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Abstract

While men and women often make joint decisions about fertility, it is typically women who give birth. This gives rise to gendered spheres of costs and, potentially, information. We develop a model in which information asymmetries over maternal health risk can persist between spouses in equilibrium and affect fertility outcomes. To empirically study the role of these information asymmetries, we conduct an experiment on couples in Zambia, varying whether the husband or wife receives information about maternal health risk. At baseline, husbands have significantly lower awareness of maternal mortality risk factors than wives. One year post intervention, husbands exhibit significant gains in knowledge of maternal risk, but only when the information is delivered directly to them. Wives' risk awareness increases regardless of which spouse is given the information. Importantly, households treated with information on maternal risk experience a sizable reduction in the probability of pregnancy. However, only when the information is delivered directly to husbands is the change in fertility *uncompensated* with transfers, and accompanied by an improvement in marital satisfaction. These findings suggest that strategic communication concerns underpin persistent information asymmetries, likely intensifying spousal disagreement over fertility, and thereby increasing fertility itself, in settings with high maternal health risk.

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One of the most important economic decisions a household can make is how many children to have. While fertility decisions are typically the joint domain of men and women in a couple, partners often have different information about the costs and benefits of childbearing because they participate in different spheres of activity. There is no more gendered sphere of activity than childbirth. In most countries in the world, men do not accompany their wives into the labor ward; even countries where norms have changed have only done so relatively recently.[1] This circumscribes direct information from the childbirth experience to women alone, and most policies providing education about childbirth and maternal health in developing countries have also been directed to women.[2] While such information could be communicated from a woman to her partner, in this paper we show how and why credible communication in the household can, in practice, break down when spouses have diverging interests, and how this phenomenon affects fertility and household welfare.

Our study examines spouses' knowledge of maternal mortality risk, how it spreads between partners over time, and how it influences gender differences in the demand for children and fertility outcomes over a 12 month horizon. To do so, we devise an experimental intervention that delivers information on maternal mortality risk to couples in Zambia, and randomly varies which spouse receives the information. Our intervention has a significant impact on fertility in a setting in which fertility has remained persistently high.[3] While spousal differences in preferences and costs have been shown to be a core source of friction in intra-household bargaining over fertility (Ashraf, Field and Lee, 2014; Doepke and Kindermann, 2019), our study highlights how differences in spouses' underlying interests also impede the flow of information which drives an even greater wedge between fertility preferences. This makes gendered information asymmetries potentially self-reinforcing, and leads to fertility outcomes that depart from the joint optimum.

In particular, we first collect novel data on beliefs about maternal health costs from both men and women, and document a significant gender gap in maternal mortality and morbidity risk awareness. Specifically, men in peri-urban Lusaka have more limited knowledge than their wives

[1]In the United Kingdom, for example, male partners' attendance during child birth was still a minority in the 1960s, and was still considered controversial even as late as the 1970s (King, 2016).

[2]As focus group participants of reproductive age in Zambia told us, "The men aren't in the labor ward with us, they don't know what we go through; "We can explain to our husbands what's going on with complications, and that we're scared, but they won't understand because they don't experience the same things" ; "I think that women need to look out for their own health, because if I die in labor ward, my husband can't die with me".

[3]Fertility rates across sub-saharan Africa remain the highest in the world,even in the face of growing economic development. In Zambia, where this study is set, the overall urban fertility rate in Zambia is about 3.7 children per woman (ZDHS 2013-14), higher than most similar middle-income countries around the world.

of the risk factors that influence childbirth outcomes, which can be attributed to the gendered spheres of direct and indirect knowledge accumulation of maternal labor and delivery outcomes that typifies much of the developing world.

To understand the persistence of asymmetric information about maternal mortality in the household and its implications, we develop a theoretical model in which gendered spheres in the household lead both to specialized information and to diverging interests that affect informative communication from the wife to the husband. Without such information asymmetries, spousal cooperation would ensure efficient levels of fertility as long as there is potential to make intra-household transfers. However, gendered spheres of activity - in particular women's responsibility both in bearing and raising children which affects her information set and her overall demand for children - and asymmetric access to resources - in particular men's ability to use transfers to implement their preferred fertility outcomes - generate barriers that impede women from effectively communicating about maternal health costs to their husbands. Fundamentally, there is a strong underlying interest for the wife, who is informed, to manipulate the information when communicating in order to reach her preferred outcome; knowing this, the less informed husband discounts the information communicated (Crawford and Sobel, 1982). This phenomenon prevents convergence in beliefs within couples.

The model also explains how information asymmetries on childbearing costs may result in sub-optimal fertility. Information frictions within couples create a persistent wedge between male and female demand for children that is not resolved with transfers. When women are better informed than men about costs, couples may be unable to implement optimal contracts over fertility. Because they cannot agree on the true risk of maternal mortality, they cannot achieve a fertility outcome that he would have been willing to compensate and she would have been willing to implement. This leads to a reduction in transfers from husbands to wives and sub-optimal fertility outcomes.

Guided by the predictions of this model, we analyze couples' response to exogenous variation in information about maternal mortality and morbidity risk provided to husbands and wives through our field experiment. We find that, when they are presented with the information, men significantly update their beliefs about maternal risk factors, and transmit some of this newly-acquired knowledge to their wife. Moreover, better information on maternal risk leads to a sizable reduction in the incidence of pregnancy over the year following treatment, a reduction that is strongest when the wife faces a higher risk of complications based on her age and health history. Households in which the husband is treated experience a 43% reduction in the probability of having a child or being pregnant in the year following the intervention. Overall, this pattern indicates that men can learn with a relatively simple intervention about a domain that is usually seen as strictly female, and that they readily internalize concerns about the health of their wife.

However, our experiment also reveals that male learning only occurs when they receive the information directly. When women receive maternal mortality information, they update their own beliefs and change their communication strategies, but they are unable to spread this information to their husbands, whose beliefs remain unchanged. Hence, while fertility may also fall when the information is delivered to wives rather than husbands, in this arm the decline in fertility is accompanied by a significant reduction in transfers from the husband to the wife. This combination of results is consistent with women updating their awareness of maternal risk while being unable to convey that effectively to their partner.

These empirical patterns are consistent with our theoretical model of communication barriers. The gender asymmetry in knowledge spillovers is driven by households in which husbands, at baseline, want a child as soon as possible. In our model, these households are the most likely to experience a conflict of interest. In the data, these men do not update their beliefs in response to their wife's treatment status, and reduce transfers to their wife more than other groups when she is treated. Likewise, when wives are treated, fertility declines are concentrated among households in which the husband has relatively low demand for children to begin with, precisely those in which communication barriers are expected to be minimal in our model. Indeed, when a man wants a child as soon as possible, providing information to his wife has *no* effect on fertility. These findings, together with those on transfers, suggest the importance of strategic communication concerns in fertility decisions. While credibility biases may impede learning from wives, as in Conlon et al. (2021), this is likely to be less important in our setting because maternal health is considered a woman's domain of expertise. Indeed, we find that male subjects also update on the portion of the maternal mortality curriculum delivered by a female facilitator.

By documenting that providing men with access to information about maternal mortality risk has a sizable effect on household behavior, and results in belief updating and a decline in pregnancy at followup, we provide new evidence on the key role of men in shaping fertility outcomes in the household and on what factors may influence such a role. While several studies have highlighted men's central role in reproductive health decision making (Vouking, Evina and Tadenfok, 2014), studies often find no effect of male-targeted family planning campaigns, or even negative ones (Ashraf, Field and Lee, 2014).[4] Maternal mortality risk is one area in which men have little ability to gain direct knowledge in our setting; we show that they respond to this knowledge rules out that they are inattentive or place little weight on a cost long considered to belong to women.

Second, we find that men do not learn from their wives, when their wives receive information about maternal cost. Women, on the contrary, do learn from their husbands. The vast literature on household decision-making assumes that household members have access to the same information, and that new information spreads seamlessly within the family (Chiappori, 1992; Lundberg and Pollak, 1996; Bourguignon et al., 1993). A smaller body of literature has examined the degree to which asymmetric information between spouses affects household decision-making (see de Laat (2005); Ashraf (2009); Stern and Friedberg (2010); Chen (2013); Baseler (2020)), furthering the evidence of inefficient outcomes in household decisions. (Udry, 1996; Duflo and Udry, 2004; Schaner, 2015). However, very little is understood about *how* and *why* information does or does not spread. This paper contributes to a novel and exciting body of recent work that has begun to explore the transmission of information within the household (Ziparo, 2020; Apedo-Amah, Djebbari and Ziparo, 2020; Conlon et al., 2021). Our paper illuminates how roles taken in the household lead to gendered spheres of knowledge, and shows just how significant the implications of this can be for important economic outcomes such as fertility. In the context of maternal mortality, we show that information asymmetries within households may persist as equilibrium outcomes, and thereby reduce the effectiveness of public health campaigns at changing household outcomes when they only target women.[5]

[4] Although some randomized public health studies found that providing contraceptive education to husbands may increase uptake of modern contraceptives (Wang et al., 1998; Terefe and Larson, 1983; Fisek and Sumbuloglu, 1978), one large study found no effect (Freedman and Takeshita, 1969). Recent evidence from rural Malawi, Tanzania, and Mozambique suggests that promoting contraceptive use among men has the potential to substantially increase take-up (Shattuck et al., 2011; McCarthy, 2019; Miller, De Paula and Valente, 2020).

