Chacko, 2001).

With regard to the role that community level normative expectations around fertility play in shaping individual contraceptive uptake, several studies have demonstrated that women are influenced by perceived community fertility expectations and commonly held beliefs regarding side-effects of modern contraceptives (Barnett,

1999, Rutenberg and Watkins, 1997, Stephenson et al., 2007, Kaggwa et al., 2008). Specifically, women in communities with a higher mean number of children have been shown to be less likely to use a contraceptive method (Kaggwa et al., 2008). The mean age at first sexual intercourse is also associated with contraceptive use and, in particular, with type of method used (Stephenson et al., 2008a). Women's reproductive health decisions – including the choice to use contraception – are shaped by the norms and beliefs of the community in which they live and also by the general level of autonomy experienced by women in the community (Rutenberg and Watkins, 1997, Stephenson et al., 2006, Stephenson et al., 2008b).

Community level gender norms and inequalities have been shown to be associated with contraceptive uptake in previous studies. Educational attainment is associated with modern contraceptive use at the community level where both the mean number of years of schooling and the proportion of women with at least a primary education have been shown to be positively associated with family planning uptake (Stephenson et al., 2007, Stephenson et al., 2008a). Furthermore, studies have shown an association between experience of intimate partner violence and contraceptive use (Kaye, 2006). Women in communities where a higher proportion of women report experiencing physical violence from their partner are more likely to use a contraceptive method (Stephenson et al., 2008b). Finally, with regard to exposure to external sources of information and health knowledge the community level, previous studies examining community level influences on modern contraceptive use have shown a positive association between exposure to media messages regarding family planning and contraceptive use (Kaggwa et al., 2008, Paek et al., 2008). Taken together, greater educational attainment and media saturation at

the community level may relate to increased levels of health knowledge and household wealth facilitating greater autonomy in seeking health care services.

In general, studies investigating community level influences on reproductive health care seeking behavior have focused primarily on the availability of services in the community and the socio-economic status of the community (Dinkelman et al., 2007, Magnani et al., 1999, Pebley et al., 1996, Stephenson and Tsui, 2003, Diez-Roux, 2001, Magadi et al., 2000, Prata, 2009). Studies have tended to focus on a limited number of community influences and many have focused on one country of analysis (Kaggwa et al., 2008, Paek et al., 2008, Burgard and Lee-Rife, 2009). Very few studies have examined a broader range of factors, especially the influence of fertility norms, gender norms and inequalities, and health knowledge. This study includes an expanded range of community level factors and offers a cross-cultural comparison of 21 different countries. By comparing distinct cultural and economic settings in the African region, the results of this analysis will contribute to a deeper understanding of the community level factors associated contraceptive use.

Data

The data used in this analysis were from nationally representative Demographic and Health Surveys (DHS) from 21 African countries. All countries that had a DHS completed between 2005 - 2009 were included to capture the most current data on contraceptive use: Benin (2006), Congo (2005), Democratic Republic of Congo (2007), Egypt (2008), Ethiopia (2005), Ghana (2008), Guinea (2005), Kenya (2008-2009), Liberia (2007), Madagascar (2008-2009), Mali (2006), Namibia (2006-2007), Niger (2006), Nigeria (2008), Rwanda (2005), Senegal (2005), Sierra Leone (2008) Swaziland

(2006-2007), Uganda (2006), Zambia (2007), Zimbabwe (2005-2006). The DHS were carried out by ORC Macro in partnership with local governments and institutions. The sampling systems used in each country were similar and were based on a two-stage sampling design. In the first stage, Primary Sample Units (PSUs) were selected using the most recent census in each country as the sample frame. Households were then selected from a listing of households in each PSU. All ever-married women of reproductive age (15 – 49) were eligible to be included. For this analysis, the samples were limited to currently married or co-habitating women. The resulting sample sizes are shown in Table 1, grouped by region. Overall response rates for the women's survey were high and ranged from 90.2% (Zimbabwe) to 99.7% (Egypt). Data on fertility, family planning, and health knowledge as well as demographic and socioeconomic information were collected. Further information about the details of the survey content and methodology are available at http://www.measuredhs.com/.

Methods

Women were asked if they were currently using a method of contraception and what method they were using. The outcome was coded 1 if they were using a modern method (pill, IUD, injections, condom, male or female sterilization, Norplant, or diaphragm/foam/jelly) and 0 if they were using a traditional method, folkloric method, or were not currently using a method. The data were analyzed using the STATA 11.1 software package (College Station, Texas).

A separate multi-level logistic model was fitted for the outcome of modern contraceptive use in each country. Although the focus of this analysis was on community level influences, the models controlled for individual and household level variables that

previous research has shown to influence contraceptive adoption. Indices were created to capture exposure to reproductive health messaging in the media, justification of violence, HIV knowledge, reproductive health knowledge, and decision-making autonomy. Bi-variate analyses were conducted between the individual and household level variables and the outcome of current contraceptive use (results not shown). Those variables significant in the bi-variate analysis were included in the model. The same model was used in each study country to allow for comparisons across all 21 countries.

The hierarchical structure of the DHS data violates the assumption of independence as women are clustered within PSUs; if ignored, the standard errors are underestimated. A multi-level modeling technique was employed to account for the hierarchical structure of the data and allow for the estimation of community level influences on modern contraceptive use (Guo and Zhao, 2000, Pickett and Pearl, 2001). Since the DHS does not collect community level data, community level variables were created by averaging individual level data to the PSU which serves as a proxy for the respondent's community in this analysis. Derived community level variables have been used previously to understand a range of health outcomes including contraceptive use (Stephenson et al., 2008b, Stephenson et al., 2007, Kaggwa et al., 2008, Pebley et al., 1996).

While some studies have begun to address the impact of the community environment on contraceptive use, they have either focused on the influence of the health care environment or focus on a single domain of the community. This study sought to expand the range of community level variables examined. Community level variables were chosen based on the findings of previous studies examining factors associated with

modern contraceptive use in the African region and conceptualized into four domains: community demographics and fertility norms, community economic prosperity, community gender norms and inequalities, and community health knowledge and media exposure (Table 2).

Community demographics and fertility norms: Attitudes towards fertility and childbearing prevalent in the community may shape individual contraceptive use by creating a normative expectation around the number of children in each family. Thus, women living in a community in which there is a general desire for a large number of children may feel social pressure to not use a contraceptive method. In addition, prevailing patterns of marriage, childbearing and intercourse may represent social scripts that women are expected to follow and may represent the social and economic opportunities available to women (Kaggwa et al., 2008, Omokhodion et al., 2007, Weldegerima and Denekew, 2008, Mace and Colleran, 2009). To measure community demographics and fertility norms, five variables were chosen: the mean age at marriage for women in the community, the mean age at first intercourse for women in the community, the mean age at first birth for women in the community, the mean ideal of number of children each woman would have in the community, and the gender composition of the children in the community. The gender composition of the children in the community was a ratio measure of the number of living boys in the community divided by the number of living girls. Values greater than 1 indicated more boys and values less than 1 indicated more girls.

Community economic prosperity - Previous studies have explored the impact of increased household and community wealth on reproductive health indicators (Gakidou

and Vayena, 2007, Stephenson et al., 2007, Burgard and Lee-Rife, 2009). In particular, evidence suggests that wealth is associated with increased contraceptive use, possibly because of the greater potential to allocate scarce resources for reproductive health (Burgard and Lee-Rife, 2009, Gakidou and Vayena, 2007, Stephenson et al., 2007). To measure community level wealth, the mean household index factor score was taken for each PSU. The wealth index factor score reflected ownership of durable goods and housing characteristics and has been shown to be an effective proxy for household wealth (Filmer and Pritchett, 1999, Filmer and Pritchett, 2001).

Community gender norms and inequalities – Gender norms and inequalities in the community impact the level of decision-making autonomy experienced by women (Paek et al., 2008). Educational attainment is often associated with increased access to social networks (Bloom et al., 2001, Habibov and Fan, 2008, Oye-Adeniran et al., 2006). To measure community gender norms and inequalities, five variables were chosen: the mean community violence justification index score, the mean community decision-making autonomy score, the proportion of women in the community with at least a primary education, the proportion of men in the community with at least a primary education, and the ratio of men to women employed in the community. The ratio of men to women currently employed in the community was calculated by dividing the total number of men employed in the community by the total number of women employed where 0=unemployed and 1=employed. The violence justification index was a 5 point scale of attitudes towards domestic violence where a lower score indicated fewer instances where the respondent justified violence. Decision-making autonomy was also measured as a 5 point scale where a higher score indicated increased decision-making autonomy.

Community health knowledge and media exposure – Previous studies have demonstrated that increased health knowledge and exposure to health messaging in the media have a positive impact on reproductive health outcomes (Habibov and Fan, 2008, Kaggwa et al., 2008). Three variables were chosen to measure health knowledge and media exposure at the community level: mean community HIV knowledge index score, mean community reproductive health knowledge index score, and mean community media exposure index score. The index for HIV knowledge was a 7 point scale where a higher score indicated greater correct knowledge of HIV. The index for reproductive health knowledge was a 4 point scale where a higher score indicated greater knowledge of reproductive health. Finally, the media exposure index was a 4 point scale where a higher score indicated exposure to a greater number of sources of reproductive health messages in the media (newspaper, TV and newspaper).

An iterative model building process was used and a random intercept fitted to account for the hierarchical structure of the data. As women are nested within communities, they violate the basic assumption of independence. Furthermore, women in the same community are more likely to be similar than individuals in different communities. Fitting a random intercept allows for the estimation of inter- and intra-cluster variance. Model 1 only included individual and household level variables and model 2 included the addition of the community level variables. A likelihood ratio test was used to examine the significance of the addition of the community level variables. The likelihood ratio test served as a chunk test for the community level variables so that the individual and household level model (Model 1) could be compared to the full model (Model 2). The full model included the community level variables while controlling for

the individual and household level variables in model 1. The difference between the two models, expressed as a p-value, can be obtained by taking the difference between the log likelihoods of each model (-2(log likelihood Model 1) - -2(log likelihood Model 2)). The difference of the log likelihoods is equivalent to a Chi Square test statistic, with degrees of freedom equal to the difference in the number of parameters between the 2 models. The p-value for the χ^2 test statistic was obtained using the CHIDIST function in Excel which returns the one-tailed probability of the chi-squared distribution. The result was then doubled to obtain the two-tailed probability, a more robust test of difference. In addition to the likelihood ratio test, the sigma mu values for model 1 and model 2 were reported to show the remaining unexplained random variance in the two models for each country.

