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DOES MEN'S INVOLVEMENT IMPROVE THE HEALTH OUTCOMES OF THEIR PARTNERS AND CHILDREN?

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**Does Men's Involvement Improve the Health Outcomes
of Their Partners and Children?**

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PREFACE

The Demographic and Health Surveys (DHS) Program is one of the principal sources of international data on fertility, family planning, maternal and child health, nutrition, mortality, environmental health, HIV/AIDS, malaria, and provision of health services.

One of the objectives of The DHS Program is to analyze DHS data and provide findings that will be useful to policymakers and program managers in low- and middle-income countries. DHS Analytical Studies serve this objective by providing in-depth research on a wide range of topics, typically including several countries, and applying multivariate statistical tools and models. These reports are also intended to illustrate research methods and applications of DHS data that may build the capacity of other researchers.

The topics in the DHS Analytical Studies series are selected by The DHS Program in consultation with the U.S. Agency for International Development.

It is hoped that the DHS Analytical Studies will be useful to researchers, policymakers, and survey specialists, particularly those engaged in work in low- and middle-income countries.

Sunita Kishor
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ABSTRACT

Men's involvement in the health of their partners and children can play an important role in improving health outcomes. Many interventions in reproductive, maternal, and child health adopt strategies that seek to increase men's positive, equitable, and supportive involvement. This study used data from men's responses in Demographic and Health Surveys (DHS) in 33 countries. We linked this information with information from women's survey responses on outcomes for family planning, maternal, and child health outcomes. The objective was to learn whether men's involvement, defined as having correct knowledge, positive attitudes, and supportive behaviors toward the health of their partners and children, has an association with specific reproductive, maternal, and child health outcomes. Adjusted logistic regression models were run for each outcome and its corresponding independent variable of interest, adjusting for control variables. Although in general few countries exhibited significant findings, the analysis found some significance in the associations between men's involvement variables and outcomes related to family planning, antenatal care, and child health. The behavior of men discussing family planning with a health care worker showed significant association with their partners' modern contraceptive use in most countries. Some countries exhibited a greater number of significant findings compared with other countries, which suggests the need for qualitative studies that could help explain these country-specific findings. The study also points to the need for strengthened measures within DHS surveys to capture men's knowledge, attitudes, and behavior related to reproductive, maternal, and child health.

KEY WORDS: men's involvement, men's knowledge, men's attitudes, men's behavior, family planning, maternal health, child health

1 BACKGROUND

1.1 Introduction

For several decades advocates for improved maternal and child health have promoted men's involvement in all aspects of health care for women and children (Gallen, Liskin, and Kak 1986; Green, Cohen, and Belhadj-El Ghouayel 1995; Wegner et al. 1998). In many parts of the world, men play a central role in decision-making regarding the health of women and children; therefore, male involvement is critical in improving maternal and child health outcomes. Although engaging men in health care for women and children is not a universal strategy, several maternal health interventions have advocated for male involvement as a means to improve outcomes for women's sexual and reproductive health, and for maternal, newborn, and child health (Barker, Ricardo, and Nascimento 2007; Barker et al. 2010; Kraft et al. 2014; Yargawa and Leonardi-Bee 2015). However, these approaches often have been short-term and small-scale. Additionally, men's involvement in their children's health is associated with better overall health outcomes for the children, including their cognitive, emotional, and social development (Allen and Daly 2007; Aluisio et al. 2011; Sarkadi et al. 2008). We also know that men's greater involvement in the lives of their children is good for men themselves, and for supporting more gender-equitable societies (Levtov et al. 2015). Thus, several interventions and programs have sought to include approaches that increase fathers' involvement in maternal and child health (Greene et al. 2006; Kululanga, Sundby, and Chirwa 2011; Sternberg and Hubley 2004). The effect of men's involvement on health outcomes for women and children is directly linked to men's knowledge and education, their attitudes, and their behaviors (Mkandawire and Hendriks 2018; Nasreen et al. 2012; Rammohan, Awofeso, and Fernandez 2012; Shattuck et al. 2011; Sternberg and Hubley 2004).

1.1.1 Men's knowledge and education

Several studies have shown that interventions to educate men about family planning, antenatal care (ANC), and maternal and newborn health improved maternal and child health outcomes (Mullany, Becker, and Hindin 2006; Shattuck et al. 2011; Tokhi et al. 2018). Men's knowledge of contraception is linked to their life course and to socioeconomic factors (Duze and Mohammed 2006; MacQuarrie et al. 2015). For example, a study across 18 countries in Africa, Asia, and Latin America and the Caribbean found that men with no children and never-married men had the lowest levels of contraceptive knowledge, while in most of the countries men's contraceptive knowledge was also positively and significantly associated with their level of education; it was highest among men age 35-45 (MacQuarrie et al. 2015).

A study in Southeast Nigeria found that men's awareness of and support for contraceptive use were significantly associated with their wives' desire to use contraception (Ezeanolue et al. 2015). The study showed that men who were aware of female contraception had three times greater odds of having spouses who wanted to use contraception compared with men who were not aware of female contraception (Ezeanolue et al. 2015). Further, in the Malawi Motivator Project, when married men were educated through their peers about the importance of using contraceptives, their contraceptives uptake increased (Shattuck et al. 2011). The Malawi Motivator Project highlights the success of the information-motivation-behavior (IMB) model. In its application of the IMB model, married men who were given information about modern family planning methods were motivated to act on this information and to follow better practices and

behavior skills related to family planning (Shattuck et al. 2011). While before the intervention all participants in both the intervention (the Malawi Motivator Project) and the control group reported not using contraceptives, after the intervention 78% in the intervention group reported using family planning methods compared with 59% in the control group. When asked about the perceived benefits, beyond the financial aspects, men discussed the health benefits for their wives, girlfriends, and children (Shattuck et al. 2011).

A study in Ethiopia found that involving men in discussions of family planning with their wives made a significant difference in modern contraceptive use; twice as many members of the intervention group were using a modern contraceptive method compared with the control group (Terefe and Larson 1993). Another study conducted in Ethiopia also found that men who participated in a family planning intervention for couples were more likely to be actively involved in family planning compared with men who did not participate (Tilahun et al. 2015). Similarly, a randomized control trial (RCT) among couples in Burkina Faso, which focused on educating husbands on their role in pregnancy and maternity care, including counseling sessions for couples, found that couples who participated in the intervention were more likely to use effective contraception eight months postpartum (Daniele et al. 2018).

A systematic review on the effectiveness of interventions that engage men in maternal and newborn health during the prenatal, delivery, and postpartum period identified several studies showing that interventions that engage and educate men resulted in more positive maternal and newborn health outcomes (Tokhi et al. 2018). In rural Tanzania, training male and female safe motherhood promoters to conduct home visits to educate husbands of pregnant women on danger signs and pregnancy complications resulted in a significant increase in birth attendance by skilled health providers, at 51% for the intervention compared with 34% for the control group (Mushi, Mpembeni, and Jahn 2010). In Indonesia a social mobilization campaign targeting husbands, midwives, and community leaders also resulted in a significant increase in skilled birth attendance, at 70% for the intervention compared with 44% for the control group (Sood et al. 2004). A complex primary health care program that included outreach to male partners and community leaders for Afghani refugees in Pakistan found significant improvements in ANC coverage and postnatal care visits, as well as a reduction in the maternal mortality ratio (Purdin, Khan, and Saucier 2009).

The father's level of education has been found to be a key factor in facilitating men's positive and active involvement in the health of their children (Levtov et al. 2015). Findings from the RCT among couples in Burkina Faso found that couples who participated in the education-focused intervention were also more likely to be exclusively breastfeeding three months postpartum (Daniele et al. 2018). In another study, data from DHS surveys were analyzed for the six countries with the lowest proportions of children vaccinated against measles: India, Indonesia, Pakistan, Nigeria, Democratic Republic of Congo, and Ethiopia; the analysis found that in all six countries the proportion of children vaccinated increased significantly as father's education increased, independently of the mother's education (Rammohan, Awofeso, and Fernandez 2012). The study also demonstrated that when both the mother and father are educated, the proportion of children vaccinated is higher. Another study in Haitian villages found that the presence of fathers' clubs had a positive effect on children's health as measured through vaccination status, growth monitoring, and vitamin A supplementation. Fathers met regularly to talk with the village nurse or health workers and to learn about child and family health (Sloand, Astone, and Gebrian 2010). Results showed that children age 2 in villages with a fathers' club had 2.6 times higher odds to be fully vaccinated, 3.75

times higher odds to receive vitamin A supplementation by age 1, and significantly more growth monitoring than children in villages with no fathers' club (Sloand, Astone, and Gebrian 2010).

1.1.2 Men's attitudes and perceptions

Changing men's attitudes and perceptions is also important to achieving better outcomes in maternal and child health; knowledge and education alone may not be enough. For example, interviews conducted among the Hausa people in Northern Nigeria showed that most men were aware of contraceptive methods (nearly two-thirds reported knowing at least one method), but 85% of men were not willing to allow their spouses to use family planning, even when they were not able financially to take care of their current number of children (Duze and Mohammed 2006). In the interviews, men reported that the reasons for their negative attitudes and perceptions toward using contraceptives were that their religion discourages the use of contraceptives to prevent childbearing and that a child's birth is accompanied by wealth, so it is desirable to have many children (Duze and Mohammed 2006). In a qualitative study conducted in Uganda, men discussed several negative aspects of women's contraceptive use, including reduced sexual pleasure for women, increased infertility risks, and fear of engagement in extramarital sexual relationships, in a belief that women who use contraception might become promiscuous if they could avoid becoming pregnant (Kabagenyi et al. 2014). A study based on data from 58 DHS surveys in 18 countries in Africa, Asia, and Latin America and the Caribbean found that most men in most of the countries agreed that contraceptive use is associated with promiscuity, even though more than half of respondents disagreed with the statement that "contraception is a woman's business" (MacQuarrie et al. 2015).

Men's perceptions also affect their wives' use of skilled birth attendants (SBAs) and prenatal care. A study using DHS data from Kenya showed that about half of women whose husbands had a positive perception of woman's health care were attended by an SBA during delivery compared with 41% of women whose husbands had a negative perception (Mangeni et al. 2012). Another study in South West Ethiopia showed that among women who reported that their husbands approved of prenatal care, 80% used prenatal care compared with only 40% of women whose husbands disapproved (Biratu and Lindstrom 2016). The relationship between husband's approval and wife's use of prenatal care is stronger than the relationship between use of prenatal care and the woman's own characteristics, including education and desire for the pregnancy (Biratu and Lindstrom 2016).

Gender-transformative approaches—that is, interventions or programs that promote understanding and challenge social norms and attitudes that perpetuate inequalities between men and women—have proven effective in changing gender inequalities and improving health-related behaviors (Doyle et al. 2018; Health Communication Capacity Collaborative (Hc3) 2014). An assessment of a gender-transformative intervention for couples on several behavioral and health-related outcomes that were influenced by gender norms and power relations found that couples that participated in the intervention had greater attendance and male participation in ANC, lower levels of child abuse, greater use of modern contraception, higher levels of men's participation in child care, and less dominance of men in decision-making (Doyle et al. 2018).

1.1.3 Men's behavior and decision-making

Concerning men's behavior toward maternal and child health, a systematic review of men's accompanying their partners during ANC visits found positive impacts on women's knowledge of danger signs during

pregnancy, increases in institutional delivery and skilled birth attendance, and higher uptake of postnatal care services (Aguiar and Jennings 2015). Another systematic review and meta-analysis of male involvement found increases in skilled birth attendance and use of postnatal care (Yargawa and Leonardi-Bee (2015). In this study male involvement included: active participation in maternal health services and care, characterized by husband's ANC attendance, presence in the delivery room, and support for health during pregnancy, delivery and postpartum; financial support for expenses related to pregnancy and childbirth; and shared decision-making with wife on maternal health (Yargawa and Leonardi-Bee 2015). The researchers also found that male involvement was significantly associated with reduced odds of postpartum depression among women.

In Kenya, approximately two-thirds of women whose husbands attended at least one ANC visit delivered with an SBA compared with less than half (43%) of women whose husbands did not attend (Mangeni et al. 2012). Similarly, in Uttar Pradesh, West Bengal, and Maharashtra, India, pregnant women who reported having their husbands present at ANC visits had 1.4 times greater odds of delivering in a health facility compared with women whose husbands did not attend ANC visits (Chattopadhyay 2012). Another study conducted in Nepal found that having husbands present during childbirth was positively associated with the extent to which women felt in control of their labor, which positively impacts a new mother's emotional well-being (Sapkota et al. 2012).

Education received during men's attendance during ANC visits was also shown to improve maternal outcomes. In India, for example, after men and women received facility-based education, whether individually or as a couple during ANC visits, significantly fewer complications were reported during pregnancy or postpartum (23% for the intervention compared with 38% for the control group) (Varkey et al. 2004). In Nepal, pregnant women who received maternal and neonatal education with their husbands at ANC visits were more likely to attend postpartum visits compared with women who received education without their husbands present or who received no education, and had twice the odds of reporting more than three birth preparations compared with women who received education without their husbands being present (Mullany, Becker, and Hindin 2006).

Several studies have also examined decision-making in relation to family planning outcomes. A study conducted in Mozambique found that couples who made joint decisions concerning their health had greater intention to use contraceptives compared with couples where only the husband made the health decisions (Mboane and Bhatta 2015). A study in Pakistan found that joint decision-making for couples (based on 13 questions regarding various aspects of decision-making) was a stronger determinant of contraceptive use compared with women making the decisions on their own. The study also found that educated men were more likely to make joint decisions with their wives about contraceptive use (65%) compared with illiterate men (55%) (Hameed et al. 2014). An RCT in Rwanda found that participation in a gender-transformative couples intervention increased the likelihood of reporting modern contraceptive use; this association was hypothesized to be due to the intervention's ability not only to provide information about contraceptives but also to strengthen couple communication, support, and joint decision-making (Doyle et al. 2018).

This report examines men's knowledge, attitudes, and behaviors toward various aspects of their partners' and children's health, based on men's responses to questions asked in DHS surveys. We linked these data with DHS data on reproductive, maternal, and child health outcomes to learn if there is a significant association. The descriptions of the variables used to measure male involvement are summarized in section

2.3. These variables arise from the only questions available in the DHS surveys that ask men directly about the topics not related to their own health, but rather related to the health of their partners and/or children. The outcomes related to the men's partners and children are described in section 2.2. The hypothesis is that a high level of knowledge, nondiscriminatory and positive attitudes, and positive behaviors among men would be associated with improved health outcomes for their partners and children, controlling for other factors.

2 DATA AND METHODS

2.1 Data

The analysis uses data from the most recent DHS survey in 33 countries, as shown in Table 1. The selection of countries was based on the availability of data on men's involvement. Countries that included all of the DHS survey questions on men's involvement, as described in section 2.3, and that had a recent DHS survey (from 2009 to 2016), were selected. Some countries with the DHS Men's Questionnaire did not include all of the questions shown in section 2.3 and therefore were not included in this analysis.

Table 1 Sample sizes and number of women and men interviewed in the surveys used in the analysis

Country	Survey year	Households interviewed	Women age 15-49 interviewed	Men interviewed
Afghanistan	2015	24,395	29,461	10,760 ^a
Armenia	2015-16	7,893	6,116	2,755 ^a
Angola	2015-16	16,109	14,379	5,684 ^b
Burkina Faso	2010	14,424	17,087	7,307 ^c
Benin	2011-12	17,422	16,599	5,180 ^d
Burundi	2010	8,596	9,389	4,280 ^c
Chad	2014-15	17,233	17,719	5,248 ^c
Comoros	2012	4,482	5,329	2,167 ^c
Congo Democratic Republic	2013-14	18,171	18,827	8,656 ^c
Côte d'Ivoire	2011-12	9,686	10,060	5,135 ^c
Ethiopia	2016	16,650	15,683	12,688 ^c
Gambia	2013	6,217	10,233	3,821 ^c
Ghana	2014	11,835	9,396	4,388 ^c
Kenya	2014	17,409	14,741	12,819 ^b
Kyrgyz Republic	2012	8,040	8,208	2,413 ^a
Lesotho	2014	9,402	6,621	2,931 ^c
Liberia	2013	9,333	9,239	4,118 ^a
Malawi	2015-16	26,361	24,562	7,478 ^b
Mali	2012-13	10,105	10,424	3,816 ^a
Mozambique	2011	13,919	13,745	4,035 ^d
Myanmar	2015-16	12,500	12,885	4,737 ^a
Namibia	2013	9,849	9,176	4,481 ^d
Nepal	2016	11,040	12,862	4,063 ^a
Nigeria	2013	38,522	38,948	17,359 ^a
Rwanda	2014-15	12,699	13,497	6,217 ^c
Senegal	2016	4,437	8,865	3,527 ^c
Sierra Leone	2013	12,629	16,658	7,262 ^a
Tanzania	2015-16	12,563	13,266	3,514 ^a
Timor-Leste	2009-10	11,463	13,137	4,076 ^a
Togo	2013-14	9,549	9,480	4,476 ^c
Uganda	2016	19,588	18,506	5,336 ^b
Zambia	2013-14	15,920	16,411	14,773 ^c
Zimbabwe	2015	10,534	9,955	8,396 ^b

Note: Ages of men interviewed: a - age 15-49; b - age 15-54; c - age 15-59; d - age 15-64

2.2 Outcome Variables

Six outcomes that cover indicators in family planning, delivery care, and child health were used in the analysis. The operational definitions of these outcomes are described below.

Unmet need for family planning

Among women age 15-49 currently in a union, the proportion who have an unmet need for family planning. This combines unmet need for spacing and for limiting.

This variable was coded as a binary variable, with 1 for women who had an unmet need and 0 if they did not (i.e., the variable is coded as a negative outcome). All other outcomes were coded as binary variables in the positive direction, i.e., a code of 1 indicated they had the positive outcome described in the definitions below. For this outcome, it is hypothesized that high level of knowledge, non-discriminatory and positive attitudes, and positive behaviors in men would be associated with lower likelihood of unmet need for family planning for the men's partners. For all other outcomes we expect the men's involvement variables to be associated with greater likelihood of the outcome.

Contraceptive prevalence rate for modern methods (mCPR)

Among women age 15-49 currently in a union, the proportion who are using a modern contraceptive method. Modern contraceptive methods include pills, IUD, injections, implants, diaphragm, female and male condoms, female and male sterilization, foam or jelly, and the lactational amenorrhea method (LAM). The mCPR may also include other modern contraceptive methods that are country-specific or less common but were reported by the respondent and identified in the datasets as modern methods.

Four or more visits for antenatal care (ANC)

Among women age 15-49 who had a birth in the past two years, the proportion who had at least four ANC visits for the most recent birth.

First ANC visit before four months of pregnancy

Among women age 15-49 who had a birth in the past two years, the proportion who had their first ANC visit for their most recent birth before four months of pregnancy.

Delivery in a health facility

Among women age 15-49 who had a birth in the past two years, the proportion whose most recent birth was delivered in a health facility. This indicator distinguishes between home deliveries and facility deliveries. Health facilities could be government, private, or another type of facility, such as a polyclinic or dispensary.

Completing three doses of DPT vaccine (DPT3)

The proportion of children age 12-23 months who have received all three doses of the DPT vaccine. The DPT3 immunization is selected for the indicator because children who receive this vaccine generally have received all of the other recommended immunizations.

Treatment for diarrhea

The proportion of children under age 2 who had diarrhea in the two weeks before the survey and for whom advice or treatment was sought from a health facility or provider. In the DHS final reports, this indicator is

reported for children under age 5. For this report, this was changed to children under age 2 to correspond to the variable on knowledge of diarrhea that was only asked for men who had children under age 2.