[5] Our paper also contributes more generally to understanding the role of information for economic behavior. A rich body of evidence has shown that information can have a substantial impact, through a process of beliefs updating or by enhancing salience, on education (Jensen, 2010; Dizon-Ross, 2019) and health outcomes (see, among others, Thornton (2008); Dupas (2011); De Paula, Shapira and Todd (2014); Delavande and Kohler (2016); Bennett, Naqvi and Schmidt (2018)). We contribute to this literature by highlighting that, if information flows between spouses are constrained, targeting particular household members will affect household behavioral responses to new information, just as in the case of cash transfers (Lundberg, Pollak and Wales, 1997). Björkman Nyqvist and Jayachandran (2017) find that educating mothers about child health in Uganda leads to greater adoption of health-promoting behaviors. In our setting, there is a strong policy argument for targeting men with information related to reproductive health since they can more readily transmit information to their spouses and

Measuring information spillovers and diffusion within the household sheds light on motivations for information sharing and influencing joint decisions in group settings. While the effect of preference misalignment on communication has been studied in the lab, our empirical application provides the first field experimental evidence that directly tests models of strategic communication, wherein persistent differences in preferences and conflict of interest impede communication and beliefs updating (Crawford and Sobel, 1982; Mailath, 1987; Crawford, 1998, 2019).[6] Our empirical setting also allows us to measure the welfare implications of communication failures. We find that the inability to transmit information may force women to implement some independent fertility choices, but at a cost to them, including a reduction of transfers they receive from their husband and a decrease in well-being.

Finally, by examining the role of beliefs about maternal mortality risk, our study also contributes to the literature on decision-making over fertility when spouses have different preferences and incentives.[7] We emphasize that initial differences in ideal fertility between men and women, which are large across sub-Saharan Africa and in Zambia (see figure Figure A1 panel a), can generate persistent and systematic disagreement over the demand for children (panel b).

The manuscript is organized as follows. Section 1 describes the study context and documents men and women's knowledge and beliefs about maternal mortality and morbidity in Lusaka. Section 2 describes our model and its predictions. Section 3 presents the experimental design and section 4 the implementation of the experiment. The empirical findings are reported in section 5. Section 6 concludes.

1 Context

We conducted this study in Lusaka, the capital city of Zambia. High fertility rates in Lusaka, coupled with rapid rural-to-urban migration, has led to the establishment of informal settlements

lead to behavior change that is not associated with reductions in transfers and intra-household cooperation.

[6] See, for instance, Dickhaut, McCabe and Mukherji (1995) and Cai and Wang (2006) test the model of Crawford and Sobel (1982) in a laboratory setup, while Dickson, Hafer and Landa (2008) show responsiveness of communication to strategic incentives in a committee voting laboratory experience.

[7] While the sociology and demography literature studying spouses' interactions on fertility decisions is well established, few studies in economics have emphasized the role of intra-household interactions (Rasul (2008); Ashraf, Field and Lee (2014); Doepke and Kindermann (2019); De Paula, Shapira and Todd (2014) and Rossi (2019)) and culture (Fernandez and Fogli, 2009) in this process. Outside of economics, see studies about fertility and contraceptives use from a theoretical perspective (Blanc, 2001; Miller, Severy and Pasta, 2004; Brehm and Schneider, 2019), in developed countries (Bauer and Kneip, 2012; Stein, Willen and Pavetic, 2014), and in Sub-Saharan Africa (Ezeh, 1993; Bond and Dover, 1997; Dodoo, 1998; DeRose et al., 2004; Pulerwitz et al., 2010; Gottert et al., 2018).

(or compounds), in which a growing proportion of the city's population resides.[8] Our study took place in some of these communities. In this section, we describe the reproductive health challenges in Zambia more generally and in our sample from the compounds of Lusaka.

1.1 Knowledge, beliefs and communication about maternal mortality and morbidity risk

According to the 2014 DHS, the maternal mortality ratio in Zambia is equal to 398 deaths per 100,000 live births. Given the high rates of fertility in the country, this ratio implies that, in expectation, 1 in 59 Zambian women dies giving birth (Central Statistical Office, 2014).

The primary causes of maternal death in Zambia are obstructed labor, hemorrhage, blood pressure disorders and sepsis (Banda, 2015). The high incidence of maternal mortality implies a correspondingly high incidence of severe maternal morbidity in the general population, which is typically believed to be orders of magnitude larger than maternal mortality.[9] Data on maternal morbidity, however, is not systematically available for Zambia nor in other comparable contexts.[10]

Our survey, collected in the Fall of 2014 on 715 couples in peri-urban Lusaka and partially overlapping with our study sample, provides unique insights into men's and women's knowledge of maternal mortality and morbidity risk (table 1, Panel A). Men are less likely than women to identify high parity (72.0% of men and 77.7% of women) and advanced maternal age (74.3% of men and 84.6% of women) as risk factors. In a sequence of questions in which respondents are asked to report the likelihood, on a scale from 0 to 10, that a hypothetical woman with given set characteristics (age, parity, most recent birth) may experience complications at birth, men report lower scores than women in six out of seven cases.[11]

As documented in Ashraf et al. (2017), in Zambia, common perceptions of the causes of

[8]According to the World Bank, 43% of the Zambian population in 2017 resided in urban cities. Data available at https://data.worldbank.org/indicator/sp.urb.totl.in.zs, last accessed May 2019.

[9]Maternal morbidity is defined as unexpected outcomes of labor and delivery that result in significant consequences to a woman's health. According to the WHO, for every woman who dies in childbirth, 20 or 30 experience acute or chronic morbidity. Across Sub-Saharan Africa, for example, the range of instances of severe morbidity over 1,000 births is estimated between 109 for Nigeria and 9 for Tanzania, hence tens of times higher than mortality, see Geller et al. (2018).

[10]The exception is the Global Network Maternal and Newborn Health (MNH) Registry Data from 2014 and 2016, that places the ratio of extremely severe morbidity ("near miss") to mortality at 19:1 (Goldenberg et al., 2017). Such an incidence would place the lifetime risk of death or near miss to over 40%.

[11]See Appendix D1 for the wording of the relevant question.

maternal mortality are influenced by deeply-rooted traditional beliefs widespread also in other parts of Sub-Saharan Africa. In particular, marital infidelity by either spouse is considered a primary cause of maternal health complications, (Nsemukila et al., 1999; Umoiyoho et al., 2005; Garenne et al., 1997; Gennaro et al., 1998), often discouraging women from seeking medical help when complications arise (Phiri et al., 2014). Indeed, 55.5% of men and 42.0% of women report (without being prompted) infidelity as a leading cause of maternal labor and delivery complications, assigning to it greater weight as a root cause of maternal mortality than lack of appropriate healthcare and poor health status combined.[12] The stigma arising from this belief is highly relevant to information transmission within the household on maternal risk, because it potentially reduces women's willingness to raise concerns about birth complications with her spouse.

When asked about the wife's direct experience with complications and difficulties at birth, men and women have very similar propensity to report experiencing birth complications (11.4% of men and 11.3% of women).[13] The majority of adverse events reported by men and women in our sample involve hemorrhages, c-sections, breech presentations, obstructed or prolonged labor, and tearing. Similarly, reported exposure to maternal mortality episodes within the community is similar for women and men when immediate family members or close family members are concerned. However, reported incidence of maternal mortality differs substantially across male and female respondents as social distance to the victim increases. Only 6.8% of men report knowing a close friend whose wife has died giving birth, while 11.0% of women know a close friend who has died giving birth. An even greater gap is observed for distant friends (10.8% vs. 5%). Women are 4 percentage points more likely to have heard of someone experiencing complications in the past year, and over 10 percentage points more likely to have heard of someone who died in childbirth over the same period. Despite this gap in experience, only 53.4% of women and 27.6% of men report having attempted to discuss maternal mortality and morbidity risk with their spouse.