Results

Prevalence of modern contraceptive methods varies significantly across the 21 study countries, from 5.9% in Rwanda to 58.0% in Zimbabwe (Table 1). The focus of this analysis is on the associations between community level variables and contraceptive use and for the purpose of this study, individual and household level variables act as controls. The individual and household level results were not surprising. At the individual level and household levels, wealth and education are positively associated with contraceptive use. Parity is negatively associated with contraceptive use as women with fewer living children have an increased likelihood of currently using a contraceptive method. Age is significantly associated with contraceptive use. Overall, the greatest proportion of women using a modern contraceptive method was between the ages of 20 and 34, with some variation between countries.

Community demographics and fertility norms (Table 3) - Mean age at marriage in the community was negatively associated with using a modern contraceptive method in two countries (Nigeria, OR 0.88 (0.80, 0.96) and Zimbabwe, OR 0.84 (0.77, 0.92)) and positively associated with contraceptive use in two other countries (Guinea OR 1.27 (1.02, 1.59) and Senegal OR 1.22 (1.02, 1.45)). Similarly, the association between age at first intercourse and contraceptive use was mixed. In Nigeria and Sierra Leone, women in communities where there was a higher mean age at first intercourse had a greater likelihood of using a contraceptive method (OR 1.09 (1.01, 1.17) and OR 1.24 (1.04, 1.49) respectively) whereas in Senegal, women were less likely to use a contraceptive method in communities with a higher mean at first intercourse (OR 0.75 (0.62, 0.91)). Community mean age at first birth was significantly associated with contraceptive use in 6 countries. In Benin, Egypt, Ethiopia, Guinea, Madagascar, Mali and Zambia, women in communities with a higher mean age at first birth were less likely to use a contraceptive method (the effect was largest in Zambia (OR 0.80 (0.69, 0.91)) and the weakest in Egypt (OR 0.92 (0.87, 0.99)). The mean ideal number of children in the community was significantly associated with contraceptive use more than half of all countries included in this analysis (DRC, Egypt, Ethiopia, Kenya, Madagascar, Namibia, Nigeria, Rwanda, Senegal, Sierra Leone, and Swaziland). Women in communities with a higher mean ideal number of children were less likely to use a contraceptive method (the effect size was greatest in Egypt OR 0.55 (0.50, 0.61) and weakest in Nigeria OR 0.92 (0.85, 1.00)). The gender composition of children in the community was significantly associated with contraceptive use in two countries. Women in communities where there were more

living boys than girls were more likely to use a contraceptive method (Guinea OR 2.14 (1.25, 3.69) and Uganda OR 1.48 (1.11, 1.97)).

Community economic prosperity (Table 3) – Community level wealth was significantly associated with contraceptive use in two countries. In both Egypt and Mali, wealth was significantly associated with contraceptive (p-value <0.05) however the effect size was negligible (OR 1.00, (1.00, 1.00) in both countries).

Community gender norms and inequalities (Table 4) - The association between violence justification at the community level and use of a contraceptive method was mixed. In Egypt and Kenya, women in communities where violence was justified in more circumstances on average were less likely to use a contraceptive method (Kenya OR 0.80 (0.71, 0.91) and Egypt OR 0.88 (0.82, 0.95)). Conversely, greater justification of violence at the community level was also associated with a greater odds of contraceptive use in two countries (Niger OR 1.21 (1.04, 1.40) and Zimbabwe OR 1.16 (1.01, 1.33)). Community level decision making autonomy was significantly associated with contraceptive use in only one country. Women in communities with a higher mean decision-making autonomy score were more likely to use a contraceptive method (Madagascar OR 1.23 (1.05, 1.43). Both men's and women's education were significantly associated with contraceptive use. Women in communities with a greater proportion of women who had at least a primary education were more likely to use a contraceptive method (Namibia OR 2.25 (1.15, 4.40) and Niger OR 7.20 (1.60, 32.48)). The association between men's education and contraceptive use was mixed. In two countries, women in communities where a greater proportion of men had at least a primary education were more likely to use a contraceptive method (Mali OR 2.14 (1.02,

4.45) and Zimbabwe OR 5.12 (1.05, 25.01)). However, in Egypt, women in communities where a greater proportion of men had at least a primary education, women had a decreased likelihood of using a modern contraceptive method (0.58 (0.38, 0.87)). The association between employment and contraceptive use was conflicting. In three countries, women in communities with a greater ratio of men than women employed were more likely to use a contraceptive method (Egypt OR 1.01 (1.01, 1.02), Liberia OR 1.10 (1.04, 1.17), and Zambia OR 1.05, (1.01, 1.10)). However, in two countries, women in communities with a greater ratio of men than women employed were less likely to use a contraceptive method (Nigeria OR 0.91 (0.84, 0.99) and Senegal 0.95 (0.91, 0.99)).

Community health knowledge and media exposure (Table 5) – Community level knowledge of HIV was only significantly in one country. Women in communities with a higher mean HIV knowledge index score had greater odds of using a contraceptive method in Ethiopia (OR 1.40 (1.15, 1.70)). The association between community level reproductive health knowledge and contraceptive use was mixed. Women in communities with a higher reproductive health knowledge index score were more likely to use a contraceptive method in three countries (Guinea OR 1.89 (1.04, 3.45), Niger OR 2.12 (1.35, 3.32), and Zimbabwe OR 1.55 (1.03, 2.34)). In one country, however, women in communities with a higher reproductive health knowledge index score were less likely to use a contraceptive method (Zambia OR 0.39 (0.24, 0.64)). The mean community level media exposure to reproductive health messages was positively associated with contraceptive use in two countries and negatively associated with contraceptive use in one country. In the DRC and Madagascar, women in communities with a higher mean community media exposure index score had greater odds of using a modern contraceptive

method (OR 2.11 (1.08, 4.10) and OR 1.41 (0.107, 1.87) respectively). Women in communities with a higher mean media exposure index score had a decreased likelihood of using a modern method of family planning in Guinea (OR 0.39 (0.22, 0.66)).

At the 0.05 alpha level, the results of the likelihood ratio test showed that in all but 5 of the 21 study countries, the addition of the community level variables as a chunk were significantly associated with the outcome of contraceptive use. In all countries, there was a decrease in the sigma mu from the individual and household level model to the full model including the community level variables. The decrease shows that the addition of community level variables accounts for more of the unexplained random variance in the models (Table 6).

Discussion

The results of this analysis demonstrate that there is no single community influence on contraceptive use. Rather, communities influence contraceptive use through prevailing fertility norms, gender inequalities, health knowledge, and exposure to family planning messages in the media. The community level factors associated with contraceptive use vary across the 21 countries included in this analysis. This variation highlights the uniqueness of country specific contexts and demonstrates the range of community level factors that shape contraceptive uptake in the African region. Measures of community level demographics and fertility norms surfaced as most commonly associated with contraceptive use across the study countries. The mean ideal number of children in the community and the mean age at first birth for women in the community were consistently negatively associated with contraceptive use. These results emphasize

that women seem to be influenced in their contraceptive choices by the fertility norms of their community and expectations around family size.

Within the domain of community gender norms and inequalities, the results showed greater variation in the impact of community level factors across countries. Attitudes towards violence may impact women's autonomy and ability to seek health services and may reflect greater gender inequalities (Diop-Sidibe et al., 2006). Furthermore, in contexts where women use contraceptives clandestinely, women may fear violence if they are discovered (Barnett, 1999). The impact of men's education at the community level was mixed suggesting that increases in men's educational attainment do not necessarily coincide with greater opportunities for women and may even result in greater gender inequalities. Increases in women's educational attainment, however, were consistently associated with a greater likelihood of using a contraceptive method. This may point to the role that education plays in expanding women's networks and allowing them to build greater social capital. Similarly, living in a community where there was a more equal ratio of men to women employed could be positively associated with contraceptive use because women's decision-making power and ability to allocate family resources for individual health needs may increase as their economic dependence on other family members decreases. Taken together, the effects of violence, men's educational attainment, and employment were mixed, once again underscoring the differences between country contexts but highlighting the importance of gender equity in shaping contraceptive use uptake.

In general, the results of this analysis confirm the findings of previous community level studies with regard to the impact of health knowledge and exposure to family

planning messages in the community (Cammack and Heaton, 2001, Kaggwa et al., 2008, Paek et al., 2008). It is probably not knowledge itself that impacts contraceptive use as evidence suggests that knowledge alone does not translate into use (Kayembe et al., 2006). Instead, health knowledge may serve as a surrogate for presence of health programs and greater exposure to health care services in the community. Increased exposure to family planning messages in the media normalizes contraceptive use at the community level and creates an enabling environment for uptake of contraceptives (Paek et al., 2008).

The community level variables included in this analysis were significantly associated with contraceptive use in all but 5 of the study countries (as demonstrated by the results of the likelihood ratio test) and accounted for a portion of the unexplained variance remaining in the individual model (as seen in the decrease in the sigma mu from model 1 to model 2). However, they do not fully account for the community level variation in contraceptive use. A limitation of this research is the inability to control for the presence of health care services in the community. It is possible that by controlling for health infrastructure level variables as well, more of the remaining variance could have been explained. Another limitation is the conceptualization of community. For this analysis, the PSU was used as proxy for the respondent's community. This is a geographic representation of community which may or may not represent the social dynamic of the community in its entirety. However, given the paucity of data collected at the community level, using the PSU as a measure of community is the best approximation available. The breadth and variation in community level variables found

to be significantly associated with contraceptive use in this analysis demonstrate the need to routinely collect community level data.

This study is the first of its kind as it includes broader range of community factors and focuses on the entire African region. The results contribute to a new understanding of the community level influences on contraceptive use and demonstrate that publicly available data can be used to identify community level influences on health. The variation in factors associated with contraceptive use reflects the diverse cultural and economic environments of the 21 countries included. When examining health behaviors, a stronger focus needs to be placed on factors beyond the individual and household levels. The findings of this innovative study highlight a range of community level factors that should be considered when planning public health interventions for increasing access to and utilization of modern contraceptive methods.