For the two child health outcomes of DPT3 and treatment for diarrhea, the indicators were computed for the youngest living child age 2 or younger. This was due to the restriction of the men's involvement questions to children age 2 or younger in the Men's Questionnaire of the DHS survey.

2.3 Independent Variables

The main independent variables of interest are derived from questions in the DHS Men's Questionnaire that ask about the respondent's involvement in different aspects of their partner's or children's health. These questions can be grouped into three domains: men's knowledge, men's attitude, and men's behavior. These variables were coded in the positive direction, i.e., correct knowledge, positive attitudes, and positive behaviors. The study's outcomes are for women and children according to the independent variables related to men's knowledge, attitudes, and behaviors.

Knowledge:

Correct knowledge of fertile period: The proportion of men who have correct knowledge of a woman's fertile period. To have correct knowledge, the respondent should give the answer of halfway between two periods. The other options for this question are: just before her period begins, during her period, right after her period has ended, other, and don't know.

Correct knowledge of fluid intake for child with diarrhea: The proportion of men who have a child under age 2 and who responded in the DHS survey that a child should be given more to drink than usual when they have diarrhea.

Attitude:

Two indicators were used to measure men's attitudes, both related to contraception. These indicators are derived from a survey question that asks men if they agree with the following statements:

1. Contraception is a woman's business and a man should not have to worry about it.
2. Women who use contraception may become promiscuous.

The two indicators were coded in the positive direction for involvement in women's health—that is, men who do not agree with each of these statements.

Behavior:

Present during ANC visit: Among men with a partner who attended an ANC visit for their most recent child under age 2, the proportion present during the ANC visit.

Discussed family planning with health care worker: The proportion of men who stated in the DHS survey that they discussed family planning with a health worker in the last few months. This is considered as a behavior variable, not a knowledge variable, because it measures the act of discussing with the health worker and not the man's level of knowledge.

Joint decision on how to spend men's earnings: The proportion of men who responded that the decision on how to use the money they earned is a joint decision between them and their wife. The DHS survey also contains a question asked of both women and men on who decides on the respondent's own health care. However, the responses from the wife on who decides on her own health care reflects her perception, not necessarily that of her husband, and thus might not be consistent with the other variables examined in the analysis, which are based on men's responses about their knowledge, attitudes, and behaviors. Therefore this was not included in the analysis.

Control variables

The control variables used in the regression include men's age (continuous variable), men's education (none and primary, secondary and above), place of residence (urban or rural), and wealth quintile (lowest, second, middle, fourth, highest). Men's age was grouped as 15-49, 15-54, or 15-59 depending on the survey (see Table 1). The wife's age was highly correlated with her husband's age, and the wife's education level was highly correlated with her husband's education level. Therefore, these characteristics of the women could not be included in the regression models.

2.4 Analysis

Men and women interviewed in the DHS survey were required to declare each other as partners to be included in this analysis. For men who had multiple wives, one wife was randomly selected to avoid bias in the models. The unit of analysis is therefore the women.

Adjusted logistic regressions were fit for each outcome and its corresponding main independent variable of interest as follows. All the models were adjusted for the control variables listed above.

Unmet need for family planning and modern contraceptive prevalence (mCPR)

Five separate logistic regression models were fit for these two outcomes. A separate model was fit that included the independent variables of: 1. correct knowledge of fertile period; 2. does not agree that contraception is only a woman's business; 3. does not agree that women who use contraceptives are promiscuous; 4. discussed family planning with a health worker; and 5. made joint decision with their partner on how to spend their earnings.

Four or more ANC visits, first ANC visit before four months of pregnancy, and delivery in health facility

Two separate logistic regression models were fit for these outcomes. A separate model was fit to include the independent variables of: 1. being present during ANC visit; and 2. made joint decision on how to spend earnings.

DPT3 vaccination

Only one logistic regression model was fit for this outcome. This model included the independent variable of joint decision on how to spend earnings. There were no questions that asked men about their knowledge, attitude, or behavior toward the vaccination of their children.

Treatment of diarrhea

Two separate logistic regression models were fit for this outcome. A separate model was fit to include the independent variables of: 1. knowing that more fluids should be given to a child with diarrhea; and 2. made joint decision on how to spend earnings.

The logistic regressions accounted for the DHS sampling design and stratification. For some surveys, the denominator for the outcome was based on fewer than 100 observations and, therefore, the regression models were not fit for these surveys. This was mainly the case for the treatment of diarrhea symptoms outcome since this is restricted to children under age 2 who had symptoms of diarrhea in the two weeks before the survey. This restriction reduced the sample size, and for Armenia, Benin, Ghana, the Kyrgyz Republic, Lesotho, Myanmar, Namibia, and Nepal there were fewer than 100 observations. There were also fewer than 100 observations for the DPT vaccine outcome in Lesotho.

The adjusted odds ratios from the regressions are summarized using forest plots with the use of the *metan* macro in Stata 15 (Harris et al. 2008). Stata 15 was used for all the analysis.

3 RESULTS

3.1 Description of Outcomes

The percentage of women using a modern contraceptive method and the level of unmet need for family planning varied across the 33 countries. As Figure 1 shows, the percentage of women age 15-59 currently using a modern contraceptive method ranged from 69% in Zimbabwe to 7% in Chad. In general, there was an inverse relationship between modern contraceptive use and unmet need for family planning; that is, countries with higher prevalence of modern contraceptive use have lower rates of unmet need. As such, Zimbabwe, with the highest level of modern contraceptive use, had the lowest percentage of women with unmet need, at 8%. The highest level of unmet need for family planning was in Angola, at 37%. Unmet need was also 30% or greater in Benin, Burundi, Ghana, Comoros, Liberia, Togo, and Timor-Leste.

Figure 1 Family planning outcomes: percentage of women age 15-49 currently using a modern contraceptive method and percentage with an unmet need for family planning

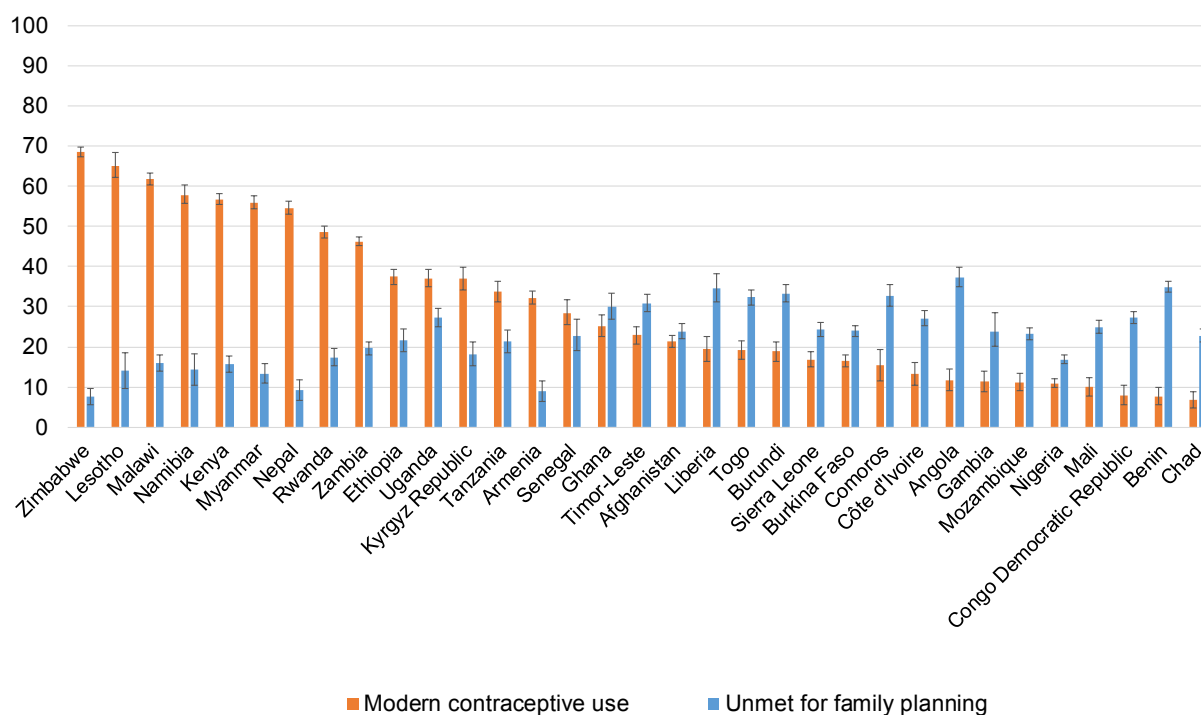
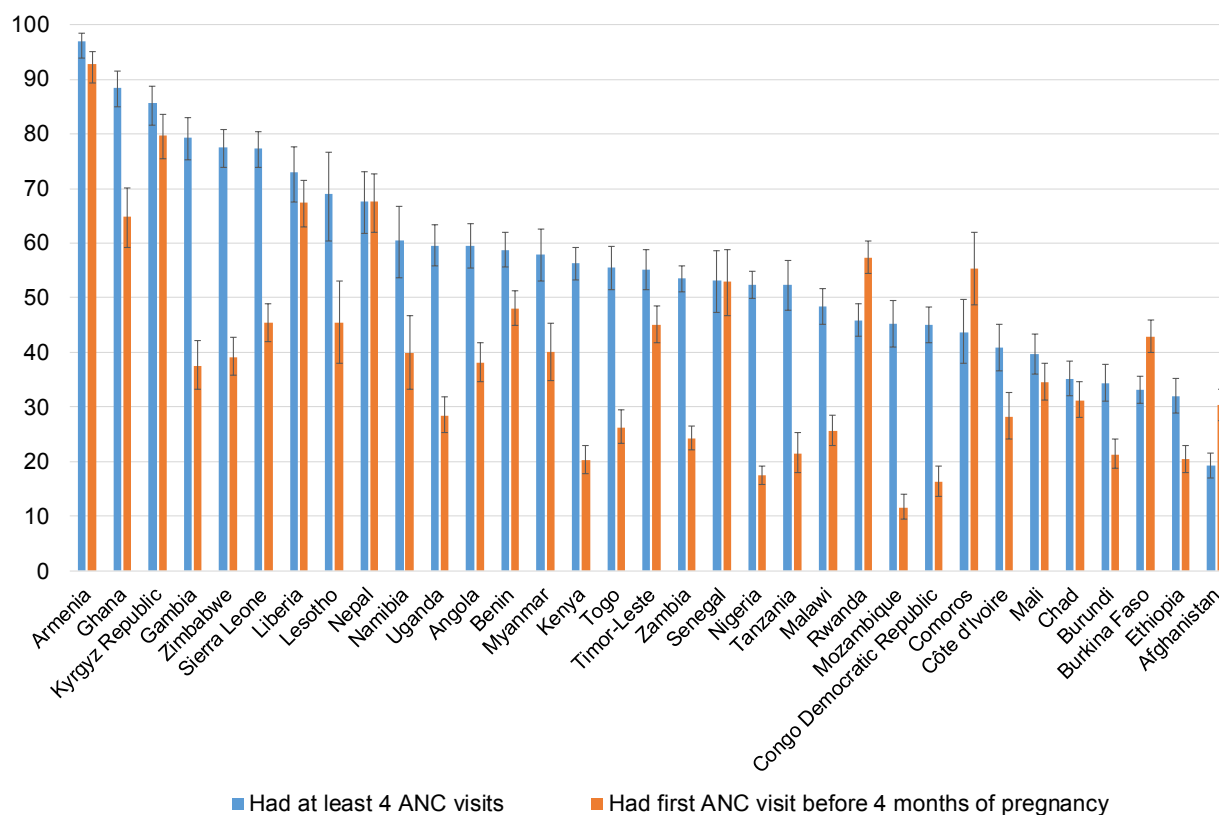


Figure 2 shows that Armenia had the highest percentage of women attending at least four ANC visits and also the highest percentage attending ANC before four months of pregnancy, at 97% and 93% respectively. In both Ghana and the Kyrgyz Republic, over 80% of women attended at least four ANC visits, but in Ghana a lower percentage attended ANC before four months of pregnancy than in the Kyrgyz Republic, at 65% and 80% respectively. Other countries with a high percentage of women attending at least four ANC visits were Gambia, Zimbabwe, Sierra Leone, and Liberia, at 70-80%. In general, more women attended at least four ANC visits than attended an ANC visit before four months of pregnancy, with a few exceptions. In Rwanda, Comoros, Burkina Faso, and Afghanistan, a higher percentage of women attended their first ANC visit before four months than attended at least four ANC visits—with the greatest difference in

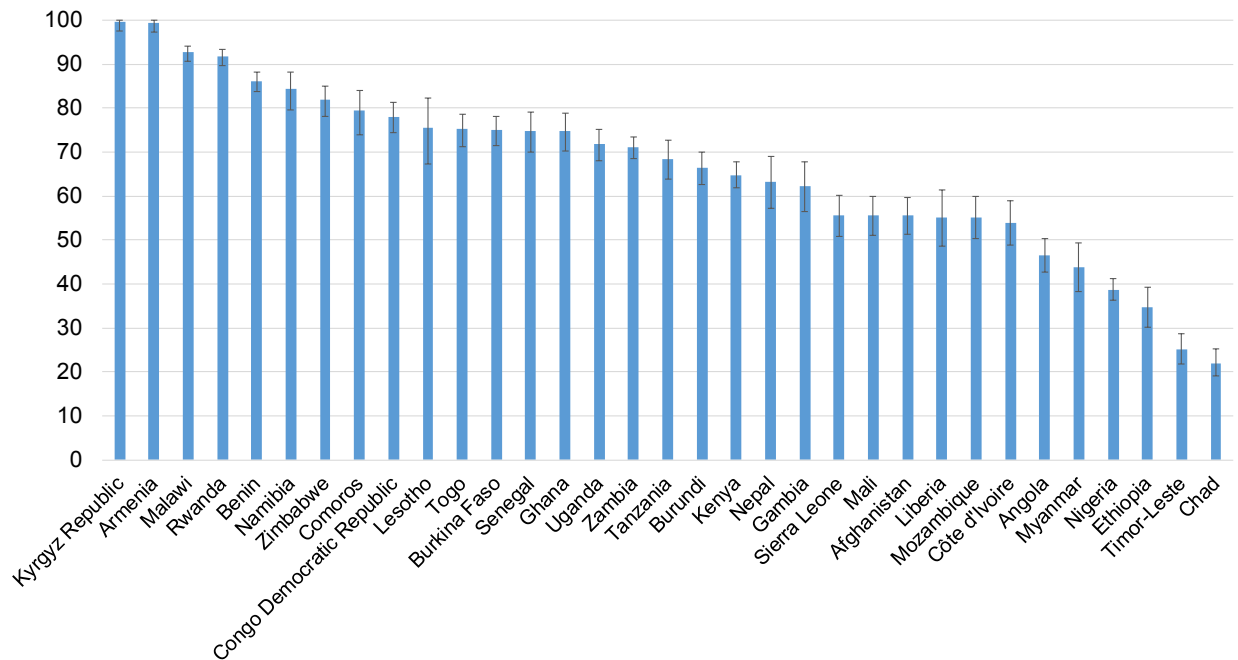
Comoros, where 44% of women attended at least four ANC visits while 55% made their first visit before four months of pregnancy. Countries with the lowest percentages of women attending their first visit before four months of pregnancy were Mozambique, Democratic Republic of Congo, and Nigeria, all below 20%.

Figure 2 Antenatal care (ANC) outcomes: percentage of women age 15-49 who attended at least four ANC visits, and percentage who attended an ANC visit before 4 months of pregnancy for their most recent pregnancy in the last 2 years before the survey



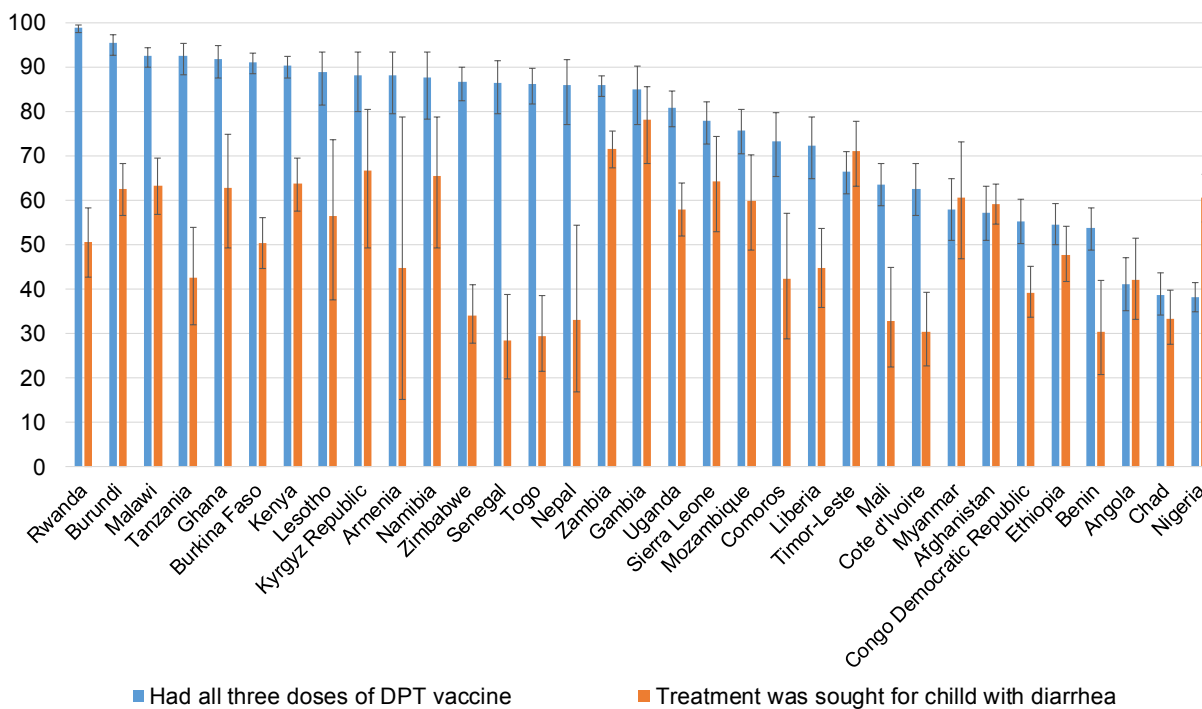
As Figure 3 shows, the percentage of women who delivered in a health facility for their most recent pregnancy was nearly universal in the Kyrgyz Republic and Armenia. Malawi and Rwanda also had high percentages of facility deliveries, at 93% and 92% respectively, and the percentage was over 80% in Benin, Namibia, and Zimbabwe. The lowest percentages of facility deliveries were in Chad (22%) and Timor-Leste (25%). Nigeria and Ethiopia also had low rates, with less than 40% of women delivering in a health facility.

Figure 3 Delivery outcome: percentage of women age 15-49 who delivered in a health facility for their most recent pregnancy in the last 2 years before the survey



Overall, as Figure 4 shows, the percentage of children age 12-23 months receiving all three doses of DPT vaccine was high, at over 90% of children in Burkina Faso, Ghana, Tanzania, Malawi, Burundi, and highest in Rwanda, at 99%. Angola, Chad, and Nigeria had the lowest rates, at about 40%. Treatment seeking for children age 0-23 months with diarrhea symptoms ranged from about 30% in four countries—Senegal (28%), Togo (29%), Côte d'Ivoire (30%), and Benin (30%)—to over 70% in Timor-Leste, Zambia, and Gambia.