Overall, our data indicate that, while maternal health is a relevant source of concern for the couples in this setting, significant gaps in exposure to information and in the understanding of

[12] To elicit the weight that respondents attribute to different causes, we gave respondents 30 buttons and asked them to allocate between causes. See the Appendix for the wording of the questions.

[13] In fact, men are more likely than women to report that any complication occurred (17.5% of men and 13.8% of women, table 1, panel B). However, this is only because men are substantially more likely to report miscarriages and stillbirths as maternal health complications. Without these events, the rates are almost identical (11.4% as reported by men and 11.3% as reported by women.

maternal mortality and morbidity risk exist within the household.

Table 1: Fertility Outcomes, Preferences, Beliefs and Attitudes at Baseline

	Women	Men	Diff. SE	p-value
Panel A: Maternal Health Experience and Communication				
Past maternal and birth complications or difficulties	0.138	0.175	(0.019)	[0.055]
Past maternal complications or difficulties	0.113	0.114	(0.017)	[0.918]
Immediate family member died from complications	0.039	0.032	(0.010)	[0.470]
Close relative died from complications	0.067	0.049	(0.012)	[0.147]
Close friend died from complications	0.110	0.068	(0.015)	[0.006]
Distant friend died from complications	0.108	0.050	(0.014)	[0.000]
Heard someone experienced complications last year	0.363	0.324	(0.025)	[0.123]
Heard someone died in childbirth last year	0.352	0.246	(0.024)	[0.000]
Communicated info about future possibility of complications	0.534	0.276	(0.025)	[0.000]
Discussed family planning with healthcare provider	0.474	0.194	(0.024)	[0.000]
Panel B: Maternal Mortality and Morbidity				
Ideal space between children (m)	41.142	36.636	(0.955)	[0.000]
Months woman should give body to recover post-birthing	27.058	26.132	(0.975)	[0.343]
Women with more kids at higher risk of complications	0.777	0.720	(0.023)	[0.013]
Older women at higher risk of complications	0.846	0.743	(0.021)	[0.000]
Likelihood of complications if immediately pregnant	8.000	7.880	(0.127)	[0.343]
Likelihood of complications if pregnant 12 months after delivery	4.722	4.686	(0.137)	[0.793]
Likelihood of complications if pregnant 24 months after delivery	2.400	2.155	(0.124)	[0.048]
Likelihood of complications if less than 4 kids	3.076	2.933	(0.121)	[0.238]
Likelihood of complications if more than 4 kids	5.805	6.014	(0.136)	[0.123]
Likelihood of complications if younger than 40	3.721	3.261	(0.130)	[0.000]
Likelihood of complications if older than 40	7.930	7.451	(0.118)	[0.000]
Reports that infidelity increases risk of complications	0.420	0.555	(0.026)	[0.000]
Relative infidelity weight	0.304	0.328	(0.009)	[0.009]
Total observations	714	714		

Notes: Baseline survey collected in the Fall of 2014. "Likelihood of complications..." variables is the reported likelihood on a scale from 0 to 10 (question wording reported in the Appendix). "Relative infidelity weight" is the percentage of points assigned to infidelity as a cause for maternal mortality as opposed to health problems or lack of healthcare. Wording of all questions in Appendix D.

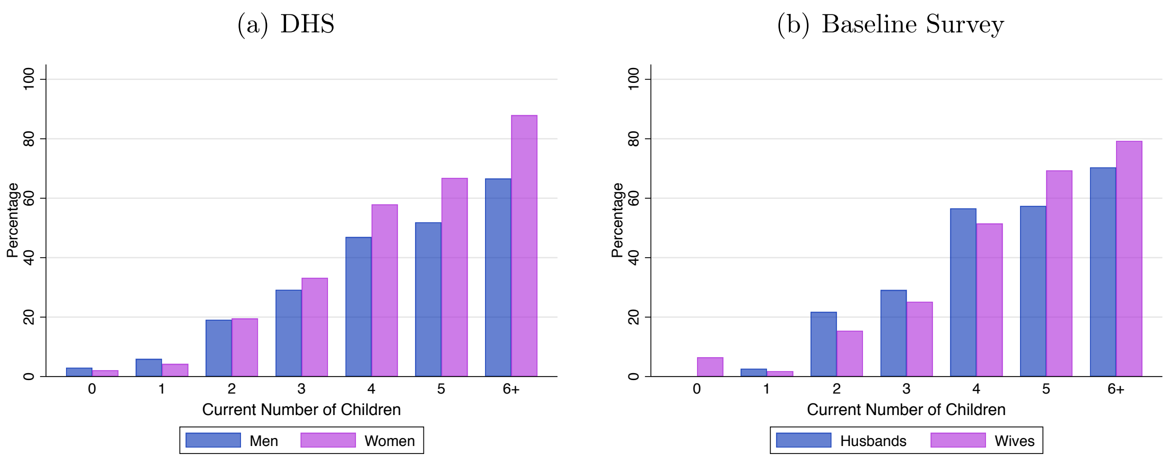
1.2 Fertility, desired fertility and contraceptive use

Zambian fertility rates are high. Data from the 2014 DHS indicate that the total fertility rate in Zambia is 5.3 children per woman aged 15-49, one child below the total fertility rate measured in the 1992 DHS. Urban areas have a somewhat lower rate, at 3.7 children per woman.

High fertility in Zambia is associated with a high unmet need for family planning services: 14% of married women report having an unmet need for spacing births and an additional 7% report an unmet need for limiting them. Nevertheless, desired fertility is also high and it differs significantly between married men and married women: in the 2014 DHS, the ideal number of children is 5.1 for married women and 5.7 for married men nationwide. Figure 1 highlights the discrepancy in the desire for additional children as a function of the current number of living children in that sample (panel a).

From our baseline survey, similar patterns emerge. Ours is a prime-age urban sample, and the average age for women is 28. Yet, women in the sample have on average 2.6 children (Appendix table A1).[14] Unmet need for family planning is high. Overall, 32% of the women in our sample report not using modern contraceptives at baseline. Of the 33% of women in our sample who want no more children, 27% are not using any modern contraceptive (8% of our overall sample). Similarly, of the 52% women in our sample who wish to delay giving birth by at least one year, 23% are not using any modern contraceptive (12% of our sample in total).

Figure 1: Percent that Want No More Children by Current Number of Children in the DHS and in the Baseline Survey



Notes: Left-hand side bar graph summarizes percentages of men and women for DHS 2013-2014 data; right-hand side bar graph summarizes percentages of husbands and wives in our sample.

As observed in the nationally-representative sample from the DHS, men in our sample have higher desired fertility on average than their wives: 4.43 for men, 4.19 for women (Appendix table A1). Indeed, the distribution of men's reported ideal fertility first order stochastically dominates that of women (see Appendix figure A2, panel b). In 35.7% of couples, there is no gap between husband and wife in ideal number of children. In 36.6% of couples, the husband wants more children than the wife (on average 1.9 more children). In the remaining 27.7%, the wife wants more children than the husband (on average 1.6 more children). Nevertheless, given

[14] Women aged 35 and above (16% of our sample), and hence closer to completed fertility, have on average 3.9 children.

the particular age distribution in our sample, men tend to have more children than their wives because of prior relationships, attenuating the potential disagreement over whether to have more children.

In our sample, men and women also exhibit substantial differences in their attitudes towards family planning and contraception. For instance, 38.3% of men report thinking that contraceptives are bad for a woman's health, against 17.2% of women (Appendix table A1). Similarly, 31.0% of men report thinking that contraceptives reduce a woman's future ability to conceive, against 17.0% of women. In addition, 57.9% of men report thinking that contraceptives enable women to be unfaithful, against 37.6% of women.

Men's desired fertility appears to influence communication about maternal mortality risk among the households in our sample. Indeed, both husbands and wives in our survey report that communication on maternal health is significantly more likely to occur and to not break down when men no longer want children compared to when they want a child as soon as possible (Appendix table A2). This correlation motivates our theoretical setup and justifies exploring heterogeneity of treatment effects by the man's demand for children.

2 Model

We construct a theoretical framework to examine how fertility decisions are made within the household, highlighting the role played by communication about maternal health cost. We first show that ex ante asymmetries of information on maternal health cost may break down the spousal agreement over fertility. Then, we study how an information intervention may affect communication and realized fertility, and discuss heterogeneity in the expected effects of the intervention.

2.1 Environment

Men and women make fertility decisions, given their preferences for children and the maternal health cost of fertility. We model these decisions within a static framework in which completed fertility is realized only once in each couple.