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Table 1: Sample sizes and proportion of current modern contraceptive use among women (15 - 49) in 21 study countries

Region	Country (Year)	Total Sample Size (N)	Currently Married or Co-Habitating Women (n)	Current modern contraceptive use (%)
Eastern Africa				
	Ethiopia (2005)	14,070	8,644	16.0
	Kenya (2008-09)	8,444	5,041	36.0
	Madagascar (2008-09)	17,375	11,903	28.4
	Rwanda (2005)	11,321	5,458	10.8
	Uganda (2006)	8,531	5,362	17.0
	Zambia (2007)	7,146	4,316	33.1
	Zimbabwe (2005-06)	8,907	5,118	58.0
Middle Africa				
	Congo (2005)	7,051	3,993	13.2
	Democratic Republic of Congo (2007)	9,995	6,586	6.4
Northern Africa				
	Egypt (2008)	16,527	15,406	55.3
Southern Africa				
	Namibia (2006-07)	9,804	3,578	51.6
	Swaziland (2006-07)	4,987	2,069	48.2
Western Africa				
	Benin (2006)	17,794	13,486	5.9
	Ghana (2008)	4,916	2,950	16.5
	Guinea (2005)	7,954	6,327	5.4
	Liberia (2007)	7,092	4,508	10.5
	Mali (2006)	14,583	12,324	7.5
	Niger (2006)	9,223	7,431	7.1
	Nigeria (2008)	33,385	23,954	8.6
	Senegal (2005)	14,602	10,221	9.5
	Sierra Leone (2008)	7,374	5,373	7.9

Table 2: Operational definitions for community level variables used in modeling determinants of modern contraceptive use in 21 study countries	
COMMUNITY LEVEL VARIABLES	**DEFINITION**
Community demographics and fertility norms	
Mean age at marriage in the community	Mean age at marriage for women ages 15 - 49 in the community
Mean age at first intercourse in the community	Mean age at first intercourse for women ages 15 - 49 in the community
Mean age at first birth in the community	Mean age at first birth for women ages 15 - 49 in the community
Mean ideal number of children in the community	Mean ideal number of children in the community
Gender composition of children in the community	Ratio of living boys to girls children in the community where
Community economic prosperity	
Mean community wealth index factor score	Mean wealth index factor score, reflects ownership of durable goods and housing characteristics
Community gender norms & inequalities	
Mean community violence justification index score	5 point scale of attitudes towards domestic violence, lower score indicates that violence is not justified.
Mean community decision-making autonomy score	5 point scale of decision making autonomy where a higher score indicates higher decision making control, instances where woman made decisions by themselves were coded 1 and all other were coded 0
Women in the community with at least a primary education	Proportion of women in the community with at least a primary education
Men in the community with at least a primary education	Proportion of men in the community with at least a primary education
Ratio of men to women employed in the community	Ratio of men employed in the community to women employed in the community (coded: 0=no; 1=yes)
Community health knowledge and media exposure	
Mean community HIV knowledge index score	7 point scale of knowledge of HIV where higher scores indicate greater knowledge of HIV
Mean community reproductive knowledge index score	4 point scale of reproductive health knowledge where higher scores indicate greater knowledge of reproductive health
Mean community media exposure index score	4 point scale of exposure to reproductive health messages in the media in the past month (radio, TV, and newspaper)

Table 3: Community level results of multilevel logistic model for the outcome of modern contraceptive use, domains of community demographics and fertility norms and community economic prosperity. Values reported as adjusted odds ratio (95% CI)*†

Region and Country		Community demographics and fertility norms					Community economic prosperity
		Mean age at marriage in the community	Mean age at first intercourse in the community	Mean age at first birth in the community	Mean ideal number of children in the community	Gender composition of children in the community	Mean community wealth index factor score
Eastern Africa							
	Ethiopia (2005)	1.04 (0.89, 1.21)	0.92 (0.77, 1.09)	0.90 (0.81, 1.00)	*0.84 (0.78, 0.91)*	0.99 (0.75, 1.31)	1.00 (1.00, 1.00)
	Kenya (2008-09)	0.93 (0.85, 1.02)	1.09 (1.00, 1.20)	1.01 (0.91, 1.11)	*0.74 (0.65, 0.83)*	1.14 (0.91, 1.43)	1.00 (1.00, 1.00)
	Madagascar (2008-09)	1.08 (0.98, 1.18)	0.98 (0.89, 1.09)	*0.89 (0.81, 0.98)*	*0.68 (0.62, 0.74)*	1.08 (0.85, 1.37)	1.00 (1.00, 1.00)
	Rwanda (2005)	1.11 (0.90, 1.35)	0.92 (0.74, 1.13)	0.93 (0.76, 1.15)	*0.70 (0.58, 0.86)*	0.93 (0.66, 1.30)	1.00 (1.00, 1.00)
	Uganda (2006)	1.11 (0.98, 1.25)	0.97 (0.83, 1.13)	0.98 (0.85, 1.13)	0.90 (0.78, 1.05)	*1.48 (1.11, 1.97)*	1.00 (1.00, 1.00)
	Zambia (2007)	1.01 (0.91, 1.11)	1.10 (0.97, 1.26)	*0.80 (0.69, 0.91)*	0.81 (0.70, 0.92)	1.00 (0.75, 1.35)	1.00 (1.00, 1.00)
	Zimbabwe (2005-06)	*0.84 (0.77, 0.92)*	1.10 (0.97, 1.24)	1.02 (0.90, 1.14)	0.81 (0.70, 0.93)	0.93 (0.74, 1.18)	1.00 (1.00, 1.00)
Middle Africa							
	Congo (2005)	1.09 (0.99, 1.20)	0.96 (0.79, 1.16)	0.99 (0.88, 1.11)	1.11 (0.93, 1.32)	0.77 (0.55, 1.07)	1.00 (1.00, .100)
	Democratic Republic of Congo (2007)	1.14 (0.95, 1.36)	0.83 (0.69, 1.00)	0.90 (0.74, 1.09)	*0.83 (0.72, 0.94)*	0.66 (0.38, 1.16)	1.00 (1.00, 1.00)
Northern Africa							
	Egypt (2008)	1.06 (0.99, 1.13)	**	*0.92 (0.87, 0.99)*	*0.55 (0.50, 0.61)*	1.02 (0.89, 1.17)	*1.00 (1.00, 1.00)*
Southern Africa							
	Namibia (2006-07)	1.02 (0.98, 1.05)	1.03 (0.97, 1.08)	0.96 (0.91, 1.01)	*0.92 (0.85, 1.00)*	0.94 (0.79, 1.11)	1.00 (1.00, 1.00)
	Swaziland (2006-07)	0.96 (0.90, 1.02)	1.03 (0.92, 1.17)	0.97 (0.88, 1.08)	*0.77 (0.65, 0.93)*	1.08 (0.85, 1.38)	1.00 (1.00, 1.00)
Western Africa							
	Benin (2006)	1.09 (0.95, 1.25)	1.00 (0.89, 1.13)	*0.85 (0.75, 0.96)*	0.92 (0.82, 1.04)	0.89 (0.66, 1.19)	1.00 (1.00, 1.00)
	Ghana (2008)	0.97 (0.87, 1.07)	0.99 (0.88, 1.13)	1.08 (0.97, 1.20)	0.94 (0.82, 1.09)	1.10 (0.83, 1.45)	1.00 (1.00, 1.00)
	Guinea (2005)	*1.27 (1.02, 1.59)*	0.96 (0.73, 1.25)	*0.83 (0.71, 0.98)*	0.87 (0.68, 1.11)	*2.14 (1.25, 3.69)*	1.00 (1.00, 1.00)
	Liberia (2007)	0.96 (0.87, 1.06)	1.11 (0.94, 1.32)	0.98 (0.88. 1.10)	0.95 (0.83, 1.09)	0.89 (0.59, 1.32)	1.00 (1.00, 1.00)
	Mali (2006)	1.09 (0.91, 1.23)	1.14 (0.97, 1.34)	*0.87 (0.78, 0.98)*	0.91 (0.81, 1.02)	1.10 (0.78, 1.57)	*1.00 (1.00, 1.00)*
	Niger (2006)	0.95 (0.68, 1.32)	1.25 (0.87, 1.79)	0.82 (0.67, 1.01)	0.94 (0.82, 1.07)	0.85 (0.53, 1.34)	1.00 (1.00, 1.00)
	Nigeria (2008)	*0.88 (0.80, 0.96)*	*1.09 (1.01, 1.17)*	0.97 (0.88, 1.06)	*0.71 (0.66, 0.76)*	1.01 (0.79, 1.27)	1.00 (1.00, 1.00)
	Senegal (2005)	*1.22 (1.02, 1.45)*	*0.75 (0.62, 0.91)*	1.00 (0.88, 1.14)	*0.72 (0.62, 0.84)*	1.04 (0.74, 1.46)	1.00 (1.00, 1.00)
	Sierra Leone (2008)	0.97 (0.87, 1.09)	*1.24 (1.04, 1.49)*	0.92 (0.82, 1.03)	*0.76 (0.61, 0.94)*	1.38 (0.88, 2.15)	1.00 (1.00, 1.00)

**Models controlled for the following individual and household level factors: age, age at marriage, partner age difference, number of living children, death of a child, gender composition of children, religion, residence, wealth, employment, education (respondent and partner), violence index, decision-making autonomy index, HIV knowledge index, reproductive health knowledge index, media exposure index.*

†Italicized figures are significant at 0.05 level

***Information on age at first intercourse not collected in the 2008 Egypt DHS - Women's Questionnaire*

Table 4: Community level results of multilevel logistic model for the outcome of modern contraceptive use, community gender norms and inequalities domain. Values reported as adjusted odds ratio (95% CI)*†