Figure 4 Child health outcomes: percentage of children age 12-23 months who received all three doses of DPT vaccine, and the percentage of children under age 2 with diarrhea for whom treatment was sought



Appendix Table 1 provides a summary of these seven indicators as well as the number of observations and confidence intervals.

3.2 Description of Main Independent Variables

Figure 5 summarizes the two independent variables used to represent men’s knowledge: knowledge to give a child more to drink when the child has diarrhea, and correct knowledge of woman’s fertile period. Correct knowledge that a child should drink more when the child has diarrhea was highest in Comoros, at 79% of men, while in Malawi and Nepal knowledge rates were about 70%. Men in Timor-Leste had the lowest levels of correct knowledge concerning proper treatment for diarrhea in children, at 13%, followed by Ghana (29%), Côte d’Ivoire (28%), and Nigeria (27%). Overall, men’s correct knowledge of woman’s fertile period was less than 50% across all countries. The percentages were highest in Comoros and Democratic Republic of Congo, at 47% and 48% respectively. Men in Mozambique and Liberia had the lowest level of correct knowledge of woman’s fertile period, at just 3% each.

Figure 5 Men's knowledge variables

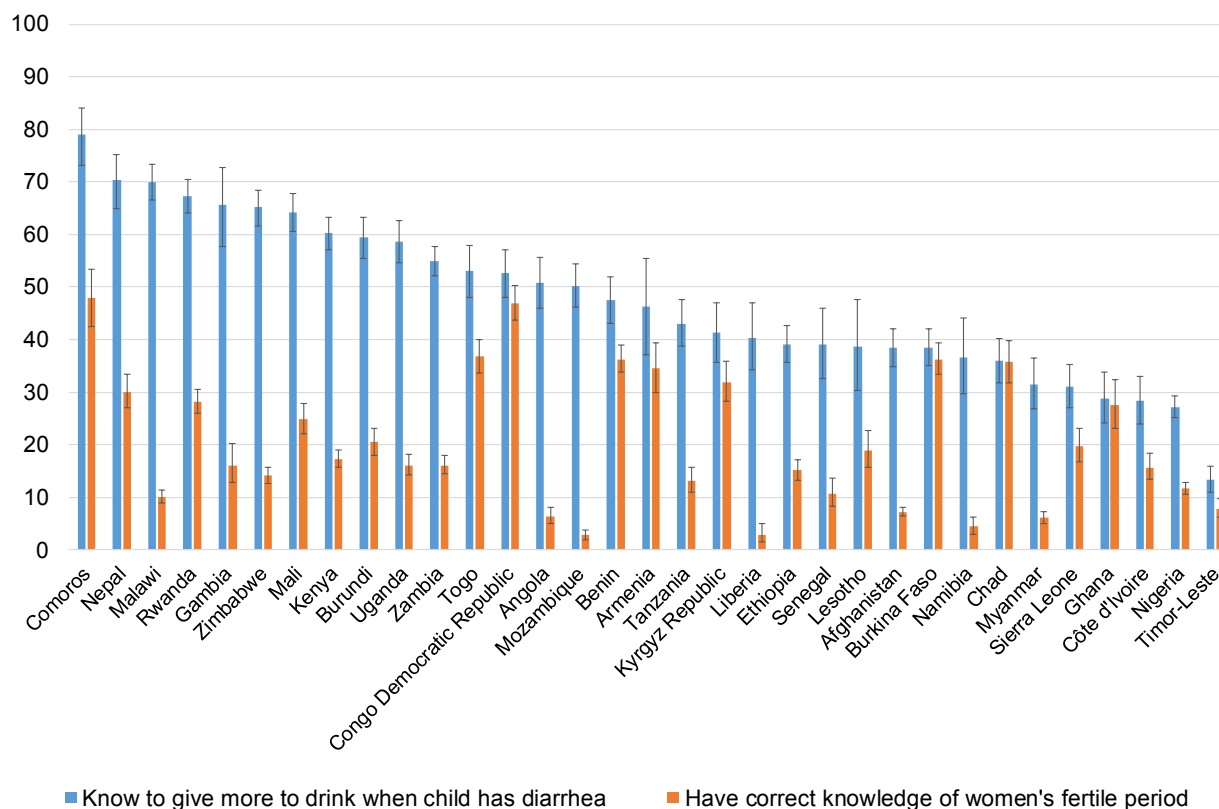
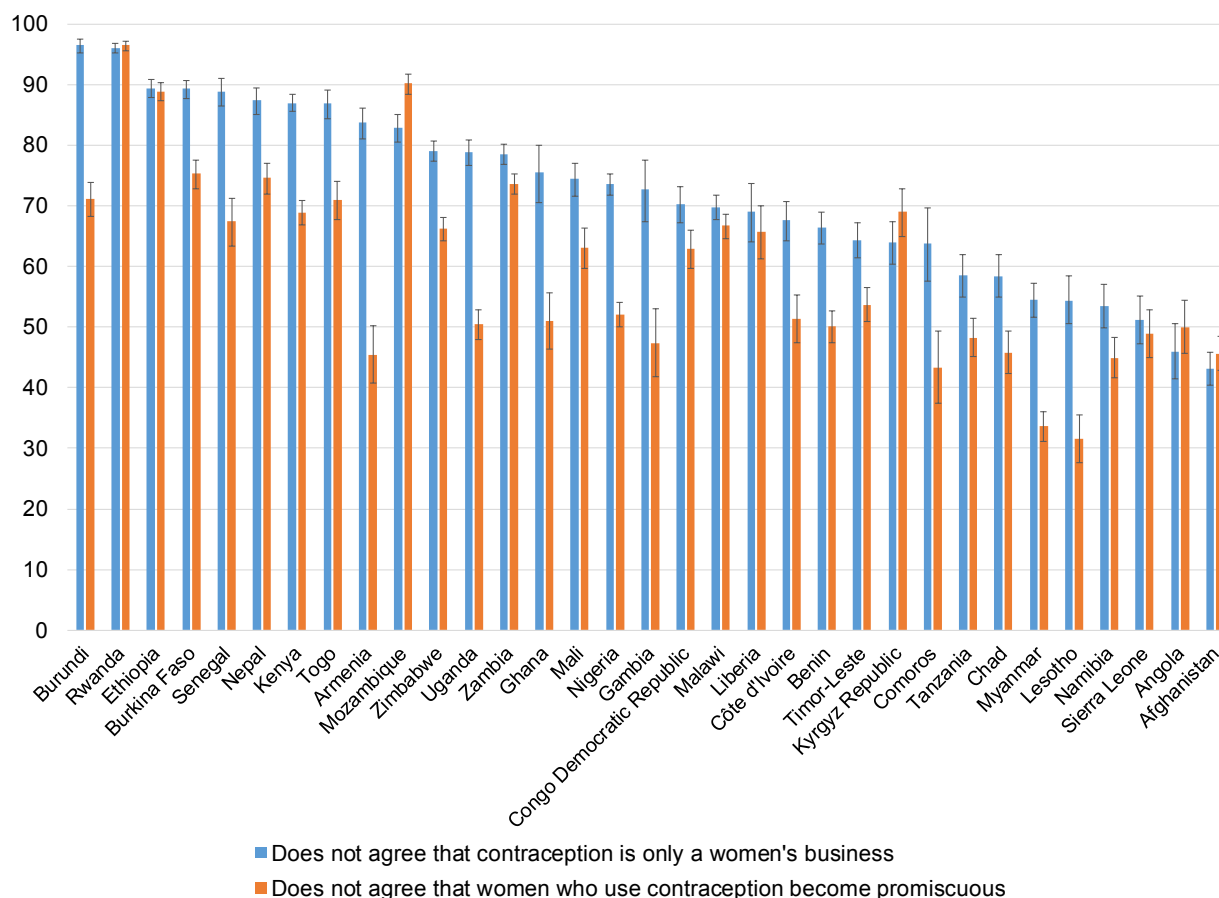


Figure 6 presents the two variables measuring men's attitude. Overall, a higher percentage of men did not agree that contraception was only a woman's business than the percentage of men who did not agree that women who use contraception might become promiscuous. The vast majority of men in Burundi (97%) and Rwanda (96%) did not agree that contraception is only a woman's business. This perception was also high in Ethiopia, Burkina Faso, Senegal, Nepal, Kenya, and Togo, all above 85%, and was lowest in Afghanistan (43%) and Angola (46%). Rwanda, Ethiopia, and Mozambique had the highest percentage of men, all above 85%, who did not agree that women who use contraception might become promiscuous; Lesotho and Myanmar had the lowest percentage, at below 35%. In a few countries—Mozambique, the Kyrgyz Republic, Angola, and Afghanistan—a higher percentage of men did not agree that women who use contraception might become promiscuous than the percentage of men who did not agree that contraception was only a woman's business.

Figure 6 Men's attitude variables



For the behavior variables, which are presented in Figure 7, a larger percentage of men were present during ANC visits than discussed family planning with a health worker in the last few months before the survey. Rwanda had both the highest percentage of men who were present during ANC visits (95%) and the highest percentage of men who discussed family planning with a health worker (49%). Myanmar (78%) and Zambia (71%) also had a high percentage of men who were present during ANC visits, while the lowest percentages were in Senegal (21%) and Burundi (18%). With the exception of Rwanda and Ethiopia, the percentage of men who recently discussed family planning with the health worker was low, at less than 30% across all countries, and lowest in Armenia at only 4%.

Appendix Table 2 provides a summary of the men's involvement variables as well as the number of observations and confidence intervals.

Figure 7 Men's behavior variables on antenatal care and family planning

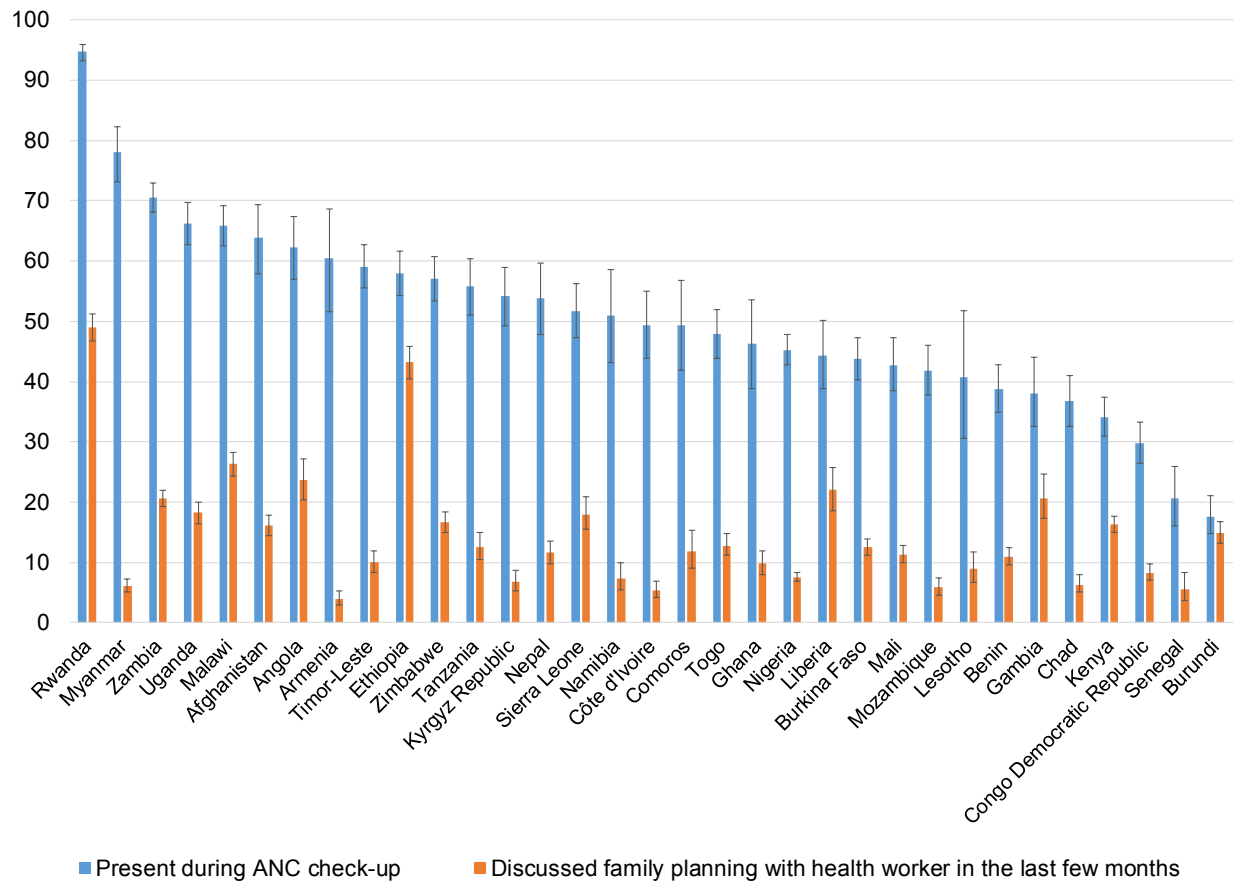
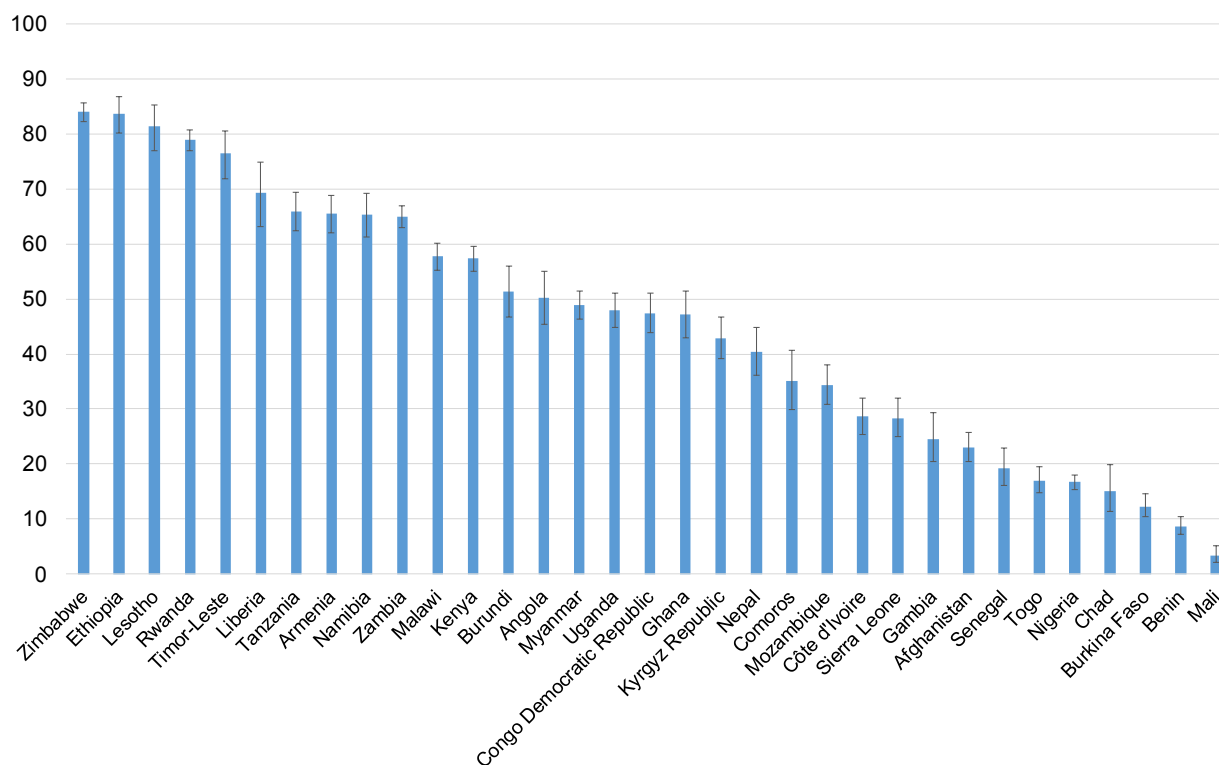


Figure 8 shows the proportion of men who stated that the decision on how to use the money they earned was a joint decision with their wife. The percentage was highest in Zimbabwe, Ethiopia, and Lesotho, all above 80%. Rwanda and Timor-Leste also had a high percentage of men reporting joint decision-making, at 79% and 76% respectively. Very few men in Mali (3%) and Benin (9%) said they made decisions jointly on how to use the money they earned. Senegal, Togo, Nigeria, Chad, and Burkina Faso also had low percentages, all below 20%.

Figure 8 Joint decision on how to spend men’s earnings



3.3 Regression Results

The results from the regression models for each outcome are described below. This is followed by a summary of the results for all the outcomes and countries. Forest plots are used to illustrate the adjusted odds ratios (AOR) for the main independent variables of interest for each outcome. The AORs and their corresponding confidence intervals are also summarized in Appendix Tables 3-9.

3.3.1 Family planning outcomes

Two outcomes related to family planning were examined in association with several men’s involvement variables related to family planning. These were married women age 15-49 with an unmet need for family planning, and women age 15-49 currently using a modern contraceptive method. The men’s involvement variables for these two outcomes covered all selected domains of knowledge, attitudes, and behavior related to family planning.

Unmet need for family planning

In Figure 9, we see the results of the model predicting unmet need for family planning among women according to husband’s knowledge of woman’s fertile period. We would expect to see a lower likelihood of unmet need among women whose partners have correct knowledge of their fertile period. Figure 9 and Appendix Table 3 show that five countries—Angola, Armenia, Benin, Liberia, and Mali—had significant odds ratios for this association. In Angola, Armenia, and Liberia the odds ratios were in the opposite of the expected direction. In these three countries men who had correct knowledge of the woman’s fertile period

had partners with higher likelihood of unmet need compared with men with incorrect knowledge. In Benin and Mali, men who had correct knowledge had partners with lower likelihood of unmet need compared with men with incorrect knowledge.