Preferences Spouses receive utility from their fertility and from transfers. They have different preferences that depend on the realized number of children. In line with the literature (see for example Rossi (2019)), each spouse wants to minimize the distance between realized fertility and their net fertility objectives, which are determined by the difference between gross fertility objectives (a combination of ideal fertility and all costs not related to maternal health) and the maternal health cost.[15] Gendered spheres of activity, where women are primarily responsible for the raising of children, can thus generate a difference in gross demand for children, even when underlying preferences in terms of ideal fertility are the same between spouses. Formally, spouses' preferences are the following:

$$U_j^H = -\left(\alpha_j^H - \delta_j\theta_j - n\right)^2 - \gamma_j t$$

$$U_j^W = -\left(\alpha_j^W - \theta_j - n\right)^2 + t$$

where α_j^i is the "gross" demand for children, θ_j is the realized maternal health cost, n is the realized number of children in the household, $t \geq 0$ is the amount transferred by the man, γ_j is the man's (finite) disutility of (monetary or in-kind) transfers, and $0 \leq \delta_j \leq 1$, that is a function of both altruism and attention, captures the extent to which the husband internalizes the maternal health cost.[16]

To replicate the empirical distribution of the "gross" demand for children, we assume that the average difference in demand between husband and wife is positive and that this difference increases as the demand of the husband increases.

While the gross demand for children is difficult to observe, when it comes to ideal fertility this assumption is easily verified by the data: it reflects the strong positive correlation between the spouses' difference in demand and the demand of the husband observed in our data and in DHS data (figure A3).[17] This correlation is expected to arise when the distribution of the gross

[15] We chose quadratic preferences in which the type enters linearly in the quadratic form because they are standard in the cheap-talk literature (since Crawford and Sobel, 1982) as they allow for closed form solutions of the partition equilibria. This particular functional form has the drawback of implying that the indirect utility of a spouse is increasing in the health cost as soon as the equilibrium number of children is higher than the ideal preferences. However, our results do not rely on this specific functional form. Results under alternative functional forms that do not have this implication are discussed in Appendix B.4.

[16] One remark is worth making: since the wife's outside option assures her to minimize her expected utility cost, the husband will always make an offer to make her indifferent between her optimal fertility and transfers. The distance between the wife's optimal fertility and that proposed by the husband is determined by γ_j. Indeed, in a Pareto optimal problem in which the husband maximizes his utility under the constraint that the utility of the wife be higher or equal to 0, the Lagrange multiplier on the wife's utility constraint is equal to γ_j. In this sense, this parameter can also be interpreted as a proxy for the bargaining power of the woman in the couple.

[17] The assumption also allows to express our theoretical predictions with respect to α_j^H, matching our baseline evidence on the role of husband's preferences and hence our stratification variables for heterogeneity. However, all the theoretical results related to communication and transfers are symmetric around $\alpha_j^H - \alpha_j^W = 0$.

demand for children of the husband first order stochastically dominates that of the wife and the two distributions have common support on the lower part of the distribution.

Maternal health cost Maternal health cost is a random variable denoted as θ, distributed with probability density function (pdf) $f^Z(\theta)$ on the interval $[0, 1]$, with first and second moments equal to θ^Z and σ^Z respectively. Uninformed agents believe that θ is drawn from a pdf denoted as $f^B(\theta)$ on the same interval, with first and second moments equal to θ^B and σ^B respectively. Uninformed agents underestimate the maternal health cost, with $\theta^B < (2\theta^Z - 1)$.

In our benchmark case with incomplete information, we assume that spouses are equally uninformed about the realisation θ: prior to the intervention, neither the husband nor the wife observe the realization of θ at the moment in which they decide fertility and they both believe that the wife cost is drawn from the distribution $f^B(\theta)$ (with mean θ^B).

To formalize the asymmetries that can arise from gendered spheres, we then study what happens when we treat one spouse and households are asymmetrically informed. In these households one spouse knows the cost realization θ_j at the moment in which optimal fertility is chosen, while the other does not observe the realization of the cost and believes the cost to be drawn from the a different distribution with mean θ^B. We also discuss what happens when one spouse is more informed ex-ante: the effect of the intervention in this type of household is described in Theoretical Appendix section B.2.3.[18]

Actions The household chooses how many children to have (n). The husband offers transfers t to the wife, compensating her for fertility levels that depart from her private optimum. As long as transfers occur, optimal fertility is determined by the maximisation of the sum of husband's and wife's fertility objectives, and who has the property right over the fertility decision has no effect on the fertility outcomes (Coase, 1960). If transfers break down – meaning that the husband is not willing to provide the level of transfers the wife requires to adapt to his fertility preferences – the wife is the ultimate decision-maker over fertility (Ashraf, Field and Lee, 2014).

[18]Allowing for bias in our baseline model allows us to incorporate the evidence from our the baseline data, that suggests that men have systematically different beliefs compared to women, on average. In the Appendix B.5, we discuss the case in which uninformed spouses know the real cost distribution in Zambia (with mean θ^Z). In such a case, uninformed agents are not biased. We present the effect of the intervention on intra-household interactions when either the husband or the wife is treated.

2.2 Benchmark case: fertility under complete information

We start by describing optimal fertility levels with complete information on maternal health cost. We define $n_j^H = (\alpha_j^H - \delta_j \theta_j)$ and $n_j^W = (\alpha_j^W - \theta_j)$ as the spouses' fertility private optima in this case.

2.2.1 Structure of household decision making

The structure of the decision-making is as follows: given the wife's preferences and beliefs, the husband computes the optimal mapping from transfers to fertility $n(t)$ so that the utility of the wife remains unchanged, and he chooses the optimal level of transfers t^*, making a take-it-or-leave-it offer to the wife. Then, optimal fertility n^* is realized. We have in mind an efficient contracting environment where the husband can compensate the wife for her utility loss. The model is solved by backward induction.

2.2.2 Equilibrium transfers and number of children

First, the husband computes the optimal transfers that would induce a fertility shift in favor of his own preferences. He knows that the wife will implement her optimum n_j^W unless she receives a transfer that compensates her for deviating. Maximizing the husband's utility function with transfers accounting for the wife's reaction, we have: $n_j^{Ht} = \frac{n_j^H + \gamma_j n_j^W}{1+\gamma_j}$. At the optimum, the husband chooses $t^* = (n_j^{Ht} - n_j^W)^2 > 0$. In equilibrium, transfers always occur and the optimal number of children in equilibrium is the optimum for the husband in the presence of such transfers $n_j^* = n_j^{Ht}$.

2.3 Fertility with incomplete information

We now study equilibrium fertility when there is incomplete information on the cost realisation. We consider the benchmark case in which both spouses do not perfectly observe the realization of the health cost and they have a biased perception of the distribution of the health cost with mean θ^G. The structure of the game is the same as the full information case. The game is solved by backward induction. The details of the computations are in the Theoretical Appendix B.1.

Equilibrium transfers and number of children The private optimal fertility of the two spouses, maximizing their expected utility, given the new assumption on the distribution of the maternal health cost is now equal to $n_b^W = \alpha^W - \theta^G$ and $n_b^W = \alpha^W - \theta^G$. This time, maximising the husband utility function with transfers, we have: $n_b^{Ht} = \frac{n_b^H + \gamma n_b^W}{1+\gamma}$. Even with biased beliefs, the husband's incentive compatibility condition is always satisfied, so the optimal fertility in equilibrium is equal to $n_b^* = n_b^{Ht}$.

2.4 Fertility and communication after the intervention

We now discuss the effect of an informational intervention that credibly communicates θ_j to participants, such as the one in our study. While providing credible information to women closely mimic reality – as women are those entering the labour ward and directly experiencing maternity process, providing information to men allow us to understand how this innovation affect the fertility outcome in the household.

When one of the spouses is treated, she gets a perfectly informative signal on her cost realization. This creates an asymmetry of information in the household, since now one spouse has perfect knowledge of the cost realization and the other does not. We study the Perfect Bayesian Equilibria of communication game about the cost realization and the fertility outcome in both the case in which the wife is treated and that in which the husband is treated.

Structure of household decision making The structure of the game is modified as now there is the possibility of a communication stage in which the informed spouse can try to provide information about her health cost realization. The structure of the game is modified as follows:

1. The informed spouse communicates about θ_j and the uninformed one updates θ_j
2. The husband offers $t(n_u^*)$ with commitment
3. The wife accept or refuses n_u^*
4. The husband pays $t(n_u^*)$

Again, the model is solved by backward induction. The details of the resolution of the models, and the lemmas and propositions related to them, are in the Theoretical Appendix B.2.

Optimal Fertility and Transfers Given that the one spouse is informed, her privately optimal fertility is equal to the complete information case while that of the other spouse depends on his beliefs about θ_j.