Region and Country		Community gender norms & inequalities				
		Mean community violence justification index score	Mean community decision-making autonomy score	Women in the community with at least a primary education	Men in the community with at least a primary education	Ratio of men to women employed in the community
Eastern Africa						
	Ethiopia (2005)	0.91 (0.79, 1.06)	1.11 (0.89, 1.38)	1.95 (0.90, 4.23)	0.93 (0.45, 1.89)	1.01 (0.99, 1.03)
	Kenya (2008-09)	*0.80 (0.71, 0.91)*	1.09 (0.91, 1.30)	1.25 (0.45, 3.50)	0.86 (0.24, 3.04)	0.94 (0.89, 1.00)
	Madagascar (2008-09)	0.98 (0.84, 1.15)	*1.23 (1.05, 1.43)*	0.82 (0.42, 1.59)	1.05 (0.52, 2.13)	0.96 (0.69, 1.33)
	Rwanda (2005)	1.22 (0.99, 1.51)	1.21 (0.98, 1.49)	2.39 (0.98, 5.82)	1.08 (0.45, 2.56)	1.01 (0.94, 1.09)
	Uganda (2006)	0.91 (0.79, 1.05)	0.98 (0.78, 1.22)	2.05 (0.87, 4.80)	2.01 (0.56, 7.27)	1.05 (0.82, 1.33)
	Zambia (2007)	0.70 (0.62, 0.78)	1.05 (0.85, 1.30)	1.42 (0.53, 3.81)	0.43 (0.13, 1.43)	*1.05 (1.01, 1.10)*
	Zimbabwe (2005-06)	*1.16 (1.01, 1.33)*	0.97 (0.82, 1.14)	0.76 (0.21, 2.80)	*5.12 (1.05, 25.01)*	1.00 (0.97, 1.02)
Middle Africa						
	Congo (2005)	1.00 (0.79, 1.28)	**	4.04 (0.86, 19.01)	0.27 (0.03, 2.78)	1.06 (0.86, 1.31)
	Democratic Republic of Congo (2007)	1.03 (0.84, 1.27)	0.98 (0.71, 1.35)	0.78 (0.22, 2.83)	0.49 (0.07, 3.37)	0.96 (0.85, 1.08)
Northern Africa						
	Egypt (2008)	*0.88 (0.82, 0.95)*	0.95 (0.86, 1.06)	1.20 (0.82, 1.75)	*0.58 (0.38, 0.87)*	*1.01 (1.01, 1.02)*
Southern Africa						
	Namibia (2006-07)	0.98 (0.87, 1.10)	1.01 (0.90, 1.15)	*2.25 (1.15, 4.40)*	0.75 (0.43, 1.32)	1.04 (0.99, 1.08)
	Swaziland (2006-07)	1.00 (0.75, 1.33)	0.98 (0.79, 1.22)	0.79 (0.31, 2.02)	0.59 (0.25, 1.40)	1.01 (0.95, 1.06)
Western Africa						
	Benin (2006)	1.08 (0.96, 1.21)	1.07 (0.91, 1.24)	0.69 (0.31, 1.55)	1.07 (0.58, 1.98)	1.18 (0.80, 1.75)
	Ghana (2008)	0.99 (0.81, 1.20)	1.07 (0.86, 1.33)	0.98 (0.43, 2.22)	0.53 (0.22, 1.24)	0.88 (0.58, 1.35)
	Guinea (2005)	1.03 (0.80, 1.34)	1.01 (0.73, 1.40)	0.71 (0.14, 3.59)	0.88 (0.25, 3.08)	1.04 (0.62, 1.74)
	Liberia (2007)	1.14 (0.97, 1.34)	1.05 (0.82, 1.35)	0.83 (0.32, 2.16)	0.75 (0.27, 2.07)	*1.10 (1.04, 1.17)*
	Mali (2006)	0.98 (0.87, 1.10)	1.09 (0.91, 1.31)	1.54 (0.62, 3.82)	*2.14 (1.02, 4.45)*	1.02 (1.00, 1.05)
	Niger (2006)	*1.21 (1.04, 1.40)*	1.23 (0.93, 1.61)	*7.20 (1.60, 32.48)*	0.37 (0.12, 1.13)	0.98 (0.94, 1.02)
	Nigeria (2008)	0.92 (0.84, 1.02)	1.01 (0.84, 1.20)	1.61 (0.78, 3.32)	1.06 (0.49, 2.30)	*0.91 (0.84, 0.99)*
	Senegal (2005)	0.98 (0.86, 1.10)	1.04 (0.80, 1.34)	1.15 (0.46, 2.85)	2.06 (0.96, 4.44)	*0.95 (0.91, 0.99)*
	Sierra Leone (2008)	0.95 (0.81, 1.11)	1.09 (0.79, 1.49)	1.94 (0.60, 6.32)	1.70 (0.62, 4.67)	1.08 (0.87, 1.34)

**Models controlled for the following individual and household level factors: age, age at marriage, partner age difference, number of living children, death of a child, gender composition of children, religion, residence, wealth, employment, education (respondent and partner), violence index, decision-making autonomy index, HIV knowledge index, reproductive health knowledge index, media exposure index.*

†Italicized figures are significant at 0.05 level

***Information on decision-making autonomy not collected in the 2005 Congo DHS – Women's Questionnaire*

Table 5: Community level results of multilevel logistic model for the outcome of modern contraceptive use, community gender health knowledge and media exposure domain. Values reported as adjusted odds ratio (95% CI)*†

Region and Country		Community health knowledge and media exposure		
		Mean community HIV knowledge index score	Mean community reproductive knowledge index score	Mean community media exposure index score
Eastern Africa				
	Ethiopia (2005)	*1.40 (1.15, 1.70)*	0.92 (0.65, 1.30)	0.85 (0.60, 1.20)
	Kenya (2008-09)	1.10 (0.85, 1.42)	1.04 (0.70, 1.55)	0.85 (0.69, 1.04)
	Madagascar (2008-09)	**	††	*1.41 (1.07, 1.87)*
	Rwanda (2005)	0.82 (0.61, 1.11)	1.79 (0.98, 3.29)	0.68 (0.44, 1.05)
	Uganda (2006)	1.05 (0.83, 1.33)	1.29 (0.77, 2.19)	1.13 (0.74, 1.72)
	Zambia (2007)	1.12 (0.83, 1.50)	*0.39 (0.24, 0.64)*	1.35 (0.97, 1.89)
	Zimbabwe (2005-06)	1.03 (0.85, 1.26)	*1.55 (1.03, 2.34)*	1.07 (0.84, 1.37)
Middle Africa				
	Congo (2005)	1.25 (0.95, 1.64)	0.85 (0.55, 1.31)	1.46 (0.98, 2.18)
	Democratic Republic of Congo (2007)	1.18 (0.86, 1.63)	1.12 (0.70, 1.79)	*2.11 (1.08, 4.10)*
Northern Africa				
	Egypt (2008)	**	0.92 (0.81, 1.04)	1.12 (0.98, 1.27)
Southern Africa				
	Namibia (2006-07)	0.89 (0.76, 1.05)	1.21 (0.84, 1.73)	0.91 (0.74, 1.12)
	Swaziland (2006-07)	1.16 (0.86, 1.57)	1.99 (1.00, 3.96)	1.04 (0.78, 1.39)
Western Africa				
	Benin (2006)	0.91 (0.75, 1.10)	1.15 (0.84, 1.57)	1.10 (0.82, 1.48)
	Ghana (2008)	1.11 (0.86, 1.43)	1.03 (0.71, 1.50)	0.90 (0.63, 1.30)
	Guinea (2005)	0.86 (0.60, 1.24)	*1.89 (1.04, 3.45)*	*0.39 (0.22, 0.66)*
	Liberia (2007)	0.95 (0.79, 1.14)	1.40 (0.93, 2.10)	1.20 (0.78, 1.84)
	Mali (2006)	0.93 (0.78, 1.09)	1.33 (0.98, 1.79)	1.01 (0.77, 1.32)
	Niger (2006)	0.79 (0.60, 1.04)	*2.12 (1.35, 3.32)*	0.65 (0.38, 1.10)
	Nigeria (2008)	0.88 (0.78, 1.00)	0.83 (0.68, 1.02)	0.93 (0.77, 1.13)
	Senegal (2005)	0.91 (0.73, 1.13)	1.14 (0.75, 1.74)	0.86 (0.63, 1.16)
	Sierra Leone (2008)	0.86 (0.67, 1.10)	1.13 (0.81, 1.59)	1.52 (0.84, 2.76)

**Models controlled for the following individual and household level factors: age, age at marriage, partner age difference, number of living children, death of a child, gender composition of children, religion, residence, wealth, employment, education (respondent and partner), violence index, decision-making autonomy index, HIV knowledge index, reproductive health knowledge index, media exposure index.*

†Italicized figures are significant at 0.05 level

***Information about HIV not collected in the 2008 Egypt DHS – Women's Questionnaire; information about HIV only collected in sub-sample of the Madagascar 2008-09 DHS - Women's Questionnaire, therefore excluded from this analysis.*

††Information about reproductive health only collected in sub-sample of the Madagascar 2008-09 DHS - Women's Questionnaire.

Table 6: Comparison of individual and household level model to community level model, sigma mu and likelihood ratio test p-value reported for 21 study countries				
Region and Country		**Individual Level Model Sigma Mu (SE)[1]**	**Community Level Model Sigma Mu (SE)[1]**	**Likelihood Ratio Test (p-value)[1]**
Eastern Africa				
	Ethiopia (2005)	0.73 (0.06)	0.66 (0.06)	<0.0001
	Kenya (2008-09)	0.50 (0.06)	0.39 (0.06)	<0.0001
	Madagascar (2008-09)	0.70 (0.04)	0.60 (0.04)	<0.0001
	Rwanda (2005)	0.63 (0.09)	0.54 (0.09)	0.0003
	Uganda (2006)	0.46 (0.07)	0.40 (0.07)	<0.0001
	Zambia (2007)	0.64 (0.06)	0.47 (0.06)	<0.0001
	Zimbabwe (2005-06)	0.47 (0.06)	0.38 (0.06)	0.0001
Middle Africa				
	Congo (2005)	*0.17 (0.16)*	*0.003 (0.028)*	0.4253
	Democratic Republic of Congo (2007)	0.72 (0.08)	0.64 (0.08)	0.0081
Northern Africa				
	Egypt (2008)	0.59 (0.03)	0.45 (0.03)	<0.0001
Southern Africa				
	Namibia (2006-07)	*0.13 (0.18)*	*0.003 (0.022)*	0.0001
	Swaziland (2006-07)	*0.003 (0.030)*	*0.002 (0.019)*	0.2863
Western Africa				
	Benin (2006)	0.56 (0.07)	0.54 (0.07)	0.6813
	Ghana (2008)	0.54 (0.10)	0.52 (0.11)	1.0000
	Guinea (2005)	0.76 (0.10)	0.64 (0.10)	0.0062
	Liberia (2007)	0.48 (0.10)	0.42 (0.11)	0.3057
	Mali (2006)	0.42 (0.06)	0.36 (0.07)	0.0002
	Niger (2006)	0.69 (0.09)	0.58 (0.09)	0.0001
	Nigeria (2008)	0.72 (0.04)	0.58 (0.04)	<0.0001
	Senegal (2005)	0.61 (0.06)	0.47 (0.06)	<0.0001
	Sierra Leone (2008)	0.71 (0.11)	0.58 (0.11)	0.0027

[1]Models where variables account for all the PSU level variation are italicized

[2]Two-tailed p-value was used

CHAPTER 4: PUBLIC HEALTH IMPLICATIONS

The results of this analysis demonstrate the strength of influence that community level factors have in shaping contraceptive use and stress the importance of considering community characteristics in designing and implementing interventions aimed at increasing contraceptive use in low-resource settings. These findings emphasize key factors that have an impact on contraceptive use as well as highlight regional differences in how community norms and attitudes translate into actual uptake of contraceptive use.