Figure 9 Forest plot of adjusted odds ratios for unmet need for family planning by men’s knowledge of fertile period

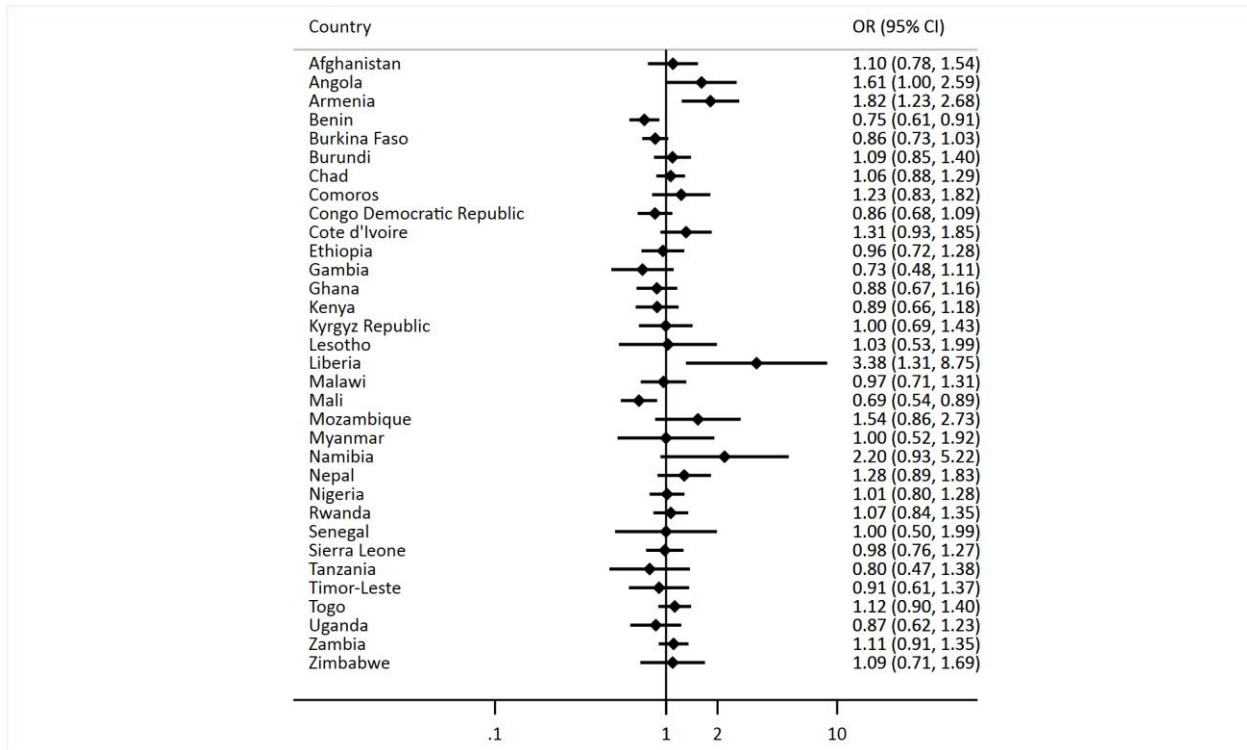
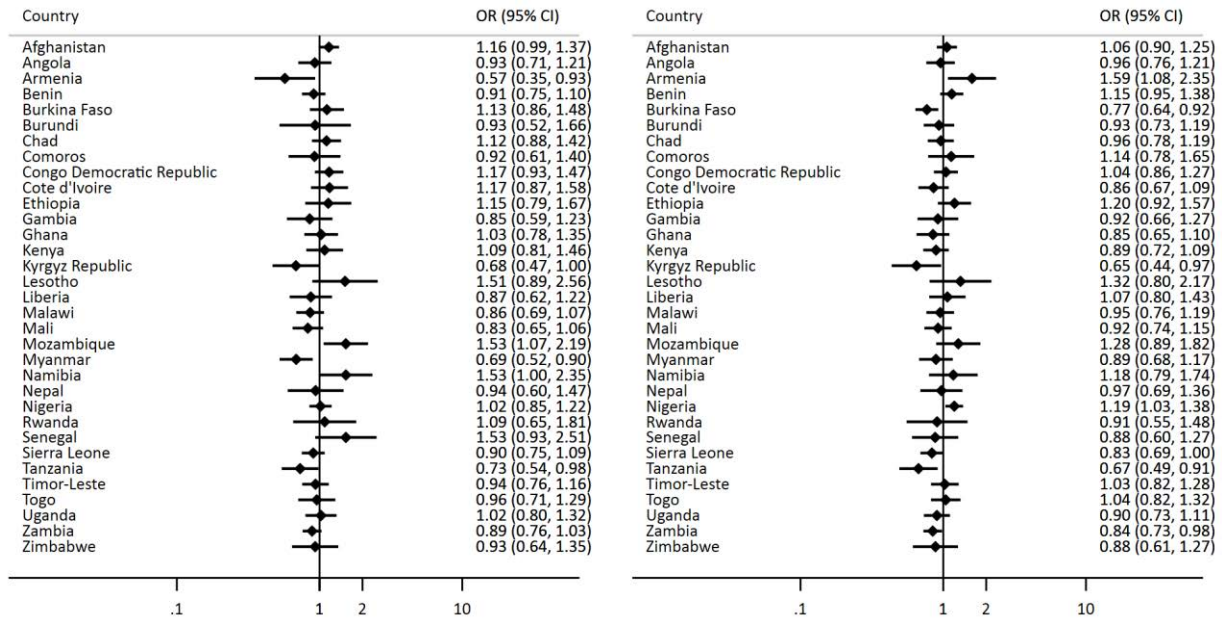


Figure 10 summarizes the adjusted odds ratios for unmet need among women according to men’s attitudes toward women using contraceptive methods. In Armenia, the Kyrgyz Republic, Myanmar, and Tanzania, men who did not agree that contraception was a woman’s business and a man should not have to worry about it had partners with lower likelihood of unmet need compared with men who agreed. For Mozambique the odds ratio was in the opposite of the expected direction. In Burkina Faso, the Kyrgyz Republic, Tanzania, and Zambia, men who did not agree that women who used contraception might become promiscuous had partners with lower likelihood of unmet need compared with men who agreed. For Armenia and Nigeria the odds ratios were in the opposite of the expected direction.

Figure 10 Forest plot of adjusted odds ratios for unmet need for family planning by men’s attitudes toward contraceptive use

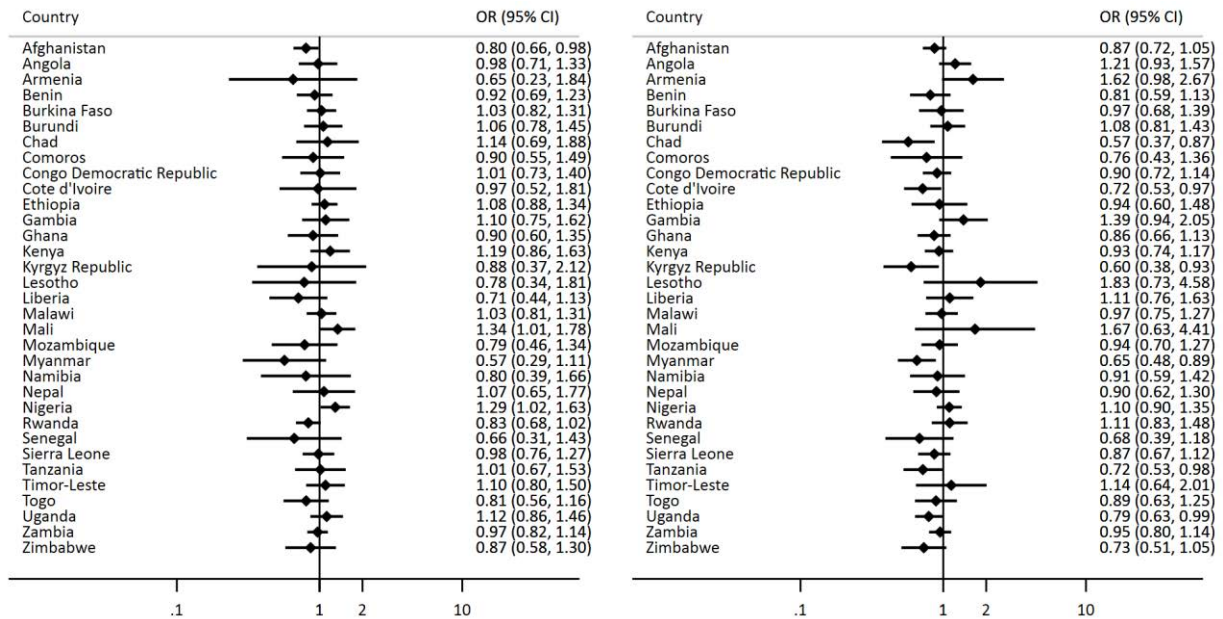


a. Adjusted odds ratios of men who do not agree that contraception is a woman’s business and men should not have to worry about it compared with men who do agree

b. Adjusted odds ratios of men who do not agree that contraception might make a woman promiscuous compared with men who do agree

Figure 11 shows the adjusted odds ratios for women’s unmet need for family planning according to men’s behavior-related variables. For most countries, discussing family planning with a health worker was not a significant predictor of their partners having unmet need. In Afghanistan, we see the expected relationship, with men who discussed family planning with a health worker having partners with lower likelihood of unmet need compared with men who did not discuss. In Mali and Nigeria the significant relationship was in the opposite of the expected direction. Figure 11b shows that in Chad, Côte d’Ivoire, the Kyrgyz Republic, Myanmar, Tanzania, and Uganda, men who made joint decisions on how to spend their earnings had partners with lower likelihood of unmet need compared with men who did not make joint decisions.

Figure 11 Forest plot of adjusted odds ratios for unmet need for family planning by men's behaviors



a. Adjusted odds ratios of men who discussed family planning with a health worker compared with men who did not

b. Adjusted odds ratios of men who make joint decisions with their partner on how to spend their earnings compared with men who do not

Modern contraceptive use

Figure 12 shows that only in Sierra Leone did men with correct knowledge of woman's fertile period have partners with significantly higher odds of modern contraceptive use compared with men who had incorrect knowledge. The odds ratio was also significant for Namibia, but in the opposite of the expected direction.

Figure 12 Forest plot of adjusted odds ratios for modern contraceptive use by men’s knowledge of the fertile period

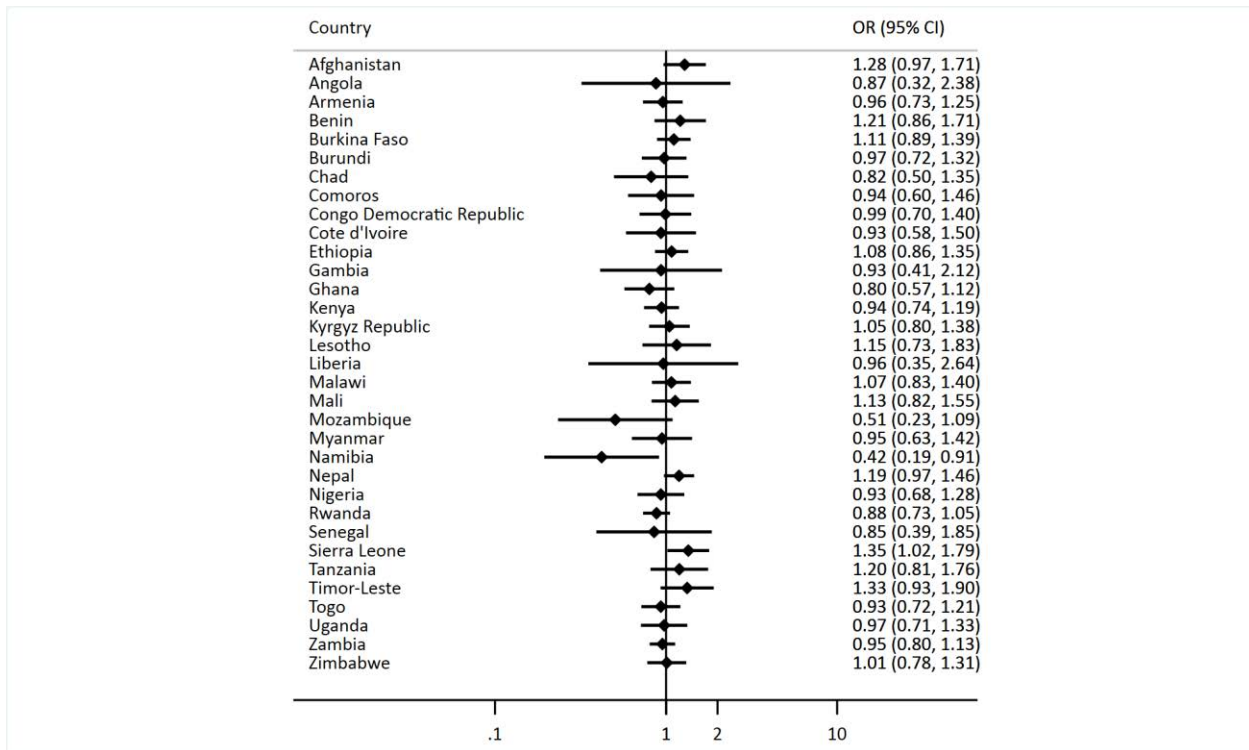
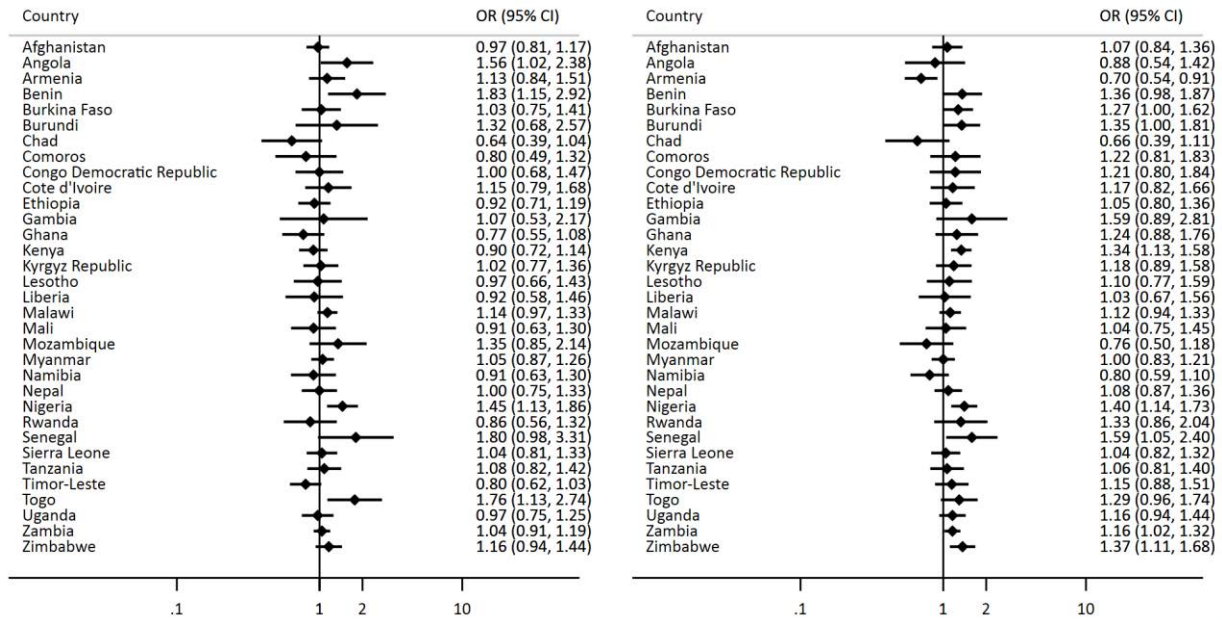


Figure 13 shows the adjusted odds ratios for women’s modern contraceptive use according to men’s attitudes toward women using contraceptive methods. In Figure 13a we see that in Angola, Benin, Nigeria, and Togo, men who did not agree that contraceptive use was only women’s business had partners with a greater likelihood of modern contraceptive use compared with men who agreed. Figure 13b shows that in seven countries—Burkina Faso, Burundi, Kenya, Nigeria, Senegal, Zambia, and Zimbabwe—men who did not agree that women who used contraception might become promiscuous had partners with greater likelihood of modern contraceptive use compared with men who agreed. For Armenia, the odds ratio was in the opposite of the expected direction, as was also found for the unmet need outcome.

Figure 13 Forest plot of adjusted odds ratios for modern contraceptive use by men's attitudes toward contraceptive use



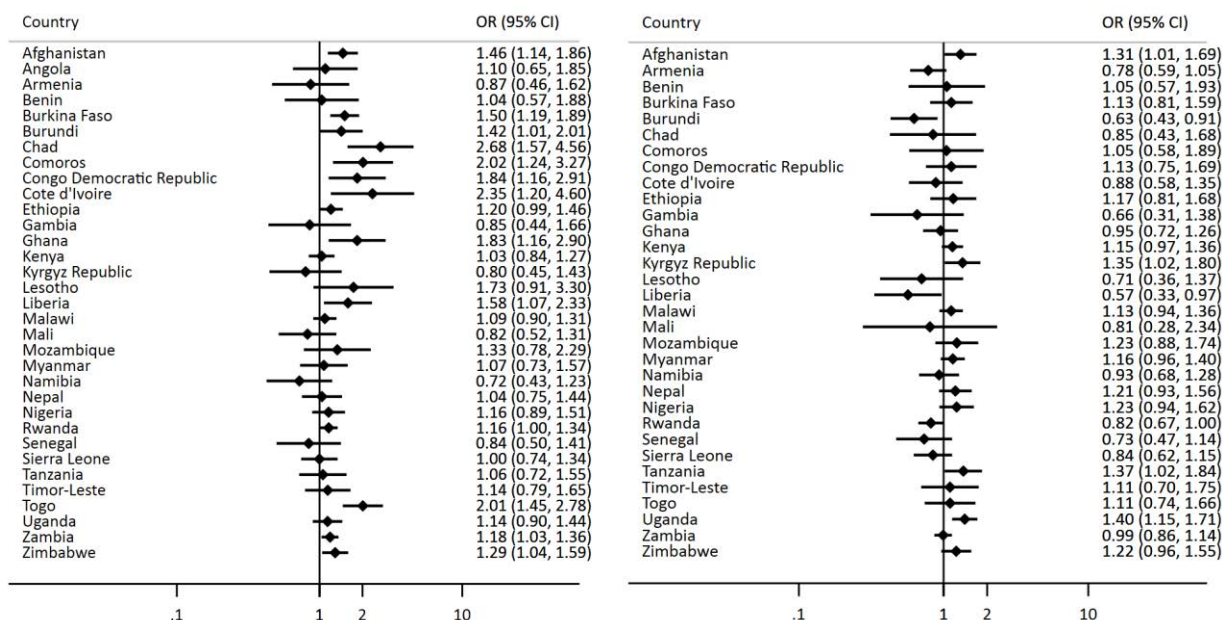
a. Adjusted odds ratios of men who do not agree that contraception is a woman's business and a man should not have to worry about it compared with men who agree

b. Adjusted odds ratios of men who do not agree that contraception may make a woman promiscuous compared with men who agree

Figure 14 shows the adjusted odds ratios for women's modern contraceptive use according to men's behaviors. In Figure 14a we see that in 13 countries men who recently discussed family planning with a health worker were significantly more likely to have partners using a modern contraceptive method compared with men who did not discuss. These countries were Afghanistan, Burkina Faso, Burundi, Chad, Comoros, Democratic Republic of Congo, Côte d'Ivoire, Ghana, Liberia, Rwanda, Togo, Zambia, and Zimbabwe. No countries were significant in the opposite of the expected direction. In addition, for Afghanistan, the odds ratio for men's family planning discussion behavior was significant and in the expected direction for both the unmet need and the modern contraceptive use outcomes.

Figure 14b shows that in Afghanistan, the Kyrgyz Republic, Tanzania, and Uganda, men who made joint decisions with their partners on how to spend their earnings had partners who were more likely to use a modern contraceptive method compared with men who did not make the decision jointly. In Burundi, Liberia, and Rwanda, the odds were also significant but not in the expected direction.