To understand optimal transfer from husband to wife, we need to study the communication game in the first stage.

Communication when the wife is treated Studying information sharing by the wife and information updating by the husband, we show that communication almost never occurs. The lack of information transmission is linked to the control the wife has on fertility: when transfers do not occur, the wife implements her private optimum, that implies no utility loss. When she has to transmit information, her incentives are such that she tries to push transfers beyond her utility loss, to reach an indirect utility higher than her back-up option. Since these incentives are independent from the cost realisation, no information can be transmitted and a pooling equilibrium is the only equilibrium possible, unless the ideal fertility preferences of the two spouses are really close.

The lack of information transmission creates a barrier in the implementation of transfers and an increase of disagreement in the household. Fertility decreases to levels that correspond to the private optimal fertility of the wife. While there may be other reasons that explain the lack of information transmission (as for example the fact that men discount any information coming from women, see Conlon et al., 2021), the consequences of a lack of information transmission on fertility are valid whatever the barrier to the sharing of information.

Communication when the husband is treated To study information sharing by the husband and information updating by the wife, we have to understand the husband's incentives to truthfully report the maternal health cost θ_j.

When men are altruistic and transfers not very costly (meaning that δ is sufficiently high and γ is sufficiently low), the husband always gets the highest level of utility telling the truth, so truthful communication occurs in equilibrium. When γ is very high, the husband has no incentives to tell the truth, and no communication occurs in equilibrium. This is due to the fact that the wife is aware that any information sharing by the husband would aim at minimizing costly transfers, regardless of the realization of θ. For intermediate levels of δ and γ, there is some information updating, without full information transmission. The information updating depends on the difference in ideal fertility between the husband and the wife (see the proof of proposition 2 for the details).

As soon as some information transmission occurs, average fertility is affected as well. Transfers increase and fertility decreases among households in which either α^H or γ are sufficiently low.

The results on information transmission between husband and wife rely on the specificity of the fertility agreement: the husband can implement his optimal fertility through transfers. When the difference in ideal fertility or the cost of transfers are sufficiently low, optimal transfers differ across cost types and this implies a unique separating equilibrium. For higher levels of difference in ideal fertility or transfers cost, partial or no information transmission occur. Standard refinements of equilibria apply.[19]

2.4.1 Cooperation among spouses and welfare

Finally, we discuss the link between information transmission, agreement on fertility outcomes, cooperation and welfare in the household. We first present the aggregate welfare effects of providing information either to the wife or to the husband. We then extend the previous model to take into account that disagreement on fertility and transfers implies that the household is stuck in a non-cooperative inefficient equilibrium that may encompass a psychological cost.

In the context of the baseline model presented above, when information is provided to only one spouse and no information transmission occurs, asymmetries of information may impede spouses to find an agreement on transfers and fertility.[20] Since barriers to information transmissions are stronger when the wife is treated we have that total household welfare is higher when the husband is treated than when the wife is treated.

Furthermore, in our baseline model there is no direct cost of not cooperating. However, spouses may suffer an additional cost, linked to an increase in conflicts in the couple, when no agreement on transfers and fertility is reached. This can be seen as corresponding to the standard assumption in the intrahousehold literature that models married (cooperative) individuals as enjoying a positive shift in their utility as compared to their utility when non-married (Browning,

[19] NITS condition applies for values of parameters not satisfying the monotonicity of the message function defined by the differential equation 4 (Chen, Kartik and Sobel, 2007).When a separating equilibrium exists, the intuitive criterion apply (Cho and Kreps, 1987). See the proof in appendix for details.

[20] Market failure due to information asymmetries is well know in the theory of markets since Akerlof (1970).

Chiappori and Weiss, 2014). Formally this means that, when transfers do not occur, the utility of the two spouses is modified as follow:

$$U^H_{j,NC} = -\left(\alpha^H - \delta\theta_j - n\right)^2 - \xi^H_{j,NC};\quad U^W_{j,NC} = \left(\alpha^W - \theta_j - n\right)^2 - \xi^W_{j,NC}$$

where $\xi^i_{j,NC}$ is the utility cost (mainly interpreted as a psychological cost) of each spouse of being in a non-cooperative situation in the household, and n is chosen by the wife to maximize her own utility. The addition of this utility cost implies that the total cost of disagreement is higher. In this case, for $\xi^H_{j,NC}$ and $\xi^W_{j,NC}$ high enough and α^H low enough, when the wife is treated, the household welfare is lower than before the intervention (the details of the computations are in the Theoretical Appendix section B.2.4).

2.5 Experimental predictions

In the previous subsections, we discussed how communication, transfers and fertility are affected by the intervention: while average fertility is expected to decrease both when we treat the husband and the wife, communication and transfers evolve very differently across the two treatments, leading to different implications for policy purposes.

We can hence formulate several predictions for how our outcomes of interest would be affected by the intervention, that we can formally test using our experimental data from Zambia. The proofs of the predictions are in the Theoretical Appendix B.3. The first two predictions relate to maternal health knowledge and fertility.

Prediction 1. ***Communication and beliefs updating.*** *After the intervention,*

(i) when the wife is treated, no information transmission occurs between husband and wife and beliefs evolve on average only for the wife, unless interests are (almost) fully aligned and δ *is sufficiently high;*

(ii) when the husband is treated, information transmission occurs when interests are sufficiently aligned (for δ *sufficiently high and* α^H *sufficiently small, or for* γ *sufficiently low), and beliefs evolve on average for both spouses.*

Prediction 2. ***Fertility.*** *After the intervention, fertility decreases both when men are treated and when women are treated.*

Fertility is expected to move both when the husbands and the wives are treated if spouses are ex-ante equally uninformed. If information is ex-ante-asymmetric, we expect the effect to be smaller when the wife is treated (as discussed in the Theoretical Appendix section B.2.3).

The third prediction is about a secondary outcome, affected indirectly by the intervention: the transfers between husband and wife.

Prediction 3. ***Transfers.*** *After the intervention,*

(i) when the wife is treated, transfers to the wife decrease on average;

(ii) when the husband is treated, transfers to the wife (slightly) increase on average.

Since husbands have incentives to under-report the maternal health cost, the increase in transfers is small relative to what a full information model would predict. Furthermore, since actual transfers in the household may be correlated with fertility for more reasons than only compensation for optimal individual fertility (i.e. to finance the consumption of children) the net effect on transfers when the husband is treated is expected to be ambiguous.

The fourth prediction involves household welfare.

Prediction 4. ***Welfare.*** *After the intervention,*

(i) when the wife is treated, total household welfare decreases on average;

(ii) when the husband is treated, total household welfare increase on average.

Finally, we present some predictions about heterogeneous effects of the intervention along two dimensions: the idiosyncratic health cost faced by the wife and the fertility preferences of the husband.

Prediction 5. ***Ex ante health cost of the wife*** *After the intervention, heterogeneous effects according to the* ex ante *health cost of the wife are as follows:*

(i) when θ_j is low, fertility does not change neither when the husband is treated nor when the wife is treated;

(ii) when θ_j is high, fertility decreases both when the husband is treated and when the wife is treated.

Prediction 6. ***Ex ante fertility preferences*** *After the intervention, heterogeneous effects according to the husband's ex ante fertility preferences are as follows:*

(i) communication occurs when the husband is treated and α^H *is low;*

(ii) fertility decreases both when the wife is treated and when the husband is treated. When the wife is treated, the effect is concentrated in households in which α^H *is low. When the husband is treated, fertility decreases for any value of* α^H*, with the strongest effect when* α^H *is low.*

The heterogeneous effects with respect to transfers mirrors the effects for fertility when α^H is high: they increase only when the husband is treated. When α^H is low, transfers decrease when the wife is treated. When the husband is treated the effect is ambiguous, as transfers are expected to increase when the husband wants more children then the wife, and decrease when he wants less children then her as long as δ is lower than 1.

All the proofs are in Appendix B.3. Prediction 1 is tested in section 5.1. Prediction 2 is tested in section 5.2. Predictions 3 and 4 are tested in section 5.3. Finally, the heterogeneous effects described in prediction 5 and 6 above are tested in section 5.4.

3 The experiment

To study and compare the effect of providing information about maternal mortality to men and women, we designed and implemented a randomized field experiment among couples in Lusaka, Zambia.