The potential pathways of influence for these community level domains are examined in the discussion of the manuscript. Reviewing the main findings of this study helps to further demonstrate the strength of association between community level variables and contraceptive use and provides a starting point for exploring the programmatic implications of these results. Measures of community level demographics and fertility norms surfaced as most commonly associated with contraceptive use across the study countries. In particular, the mean ideal number of children in the community was found to be negatively associated with contraceptive use in 11 of the 21 study counties. Contrary to what might have been expected given evidence in the literature regarding the impact of wealth on contraceptive use, our measure of community economic prosperity was only marginally significantly associated with contraceptive use in two countries (Egypt and Mali). Mixed results were found for measures of community gender norms and inequalities. For example, greater community tolerance of violence was positively associated with contraceptive use in Niger and Zimbabwe and negatively associated with contraceptive use in Egypt and Kenya. With regard to community health

knowledge and media exposure, results demonstrate that in some countries, increased community health knowledge and media exposure was associated with greater odds of contraceptive use; however, in other countries, the opposite association was found.

Through including a significant range of community level indicators, this study provides a broad picture of the contextual factors that influence contraceptive use. All of the community level factors included in this analysis were significantly associated with contraceptive use in at least one of the study countries. When added as a chunk, in all but five of the study countries community level variables were significantly associated with contraceptive use and helped to explain the random variance remaining after controlling for individual level variables. Using similar indicators across the study countries allows for cross-cultural comparisons of key factors associated with contraceptive use and highlights the need for individualized approaches to family planning programmatic efforts.

Future Directions

A limitation of this research is the inability to control for the presence of health care services in each community. Previous studies examining contextual influences on contraceptive use have shown that the presence and quality of health facilities in a community impact women's use of a modern contraceptive method (Magnani et al., 1999, Hong et al., 2006, Chacko, 2001). It is possible that the absence of health infrastructure data in this study is reflected in the remaining variation in each model. To achieve a more complete picture of contextual influences on contraceptive use, future studies should include measures of health infrastructure quality and presence in addition to the measures of cultural norms and health awareness explored in this analysis.

This study focused on current use of any modern contraceptive method as an endpoint. Method choice is often influenced by beliefs shared among women regarding side effects of various methods and the acceptability of contraceptives more broadly (Rutenberg and Watkins, 1997, Magadi and Curtis, 2003). In communities where contraceptive prevalence is low, some evidence suggests that the first women to start using modern contraceptives are more likely to be clandestine users and depend on less visible methods (Barnett, 1999). One study from South Africa showed that method choice was influenced by the level of women's educational attainment in the community. Specifically, in communities where there was a greater proportion of women with only a primary school education, women were more likely to use injections than to use the pill (Stephenson et al., 2008a). Since preference for different contraceptive methods varies across countries, a deeper look at community level influences on method choice would help to inform family planning programmatic efforts. Through understanding method choice preference more fully, programs could tailor approaches to match women's needs and decrease discontinuation rates.

This study used the PSU as a proxy for the community and relied on derived community level variables. The results of this study further confirm the importance of investigating community level influences on health outcomes and highlight, once again, the need to collect data at the community level instead of relying on derived community level variables and geographic definitions of community. In order to translate the results of this study into action, it should be followed up by a close examination of trends and norms within individual countries and intervention communities.

As a result of the success of family planning programs in the 1990s and the impact of HIV/AIDS in the African region, funding for family planning programs has decreased (Singh et al., 2009, Smith et al., 2009). For example, Kenya received $12 million for family planning programming in 1995 from USAID but this was reduced to $8.9 million per year in 2005 meanwhile funding for HIV/AIDS increased from $2 million to $108 million in the same time period (USAID, 2009). USAID has since re-evaluated the allocation of funds for family planning programming and has increased the amount of funds allocated for family planning efforts. Despite these increases, funds are scarce and must be distributed carefully.

The actual delivery of family planning services could be better integrated into existing health care provision: HIV services, maternal health services, child immunization services, and post-abortion services (Smith et al., 2009). In addition to strengthening health service provision and ensuring the accessibility of services, investing in programs that address the underlying causes of poor sexual and reproductive health will provide the missing link to increasing contraceptive prevalence. For example, CARE International works in individual communities to change attitudes towards family planning through holding community conversations and providing women with a chance to discuss issues relating to birth spacing and limiting more openly. As a result of supporting community dialogue and health infrastructure strengthening, communities in CARE's project catchment area have shown dramatic increases in contraceptive prevalence (CARE International, 2008).

Conclusion

Continuing to prioritize family planning programming and research on barriers to contraceptive uptake will help to improve health outcomes for women in low-resource settings. As the results of this analysis have demonstrated, increased focus needs to be given to the influence of contextual factors in shaping women's use of modern contraceptives. In addition to strengthening the health-systems level response to unmet need for contraceptives, programs need to be sensitive to prevailing fertility and gender norms operating at the community level and tailor interventions to maximize impact on women's empowerment.

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APPENDIX

The individual and household level results of the multilevel logistic models for the outcome of modern contraceptive use in the 21 study countries are presented here by region. In addition to the individual and household level variables shown in the tables that follow, the models controls for the following community level factors: mean age at marriage in the community, mean age at first intercourse in the community, mean age at first birth in the community, mean ideal number of children in the community, gender composition of children in the community, mean community wealth index factor score, ratio of men to women employed in the community, mean community violence justification index score, mean community decision-making autonomy score, men and women in the community with at least a primary education, mean community HIV knowledge index score, mean community reproductive knowledge index score, mean community media exposure index score.

Table 1: Individual and household level results of multilevel logistic model for the outcome of modern contraceptive use in 3 countries in Eastern Africa. Values reported as adjusted odds ratio (95% CI)†

Individual and Household Level Variables	EASTERN AFRICA		
	Ethiopia	**Kenya**	**Madagascar**
Age (15 - 19)			
20 - 24	1.15 (0.83, 1.58)	1.44 (0.96, 2.17)	*1.51 (1.24, 1.84)*
25 - 29	0.92 (0.66, 1.29)	*1.62 (1.07, 2.47)*	*1.63 (1.32, 2.00)*
30 - 34	*0.68 (0.47, 0.99)*	*1.92 (1.23, 2.97)*	*1.50 (1.21, 1.87)*
35 - 39	0.58 (0.39, 0.87)	1.44 (0.90, 2.30)	*1.29 (1.02, 1.64)*
40 +	0.23 (0.15, 0.36)	1.21 (0.75, 1.95)	0.64 (0.50, 0.83)
Age at marriage (≤18)			
>18	1.06 (0.88, 1.29)	0.96 (0.82, 1.12)	*0.89 (0.80, 0.99)*
Partner age difference (Less than or equal 5 years)			
Greater than or equal to 6 years	1.03 (0.89, 1.19)	0.96 (0.83, 1.10)	0.94 (0.86, 1.04)
Unknown	0.87 (0.29, 2.55)	1.19 (0.35, 4.07)	0.49 (0.20, 1.25)
Number of living children	*1.27 (1.21, 1.34)*	*1.13 (1.08, 1.18)*	*1.18 (1.15, 1.22)*
Death of a child (No)			
Yes	*0.83 (0.70, 0.99)*	0.86 (0.72, 1.02)	0.98 (0.87, 1.10)
Gender composition of children (Equal)			
More boys	0.93 (0.76, 1.14)	*0.79 (0.66, 0.95)*	*0.68 (0.60, 0.77)*
More girls	0.94 (0.77, 1.16)	0.89 (0.73, 1.07)	*0.88 (0.77, 1.00)*
Religion (Dominant)			
Second dominant	*0.75 (0.61, 0.92)*	*0.74 (0.55, 0.99)*	1.00 (0.90, 1.11)
Other	*0.57 (0.45, 0.74)*	*0.80 (0.68, 0.95)*	*0.79 (0.69, 0.90)*
Residence (Urban)			
Rural	0.73 (0.46, 1.16)	1.12 (0.81, 1.54)	0.99 (0.77, 1.26)
Wealth Quintile (Poorest)			
Poorer	1.41 (0.98, 2.03)	*1.46 (1.12, 1.91)*	1.11 (0.94, 1.31)
Middle	*2.41 (1.71, 3.40*	*1.75 (1.34, 2.29)*	1.18 (0.98, 1.41)
Richer	*2.95 (2.08, 4.16)*	*2.07 (1.54, 2.77)*	*1.46 (1.20, 1.77)*
Richest	*3.56 (2.42, 5.24)*	*1.74 (1.17, 2.60)*	*1.43 (1.10, 1.85)*
Employment (Neither)			
Either	1.23 (0.56, 2.71)	3.39 (0.37, 30.79)	1.22 (0.70, 2.15)
Both	1.59 (0.71, 3.53)	4.35 (0.48, 39.59)	1.42 (0.81, 2.50)
Education - Respondent (No Education)			
Primary	1.14 (0.93, 1.40)	*1.58 (1.10, 2.26)*	*1.44 (1.24, 1.67)*
Secondary	*1.38 (1.03, 1.84)*	*2.05 (1.37, 3.07)*	*1.57 (1.30, 1.88)*
Higher	0.96 (0.57, 1.63)	*2.19 (1.35, 3.56)*	*1.46 (1.03, 2.06)*
Education - Partner (No Education)			
Primary	*1.29 (1.06, 1.57)*	1.42 (0.94, 2.14)	*1.23 (1.05, 1.44)*
Secondary	1.25 (0.97, 1.61)	1.36 (0.89, 2.08)	1.17 (0.97, 1.40)
Higher	1.28 (0.87, 1.89)	1.29 (0.80, 2.08)	0.85 (0.64, 1.14)
Don't Know	0.45 (0.09, 2.33)	§	1.16 (0.89, 1.50)
Violence index	1.02 (0.98, 1.07)	1.00 (0.95, 1.05)	*1.05 (1.01, 1.08)*
Decision-making autonomy index	1.02 (0.95, 1.10)	1.01 (0.96, 1.07)	*1.05 (1.01, 1.08)*
HIV knowledge index	*1.08 (1.02, 1.15)*	*1.17 (1.08, 1.27)*	¶
Reproductive knowledge index	*1.32 (1.18, 1.47)*	1.11 (0.97, 1.27)	¶
Media index	*1.11 (1.00, 1.23)*	*1.09 (1.02, 1.18)*	1.05 (0.97, 1.13)

†Italicized figures are significant at 0.05 level

§No respondents who did not know the educational attainment of their partner

¶ Information about HIV and reproductive health only collected in a sub-sample of the Madagascar 2008-09 DHS, therefore excluded from this analysis.