Figure 14 Forest plot of adjusted odds ratios for modern contraceptive use by men’s behaviors



a. Adjusted odds ratios of men who recently discussed family planning with a health worker compared with men who did not

b. Adjusted odds ratios of men who make joint decisions with their partners on how to spend their earnings compared with men who do not

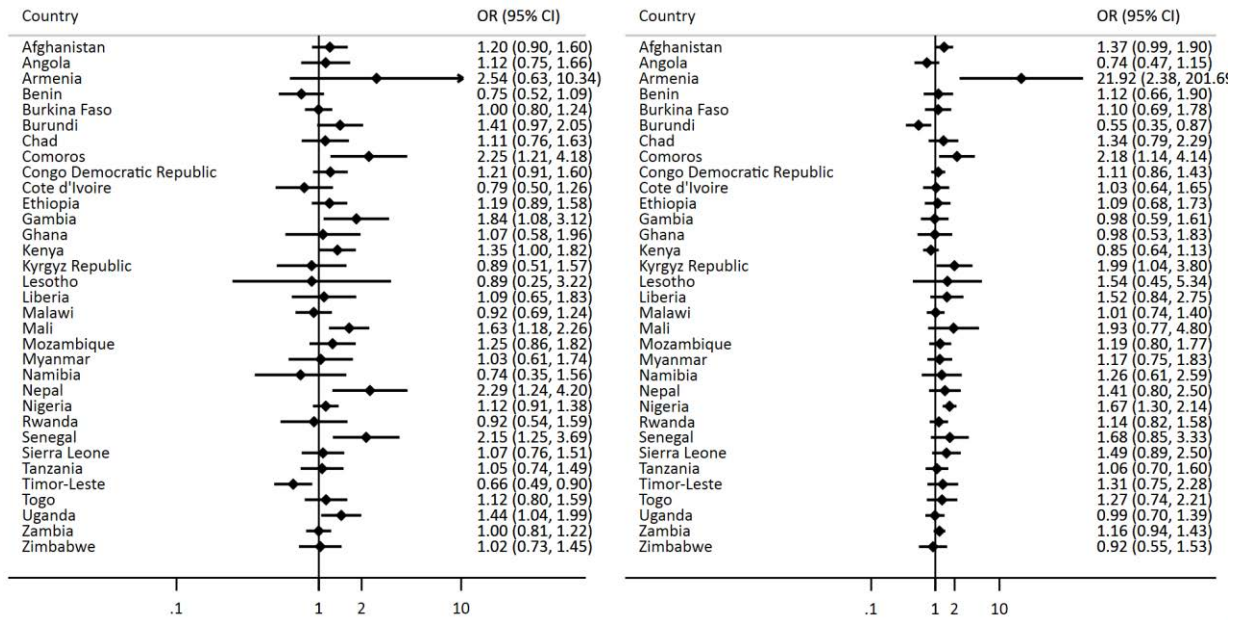
3.3.2 ANC and delivery outcomes

Two outcomes related to ANC visits and one outcome related to delivery in a health facility were examined in association with several men’s involvement variables. The ANC outcomes were women age 15–49 who attended at least four ANC visits for their most recent birth in the last two years before the survey, and women age 15–49 who went for their first ANC visit for their most recent pregnancy before four months of pregnancy. The facility delivery outcome was women age 15–49 who delivered their most recent birth in a health facility. The men’s involvement variables only covered the behaviors of being present during ANC visits and of making a joint decision on how to spend their earnings. There were no knowledge or attitude variables related to ANC visits or facility delivery.

At least four ANC visits

Figure 15a shows that in seven countries—Comoros, Gambia, Kenya, Mali, Nepal, Senegal, and Uganda—men who were present during an ANC visit had partners with significantly higher odds of attending at least four ANC visits compared with men who were not present. In Timor-Leste, however, the odds were significant in the opposite of the expected direction, which indicates that men who were present during ANC had partners with lower odds of having at least four ANC visits compared with men who were not present. Figure 15b shows that in Armenia, Comoros, the Kyrgyz Republic, and Nigeria, men’s partners had greater odds of attending at least four ANC visits if the men made a joint decision on how to spend their earnings compared with men who did not make a joint decision. In Burundi the odds were in the opposite of the expected direction.

Figure 15 Forest plot of adjusted odds ratios for women attending at least four antenatal care visits by men's behaviors



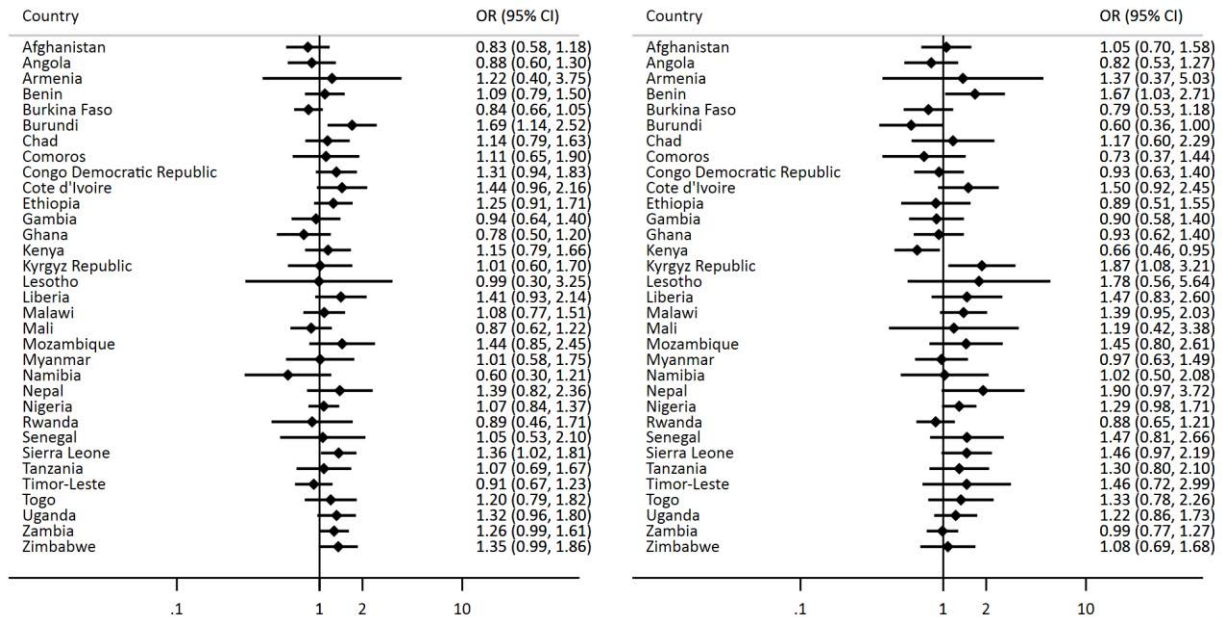
a. Adjusted odds ratios of men who were present at an ANC visit compared with men who were not

b. Adjusted odds ratios of men who make joint decisions with their partners on how to spend their earnings compared with men who do not

ANC visit before four months of pregnancy

As Figure 16a shows, men in Burundi and Sierra Leone had partners with significantly higher odds of attending an ANC visit before four months of pregnancy if they were present during an ANC visit compared with not being present. Figure 16b shows that men in Benin and the Kyrgyz Republic had partners with higher odds of attending an ANC visit before four months of pregnancy if they made a joint decision on how to spend their earnings compared with not making a joint decision. For Burundi and Kenya, the odds were in the opposite of the expected direction, with lower odds of the outcome.

Figure 16 Forest plot of adjusted odds ratios for women attending the first antenatal care visit before 4 months of pregnancy by men's behaviors



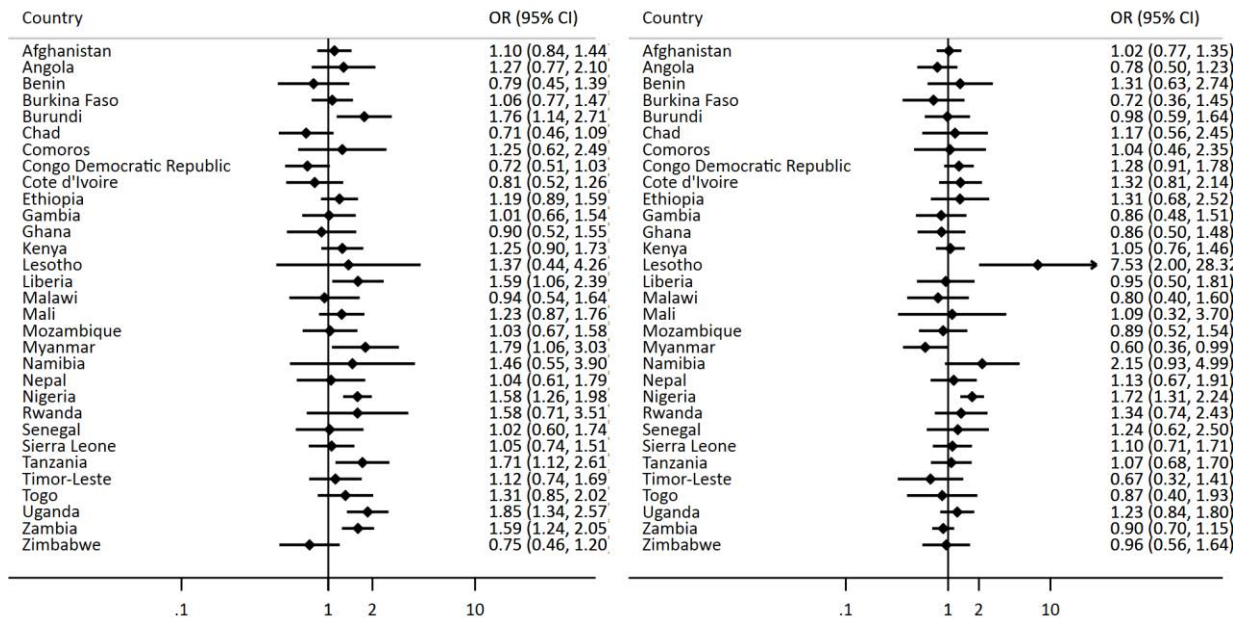
a. Adjusted odds ratios of men who were present during an ANC visit compared with men who were not

b. Adjusted odds ratios of men who make joint decisions with their partners on how to spend their earnings compared with men who do not

Delivery in a health facility

Figure 17a shows that in seven countries —Burundi, Liberia, Myanmar, Nigeria, Tanzania, Uganda, and Zambia—men had partners with significantly higher odds of delivering in a health facility if they were present during an ANC visit compared with not being present. Figure 17b shows that only men in Lesotho and Nigeria had partners with higher odds of facility delivery if they made a joint decision on how to spend their earnings compared with not making a joint decision. For Myanmar the odds were lower, and in the opposite of the expected direction.

Figure 17 Forest plot of adjusted odds ratios for delivery in a health facility by men's behaviors



a. Adjusted odds ratios of men who were present during an ANC visit compared with men who were not

b. Adjusted odds ratios of men who make joint decisions with their partners on how to spend their earnings compared with men who do not

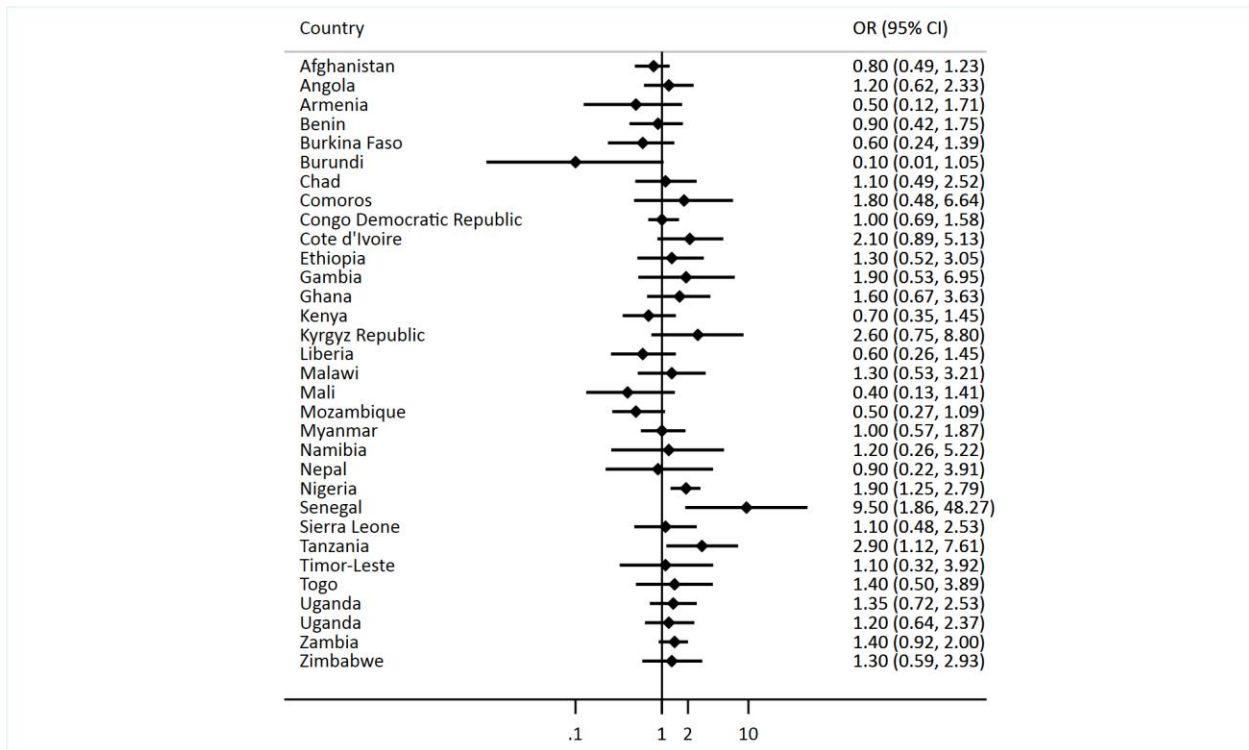
3.3.3 Child health outcomes

Two child health outcomes were examined in association with men's involvement variables. These were the most recent child age 12-23 months receiving all three doses of DPT vaccine (DPT3), and treatment sought from a health provider or health facility for the most recent child under age 2 with diarrhea. The DPT3 outcome did not have any corresponding variable related to men's knowledge, attitudes, or behavior. For this outcome, only joint decision-making on earnings was examined. For treatment of diarrhea, an additional variable was examined for men's correct knowledge of amount of fluid to give to a child with diarrhea. Estimates could not be produced for some surveys due to low counts or missing data, and this was the case for more surveys for the treatment of diarrhea outcome than for the DPT3 outcome, as shown in Appendix Tables 8 and 9.

DPT3 vaccination

Figure 18 shows the adjusted odds ratios for the most recent child completing three doses of DPT vaccine according to whether their fathers make joint decisions on their earnings. In Nigeria, Senegal, and Tanzania, the odds of complete DPT vaccination were higher for children of men who made joint decisions on earnings compared with men who did not. For all other surveys the adjusted odds ratios were not significant.

Figure 18 Forest plot of adjusted odds ratios for most recent child completing three doses of DPT vaccine by men’s behavior of making joint decisions on earnings



Treatment for diarrhea

Figure 19 summarizes the adjusted odds ratios for the most recent child under age 2 receiving treatment for diarrhea by men’s knowledge to give more fluids when a child has diarrhea. Afghanistan, Democratic Republic of Congo, and Togo had significant odds ratios in the expected direction—that is, men who knew to give a child more fluids when they have diarrhea had children with higher odds of having treatment sought for them compared with men with incorrect knowledge. Nigeria also had a significant odds ratio but it was not in the expected direction.

Figure 19 Forest plot of adjusted odds ratios for most recent child receiving treatment of diarrhea by men's knowledge to give more fluids when the child has diarrhea

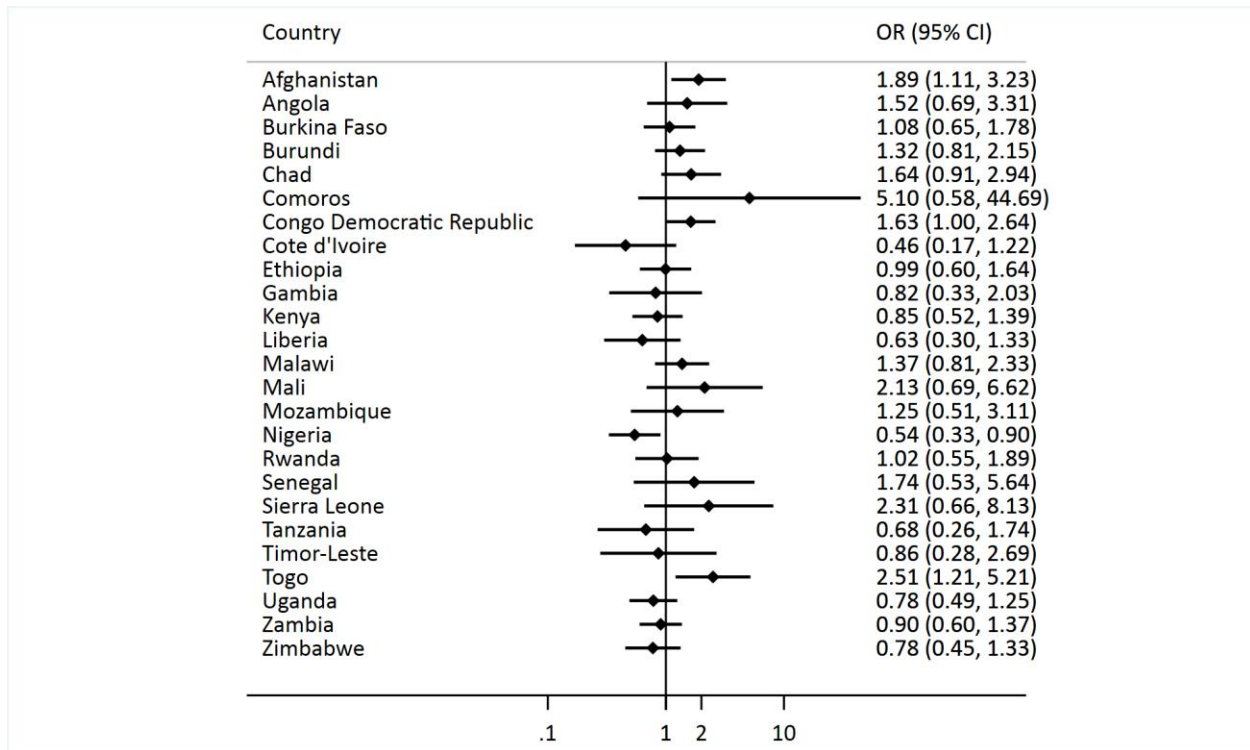
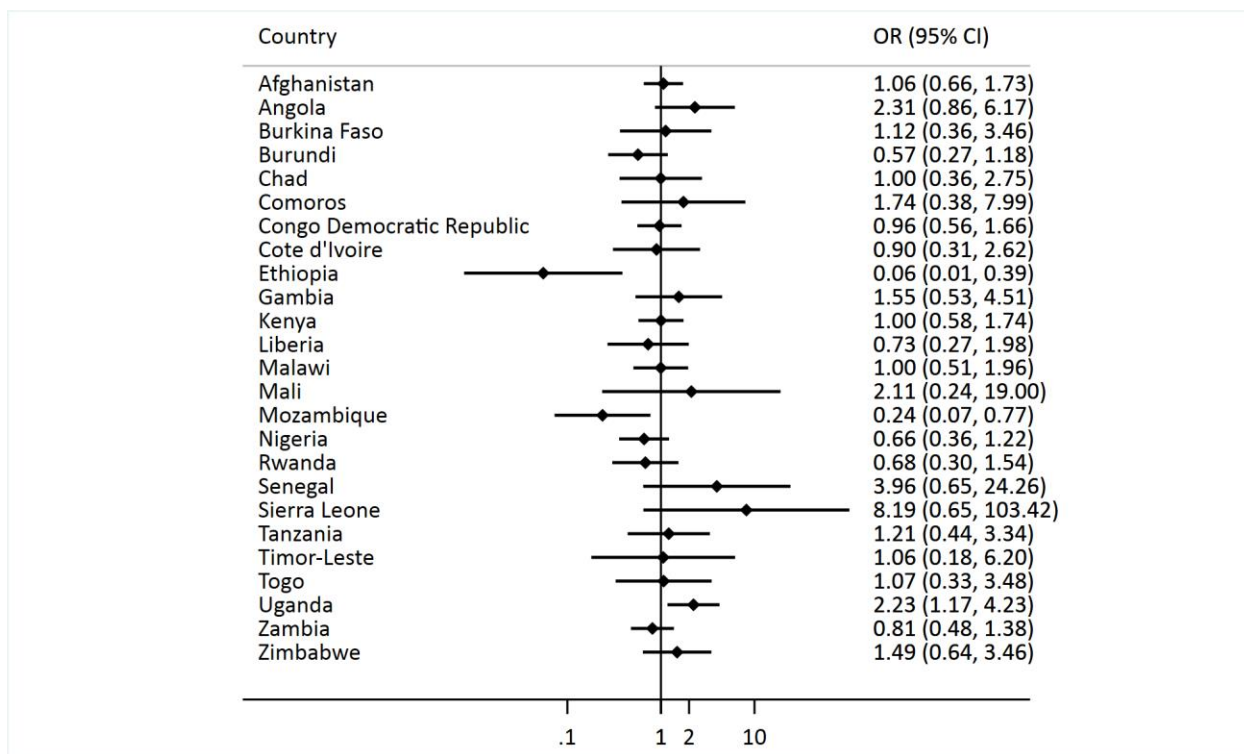


Figure 20 shows that only men in Uganda who made joint decisions on how to spend their earnings had children with higher odds of treatment for diarrhea compared with men who did not make joint decisions. The odds ratios were also significant in Ethiopia and Mozambique, but not in the expected direction.