3.1 Design

Our intervention experimentally varied the provision of information about maternal mortality and morbidity risk to either the husband or the wife of each household relative to a control group. Both spouses in all households were invited to participate in a gender-specific group meeting. In order to identify gender differences in responsiveness to information separately from potential gender differences in take-up, only households in which both husbands and wives agreed to participate were included in the study. Each household was randomly assigned to one of three study arms (see table 2):

i) The husband was exposed to both a maternal mortality curriculum and a family planning curriculum $(FP + MM)^h$ and the wife was exposed to the family planning curriculum FP^w. This arm is denoted in short as $FP + MM^h$.

ii) The wife was exposed to both the maternal mortality curriculum and the family planning curriculum $(FP+MM)^w$ and the husband was exposed to the family planning FP^h curriculum. This arm is denoted in short as $FP + MM^w$.

iii) Both spouses received the FP curriculum. This arm is hence denoted in short as FP.

Table 2: Experimental design

		Husband	Wife
Husband treated	$[FP + MM^h]$	$(FP + MM)$	FP
Wife treated	$[FP + MM^w]$	FP	$(FP + MM)$
Control	$[FP]$	FP	FP

3.2 Identification and empirical specification

The primary goal for our design is to identify the direct and indirect effects of providing information on maternal mortality to men and women. In the experiment, maternal health information (MM) is always delivered alongside information about family planning (FP), which is also provided to the control group. This design ensures that *all* participants attend a reproductive health group meeting, addressing the concern that a direct effect or an experimenter demand effect generated by the group meetings may confound the estimates of the effect of maternal health information. This design implies the control group may be influenced by the family planning information itself, making some effects potentially harder to detect, but it allows us to unambiguously isolate the incremental effects of the maternal mortality information.

Our experiment focuses on two sets of empirical objects. First, we are interested in separately estimating the average treatment effects of delivering both maternal health and family planning information ($(FP + MM)^j$) to each spouse $j \in \{h, w\}$ compared to delivering family planning information alone ($(FP)^j$) on a hypothetical outcome of interest Y, measured at either the household level(e.g. take up of family planning and fertility) or the individual level (e.g. knowledge of maternal health, attitudes towards family planning), for either the treated spouse (direct effect) or the untreated spouse (indirect or spillover effect). The second object we are interested in estimating is the comparison of the direct or spillover impact of providing information about maternal mortality to men compared to women on household-level and individual-level outcomes.

The main challenge associated with estimating these objects is that, in our design, participants choose to attend a community meeting, generating an imperfect take-up problem. This challenge is addressed by our standard double-blind approach: the surveyors who invite households to the community meetings do not know what type of meeting each individual is invited to and only one type of invitation card is provided to participants in all treatment arms, ensuring that selection into participation in the community workshop is the same within genders, and hence that we can estimate a treatment-on-the-treated effect TOT^j within husbands and wives separately. Participants were invited to attend a health-related meeting. Nor family planning nor maternal health were mentioned in the invitation.

Even with double-blind invitations, we may be left with a second concern: that the pool of women and men who decide to attend the community meeting may come from different types of households, if the characteristics that govern the selection of a household into participation when a man is invited differ from those governing the selection when a woman is invited.[21] If this is the case, then the difference in the treatment-on-the-treated effects by gender may not only be driven by the differential impact of maternal health information on men compared to women, but also by the differential take-up.[22]

To address this issue, we chose to invite *both* spouses to attend workshops together, and hence to have a three-arm design in which men and women in all households receive information on family planning, while the treated spouse receives maternal health information as well. Considering households in which both spouses have attended a community workshop implies estimating the gender difference in the treatment-on-the treated effects estimated on directly comparable samples.[23] The cost of achieving this comparability is that we can only estimate

[21] Suppose, for example, that women from more conservative households are unable to attend a meeting on their own, while their husbands would be willing to participate. If conservative households have different treatment effects from the rest of the sample, we may detect a difference between treatment effects across arms that depends on take-up and not on differential effects across genders.

[22] Without inviting both spouses to the meeting, the estimated effects is

$$\left[E[Y(FP+MM)^h - Y(FP)^h | p^h = 1]\right] - \left[E[Y(FP+MM)^w - Y(FP)^w | p^w = 1]\right]$$

where p^j takes value 1 when spouse j attends the community meeting and 0 otherwise (take-up).

[23] The treatment-on the trested effect that can be estimated in this case is equal to:

$$\Delta TOT = E[\left(Y(FP+MM^h) - Y(FP+MM^w)\right) | p^h = 1, p^w = 1].$$

the effect of receiving a maternal mortality intervention when *both spouses* are exposed to the family planning curriculum. This setup can then allow us to study both the direct effects of the intervention on treated respondents and the indirect effects on the respondents' spouse.

Our estimation equations follow straightforwardly from our design. When considering outcome Y for household i (e.g. fertility), we estimate the following specification on the sample of treated households:

$$Y_i = \alpha + \beta_H Husband\ Treated_i + \beta_W Wife\ Treated_i + \theta X_i + \epsilon_i \tag{1}$$

Variables $Husband\ Treated_i = \mathbb{1}\left[FP + MM^h\right]_i$ and $Wife\ Treated_i = \mathbb{1}\left[FP + MM^w\right]_i$ are indicators for assignment to either the husband's or the wife's treatment arm. Hence, β_H and β_W identify the average treatment-on-the-treated effects for men and women respectively, while their difference captures the difference in the effect of treating a given spouse. In the tables, we report the p-value of this F-test. The vector of baseline control variables X_i includes wife's age, husband's age, wife's education, husband's education, number of children, age of last child born before the group meeting, number of people who attended the group meeting, modern contraceptive use at baseline, quadratic weekly income plus the stratification variables.[24] As a robustness check, in the Appendix, we also perform post double selection LASSO to select the control variables.

We also consider specifications in which the outcome variable is measured at the individual, rather than household, level for spouse $j \in \{h, w\}$ in household i (e.g. beliefs). Our design allows us to compare the direct effect of treating a subject with the spillover (indirect treatment) effect on his or her partner, by estimating

$$\begin{aligned} Y_i^j = {} & \delta_H^h Husband\ Respondent_j \times Husband\ Treated_i + \delta_W^h Husband\ Respondent_j \times Wife\ Treated_i \\ & + \delta_H^w Wife\ Respondent_j \times Husband\ Treated_i + \delta_W^w Wife\ Respondent_j \times Wife\ Treated_i \\ & + \zeta X_i + \eta X_i \times Husband\ Respondent_j + \upsilon_{i,j} \end{aligned} \tag{2}$$

[24]Stratification variables are primarily variables likely to affect the relevance of maternal health information for fertility decisions: i) a dummy for whether wife over 35; ii) a dummy for whether the couple is childless; iii) a dummy for whether the wife thinks that the husband wants another child later and for whether the wife thinks the husband does not want another child; iv) a dummy for whether the husband does not know any woman who died at childbirth; v) a dummy for whether the wife is actively trying to get pregnant; vi) block size; vii) availability of baseline data.

where $Husband\ Respondent_j = \mathbb{1}[j = h]$ and $Wife\ Respondent_j = \mathbb{1}[j = w]$ are dummies capturing the identity of the respondent. Here, the coefficients have the following interpretation: i) δ_H^h represents the direct effect of treating the husband on the husband's outcome variable Y_i^h; ii) δ_W^h represent the spillover effect of treating the wife on the husband's outcome Y_i^h; iii) δ_H^w represents the spillover effect of treating the husband on the wife's outcome variable Y_i^w iv) δ_W^w represent the direct effect of treating the wife on the wife's outcome Y_i^w.

We report the p-values of the following F-tests:

i) the difference between direct and spillover effects on the husband, i.e. between the effect of treating the husband himself or his wife on the husband's answer ($\delta_H^h = \delta_W^h$), denoted as *Direct vs. spillover effect on husband F-test p-value*;

ii) the difference between direct and spillover effects on the wife, i.e. between the effect of treating the wife herself or her husband on the wife's answer ($\delta_W^w = \delta_H^w$), denoted as *Direct vs. spillover effect on wife F-test p-value*;

iii) the difference between spillover effects, i.e. between the effect of treating the husband on the wife's answer and that of treating the wife on the husband's answer ($\delta_H^w = \delta_W^h$), denoted as *Symmetry of intra-household spillover effects F-test p-value*;

iv) the difference between direct effects, i.e. between the effect of treating the husband on his answer and that of treating the wife on her answer ($\delta_H^h = \delta_W^w$), denoted as *Direct treatment effects F-test p-value.*

4 Implementation and data collection

The study involved two waves of a panel household survey, administered separately to both the husband and the wife of each household, and a randomized controlled trial.

4.1 Sample

Couples were recruited from the catchment area of Chipata and Chaisa Clinics, located in the poor suburbs of Lusaka. Eligibility for the study followed exclusion criteria meant either to protect women that may face adverse consequences if using hormonal contraception or to exclude women that could not adjust their fertility behavior to the information provided in the intervention.[25] We also ruled out that sampled households had previously participated in the Ashraf, Field and Lee (2014) study.