Table 1 continued: Individual and household level results of multilevel logistic model for the outcome of modern contraceptive use in 4 countries in Eastern Africa. Values reported as adjusted odds ratio (95% CI)†

Individual and Household Level Variables	EASTERN AFRICA			
	Rwanda	**Uganda**	**Zambia**	**Zimbabwe**
Age (15 - 19)				
20 - 24	1.99 (0.45, 8.73)	*1.93 (1.22, 3.07)*	1.19 (0.81, 1.74)	*1.41 (1.06, 1.87)*
25 - 29	1.80 (0.41, 7.95)	*1.88 (1.16, 3.04)*	0.95 (0.64, 1.41)	1.34 (0.98, 1.83)
30 - 34	1.72 (0.38, 7.74)	*2.00 (1.20, 3.34)*	*0.62 (0.40, 0.96)*	0.85 (0.60, 1.20)
35 - 39	1.50 (0.33, 6.90)	*1.75 (1.00, 3.04)*	*0.45 (0.27, 0.72)*	*0.62 (0.42, 0.92)*
40 +	0.62 (0.13, 2.95)	1.58 (0.89, 2.81)	*0.21 (0.13, 0.35)*	*0.28 (0.18, 0.42)*
Age at marriage (≤18)				
>18	0.84 (0.67, 1.06)	0.84 (0.69, 1.03)	1.19 (1.00, 1.43)	0.97 (0.83, 1.14)
Partner age difference (Less than or equal 5 years)				
Greater than or equal to 6 years	0.92 (0.75, 1.12)	0.96 (0.81, 1.13)	0.94 (0.81, 1.09)	*0.85 (0.74, 0.98)*
Unknown	‡	1.57 (0.60, 4.12)	1.52 (0.59, 3.93)	2.00 (0.67, 5.97)
Number of living children	*1.31 (1.22, 1.40)*	*1.14 (1.09, 1.20)*	*1.34 (1.27, 1.41)*	*1.44 (1.36, 1.52)*
Death of a child (No)				
Yes	0.88 (0.70, 1.09)	0.89 (0.74, 1.06)	1.03 (0.87, 1.21)	*0.76 (0.63, 0.93)*
Gender composition of children (Equal)				
More boys	0.97 (0.75, 1.26)	0.79 (0.63, 0.99)	*0.70 (0.57, 0.86)*	*0.64 (0.53, 0.78)*
More girls	0.86 (0.66, 1.13)	0.86 (0.69, 1.08)	0.86 (0.70, 1.06)	0.91 (0.75, 1.11)
Religion (Dominant)				
Second dominant	*0.67 (0.53, 0.84)*	0.91 (0.75, 1.10)	1.07 (0.88, 1.30)	*1.43 (1.18, 1.75)*
Other	0.95 (0.73, 1.24)	1.04 (0.85, 1.29)	0.55 (0.28, 1.10)	*1.33 (1.13, 1.56)*
Residence (Urban)				
Rural	1.05 (0.75, 1.48)	0.96 (0.67, 1.39)	1.17 (0.82, 1.68)	1.15 (0.75, 1.78)
Wealth Quintile (Poorest)				
Poorer	0.90 (0.63, 1.30)	*1.57 (1.13, 2.19)*	0.88 (0.68, 1.14)	*1.30 (1.04, 1.62)*
Middle	1.01 (0.71, 1.45)	*1.47 (1.04, 2.07)*	0.83 (0.64, 1.08)	1.20 (0.94, 1.53)
Richer	1.13 (0.80, 1.60)	*1.85 (1.31, 2.62)*	1.32 (0.93, 1.87)	*1.78 (1.29, 2.47)*
Richest	*1.65 (1.14, 2.40)*	*2.87 (1.92, 4.31)*	1.33 (0.82, 2.15)	*2.15 (1.39, 3.33)*
Employment (Neither)				
Either	0.98 (0.07, 14.39)	1.18 (0.92, 1.52)	1.09 (0.93, 1.28)	1.37 (1.17, 1.61)
Both	1.08 (0.07, 15.82)	‖	‖	‖
Education - Respondent (No Education)				
Primary	1.21 (0.92, 1.59)	*1.49 (1.14, 1.94)*	1.01 (0.78, 1.31)	*1.80 (1.25, 2.60)*
Secondary	2.39 (1.60, 3.56)	*1.91 (1.35, 2.72)*	1.31 (0.95, 1.79)	*2.36 (1.58, 3.53)*
Higher	3.88 (1.59, 9.49)	1.43 (0.85, 2.39)	1.13 (0.68, 1.89)	*3.44 (1.87, 6.31)*
Education - Partner (No Education)				
Primary	1.21 (0.92, 1.59)	1.46 (0.95, 2.25)	1.12 (0.79, 1.59)	1.42 (0.95, 2.12)
Secondary	1.19 (0.81, 1.74)	*1.64 (1.03, 2.60)*	1.30 (0.90, 1.89)	*1.63 (1.08, 2.47)*
Higher	0.99 (0.50, 1.97)	*2.10 (1.25, 3.52)*	*1.89 (1.19, 3.02)*	1.29 (0.77, 2.17)
Don't Know	0.96 (0.31, 2.99)	1.09 (0.57, 2.06)	1.14 (0.57, 2.30)	0.86 (0.39, 1.87)
Violence index	1.03 (0.94, 1.12)	0.99 (0.94, 1.04)	1.02 (0.97, 1.06)	0.96 (0.91, 1.00)
Decision-making autonomy index	0.89 (0.83, 0.96)	1.06 (0.98, 1.14)	0.96 (0.89, 1.03)	0.96 (0.91, 1.01)
HIV knowledge index	1.03 (0.92, 1.16)	*1.14 (1.04, 1.24)*	1.03 (0.95, 1.12)	1.05 (0.99, 1.12)
Reproductive knowledge index	1.23 (1.00, 1.50)	1.13 (0.94, 1.35)	*1.25 (1.06, 1.48)*	1.04 (0.90, 1.21)
Media index	1.65 (1.42, 1.91)	1.05 (0.92, 1.20)	*1.18 (1.08, 1.30)*	0.97 (0.89, 1.06)

†Italicized figures are significant at 0.05 level

‡No respondents who did not know the age of their partner

‖ Too few observations where both the respondent and her partner were employed to include as a category

Table 2: Individual and household level results of multilevel logistic model for the outcome of modern contraceptive use in 2 countries in Middle Africa and 1 country in Northern Africa. Values reported as adjusted odds ratio (95% CI)*†

Individual and Household Level Variables	MIDDLE AFRICA		NORTHERN AFRICA
	Congo	DRC	Egypt
Age (15 - 19)			
20 - 24	0.99 (0.63, 1.55)	1.38 (0.82, 2.35)	*1.86 (1.47, 2.37)*
25 - 29	0.79 (0.49, 1.27)	0.96 (0.55, 1.67)	*2.17 (1.70, 2.77)*
30 - 34	*0.59 (0.35, 0.98)*	0.73 (0.40, 1.33)	*2.29 (1.77, 2.96)*
35 - 39	*0.44 (0.25, 0.78)*	0.95 (0.50, 1.79)	*2.52 (1.93, 3.30)*
40 +	*0.28 (0.15, 0.53)*	0.80 (0.41, 1.54)	1.26 (0.96, 1.65)
Age at marriage (≤18)			
>18	0.93 (0.75, 1.15)	0.94 (0.74, 1.20)	1.05 (0.96, 1.15)
Partner age difference (Less than or equal 5 years)			
Greater than or equal to 6 years	0.87 (0.71, 1.06)	1.01 (0.81, 1.26)	*0.91 (0.84, 0.98)*
Unknown	1.39 (0.64, 2.99)	2.18 (0.77, 6.13)	‡
Number of living children	*1.13 (1.05, 1.22)*	*1.09 (1.02, 1.16)*	*1.62 (1.56, 1.67)*
Death of a child (No)			
Yes	1.04 (0.82, 1.33)	0.99 (0.77, 1.28)	*0.76 (0.68, 0.86)*
Gender composition of children (Equal)			
More boys	0.79 (0.61, 1.03)	0.85 (0.63, 1.14)	*0.62 (0.56, 0.68)*
More girls	0.77 (0.59, 1.01)	0.94 (0.69, 1.28)	*0.68 (0.61, 0.75)*
Religion (Dominant)			
Second dominant	0.93 (0.72, 1.21)	0.92 (0.69, 1.22)	*1.25 (1.05, 1.49)*
Other	0.89 (0.71, 1.13)	0.88 (0.67, 1.15)	§
Residence (Urban)			
Rural	1.04 (0.70, 1.54)	0.94 (0.59, 1.51)	1.11 (0.98, 1.26)
Wealth Quintile (Poorest)			
Poorer	0.93 (0.60, 1.43)	1.01 (0.60, 1.69)	0.93 (0.83, 1.06)
Middle	1.36 (0.85, 2.18)	1.26 (0.77, 2.07)	0.90 (0.79, 1.03)
Richer	1.51 (0.89, 2.57)	*2.02 (1.20, 3.41)*	0.85 (0.73, 1.00)
Richest	1.60 (0.89, 2.88)	*2.27 (1.15, 4.48)*	0.79 (0.65, 0.96)
Employment (Neither)			
Either	0.74 (0.45, 1.20)	*3.26 (1.26, 8.43)*	*1.28 (1.03, 1.58)*
Both	0.73 (0.45, 1.20)	*3.15 (1.21, 8.20)*	*1.54 (1.22, 1.95)*
Education - Respondent (No Education)			
Primary	0.73 (0.43, 1.24)	1.28 (0.83, 1.97)	1.06 (0.93, 1.21)
Secondary	0.95 (0.56, 1.62)	*1.62 (1.00, 2.61)*	*1.19 (1.05, 1.34)*
Higher	1.92 (0.93, 3.97)	1.36 (0.62, 2.96)	0.92 (0.76, 1.11)
Education - Partner (No Education)			
Primary	1.37 (0.59, 3.21)	1.11 (0.61, 2.04)	*1.34 (1.18, 1.52)*
Secondary	1.87 (0.82, 4.27)	0.93 (0.51, 1.69)	*1.40 (1.24, 1.59)*
Higher	1.65 (0.70, 3.92)	1.09 (0.56, 2.15)	*1.36 (1.15, 1.61)*
Don't Know	1.64 (0.67, 4.01)	1.11 (0.48, 2.56)	‖
Violence index	1.04 (0.95, 1.14)	0.99 (0.92, 1.06)	*0.95 (0.93, 0.98)*
Decision-making autonomy index	¶	1.03 (0.95, 1.12)	*0.92 (0.88, 0.96)*
HIV knowledge index	*1.16 (1.05, 1.28)*	*1.17 (1.05, 1.29)*	#
Reproductive knowledge index	*1.23 (1.04, 1.45)*	*1.62 (1.36, 1.93)*	1.00 (0.96, 1.04)
Media index	*1.15 (1.01, 1.30)*	1.08 (0.92, 1.26)	*1.08 (1.03, 1.14)*