Figure 20 Forest plot of adjusted odds ratios for treatment of diarrhea in children by men’s behavior of making joint decisions on earnings



3.3.4 Summary

Figure 21 presents a summary of the results from the forest plots in Figures 9-20. The figure shows which countries were significant for each outcome and independent variable in the analysis. The countries in green indicate that the odds ratio was in the expected direction, while the countries in red indicate that the odds were in the opposite of the expected direction. It is difficult to assess these findings across all the outcomes since only the outcomes related to family planning had male involvement variables that covered all selected domains of knowledge, attitude, and behavior. Only the variable on joint decision-making on men’s earnings cut across all outcomes.

When we compare the two family planning outcomes, we see that modern contraceptive use had more significant findings and in the expected direction than was the case for unmet need for family planning. The summary also shows that the behavior of men discussing family planning with a health worker in the last few months is a significant predictor of modern contraceptive use in the most countries compared with any other involvement variable and outcome. For the two men’s attitudes related to family planning, the attitude that women who use contraception may become promiscuous was a significant predictor of modern contraceptive use in more countries than was the attitude that contraception is only women’s business. Only Nigeria showed significance in the expected direction for both of the attitude variables with modern contraceptive use. For unmet need, the Kyrgyz Republic and Tanzania showed significance in the expected direction for both of the attitude variables.

For the indicators related to ANC visits and health facility delivery, Figure 21 shows that men's presence during ANC was an important predictor of the outcomes of at least four ANC visits and delivery in a health facility in several countries. However, men's presence during ANC was a significant predictor for both of these outcomes only in Uganda. Men's presence during ANC significantly predicted having an ANC visit before four months of pregnancy in just two countries.

For the child health outcomes, correct knowledge of fluid intake for a child with diarrhea was only significant in the expected direction in three countries. There was no knowledge-related variable for child vaccination.

The behavior of making a joint decision on how to spend the men's earnings was used in the models for all of the outcomes in the analysis. In general, Figure 21 shows that this was not a significant predictor in many countries for any of the outcomes. It was significant and in the expected direction in the Kyrgyz Republic for the family planning outcomes and for the two ANC indicators. For Uganda and Tanzania, it was significant in the expected direction for the family planning outcomes and for one of the child health outcomes. For Nigeria, it was significant and in the expected direction for the outcomes of four or more ANC visits, facility delivery, and three doses of DPT vaccine. All other countries varied in the significance of this behavior variable according to the outcome.

Figure 21 Summary of significant findings from all the regression models

	Unmet for family planning	Modern contraceptive use	Had at least 4 ANC visits	Had first ANC visit before 4 months of pregnancy	Delivered in a health facility	Child had all three doses of DPT vaccine ¹	Treatment was sought for child with diarrhea ²
Knowledge							
Have correct knowledge of women's fertile period (compared with incorrect knowledge)	Angola + Armenia + Benin - Liberia + Mali -	Namibia - Sierra Leone +					
Know to give more to drink when child has diarrhea (compared with did not know)							Afghanistan + Congo DR + Nigeria - Togo +
Attitudes							
Does not agree that contraception is only women's business (compared with agree)	Armenia - Kyrgyz Republic - Mozambique + Myanmar - Tanzania -	Angola + Benin + Nigeria + Togo +					
Does not agree that women who use contraception may become promiscuous (compared with agree)	Armenia + Burkina Faso - Kyrgyz Republic - Tanzania - Zambia - Nigeria +	Armenia - Burkina Faso + Burundi + Kenya + Nigeria + Senegal + Zambia + Zimbabwe +					
Behavior							
Discussed family planning with health worker in the last few months (compared with did not discuss)	Afghanistan - Mali + Nigeria +	Afghanistan + Burkina Faso + Burundi + Chad + Comoros + Congo DR + Côte d'Ivoire + Ghana + Liberia + Rwanda + Togo + Zambia + Zimbabwe +					

	Unmet for family planning	Modern contraceptive use	Had at least 4 ANC visits	Had first ANC visit before 4 months of pregnancy	Delivered in a health facility	Child had all three doses of DPT vaccine ¹	Treatment was sought for child with diarrhea ²
Behavior (continued)							
Present during ANC visit (compared with was not present)			Comoros + Gambia + Kenya + Mali + Nepal + Senegal + Timor-Leste - Uganda +	Burundi + Sierra Leone +	Burundi + Liberia + Myanmar + Nigeria + Tanzania + Uganda + Zambia +		
Joint decision on how to spend respondent's earnings (compared with decision not made jointly)	Chad - Côte D'Ivoire - Kyrgyz Republic - Myanmar - Tanzania - Uganda -	Afghanistan + Burundi - Kyrgyz Republic + Liberia - Rwanda - Tanzania + Uganda +	Armenia + Burundi - Comoros + Kyrgyz Republic + Nigeria +	Benin + Burundi - Kenya - Kyrgyz Republic +	Lesotho + Myanmar - Nigeria +	Nigeria + Senegal + Tanzania +	Ethiopia - Mozambique - Uganda +

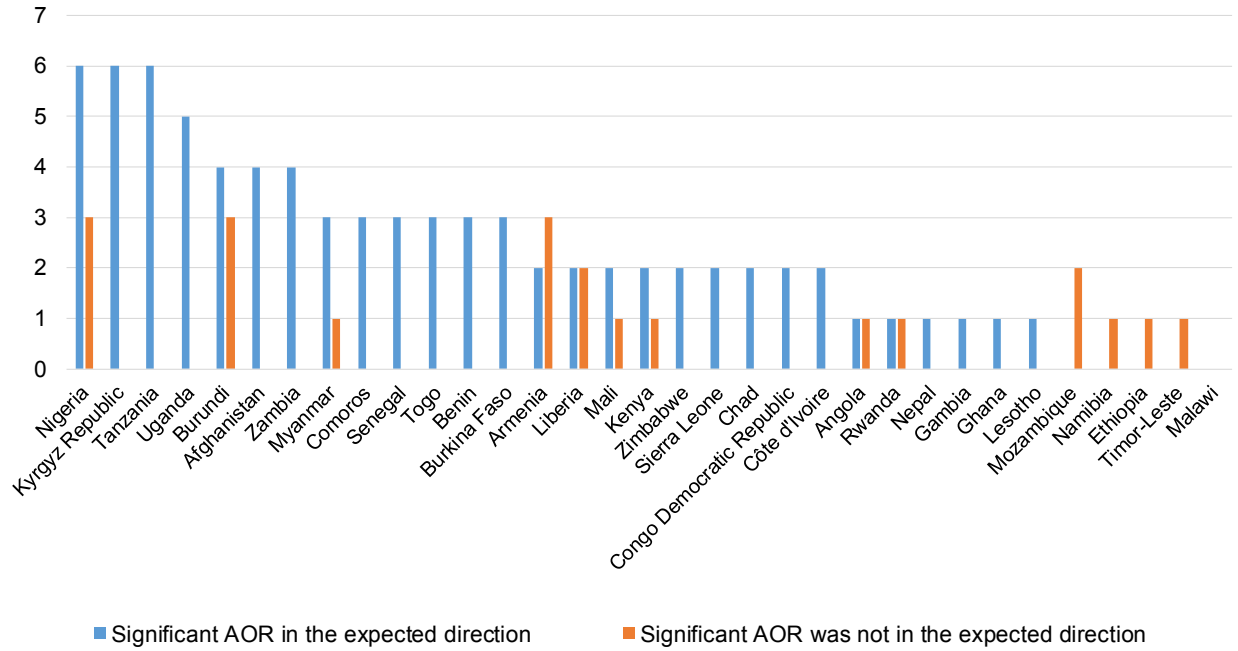
Note: Red indicates that the AOR was in the opposite of the expected direction, green indicates an AOR in the expected direction. A + sign indicates a positive association (OR above 1) and a - sign indicates a negative association (OR less than 1).

1. Lesotho was excluded from the analysis of DPT vaccine due to low number of observations.

2. Armenia, Benin, Ghana, Kyrgyz Republic, Lesotho, Myanmar, Namibia, and Nepal were excluded from the analysis of treatment for diarrhea due to low number of observations.

Figure 22 shows the number of times a country showed a significant odds ratio from the 19 possible hypotheses tested (if we count all of the models fit for each independent variable and each outcome). Nigeria, the Kyrgyz Republic, and Tanzania had the most significant results in the expected direction (six). Nigeria also had three odds ratios in the opposite of the expected direction. Twenty countries had no more than two odds ratios that were significant in the expected direction, and most of these countries also had odds ratios in the opposite of the expected direction.

Figure 22 Number of times each country showed a significant adjusted odds ratio from a total of 19 possible hypotheses



4 DISCUSSION

This report used data from the most recent DHS survey in 33 countries with availability of data on men's involvement. These surveys asked men questions (or proxies) on their knowledge, attitude, and behavior toward selected health-related outcomes of their partners and children. However, most of these questions were asked only in relation to family planning. There were no attitude questions related to maternal or child health, only one knowledge question on child health (amount of fluid to give a child with diarrhea), and only one behavior-specific question related to maternal health (present during ANC visit). Therefore, it was difficult to compare the level of male involvement across the outcomes.

For the available data, results were found to be mainly country-specific. In general, few countries exhibited significant findings based on the available questions, as summarized in Figures 21 and 22, and for a few countries the significant findings were in the opposite of the expected direction. The lack of significance found in some of these involvement variables could be due to the nature of the survey question. For some, there is a direct link between the question and the outcome, such as men discussing family planning with a health worker in the last few months and current modern contraceptive use by their partners. For other questions, however, such as having correct knowledge of a woman's fertile period, the link with the outcomes is not direct. In general, we did not find many significant associations between the knowledge variables and the outcomes for family planning and treatment for childhood diarrhea. Perhaps more suitable questions directly related to men's knowledge on unmet need for family planning and on modern contraceptive use would have been more appropriate for the analysis than the question on knowledge of the fertile period. However, such questions were not available in the DHS Men's Questionnaire.

Four countries—Nigeria, the Kyrgyz Republic, Tanzania, and Uganda—had a high number of significant findings in the expected direction compared with the other countries (see Figure 22). While in the case of Nigeria this finding could be for analytical reasons (the large sample size), this is not the case for the other three countries. In these countries it appears that the measures of male involvement used in the analysis may have a more positive effect on the health outcomes of their partners and children. Qualitative studies and in-depth country-specific analysis are needed to understand these country-specific findings and whether cultural factors could explain the differences between countries; for instance, why some countries are showing significance in the opposite of the expected direction, or why some countries are showing a greater number of significant findings compared to others.

The summary also shows that the behavior of men discussing family planning with a health worker in the last few months is a significant predictor of a positive health outcome in more countries than for any other men's involvement variable (significant in 13 countries, all in the expected direction). Other studies have also found that men who participated in male-only or couples counseling sessions with health care providers were more likely to report using modern contraception as a couple compared with men who did not participate in such sessions (Daniele et al. 2018; Shattuck et al. 2011; Tilahun et al. 2015). However, there is a limitation to this model, since women (whether themselves or their partner) who are already using a modern contraceptive method might not need to discuss family planning with a health worker. In that case, however, we would have expected to see some significance in the opposite of the expected direction, since those who did not discuss family planning would be more likely to be already using modern contraception. However, this was not the case in the analysis, as none of the countries were significant in the opposite of

the expected direction, indicating that the timing between the variables is not a major limitation. The quality of the discussion with the health worker could also be factor for not observing more significant findings. If the quality of the discussion or counseling was poor, this could have a negative impact on the likelihood of using a modern method. Several studies have shown that good quality of counseling in family planning can increase the likelihood of contraceptive use and continuation (Abdel-Tawab and Roter 2002; Daniele et al. 2018; Dehlendorf et al. 2016; Kamhawi et al. 2013; Lee et al. 2011). However, these studies only looked at counseling provided to women.

Joint decision-making on how to spend men's earnings was the only variable that was examined for all outcomes. Our analysis used joint decision-making on earnings as a proxy for the level of partner communication. However, this variable may not have captured its intended purpose. Joint decision-making on earnings showed significance in the expected direction in only a few surveys. In addition, a few surveys showed results in the opposite of the expected direction, suggesting that making a joint decision on men's earnings caused worse health-related outcomes compared with not making a decision jointly. There are several limitations for this variable. The analysis did not distinguish between the partner or others making the decision alone and the women making the decision alone. While the latter is usually found infrequently, it is possible that women who make decisions alone are more likely to attend ANC visits compared with women who make a decision jointly with their partners, therefore causing some findings in the opposite direction to the expectation (Allendorf 2007; Haque et al. 2012). It is important to note that joint decision-making was only examined in relation to men's earnings, while in several countries decision-making around income is seen as being within "man's domain." As Figure 8 shows, in 20 of the 33 countries in the analysis less than 50% of men reported making decisions jointly on how to spend their earnings. Therefore, it is possible that the variable is not a good measure of the level of communication or involvement within couples. The other limitation is that the variable on men's earnings is not directly linked to any of the health outcomes. It possible that some funds are needed for women to obtain family planning, go to an ANC visit, or treat the child for diarrhea, for instance; however, this is not expected to be a large enough burden to affect the outcomes in our analysis.

We found very little significance for the male-involvement variables and the two outcomes related to child health—DPT3 vaccination and treatment for diarrhea. In this study we were not able to look at men's attitudes and behaviors for child health outcomes, because in general few studies have examined the impact of male involvement on direct child health measures such as immunizations and seeking medical treatment. One limitation of the vaccine outcome is that vaccination may be a requirement in most countries, and therefore men's involvement would most likely be irrelevant—the child would be vaccinated regardless of whether the father was involved. What might be more important is male involvement in groups in which men are able to discuss child and family health with health care providers. In Haiti, fathers' participation in fathers' clubs significantly increased children's vaccination status (Sloand, Astone, and Gebrian 2010). In addition, it is possible that child health care, including vaccination, is viewed as the mother's role. In Tanzania, a qualitative assessment found that respondents felt that it was the mother's role to take the child to be vaccinated so that she can soothe the child afterwards by breastfeeding, and also because it would be the mother's responsibility to provide care if the child got sick due to not being vaccinated (Mushi et al. 2008). In addition, it is likely that children's vaccination is performed as part of the mother's postpartum care and therefore does not require men's involvement.

The main limitation for the outcome concerning treatment for diarrhea is primarily an analytical issue, since the outcome has only a few observations for most surveys. In fact, eight countries were removed from the analysis for this outcome because of small sample size. Having a low number of observations could reduce the power to detect significance in the regression models. Another limitation is that we do not know who took the child for treatment, and therefore the link between the father and the treatment is unclear.

One of the main limitations of this analysis is that our data are cross-sectional. In contrast, many of the studies discussed in the literature review that have shown positive effects of men's involvement are prospective case-control studies. For instance, four studies (Daniele et al. 2018; Shattuck et al. 2011; Terefe and Larson 1993; Tilahun et al. 2015) found that discussions or education with the male partner on family planning increased contraceptive use in an intervention group compared with the control group. Gender-transformative interventions that include educating men through discussion with health care providers have also been found to result in greater attendance and male participation in ANC (Doyle et al. 2018). With the DHS data, we cannot directly measure the impact of discussion with the health worker, which could have happened before or perhaps after the women began using a contraceptive method. This is also the case for men being present during ANC visits. We do not know the frequency or timing of these ANC visits and therefore what relationship they had with the two ANC outcomes. This is not the case for the facility delivery outcome, since we know that delivery follows ANC, and a positive association was seen in a number of countries. The lack of significance between men being present during ANC and the outcome of delivery in the health facility could be due to normative behavior in which men might report that they attended ANC visits in order to appear favorable to the interviewer, when in fact they were not present. This could also have been the case for the other men's variables related to their knowledge, attitudes, and behavior, which could have biased the results.

The analysis found some significant findings in the association between men's involvement variables and the outcomes for family planning, maternal health, and child health. The highest number of significant findings was between discussion of family planning with a health worker and modern contraceptive use. Variables related to men's knowledge appeared to have the weakest link to health outcomes, although a knowledge component was only available in relation to family planning outcomes and treatment for diarrhea. In addition, the lack of questions in the DHS surveys related to men's knowledge, attitudes, and behaviors in relation to maternal and child health outcomes made it difficult to compare our results across outcomes. It is recommended that more appropriate and cross-cutting questions to measure men's involvement be included in the DHS questionnaires, and especially in relation to maternal and child health. The country-specific findings and the fact that some countries show more significant findings than others suggest the need for qualitative studies to understand the underlying cultural factors that may affect these results.