4.2 Data collection and intervention

The first wave of data consisted of a baseline survey in the first visit administered both to the husband and the wife. Baseline data collection occurred between August and December 2014. 715 couples were interviewed, with the husband and the wife surveyed separately. All couples in the sample are monogamous, with polygyny being rare in Lusaka, at around 2% of marriages (Central Statistical Office, 2014). The sample was re-screened prior to the actual start of the intervention, which occurred in November 2015. In order to determine which treatment arm each household was assigned to, we randomized treatment at the couple level stratifying on the following characteristics: (i) whether the couple had a child or not; (ii) whether the wife was older or younger than 35 years old; (iii) whether the couple wanted another child at baseline; (iv) residential size of the block in which the couple lived; (v) whether the wife believed that the husband wanted another child; (vi) whether the wife believed that the husband wanted another child as soon as possible; (vii) whether the husband knew someone who died at childbirth.

The intervention stage took place between November 2015 and May 2016. It involved a community meeting - in which spouses would receive information on maternal health related issues and family planning - occurring during weekends. Households were invited to attend on a weekly roll-out basis. We randomly varied the first intervention week by treatment arm for each household. To avoid contamination across treatment arms, each type of community meeting took place in a different time slot. This implied that there was a non-negligible amount of time between the randomization and the actual invitation to the intervention.

The lag between the baseline data collection and the intervention led to a strong reduction in eligibility in the sample. Hence, between October 2015 and February 2016, 442 households

[25] Any couple in which the wife was aged between 18 and 40 and lived in the catchment area of the Chipata and Chaisa clinic was eligible to be recruited. A random-address generator was used to recruit couples. The following exclusion criteria was agreed upon with the competent Research Ethics Committees: (i) households in which the wife had diabetes, heart disease or high blood pressure at baseline; (ii) households in which the wife was younger than 18 years of age or older than 40 at baseline; (iii) households in which the wife was less than 8 weeks postpartum; (iv) households in which the wife has been sterilized or had a hysterectomy; (v) men or women who were not currently married; (vi) households in which the wife was pregnant at recruitment or the intervention phase; (vii) households in which the spouses were actively trying to have a baby when invited for the intervention; (viii) households in which the wife was on long-term contraceptives when invited for the intervention. Exclusion criteria (iv) to (vii) relate to our study objectives, but are not medically motivated.

were subsequently included in the sample. For these households, a subset of baseline questions was asked to the wife for stratification purposes.[26] Thus, the sample of households eligible for intervention consists of 1,137 couples. Of these, in total, 772 households were eligible to be invited to the intervention. This implies that 21% of the sample became ineligible between baseline and intervention, mostly due to pregnancy and to shifts outside the catchment area of our partner clinics. Pregnant women were deemed ineligible because they could not modify their fertility behavior in the medium term. Recruitment and invitations were double-blind and drop-outs occurred *before* treatment assignment, and hence it is orthogonal to it.

Participants were asked to show up for the meetings together with their spouse, and were separated into different rooms for parallel, gender-specific sessions. Participants were not told the content of their partner's session. Each session involved approximately 20 participants and was led by two trained local facilitators, one man and one woman, each working in meetings of men and women to ensure we do not include a facilitator-specific effect in the treatment effect. In the FP curriculum, the educators discussed the types of modern contraceptives available at the clinic, dispelled common misconceptions surrounding family planning, and referred the participants to the public clinic for further information. In the FP+MM curriculum, the educators delivered this same information, but also added informational content about maternal health risk. The material focused on the magnitude of the risk of maternal mortality in Zambia, the primary medical causes of maternal mortality and morbidity and the risk factors such as low birth spacing, high parity and advanced age.

The trained facilitators followed a scripted curriculum, helped by visual material designed for the study. These features allowed our team to extensively monitor the information presented and ensure consistency across groups. All scripts are included in Appendix C. Illustrated materials, designed by a local artist for the study and organized in flipcharts, supported the group meeting.

We tested and implemented a number of steps to maximize participants' attendance to the community workshops. First, workshops were held on weekends. The exact time of the workshops was decided based on focus group discussions and a small survey. Assignment of workshop time slots to study arms was randomized. Second, couples who missed their first community

[26] These additional couples were enrolled in the study if they satisfied the eligibility criteria and consented to participate. While other study participants took part in a baseline survey before being invited to community meetings, these couples did not undergo a complete baseline, but the wife answered a small subset if the baseline questions, crucial for our heterogeneity analysis. We first recruited these households, then went back and conducted the invitations to community meetings, similar to the rest of the sample.

workshops were re-invited again several additional times. Third, each spouse received 25 Zambian Kwacha (approximately 5 USD at the time of the intervention) as transport reimbursement, an amount comparable to the amounts households receive in Lusaka for attending this type of events. Last, a raffle was associated with each set of workshops, and only participants to the workshop received a raffle ticket for winning a small electric cooking stove. In the end, a total of 562 couples attended out of 772 (73% of invited couples) attended a group meeting.

After the group meetings, we used a Becker-DeGroot-Marschak mechanism to elicit the participants' willingness to pay (WTP). We elicited the husband's WTP for a voucher to get priority access to family planning services at the public clinic, to test whether the maternal health curriculum had any immediate effect on the demand for contraceptives. The facilitators explained to the participants that the voucher granted access to a nurse dedicated to the study, who would provide them with information about family planning and with any method of their choice, similar to the voucher that was provided in the Ashraf, Field and Lee (2014) study.

Finally, between October 2016 and March 2017, we collected follow-up data for the households that attended the intervention, with an attrition rate of 10%: for those households, we recollected measures of knowledge of maternal health, use of and attitudes toward contraception, balance of power, fertility demand and realized fertility. Attrition is comparable across treatment arms.

5 Empirical findings

In this section, we report the empirical findings from the experiment. We begin by examining changes in knowledge and beliefs about maternal mortality, and the flow of such information within the household. We then study how providing maternal health information affects fertility, transfers and relationship well-being. Finally, we examine the model's empirical predictions with respect to heterogeneous treatment effects.

5.1 Knowledge and beliefs about maternal health

We begin by examining the effect of treatment on knowledge and beliefs about maternal mortality and morbidity risk. First, to measure what participants have retained from the session, we consider an index that combined the two main sets of questions on beliefs. The first set of questions asks respondents to identify risk factors for maternal complications, such as advanced maternal age, high parity and low birth spacing, all discussed during the treatment workshops. The second set of questions are ladder scale questions in which respondents are asked to report, on a scale from 0 to 10, the likelihood that a woman with fixed characteristics would experience birth complications. We build an index averaging the six (standardized) questions about risk factors and the seven (standardized) ladder scale questions, and also look at the risk factor and ladder questions as separate indices.

Relative to the control group, we observe a significant increase in maternal health risk awareness among treated men and also among treated women, a noisy increase among the wives of treated men, and a decline among the husbands of treated women (table 3, column 1). Our Wald tests indicate that direct effects of treatment differ significantly from the indirect effects on men (p-value less than 0.001) but not on women, and therefore that spillovers within the household are asymmetric (p-value 0.022).

When we examine the risk factors questions alone in a single index, we detect even clearer patterns with respect to our theoretical predictions. In particular, we observe a very stark and statistically significant increase in awareness of risk factors in the answers given by both treated husbands and treated wives (table 3, column 2). Even more interestingly, we find clearer evidence of a spillover effect of the treatment from husbands to wives: the wives of treated husbands also exhibit an increase in awareness of maternal health risk factors. Meanwhile, in line with the predictions of our model, we find no spillover effects flowing from treated wives to their husband. We can firmly rule out that treating the wife and treating the husband have the same impacts on men's knowledge of risk factors (p-value less than 0.001), while no such difference is detected in women's updating. As a result, we can rule out that spillover effects are symmetric within the household (p-value equal to 0.097). Women learn from their husbands about maternal risk factors, but men do not appear to learn from their wives when the wives update their own beliefs. In Appendix table A6, we report the effect of treatment on each of the components of the risk factors index.