†Italicized figures are significant at 0.05 level

‡No respondents who did not know the age of their partner

§No respondents reported a religion other than the 2 dominant religions

‖No respondents who did not know the educational attainment of their partner

¶No information regarding decision-making autonomy collected in the 2005 Congo DHS - Women's Questionnaire

#No information regarding HIV collected in the 2008 Egypt DHS - Women's Questionnaire

Table 3: Individual and household level results of multilevel logistic model for the outcome of modern contraceptive use in 2 countries in Southern Africa. Values reported as adjusted odds ratio (95% CI)*†		
Individual and Household Level Variables	**SOUTHERN AFRICA**	
	Namibia	**Swaziland**
Age (15 - 19)		
20 - 24	0.89 (0.56, 1.42)	*0.56 (0.32, 0.95)*
25 - 29	0.71 (0.45, 1.13)	*0.50 (0.28, 0.87)*
30 - 34	0.63 (0.39, 1.02)	0.66 (0.37, 1.19)
35 - 39	*0.54 (0.33, 0.89)*	*0.37 (0.20, 0.68)*
40 +	*0.40 (0.24, 0.67)*	*0.18 (0.10, 0.35)*
Age at marriage (≤18)		
>18	0.95 (0.79, 1.15)	*1.54 (1.21, 1.96)*
Partner age difference (Less than or equal 5 years)		
Greater than or equal to 6 years	0.87 (0.74, 1.01)	*0.79 (0.65, 0.97)*
Unknown	0.78 (0.50, 1.23)	0.40 (0.14, 1.11)
Number of living children	*1.20 (1.15, 1.27)*	*1.25 (1.18, 1.34)*
Children died (No)		
Yes	1.04 (0.85, 1.27)	0.98 (0.77, 1.26)
Gender composition of children (Equal)		
More boys	0.89 (0.73, 1.09)	*0.75 (0.57, 0.99)*
More girls	0.92 (0.75, 1.13)	0.78 (0.59, 1.04)
Religion (Dominant)		
Second dominant	0.93 (0.78, 1.11)	1.15 (0.86, 1.53)
Other	*0.53 (0.31, 0.91)*	1.15 (0.90, 1.46)
Residence (Urban)		
Rural	1.07 (0.87, 1.31)	1.10 (0.79, 1.54)
Wealth Quintile (Poorest)		
Poorer	1.54 (0.17, 2.02)	1.07 (0.75, 1.51)
Middle	*1.38 (1.05, 1.82)*	1.32 (0.91, 1.90)
Richer	*1.64 (1.12, 2.38)*	0.83 (0.55, 1.25)
Richest	1.57 (0.95, 2.60)	1.07 (0.64, 1.78)
Employment (Neither)		
Either	1.09 (0.73, 1.62)	1.08 (0.75, 1.57)
Both	1.43 (0.95, 2.14)	1.27 (0.86, 1.87)
Education - Respondent (No Education)		
Primary	0.94 (0.70, 1.27)	*1.60 (1.08, 2.37)*
Secondary	*1.41 (1.02, 1.95)*	*2.17 (1.43, 3.31)*
Higher	1.45 (0.93, 2.27)	*3.08 (1.68, 5.66)*
Education - Partner (No Education)		
Primary	*1.60 (1.23, 2.08)*	1.36 (0.94, 1.95)
Secondary	*1.62 (1.22, 2.14)*	*1.70 (1.16, 2.49)*
Higher	1.36 (0.92, 2.01)	*1.83 (1.06, 3.15)*
Don't Know	0.90 (0.55, 1.45)	§
Violence index	0.98 (0.92, 1.04)	1.03 (0.92, 1.16)
Decision-making autonomy index	1.01 (0.95, 1.07)	1.03 (0.95, 1.13)
HIV knowledge index	1.08 (1.00, 1.16)	1.10 (0.98, 1.25)
Reproductive knowledge index	1.12 (0.95, 1.31)	1.05 (0.83, 1.34)
Media index	*1.10 (1.01, 1.20)*	*1.18 (1.04, 1.33)*

†Italicized figures are significant at 0.05 level

§No respondents who did not know the educational attainment of their partner

Table 4: Individual and household level results of multilevel logistic model for the outcome of modern contraceptive use in 4 countries in Western Africa. Values reported as adjusted odds ratio (95% CI)*†

Individual and Household Level Variables	WESTERN AFRICA		
	Benin	**Ghana**	**Guinea**
Age (15 - 19)			
20 - 24	1.03 (0.60, 1.79)	1.86 (0.75, 4.63)	1.02 (0.60, 1.74)
25 - 29	0.90 (0.52, 1.57)	1.07 (0.42, 2.70)	0.92 (0.54, 1.58)
30 - 34	0.89 (0.50, 1.58)	1.30 (0.51, 3.33)	0.69 (0.38, 1.24)
35 - 39	0.98 (0.54, 1.78)	1.16 (0.44, 3.02)	0.64 (0.34, 1.20)
40 +	0.79 (0.43, 1.47)	0.73 (0.27, 1.96)	0.52 (0.26, 1.00)
Age at marriage (≤18)			
>18	0.94 (0.78, 1.13)	1.12 (0.87, 1.44)	0.78 (0.55, 1.10)
Partner age difference (Less than or equal 5 years)			
Greater than or equal to 6 years	0.93 (0.79, 1.09)	0.94 (0.75, 1.17)	*0.72 (0.53, 0.98)*
Unknown	0.66 (0.31, 1.40)	0.71 (0.24, 2.15)	0.75 (0.14, 4.02)
Number of living children	*1.20 (1.13, 1.26)*	*1.23 (1.14, 1.33)*	*1.20 (1.11, 1.30)*
Death of a child (No)			
Yes	1.05 (0.87, 1.25)	0.99 (0.76, 1.29)	0.94 (0.71, 1.25)
Gender composition of children (Equal)			
More boys	*0.81 (0.66, 1.00)*	0.87 (0.65, 1.17)	1.28 (0.90, 1.83)
More girls	*0.77 (0.63, 0.96)*	1.06 (0.79, 1.43)	1.10 (0.76, 1.61)
Religion (Dominant)			
Second dominant	1.02 (0.79, 1.32)	0.86 (0.59, 1.27)	0.74 (0.44, 1.26)
Other	1.02 (0.84, 1.23)	1.05 (0.82, 1.34)	0.78 (0.31, 1.94)
Residence (Urban)			
Rural	0.94 (0.74, 1.19)	1.06 (0.73, 1.56)	0.70 (0.41, 1.21)
Wealth Quintile (Poorest)			
Poorer	*1.46 (1.04, 2.04)*	0.82 (0.55, 1.22)	0.98 (0.59, 1.63)
Middle	*1.82 (1.31, 2.52)*	1.04 (0.65, 1.66)	1.41 (0.87, 2.28)
Richer	*2.10 (1.49, 2.96)*	1.24 (0.72, 2.14)	1.56 (0.92, 2.64)
Richest	*3.21 (2.15, 4.79)*	1.19 (0.61, 2.33)	1.21 (0.56, 2.62)
Employment (Neither)			
Either	1.25 (0.96, 1.62)	1.76 (1.13, 2.72)	1.31 (0.90, 1.91)
Both	‡	‡	‡
Education - Respondent (No Education)			
Primary	*1.34 (1.08, 1.66)*	1.36 (0.95, 1.94)	1.20 (0.79, 1.82)
Secondary	*1.57 (1.18, 2.11)*	1.37 (0.94, 1.98)	*1.96 (1.27, 3.04)*
Higher	*2.21 (1.12, 4.37)*	1.08 (0.51, 2.28)	2.38 (0.89, 6.39)
Education - Partner (No Education)			
Primary	*1.44 (1.14, 1.81)*	1.46 (0.91, 2.34)	0.91 (0.55,1.50)
Secondary	*1.39 (1.07, 1.80)*	1.46 (0.99, 2.17)	1.35 (0.93, 1.97)
Higher	*1.55 (1.03, 2.32)*	1.50 (0.87, 2.56)	1.53 (0.95, 2.47)
Don't Know	1.07 (0.74, 1.55)	0.83 (0.40, 1.72)	*3.29 (1.43, 7.57)*
Violence index	0.98 (0.93, 1.04)	1.03 (0.94, 1.12)	*0.90 (0.83, 0.97)*
Decision-making autonomy index	1.03 (0.97, 1.09)	0.95 (0.86, 1.05)	0.95 (0.86, 1.05)
HIV knowledge index	1.04 (0.96, 1.12)	1.02 (0.91, 1.13)	*1.32 (1.17, 1.49)*
Reproductive knowledge index	*1.31 (1.17, 1.48)*	*1.22 (1.02, 1.47)*	*1.31 (1.07, 1.60)*
Media index	*1.20 (1.09, 1.33)*	0.95 (0.81, 1.11)	*1.32 (1.10, 1.58)*