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APPENDIX

Appendix Table 1 Percentage with 95% confidence intervals for the outcomes used in the analysis

Country	Survey year	Unmet need		Modern CPR		At least 4 ANC visits		Had ANC visit before 4 months of pregnancy		Delivered in a health facility		Child had all three doses of DPT		Treatment was sought for child with diarrhea	
		% [95% C.I.]	N	% [95% C.I.]	N	% [95% C.I.]	N	% [95% C.I.]	N	% [95% C.I.]	N	% [95% C.I.]	N	% [95% C.I.]	N
Afghanistan	2015	23.9 [22.4,25.5]	10155	21.3 [19.3,23.3]	10155	19.2 [17.0,21.6]	4526	30.4 [27.6,33.3]	4526	55.5 [51.3,59.6]	4526	57.3 [51.1,63.2]	2051	59.2 [54.6,63.7]	1353
Armenia	2015-16	9.0 [7.6,10.7]	1469	32.2 [29.7,34.8]	1469	96.9 [93.9,98.4]	271	92.7 [89.3,95.1]	271	99.4 [97.3,99.9]	271	88.1 [79.4,93.5]	112	44.8 [35.1,51.6]	12 ^a
Angola	2015-16	37.3 [34.7,40.1]	2348	11.7 [9.5,14.2]	2348	59.5 [55.4,63.5]	1148	38.1 [34.6,41.8]	1148	46.6 [42.8,50.4]	1148	41.1 [35.2,47.2]	529	50.4 [44.6,56.2]	164
Burkina Faso	2010	24.0 [22.5,25.6]	4153	16.4 [15.1,17.8]	4153	33.1 [30.6,35.7]	1902	42.9 [40.0,45.9]	1902	75.0 [71.6,78.7]	1902	91.1 [88.6,93.1]	876	42.0 [34.4,51.6]	350
Benin	2011-12	34.9 [32.7,37.2]	2589	7.7 [6.5,9.1]	2589	58.8 [55.6,62.0]	1159	48.1 [45.0,51.3]	1159	86.1 [83.7,88.2]	1159	53.7 [48.9,58.4]	553	30.4 [20.8,42.1]	83 ^a
Burundi	2010	33.2 [30.8,35.7]	2184	18.8 [16.8,21.0]	2184	34.4 [31.1,37.9]	1176	21.3 [18.8,24.1]	1176	66.5 [62.6,70.1]	1176	95.4 [92.6,97.2]	547	62.6 [56.5,68.3]	403
Congo Democratic Republic	2013-14	27.2 [25.0,29.6]	4286	7.9 [6.6,9.5]	4286	45.0 [41.7,48.3]	2264	16.3 [13.7,19.2]	2264	78.0 [74.4,81.2]	2264	55.3 [50.3,60.3]	982	39.2 [33.7,45.1]	521
Côte d'Ivoire	2011-12	27.0 [24.3,29.9]	1906	13.2 [11.4,15.3]	1906	40.8 [36.7,45.1]	803	28.2 [24.1,32.7]	803	54.0 [48.9,59.0]	803	62.6 [56.6,68.3]	365	30.3 [22.7,39.2]	171
Ethiopia	2016	21.5 [19.6,23.4]	6654	37.5 [34.8,40.4]	6654	32.0 [28.9,35.3]	2778	20.4 [18.1,22.9]	2778	34.6 [30.2,39.2]	2778	54.6 [50.0,59.2]	1267	47.8 [41.7,54.1]	430
Ghana	2014	30.1 [27.6,32.8]	1710	25.2 [22.1,28.6]	1710	88.5 [84.9,91.4]	664	64.9 [59.3,70.1]	664	74.7 [70.2,78.8]	664	91.9 [87.6,94.9]	323	62.9 [49.2,74.8]	86 ^a
Gambia	2013	23.7 [21.2,26.4]	1154	11.3 [7.8,16.2]	1154	79.4 [75.2,83.0]	620	37.6 [33.3,42.1]	620	62.3 [56.5,67.9]	620	84.9 [77.0,90.3]	284	78.1 [68.2,85.5]	137
Kenya	2014	15.6 [14.3,17.0]	5157	56.8 [54.8,58.9]	5157	56.3 [53.3,59.2]	1859	20.3 [17.9,23.0]	1859	64.8 [61.9,67.7]	1859	90.3 [87.6,92.4]	935	63.7 [57.5,69.5]	380
Comoros	2012	32.6 [28.8,36.5]	938	15.4 [12.8,18.4]	938	43.7 [38.0,49.7]	419	55.4 [48.8,61.9]	419	79.4 [73.9,84.0]	419	73.2 [65.3,79.8]	193	42.3 [28.8,57.2]	104
Kyrgyz Republic	2012	18.1 [15.5,21.0]	1388	36.9 [34.0,40.0]	1388	85.6 [81.6,88.8]	474	79.7 [75.4,83.5]	474	99.7 [97.5,100.0]	474	88.2 [80.1,93.3]	213	66.8 [49.4,80.5]	37 ^a
Liberia	2013	34.5 [31.4,37.7]	1770	19.5 [16.3,23.1]	1770	72.9 [67.6,77.6]	681	67.4 [62.9,71.5]	681	55.2 [48.7,61.5]	681	72.4 [64.9,78.8]	321	44.7 [36.0,53.7]	149
Lesotho	2014	14.2 [11.3,17.5]	730	65.1 [60.5,69.5]	730	69.1 [60.3,76.7]	189	45.4 [38.0,53.1]	189	75.6 [67.4,82.3]	189	88.9 [81.5,93.5]	97 ^a	56.5 [37.6,73.7]	34 ^a
Mali	2012-13	24.9 [22.7,27.2]	2606	9.9 [8.5,11.5]	2606	39.6 [36.0,43.4]	1227	34.5 [31.2,38.0]	1227	55.5 [51.1,59.9]	1227	63.6 [58.7,68.2]	561	32.8 [22.6,44.9]	117
Myanmar	2015-16	13.3 [11.7,15.1]	2661	55.9 [53.5,58.3]	2661	57.9 [53.1,62.5]	606	40.0 [34.8,45.4]	606	43.8 [38.3,49.4]	606	58.0 [51.0,64.8]	302	60.7 [46.8,73.1]	77 ^a
Malawi	2015-16	16.0 [14.6,17.5]	3884	61.8 [59.8,63.7]	3884	48.4 [45.1,51.7]	1376	25.7 [22.9,28.6]	1376	92.7 [90.7,94.2]	1376	92.5 [89.9,94.4]	672	63.4 [56.9,69.5]	394
Mozambique	2011	23.2 [21.1,25.5]	2239	11.2 [9.8,12.7]	2239	45.3 [41.0,49.6]	1022	11.5 [9.4,14.1]	1022	55.2 [50.3,60.0]	1022	75.8 [70.4,80.6]	445	60.0 [48.9,70.2]	109
Nigeria	2013	16.8 [15.7,18.0]	7837	10.9 [9.8,12.2]	7837	52.4 [49.9,54.9]	3783	17.5 [15.9,19.2]	3783	38.7 [36.2,41.2]	3783	38.2 [35.0,41.5]	1672	60.6 [55.1,65.8]	447
Namibia	2013	14.4 [12.3,16.8]	1149	57.9 [53.8,61.8]	1149	60.4 [53.6,66.8]	267	39.8 [33.2,46.8]	267	84.4 [79.5,88.3]	267	87.7 [78.4,93.4]	122	65.6 [49.3,78.9]	60 ^a
Nepal	2016	9.3 [7.9,11.1]	2376	54.5 [51.9,57.1]	2376	67.6 [61.8,73.0]	459	67.6 [62.0,72.7]	459	63.2 [57.2,68.9]	459	86.0 [77.0,91.8]	222	33.1 [17.0,54.4]	50 ^a
Rwanda	2014-15	17.4 [16.0,19.0]	2964	48.5 [46.4,50.7]	2964	45.9 [42.9,48.9]	1159	57.4 [54.4,60.3]	1159	91.7 [89.7,93.4]	1159	99.0 [97.7,99.6]	560	50.6 [42.7,58.4]	159
Sierra Leone	2013	24.4 [22.5,26.3]	3391	16.9 [15.2,18.7]	3391	77.3 [73.8,80.5]	1298	45.5 [42.0,49.0]	1298	55.6 [50.8,60.2]	1298	77.9 [72.8,82.2]	531	64.4 [52.9,74.5]	114
Senegal	2016	22.7 [19.7,26.0]	1184	28.5 [24.8,32.6]	1184	53.1 [47.4,58.7]	496	52.9 [46.8,58.9]	496	74.9 [70.0,79.1]	496	86.5 [79.4,91.4]	238	28.4 [19.9,38.9]	113
Chad	2014-15	22.7 [20.7,24.7]	2755	6.7 [5.3,8.5]	2755	35.1 [32.0,38.4]	1377	31.2 [28.1,34.6]	1377	21.9 [19.0,25.1]	1377	38.8 [34.1,43.8]	575	33.4 [27.5,39.9]	375
Togo	2013-14	32.3 [30.0,34.7]	1973	19.1 [17.2,21.1]	1973	55.5 [51.5,59.4]	803	26.3 [23.3,29.5]	803	75.2 [71.2,78.7]	803	86.2 [81.6,89.8]	416	29.4 [21.5,38.6]	153
Timor-Leste	2009-10	30.9 [28.7,33.1]	2001	22.9 [20.7,25.2]	2001	56.2 [51.4,58.9]	1025	45.1 [41.7,48.6]	1025	25.0 [21.7,28.7]	1025	66.4 [61.4,71.0]	474	41.0 [33.2,51.8]	187
Tanzania	2015-16	21.3 [18.8,24.0]	1558	37.7 [30.8,36.7]	1558	52.3 [47.7,56.8]	704	68.5 [63.9,72.8]	704	68.5 [63.9,72.8]	704	92.5 [88.3,95.3]	357	42.6 [32.1,53.9]	130
Uganda	2016	27.2 [25.2,29.4]	2408	33.1 [34.8,39.4]	2408	59.6 [55.8,63.3]	1090	28.5 [25.4,31.9]	1090	71.1 [68.1,75.2]	1090	80.9 [76.5,84.6]	493	58.0 [51.9,63.9]	326
Zambia	2013-14	19.7 [18.6,20.9]	7092	46.3 [44.7,47.8]	7092	53.5 [51.1,55.9]	2987	24.3 [22.2,26.6]	2987	71.1 [68.5,73.5]	2987	85.9 [83.3,88.1]	1503	71.7 [67.3,75.7]	630
Zimbabwe	2015	7.7 [6.8,8.9]	3499	68.5 [66.5,70.5]	3499	77.5 [73.9,80.8]	1173	39.2 [35.8,42.8]	1173	81.9 [78.2,85.1]	1173	86.7 [82.5,89.9]	575	34.1 [27.8,41.1]	286

Note: a - Regression models were not fit due to small number of observations.

Appendix Table 3 Adjusted odds ratios with 95% confidence intervals for women's unmet need for family planning by men's involvement variables

Country	Survey year	Knowledge		Attitude				Behavior			
		Correct knowledge of fertile period versus incorrect		Does not agree that contraception is only a women's business versus agrees		Does not agree that women who use contraception become promiscuous versus agrees		Discussed family planning with health worker in the last few months versus did not discuss		Joint decision on how to spend respondent's earnings versus not joint	
		AOR	95% C.I.	AOR	95% C.I.	AOR	95% C.I.	AOR	95% C.I.	AOR	95% C.I.
Afghanistan	2015	1.1	[0.8,1.5]	1.2	[1.0,1.4]	1.1	[0.9,1.2]	0.8*	[0.7,1.0]	0.9	[0.7,1.1]
Angola	2015-16	1.6*	[1.0,2.6]	0.9	[0.7,1.2]	1.0	[0.8,1.2]	1.0	[0.7,1.3]	1.2	[0.9,1.6]
Armenia	2015-16	1.8**	[1.2,2.7]	0.6*	[0.4,0.9]	1.6*	[1.1,2.3]	0.7	[0.2,1.8]	1.6	[1.0,2.7]
Benin	2011-12	0.7**	[0.6,0.9]	0.9	[0.8,1.1]	1.1	[1.0,1.4]	0.9	[0.7,1.2]	0.8	[0.6,1.1]
Burkina Faso	2010	0.9	[0.7,1.0]	1.1	[0.9,1.5]	0.8**	[0.6,0.9]	1.0	[0.8,1.3]	1.0	[0.7,1.4]
Burundi	2010	1.1	[0.8,1.4]	0.9	[0.5,1.7]	0.9	[0.7,1.2]	1.1	[0.8,1.4]	1.1	[0.8,1.4]
Chad	2014-15	1.1	[0.9,1.3]	1.1	[0.9,1.4]	1.0	[0.8,1.2]	1.1	[0.7,1.9]	0.6**	[0.4,0.9]
Comoros	2012	1.2	[0.8,1.8]	0.9	[0.6,1.4]	1.1	[0.8,1.6]	0.9	[0.5,1.5]	0.8	[0.4,1.4]
Congo Democratic Republic	2013-14	0.9	[0.7,1.1]	1.2	[0.9,1.5]	1.0	[0.9,1.3]	1.0	[0.7,1.4]	0.9	[0.7,1.1]
Côte d'Ivoire	2011-12	1.3	[0.9,1.8]	1.2	[0.9,1.6]	0.9	[0.7,1.1]	1.0	[0.5,1.8]	0.7*	[0.5,1.0]
Ethiopia	2016	1.0	[0.7,1.3]	1.2	[0.8,1.7]	1.2	[0.9,1.6]	1.1	[0.9,1.3]	0.9	[0.6,1.5]
Gambia	2013	0.7	[0.5,1.1]	0.9	[0.6,1.2]	0.9	[0.7,1.3]	1.1	[0.8,1.6]	1.4	[0.9,2.1]
Ghana	2014	0.9	[0.7,1.2]	1.0	[0.8,1.3]	0.8	[0.6,1.1]	0.9	[0.6,1.4]	0.9	[0.7,1.1]
Kenya	2014	0.9	[0.7,1.2]	1.1	[0.8,1.5]	0.9	[0.7,1.1]	1.2	[0.9,1.6]	0.9	[0.7,1.2]
Kyrgyz Republic	2012	1.0	[0.7,1.4]	0.7*	[0.5,1.0]	0.6*	[0.4,1.0]	0.9	[0.4,2.1]	0.6*	[0.4,0.9]
Lesotho	2014	1.0	[0.5,2.0]	1.5	[0.9,2.6]	1.3	[0.8,2.2]	0.8	[0.3,1.8]	1.8	[0.7,4.6]
Liberia	2013	3.4*	[1.3,8.8]	0.9	[0.6,1.2]	1.1	[0.8,1.4]	0.7	[0.4,1.1]	1.1	[0.8,1.6]
Malawi	2015-16	1.0	[0.7,1.3]	0.9	[0.7,1.1]	1.0	[0.8,1.2]	1.0	[0.8,1.3]	1.0	[0.7,1.3]
Mali	2012-13	0.7**	[0.5,0.9]	0.8	[0.6,1.1]	0.9	[0.7,1.1]	1.3*	[1.0,1.8]	1.7	[0.6,4.4]
Mozambique	2011	1.5	[0.9,2.7]	1.5*	[1.1,2.2]	1.3	[0.9,1.8]	0.8	[0.5,1.3]	0.9	[0.7,1.3]
Myanmar	2015-16	1.0	[0.5,1.9]	0.7**	[0.5,0.9]	0.9	[0.7,1.2]	0.6	[0.3,1.1]	0.7**	[0.5,0.9]
Namibia	2013	2.2	[0.9,5.2]	1.5	[1.0,2.3]	1.2	[0.8,1.7]	0.8	[0.4,1.7]	0.9	[0.6,1.4]
Nepal	2016	1.3	[0.9,1.8]	0.9	[0.6,1.5]	1.0	[0.7,1.4]	1.1	[0.6,1.8]	0.9	[0.6,1.3]
Nigeria	2013	1.0	[0.8,1.3]	1.0	[0.8,1.2]	1.2*	[1.0,1.4]	1.3*	[1.0,1.6]	1.1	[0.9,1.3]
Rwanda	2014-15	1.1	[0.8,1.3]	1.1	[0.7,1.8]	0.9	[0.6,1.5]	0.8	[0.7,1.0]	1.1	[0.8,1.5]
Senegal	2016	1.0	[0.5,2.0]	1.5	[0.9,2.5]	0.9	[0.6,1.3]	0.7	[0.3,1.4]	0.7	[0.4,1.2]
Sierra Leone	2013	1.0	[0.8,1.3]	0.9	[0.8,1.1]	0.8	[0.7,1.0]	1.0	[0.8,1.3]	0.9	[0.7,1.1]
Timor-Leste	2009-10	0.9	[0.6,1.4]	0.9	[0.8,1.2]	1.0	[0.8,1.3]	1.1	[0.8,1.5]	1.1	[0.6,2.0]
Tanzania	2015-16	0.8	[0.5,1.4]	0.7*	[0.5,1.0]	0.7*	[0.5,0.9]	1.0	[0.7,1.5]	0.7*	[0.5,1.0]
Togo	2013-14	1.1	[0.9,1.4]	1.0	[0.7,1.3]	1.0	[0.8,1.3]	0.8	[0.6,1.2]	0.9	[0.6,1.2]
Uganda	2016	0.9	[0.6,1.2]	1.0	[0.8,1.3]	0.9	[0.7,1.1]	1.1	[0.9,1.5]	0.8*	[0.6,1.0]
Zambia	2013-14	1.1	[0.9,1.4]	0.9	[0.8,1.0]	0.8*	[0.7,1.0]	1.0	[0.8,1.1]	1.0	[0.8,1.1]
Zimbabwe	2015	1.1	[0.7,1.7]	0.9	[0.6,1.4]	0.9	[0.6,1.3]	0.9	[0.6,1.3]	0.7	[0.5,1.1]

Note: * p<0.05, ** p<0.01, *** p<0.001

Appendix Table 4 Adjusted odds ratios with 95% confidence intervals for women's modern contraceptive use by men's involvement variables

Country	Survey year	Knowledge		Attitude				Behavior			
		Correct knowledge of fertile period versus incorrect		Does not agree that contraception is only a women's business versus agrees		Does not agree that women who use contraception become promiscuous versus agrees		Discussed family planning with health worker in the last few months versus did not discuss		Joint decision on how to spend respondents earnings versus not joint	
		AOR	95% C.I.	AOR	95% C.I.	AOR	95% C.I.	AOR	95% C.I.	AOR	95% C.I.
Afghanistan	2015	1.3	[1.0,1.7]	1.0	[0.8,1.2]	1.1	[0.8,1.4]	1.5**	[1.1,1.9]	1.3*	[1.0,1.7]
Angola	2015-16	0.9	[0.3,2.4]	1.6*	[1.0,2.4]	0.9	[0.5,1.4]	1.1	[0.7,1.9]	1.4	[0.8,2.4]
Armenia	2015-16	1.0	[0.7,1.3]	1.1	[0.8,1.5]	0.7**	[0.5,0.9]	0.9	[0.5,1.6]	0.8	[0.6,1.0]
Benin	2011-12	1.2	[0.9,1.7]	1.8*	[1.1,2.9]	1.4	[1.0,1.9]	1.0	[0.6,1.9]	1.1	[0.6,1.9]
Burkina Faso	2010	1.1	[0.9,1.4]	1.0	[0.7,1.4]	1.3*	[1.0,1.6]	1.5***	[1.2,1.9]	1.1	[0.8,1.6]
Burundi	2010	1.0	[0.7,1.3]	1.3	[0.7,2.6]	1.3*	[1.0,1.8]	1.4*	[1.0,2.0]	0.6*	[0.4,0.9]
Chad	2014-15	0.8	[0.5,1.3]	0.6	[0.4,1.0]	0.7	[0.4,1.1]	2.7***	[1.6,4.6]	0.8	[0.4,1.7]
Comoros	2012	0.9	[0.6,1.5]	0.8	[0.5,1.3]	1.2	[0.8,1.8]	2.0**	[1.2,3.3]	1.0	[0.6,1.9]
Congo Democratic Republic	2013-14	1.0	[0.7,1.4]	1.0	[0.7,1.5]	1.2	[0.8,1.8]	1.8**	[1.2,2.9]	1.1	[0.8,1.7]
Côte d'Ivoire	2011-12	0.9	[0.6,1.5]	1.2	[0.8,1.7]	1.2	[0.8,1.7]	2.3*	[1.2,4.6]	0.9	[0.6,1.4]
Ethiopia	2016	1.1	[0.9,1.3]	0.9	[0.7,1.2]	1.0	[0.8,1.4]	1.2	[1.0,1.5]	1.2	[0.8,1.7]
Gambia	2013	0.9	[0.4,2.1]	1.1	[0.5,2.2]	1.6	[0.9,2.8]	0.9	[0.4,1.7]	0.7	[0.3,1.4]
Ghana	2014	0.8	[0.6,1.1]	0.8	[0.5,1.1]	1.2	[0.9,1.8]	1.8**	[1.2,2.9]	1.0	[0.7,1.3]
Kenya	2014	0.9	[0.7,1.2]	0.9	[0.7,1.1]	1.3***	[1.1,1.6]	1.0	[0.8,1.3]	1.2	[1.0,1.4]
Kyrgyz Republic	2012	1.0	[0.8,1.4]	1.0	[0.8,1.4]	1.2	[0.9,1.6]	0.8	[0.4,1.4]	1.4*	[1.0,1.8]
Lesotho	2014	1.2	[0.7,1.8]	1.0	[0.7,1.4]	1.1	[0.8,1.6]	1.7	[0.9,3.3]	0.7	[0.4,1.4]
Liberia	2013	1.0	[0.4,2.6]	0.9	[0.6,1.5]	1.0	[0.7,1.6]	1.6*	[1.1,2.3]	0.6*	[0.3,1.0]
Malawi	2015-16	1.1	[0.8,1.4]	1.1	[1.0,1.3]	1.1	[0.9,1.3]	1.1	[0.9,1.3]	1.1	[0.9,1.4]
Mali	2012-13	1.1	[0.8,1.6]	0.9	[0.6,1.3]	1.0	[0.8,1.4]	0.8	[0.5,1.3]	0.8	[0.3,2.3]
Mozambique	2011	0.5	[0.2,1.1]	1.3	[0.9,2.1]	0.8	[0.5,1.2]	1.3	[0.8,2.3]	1.2	[0.9,1.7]
Myanmar	2015-16	0.9	[0.6,1.4]	1.1	[0.9,1.3]	1.0	[0.8,1.2]	1.1	[0.7,1.6]	1.2	[1.0,1.4]
Namibia	2013	0.4*	[0.2,0.9]	0.9	[0.6,1.3]	0.8	[0.6,1.1]	0.7	[0.4,1.2]	0.9	[0.7,1.3]
Nepal	2016	1.2	[1.0,1.5]	1.0	[0.8,1.3]	1.1	[0.9,1.4]	1.0	[0.8,1.4]	1.2	[0.9,1.6]
Nigeria	2013	0.9	[0.7,1.3]	1.4**	[1.1,1.9]	1.4**	[1.1,1.7]	1.2	[0.9,1.5]	1.2	[0.9,1.6]
Rwanda	2014-15	0.9	[0.7,1.1]	0.9	[0.6,1.3]	1.3	[0.9,2.0]	1.2*	[1.0,1.3]	0.8*	[0.7,1.0]
Senegal	2016	0.9	[0.4,1.9]	1.8	[1.0,3.3]	1.6*	[1.0,2.4]	0.8	[0.5,1.4]	0.7	[0.5,1.1]
Sierra Leone	2013	1.3*	[1.0,1.8]	1.0	[0.8,1.3]	1.0	[0.8,1.3]	1.0	[0.7,1.3]	0.8	[0.6,1.1]
Timor-Leste	2009-10	1.3	[0.9,1.9]	0.8	[0.6,1.0]	1.1	[0.9,1.5]	1.1	[0.8,1.6]	1.1	[0.7,1.7]
Tanzania	2015-16	1.2	[0.8,1.8]	1.1	[0.8,1.4]	1.1	[0.8,1.4]	1.1	[0.7,1.5]	1.4*	[1.0,1.8]
Togo	2013-14	0.9	[0.7,1.2]	1.8*	[1.1,2.7]	1.3	[1.0,1.7]	2.0***	[1.5,2.8]	1.1	[0.7,1.7]
Uganda	2016	1.0	[0.7,1.3]	1.0	[0.8,1.3]	1.2	[0.9,1.4]	1.1	[0.9,1.4]	1.4**	[1.1,1.7]
Zambia	2013-14	1.0	[0.8,1.1]	1.0	[0.9,1.2]	1.2*	[1.0,1.3]	1.2*	[1.0,1.4]	1.0	[0.9,1.1]
Zimbabwe	2015	1.0	[0.8,1.3]	1.2	[0.9,1.4]	1.4**	[1.1,1.7]	1.3*	[1.0,1.6]	1.2	[1.0,1.6]

Note: * p<0.05, ** p<0.01, *** p<0.001

Appendix Table 5 Adjusted odds ratios with 95% confidence intervals for having at least 4 antenatal care visits by men's involvement variables

Country	Survey year	Behavior			
		Present during ANC check-up versus not present		Joint decision on how to spend respondent's earnings versus not joint	
		AOR	95% C.I.	AOR	95% C.I.
Afghanistan	2015	1.2	[0.9,1.6]	1.4	[1.0,1.9]
Angola	2015-16	1.1	[0.8,1.7]	0.7	[0.5,1.2]
Armenia	2015-16	2.5	[0.6,10.3]	21.9**	[2.4,201.7]
Benin	2011-12	0.8	[0.5,1.1]	1.1	[0.7,1.9]
Burkina Faso	2010	1.0	[0.8,1.2]	1.1	[0.7,1.8]
Burundi	2010	1.4	[1.0,2.0]	0.5*	[0.3,0.9]
Chad	2014-15	1.1	[0.8,1.6]	1.3	[0.8,2.3]
Comoros	2012	2.2*	[1.2,4.2]	2.2*	[1.1,4.1]
Congo Democratic Republic	2013-14	1.2	[0.9,1.6]	1.1	[0.9,1.4]
Côte d'Ivoire	2011-12	0.8	[0.5,1.3]	1.0	[0.6,1.6]
Ethiopia	2016	1.2	[0.9,1.6]	1.1	[0.7,1.7]
Gambia	2013	1.8*	[1.1,3.1]	1.0	[0.6,1.6]
Ghana	2014	1.1	[0.6,2.0]	1.0	[0.5,1.8]
Kenya	2014	1.4*	[1.0,1.8]	0.9	[0.6,1.1]
Kyrgyz Republic	2012	0.9	[0.5,1.6]	2.0*	[1.0,3.8]
Lesotho	2014	0.9	[0.2,3.2]	1.5	[0.4,5.3]
Liberia	2013	1.1	[0.6,1.8]	1.5	[0.8,2.8]
Malawi	2015-16	0.9	[0.7,1.2]	1.0	[0.7,1.4]
Mali	2012-13	1.6**	[1.2,2.3]	1.9	[0.8,4.8]
Mozambique	2011	1.2	[0.9,1.8]	1.2	[0.8,1.8]
Myanmar	2015-16	1.0	[0.6,1.7]	1.2	[0.8,1.8]
Namibia	2013	0.7	[0.4,1.6]	1.3	[0.6,2.6]
Nepal	2016	2.3**	[1.2,4.2]	1.4	[0.8,2.5]
Nigeria	2013	1.1	[0.9,1.4]	1.7**	[1.3,2.1]
Rwanda	2014-15	0.9	[0.5,1.6]	1.1	[0.8,1.6]
Senegal	2016	2.2**	[1.3,3.7]	1.7	[0.9,3.3]
Sierra Leone	2013	1.1	[0.8,1.5]	1.5	[0.9,2.5]
Timor-Leste	2009-10	0.7**	[0.5,0.9]	1.3	[0.8,2.3]
Tanzania	2015-16	1.1	[0.7,1.5]	1.1	[0.7,1.6]
Togo	2013-14	1.1	[0.8,1.6]	1.3	[0.7,2.2]
Uganda	2016	1.4*	[1.0,2.0]	1.0	[0.7,1.4]
Zambia	2013-14	1.0	[0.8,1.2]	1.2	[0.9,1.4]
Zimbabwe	2015	1.0	[0.7,1.4]	0.9	[0.6,1.5]

Note: * p<0.05, ** p<0.01, *** p<0.001

Appendix Table 6 Adjusted odds ratios with 95% confidence intervals for having antenatal care visit before 4 months of pregnancy by men's involvement variables

Country	Survey year	Behavior			
		Present during ANC check-up versus not present		Joint decision on how to spend respondent's earnings versus not joint	
		AOR	95% C.I.	AOR	95% C.I.
Afghanistan	2015	0.8	[0.6,1.2]	1.1	[0.7,1.6]
Angola	2015-16	0.9	[0.6,1.3]	0.8	[0.5,1.3]
Armenia	2015-16	1.2	[0.4,3.8]	1.4	[0.4,5.0]
Benin	2011-12	1.1	[0.8,1.5]	1.7*	[1.0,2.7]
Burkina Faso	2010	0.8	[0.7,1.1]	0.8	[0.5,1.2]
Burundi	2010	1.7**	[1.1,2.5]	0.6*	[0.4,1.0]
Chad	2014-15	1.1	[0.8,1.6]	1.2	[0.6,2.3]
Comoros	2012	1.1	[0.6,1.9]	0.7	[0.4,1.4]
Congo Democratic Republic	2013-14	1.3	[0.9,1.8]	0.9	[0.6,1.4]
Côte d'Ivoire	2011-12	1.4	[1.0,2.2]	1.5	[0.9,2.4]
Ethiopia	2016	1.2	[0.9,1.7]	0.9	[0.5,1.6]
Gambia	2013	0.9	[0.6,1.4]	0.9	[0.6,1.4]
Ghana	2014	0.8	[0.5,1.2]	0.9	[0.6,1.4]
Kenya	2014	1.1	[0.8,1.7]	0.7*	[0.5,0.9]
Kyrgyz Republic	2012	1.0	[0.6,1.7]	1.9*	[1.1,3.2]
Lesotho	2014	1.0	[0.3,3.2]	1.8	[0.6,5.6]
Liberia	2013	1.4	[0.9,2.1]	1.5	[0.8,2.6]
Malawi	2015-16	1.1	[0.8,1.5]	1.4	[0.9,2.0]
Mali	2012-13	0.9	[0.6,1.2]	1.2	[0.4,3.4]
Mozambique	2011	1.4	[0.8,2.4]	1.4	[0.8,2.6]
Myanmar	2015-16	1.0	[0.6,1.8]	1.0	[0.6,1.5]
Namibia	2013	0.6	[0.3,1.2]	1.0	[0.5,2.1]
Nepal	2016	1.4	[0.8,2.4]	1.9	[1.0,3.7]
Nigeria	2013	1.1	[0.8,1.4]	1.3	[1.0,1.7]
Rwanda	2014-15	0.9	[0.5,1.7]	0.9	[0.6,1.2]
Senegal	2016	1.1	[0.5,2.1]	1.5	[0.8,2.7]
Sierra Leone	2013	1.4*	[1.0,1.8]	1.5	[1.0,2.2]
Timor-Leste	2009-10	0.9	[0.7,1.2]	1.5	[0.7,3.0]
Tanzania	2015-16	1.1	[0.7,1.7]	1.3	[0.8,2.1]
Togo	2013-14	1.2	[0.8,1.8]	1.3	[0.8,2.3]
Uganda	2016	1.3	[1,1.8]	1.2	[0.9,1.7]
Zambia	2013-14	1.3	[1.0,1.6]	1.0	[0.8,1.3]
Zimbabwe	2015	1.4	[1.0,1.9]	1.1	[0.7,1.7]

Note: * p<0.05, ** p<0.01, *** p<0.001

Appendix Table 7 Adjusted odds ratios with 95% confidence intervals for delivering in a health facility by men's involvement variables

Country	Survey year	Behavior			
		Present during ANC check-up versus not present		Joint decision on how to spend respondent's earnings versus not joint	
		AOR	95% C.I.	AOR	95% C.I.
Afghanistan	2015	1.1	[0.8,1.4]	1.0	[0.8,1.3]
Angola	2015-16	1.3	[0.8,2.1]	0.8	[0.5,1.2]
Armenia	2015-16	NC	NC	NC	NC
Benin	2011-12	0.8	[0.5,1.4]	1.3	[0.6,2.7]
Burkina Faso	2010	1.1	[0.8,1.5]	0.7	[0.4,1.4]
Burundi	2010	1.8*	[1.1,2.7]	1.0	[0.6,1.6]
Chad	2014-15	0.7	[0.5,1.1]	1.2	[0.6,2.4]
Comoros	2012	1.2	[0.6,2.5]	1.0	[0.5,2.3]
Congo Democratic Republic	2013-14	0.7	[0.5,1.0]	1.3	[0.9,1.8]
Côte d'Ivoire	2011-12	0.8	[0.5,1.3]	1.3	[0.8,2.1]
Ethiopia	2016	1.2	[0.9,1.6]	1.3	[0.7,2.5]
Gambia	2013	1.0	[0.7,1.5]	0.9	[0.5,1.5]
Ghana	2014	0.9	[0.5,1.6]	0.9	[0.5,1.5]
Kenya	2014	1.2	[0.9,1.7]	1.1	[0.8,1.5]
Kyrgyz Republic	2012	NC	NC	NC	NC
Lesotho	2014	1.4	[0.4,4.3]	7.5**	[2,28.3]
Liberia	2013	1.6*	[1.1,2.4]	0.9	[0.5,1.8]
Malawi	2015-16	0.9	[0.5,1.6]	0.8	[0.4,1.6]
Mali	2012-13	1.2	[0.9,1.8]	1.1	[0.3,3.7]
Mozambique	2011	1.0	[0.7,1.6]	0.9	[0.5,1.5]
Myanmar	2015-16	1.8*	[1.1,3.0]	0.6*	[0.4,1.0]
Namibia	2013	1.5	[0.5,3.9]	2.2	[0.9,5.0]
Nepal	2016	1.0	[0.6,1.8]	1.1	[0.7,1.9]
Nigeria	2013	1.6***	[1.3,2.0]	1.7***	[1.3,2.2]
Rwanda	2014-15	1.6	[0.7,3.5]	1.3	[0.7,2.4]
Senegal	2016	1.0	[0.6,1.7]	1.2	[0.6,2.5]
Sierra Leone	2013	1.1	[0.7,1.5]	1.1	[0.7,1.7]
Timor-Leste	2009-10	1.1	[0.7,1.7]	0.7	[0.3,1.4]
Tanzania	2015-16	1.7*	[1.1,2.6]	1.1	[0.7,1.7]
Togo	2013-14	1.3	[0.8,2.0]	0.9	[0.4,1.9]
Uganda	2016	1.9***	[1.3,2.6]	1.2	[0.8,1.8]
Zambia	2013-14	1.6***	[1.2,2.1]	0.9	[0.7,1.1]
Zimbabwe	2015	0.7	[0.5,1.2]	1.0	[0.6,1.6]

Note: * p<0.05, ** p<0.01, *** p<0.001; NC: not computed due to small number of observations or missing data

Appendix Table 8 Adjusted odds ratios with 95% confidence intervals for the youngest child 12-23 months with all three doses of DPT vaccine by men's involvement variables

Country	Survey year	Behavior	
		Joint decision on how to spend respondent's earnings versus not joint	
		AOR	95% C.I.
Afghanistan	2015	0.8	[0.5,1.2]
Angola	2015-16	1.2	[0.6,2.3]
Armenia	2015-16	0.5	[0.1,1.7]
Benin	2011-12	0.9	[0.4,1.7]
Burkina Faso	2010	0.6	[0.2,1.4]
Burundi	2010	0.1	[0.0,1.0]
Chad	2014-15	1.1	[0.5,2.5]
Comoros	2012	1.8	[0.5,6.6]
Congo Democratic Republic	2013-14	1.0	[0.7,1.6]
Côte d'Ivoire	2011-12	2.1	[0.9,5.1]
Ethiopia	2016	1.3	[0.5,3.1]
Gambia	2013	1.9	[0.5,7.0]
Ghana	2014	1.6	[0.7,3.6]
Kenya	2014	0.7	[0.4,1.5]
Kyrgyz Republic	2012	2.6	[0.8,8.8]
Lesotho	2014	NC	NC
Liberia	2013	0.6	[0.3,1.4]
Malawi	2015-16	1.3	[0.5,3.2]
Mali	2012-13	0.4	[0.1,1.4]
Mozambique	2011	0.5	[0.3,1.1]
Myanmar	2015-16	1.0	[0.6,1.9]
Namibia	2013	1.2	[0.3,5.2]
Nepal	2016	0.9	[0.2,3.9]
Nigeria	2013	1.9**	[1.3,2.8]
Rwanda	2014-15	NC	NC
Senegal	2016	9.5**	[1.9,48.3]
Sierra Leone	2013	1.1	[0.5,2.5]
Tanzania	2015-16	2.9*	[1.1,7.6]
Timor-Leste	2009-10	1.1	[0.3,3.9]
Togo	2013-14	1.4	[0.5,3.9]
Uganda	2016	1.4	[0.7,2.5]
Zambia	2013-14	1.4	[0.9,2.0]
Zimbabwe	2015	1.3	[0.6,2.9]

Note: * p<0.05, ** p<0.01, *** p<0.001; NC: not computed due to small number of observations

Appendix Table 9 Adjusted odds ratios with 95% confidence intervals for the youngest child under age 2 with diarrhea that had treatment sought for them by men's involvement variables

Country	Survey year	Knowledge		Behavior	
		AOR	95% C.I.	AOR	95% C.I.
Afghanistan	2015	1.9*	[1.1,3.2]	1.1	[0.7,1.7]
Angola	2015-16	1.5	[0.7,3.3]	2.3	[0.9,6.2]
Armenia	2015-16	NC	NC	NC	NC
Benin	2011-12	NC	NC	NC	NC
Burkina Faso	2010	1.1	[0.6,1.8]	1.1	[0.4,3.5]
Burundi	2010	1.3	[0.8,2.1]	0.6	[0.3,1.2]
Chad	2014-15	1.6	[0.9,2.9]	1.0	[0.4,2.7]
Comoros	2012	5.1	[0.6,44.7]	1.7	[0.4,8.0]
Congo Democratic Republic	2013-14	1.6*	[1.0,2.6]	1.0	[0.6,1.7]
Côte d'Ivoire	2011-12	0.5	[0.2,1.2]	0.9	[0.3,2.6]
Ethiopia	2016	1.0	[0.6,1.6]	0.1**	[0.0,0.4]
Gambia	2013	0.8	[0.3,2]	1.6	[0.5,4.5]
Ghana	2014	NC	NC	NC	NC
Kenya	2014	0.8	[0.5,1.4]	1.0	[0.6,1.7]
Kyrgyz Republic	2012	NC	NC	NC	NC
Lesotho	2014	NC	NC	NC	NC
Liberia	2013	0.6	[0.3,1.3]	0.7	[0.3,2.0]
Malawi	2015-16	1.4	[0.8,2.3]	1.0	[0.5,2.0]
Mali	2012-13	2.1	[0.7,6.6]	2.1	[0.2,19.0]
Mozambique	2011	1.3	[0.5,3.1]	0.2*	[0.1,0.8]
Myanmar	2015-16	NC	NC	NC	NC
Namibia	2013	NC	NC	NC	NC
Nepal	2016	NC	NC	NC	NC
Nigeria	2013	0.5*	[0.3,0.9]	0.7	[0.4,1.2]
Rwanda	2014-15	1.0	[0.6,1.9]	0.7	[0.3,1.5]
Senegal	2016	1.7	[0.5,5.6]	4.0	[0.6,24.3]
Sierra Leone	2013	2.3	[0.7,8.1]	8.2	[0.6,103.4]
Timor-Leste	2009-10	0.9	[0.3,2.7]	1.1	[0.2,6.2]
Tanzania	2015-16	0.7	[0.3,1.7]	1.2	[0.4,3.3]
Togo	2013-14	2.5*	[1.2,5.2]	1.1	[0.3,3.5]
Uganda	2016	0.8	[0.5,1.2]	2.2*	[1.2,4.2]
Zambia	2013-14	0.9	[0.6,1.4]	0.8	[0.5,1.4]
Zimbabwe	2015	0.8	[0.5,1.3]	1.5	[0.6,3.5]

Note: * p<0.05, ** p<0.01, *** p<0.001; NC: not computed due to small number of observations