†Italicized figures are significant at 0.05 level

‡Too few observations where both the respondent and her partner were employed to include

Table 4 continued: Individual and household level results of multilevel logistic model for the outcome of modern contraceptive use in 5 countries in Western Africa. Values reported as adjusted odds ratio (95% CI)*†

Individual and Household Level Variables	WESTERN AFRICA		
	Liberia	**Mali**	**Niger**
Age (15 - 19)			
20 - 24	1.17 (0.54, 2.54)	1.08 (0.81, 1.45)	*1.84 (1.06, 3.19)*
25 - 29	*2.19 (1.03, 4.69)*	0.88 (0.64, 1.22)	1.59 (0.91, 2.81)
30 - 34	1.30 (0.59, 2.87)	*0.62 (0.43, 0.90)*	1.30 (0.70, 2.40)
35 - 39	1.41 (0.62, 3.18)	0.72 (0.48, 1.07)	0.89 (0.46, 1.74)
40 +	0.73 (0.31, 1.74)	*0.36 (0.23, 0.56)*	0.79 (0.39, 1.59)
Age at marriage (≤18)			
>18	0.94 (0.73, 1.20)	0.97 (0.80, 1.19)	1.11 (0.82, 1.50)
Partner age difference (Less than or equal 5 years)			
Greater than or equal to 6 years	1.07 (0.85, 1.34)	0.87 (0.72, 1.06)	1.10 (0.84, 1.45)
Unknown	1.22 (0.57, 2.63)	0.60 (0.13, 2.74)	‡
Number of living children	*1.24 (1.16, 1.34)*	*1.26 (1.20, 1.32)*	*1.19 (1.12, 1.27)*
Death of a child (No)			
Yes	1.08 (0.84, 1.38)	1.06 (0.88, 1.26)	0.85 (0.66, 1.08)
Gender composition of children (Equal)			
More boys	1.17 (0.86, 1.59)	1.12 (0.90, 1.40)	1.01 (0.75, 1.35)
More girls	0.97 (0.71, 1.32)	1.19 (0.95, 1.49)	1.13 (0.84, 1.53)
Religion (Dominant)			
Second dominant	0.68 (0.45, 1.04)	*1.66 (1.14, 2.40)*	1.34 (0.48, 3.73)
Other	*0.19 (0.05, 0.82)*	0.88 (0.53, 1.45)	0.63 (0.08, 5.16)
Residence (Urban)			
Rural	0.74 (0.51, 1.06)	*0.68 (0.51, 0.90)*	0.65 (0.39, 1.09)
Wealth Quintile (Poorest)			
Poorer	1.30 (0.84, 2.01)	1.29 (0.91, 1.81)	0.96 (0.56, 1.64)
Middle	*1.69 (1.08, 2.65)*	1.18 (0.83, 1.67)	0.71 (0.41, 1.24)
Richer	1.59 (0.94, 2.70)	*1.82 (1.30, 2.54)*	1.22 (0.76, 1.97)
Richest	1.38 (0.75, 2.55)	*2.30 (1.55, 3.43)*	1.16 (0.66, 2.04)
Employment (Neither)			
Either	1.29 (0.58, 2.85)	0.97 (0.82, 1.15)	0.62 (0.16, 2.46)
Both	1.17 (0.53, 2.60)	§	0.84 (0.21, 3.33)
Education - Respondent (No Education)			
Primary	*1.40 (1.04, 1.87)*	*1.29 (1.03, 1.61)*	*1.35 (1.01, 1.80)*
Secondary	*1.70 (1.21, 2.40)*	*1.50 (1.16, 1.94)*	1.00 (0.68, 1.47)
Higher	0.77 (0.28, 2.07)	1.53 (0.80, 2.91)	1.95 (0.75, 5.08)
Education - Partner (No Education)			
Primary	1.06 (0.70, 1.63)	*1.40 (1.11, 1.78)*	1.32 (0.93, 1.86)
Secondary	*1.67 (1.17, 2.39)*	*1.47 (1.16, 1.86)*	*2.69 (1.93, 3.76)*
Higher	*1.82 (1.08, 3.05)*	*1.54 (1.07, 2.20)*	*2.29 (1.36, 3.84)*
Don't Know	2.29 (0.63, 8.36)	1.08 (0.66, 1.78)	1.65 (0.84, 3.23)
Violence index	1.04 (0.96, 1.12)	1.00 (0.95, 1.05)	1.00 (0.84, 1.07)
Decision-making autonomy index	1.12 (0.99, 1.26)	1.03 (0.97, 1.09)	0.96 (0.87, 1.05)
HIV knowledge index	*1.17 (1.07, 1.28)*	*1.09 (1.03, 1.16)*	*1.14 (1.03, 1.25)*
Reproductive knowledge index	1.17 (0.96, 1.44)	*1.50 (1.35, 1.67)*	*1.50 (1.27, 1.76)*
Media index	1.21 (0.99, 1.49)	*1.37 (1.25, 1.51)*	*1.36 (1.20, 1.55)*

†Italicized figures are significant at 0.05 level

‡No respondents who did not know the age of their partner

§Too few observations where both the respondent and her partner were employed to include

Table 4 continued: Individual and household level results of multilevel logistic model for the outcome of modern contraceptive use in 5 countries in Western Africa. Values reported as adjusted odds ratio (95% CI)*†

Individual and Household Level Variables	WESTERN AFRICA		
	Nigeria	Senegal	Sierra Leone
Age (15 - 19)			
20 - 24	0.96 (0.67, 1.38)	0.98 (0.69, 1.39)	*5.61 (1.31, 24.10)*
25 - 29	0.72 (0.50, 1.03)	0.70 (0.48, 1.01)	*7.04 (1.66, 29.77)*
30 - 34	0.76 (0.52, 1.11)	0.76 (0.51, 1.13)	*5.02 (1.16, 21.67)*
35 - 39	*0.63 (0.42, 0.93)*	0.75 (0.49, 1.15)	*5.40 (1.24, 23.52)*
40 +	*0.41 (0.28, 0.63)*	*0.44 (0.28, 0.70)*	2.67 (0.60, 11.93)
Age at marriage (≤18)			
>18	*1.19 (1.05, 1.35)*	1.14 (0.95, 1.36)	1.05 (0.80, 1.39)
Partner age difference (Less than or equal 5 years)			
Greater than or equal to 6 years	*0.87 (0.78, 0.98)*	0.84 (0.70, 1.01)	0.91 (0.70, 1.19)
Unknown	0.96 (0.58, 1.59)	0.97 (0.57, 1.66)	1.27 (0.69, 2.33)
Number of living children	*1.30 (1.25, 1.35)*	*1.30 (1.24, 1.36)*	*1.27 (1.17, 1.38)*
Death of a child (No)			
Yes	0.95 (0.84, 1.07)	0.83 (0.69, 1.01)	0.96 (0.74, 1.25)
Gender composition of children (Equal)			
More boys	0.92 (0.80, 1.06)	0.84 (0.68, 1.04)	1.04 (0.76, 1.42)
More girls	0.87 (0.75, 1.01)	0.92 (0.74, 1.14)	0.87 (0.63, 1.22)
Religion (Dominant)			
Second dominant	*1.53 (1.30, 1.81)*	1.34 (0.98, 1.84)	0.90 (0.67, 1.20)
Other	1.20 (0.97, 1.49)	1.31 (0.22, 7.81)	1.79 (0.51, 6.33)
Residence (Urban)			
Rural	*0.81 (0.68, 0.98)*	0.93 (0.70, 1.24)	1.19 (0.76, 1.86)
Wealth Quintile (Poorest)			
Poorer	1.00 (0.79, 1.28)	1.18 (0.84, 1.65)	0.69 (0.40, 1.19)
Middle	1.19 (0.92, 1.53)	*1.61 (1.13, 2.31)*	0.99 (0.60, 1.66)
Richer	*1.37 (1.03, 1.83)*	*1.76 (1.15, 2.67)*	1.40 (0.84, 2.33)
Richest	*1.44 (1.03, 2.02)*	*1.73 (1.07, 2.78)*	1.26 (0.67, 2.38)
Employment (Neither)			
Either	1.21 (1.05, 1.40)	0.66 (0.40, 1.07)	1.29 (0.95, 1.77)
Both	§	0.82 (0.50, 1.35)	§
Education - Respondent (No Education)			
Primary	*1.54 (1.27, 1.89)*	*1.96 (1.61, 2.38)*	1.29 (0.90, 1.84)
Secondary	*1.59 (1.28, 1.98)*	*2.18 (1.66, 2.86)*	*1.52 (1.06, 2.18)*
Higher	*1.64 (1.24, 2.17)*	1.49 (0.62, 3.56)	0.96 (0.48, 1.92)
Education - Partner (No Education)			
Primary	1.08 (0.87, 1.34)	*1.51 (1.19, 1.92)*	1.05 (0.68, 1.63)
Secondary	1.05 (0.85, 1.31)	*1.89 (1.49, 2.41)*	*1.76 (1.26, 2.45)*
Higher	1.15 (0.90, 1.47)	*1.59 (1.11, 2.28)*	1.42 (0.89, 2.26)
Don't Know	0.66 (0.25, 1.76)	*1.69 (1.32, 2.17)*	1.05 (0.35, 3.16)
Violence index	1.00 (0.97, 1.04)	0.96 (0.91, 1.00)	1.04 (0.96, 1.12)
Decision-making autonomy index	1.02 (0.97, 1.07)	0.97 (0.91, 1.04)	*1.12 (1.01, 1.23)*
HIV knowledge index	1.02 (0.98, 1.06)	1.08 (0.99, 1.17)	*1.11 (1.01, 1.21)*
Reproductive knowledge index	*1.48 (1.37, 1.60)*	*1.36 (1.21, 1.53)*	*1.70 (1.41, 2.05)*
Media index	*1.21 (1.13, 1.28)*	*1.22 (1.12, 1.33)*	*1.25 (1.03, 1.51)*

†Italicized figures are significant at 0.05 level

§Too few observations where both the respondent and her partner were employed to include