Finally, answers to the ladder scale questions bear qualitatively similar results, but are substantially more noisy, as we can see by examining an index. We do not find a statistically significant increase of the index variable that combined all standardized ladder scale questions in response to treatment in any subgroup (table 3, column 3). Male respondents married to

Table 3: Knowledge and Beliefs Indices

	(1) Beliefs Index	(2) Risk factors Index	(3) Ladder Index
H Respondent × H Treated (δ_H^h)	0.074	0.143	0.014
	(0.038)	(0.053)	(0.052)
	[0.055]	[0.008]	[0.783]
H Respondent × W Treated (δ_W^h)	-0.072	-0.039	-0.101
	(0.037)	(0.052)	(0.053)
	[0.057]	[0.459]	[0.059]
W Respondent × H Treated (δ_H^w)	0.054	0.083	0.030
	(0.039)	(0.050)	(0.047)
	[0.169]	[0.100]	[0.527]
W Respondent × W Treated (δ_W^w)	0.094	0.100	0.083
	(0.043)	(0.052)	(0.054)
	[0.034]	[0.057]	[0.124]
Stratification Variables	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes
H Respondent Interactions	Yes	Yes	Yes
F-test p-values:			
Direct vs. spillover effect on husband (δ_H^h=δ_W^h)	0.000	0.000	0.030
Direct vs. spillover effect on wife (δ_W^w=δ_H^w)	0.387	0.758	0.338
Symmetry of intra-hh spillover effects (δ_H^w=δ_W^h)	0.022	0.097	0.060
Direct treatment effects (δ_H^h=δ_W^w)	0.729	0.561	0.350
Observations	1050	1050	1050

Notes: SE clustered at the meeting level in parentheses. P-values in brackets. Index variable in column 1 is the mean of all standardized variables in Appendix tables A6 (risk factors) and A7 (likelihood scales), with the index for each of the tables appearing in column 2 and 3 respectively. Stratifying control variables include if couple has children, wife over 35, wife thinks that husband wants another child later, wife thinks husband does not want another child, husband does not know of women who died at childbirth, block size, and baseline data present. Demographic control variables include wife age, husband age, wife education, husband education, number of children, age of last child born before meeting, wife is actively trying to get pregnant, baseline contraceptive use, and household weekly income. Each control variable and the constant are also interacted with a dummy for the husband being the respondent.

treated wives actually appear to report a lower perceived likelihood of complications. Overall, treating the wife has a statistically significantly different effect than treating the husband on the husband's ladder scale responses (p-value of the direct vs spillover effect on husband is less than 0.030), while no such difference is detected in the wife's answers. Again, we can rule out that spillover effects are symmetric (p-value equal to 0.060). When we examine the components of this ladder scale index, we find the same pattern as for the risk factors on the question that involves a high-risk group: women aged 40 and above (Appendix table A7 column 2). Relative to the control group, treated husbands, treated wives, and wives of treated husbands all report a higher perceived likelihood for this hypothetical group, while no effect can be detected for husbands of treated wife.[27] Moreover, we note that the negative effect of treating the wife on the husband's responses that we detect in the index appears to be driven by the beliefs over the relatively low-risk groups, and especially women with fewer than four children (column 3) and women who become pregnant after adequate spacing (column 5).

Considering the three indices together, the data indicate a strong pattern of greater maternal health risk awareness among men and women as a result of the intervention, except among men whose wives are given the information. In fact, we observe some evidence that men actually update negatively when their wives are treated, though this is not observed in the risk factors index. That pattern could potentially reflect the reaction towards the wife who initiates communication with her husband post-treatment, perceived by him as exaggerating. This reminder could potentially lead him to update even further away from his low-risk prior, but would not lead him to mischaracterize the risk factors of maternal mortality, consistent with the lack of a significant negative effect in column 2.

Our model hypothesizes that treating husbands would raise intra-household communication about maternal health, which could explain how untreated women married to treated men report different beliefs compared to the control group. We also examine this hypothesis directly by considering an array of questions about intra-household communications over reproductive health. We find that treated men report more communication with their spouse over maternal mortality and contraceptive use (Appendix table A8, column 1 for the index variable). In particular, treated men are the only subgroup that reports increased communication over maternal mortality relative to the control group (columns 2 and 3). Husbands of treated women do not report increased communication over maternal health; they *do* however report a statistically significant increase in the probability that their wife has tried to convince them to use contraceptives (columns 6), which could potentially account for the backlash observed in the previous table. That is, when treated women try to convince their husbands of the importance of family planning due to their updated beliefs about maternal risk, their husbands (who were at the same time exposed to the family planning information provided to every participant, including in the control group) perceive it to be an attempt at persuading them to have fewer children. They

[27] In Appendix figure A4, we plot the shift in the distribution of this likelihood scale question. We observe a clear positive shift in all respondent groups' answers, except the husbands of treated women.

may thus "overcorrect" their beliefs on health risk.

While a credibility bias could potentially explain the information transmission from women, it appears that in this context men recognize maternal health as a woman's domain of expertise. Unlike the case of Conlon et al. (2021), men here do update from the information provided by women who are not their wife. Each group workshop featured a male and female facilitator and in each session, it was the female motivator who discussed low birth spacing as a risk factor. At followup, treated men are 6.4pp more likely than the control group to correctly identify it as such (Appendix table A6 column 4), showing that they incorporate the material covered by the female facilitator in their answers.

5.2 Pregnancy and fertility

We next examine how updating beliefs on maternal risk translates into realized fertility outcomes. Our primary outcome of interest is pregnancy, and we consider that alongside expected future fertility. In particular, we measure whether the wife reports being pregnant at endline (table 4 column 2), whether she became pregnant or gave birth starting 8 months after the intervention (column 3), her reported likelihood of having more children on a 0-10 ladder scale (column 4), and the spacing between the intervention and birth (column 5).[28] An index of these variables, computed as the average of their standardized transformation, is reported in column 1.

Consistent with the patterns of changes in beliefs induced by the information treatment, when the husband is treated, we observe a 5.2pp decrease in the probability of the wife being pregnant at endline, a 43% reduction relative to the control group (column 2). We observe a similar pattern in the other measures of fertility. While no significant effect is observed when the wife is treated, the information treatment is associated with a large negative point estimate, and we cannot rule out that the effect on fertility of treating wives versus husbands is the same. When we consider the husband's reports of pregnancy and likelihood of having other children, the same patterns arise (Appendix table A3).[29]

[28]To construct the birth spacing variable, we assume a due date of 4.5 month after the survey for pregnant women.

[29]Husbands were not asked about their wife's past pregnancy history, and here there is no spacing variables for men. In Appendix figure A5, we plot the shift in the distribution of the answer to the question about the likelihood of having another child. We observe a clear positive shift in all respondent groups' answers. The concordance in spouses' answers lends confidence that our findings are unlikely driven by reporting bias caused by having received the maternal mortality information in addition to the family planning curriculum.

Table 4: Pregnancy and fertility

	(1) Fertility Index	(2) Currently Pregnant	(3) Became Pregnant Post-Int.	(4) Likelihood Have More Kids	(5) Birth Spacing (mo)
Husband Treated (β_H)	-0.157	-0.052	-0.051	-0.813	0.282
	(0.076)	(0.029)	(0.030)	(0.359)	(0.482)
	[0.041]	[0.080]	[0.096]	[0.026]	[0.559]
Wife Treated (β_W)	-0.088	-0.040	-0.033	-0.619	-0.196
	(0.079)	(0.031)	(0.033)	(0.381)	(0.434)
	[0.267]	[0.191]	[0.318]	[0.107]	[0.653]
Stratification Variables	Yes	Yes	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes	Yes	Yes
F-test p-value (β_H=β_W)	0.323	0.700	0.599	0.564	0.319
Mean of Control Group		0.120	0.170	6.450	9.980
Observations	534	534	534	534	534

Notes: SE clustered at the meeting level in parentheses. P-values in brackets. Index variable in column 1 is the mean of all standardized variables in columns 2 and 4 and the opposite of the variable in column 5. Stratifying control variables include if couple has children, wife over 35, wife thinks that husband wants another child later, wife thinks husband does not want another child, husband does not know of women who died at childbirth, block size, and baseline data present. Demographic control variables include wife age, husband age, wife education, husband education, number of children, age of last child born before meeting, wife is actively trying to get pregnant, baseline contraceptive use, and household weekly income.

A negative fertility response is consistent with the pattern of beliefs updating observed in table 3. Since husbands in the former arm do not change their beliefs on risk, reductions in fertility driven by changes in wives' preferences only should be accompanied by adjustments in the amount of risk compensation wives receive from husbands in the form of transfers, which we examine in the following subsection.

We build an index that comprises of the mean of the standardized fertility variables, adjusting the sign so that a decrease in fertility would be associated with a negative coefficient.[30] The fertility index variable confirms what emerges from the disaggregated variables: providing maternal health cost information to husbands leads a 0.157 decline in the index variable (p-value 0.040) and providing it to wives has a non-statistically significant effect in the same direction.

Changes in realized fertility are also associated with changes in the demand for children and in beliefs over the partner's demand for children among husbands (Appendix table A4). To study self-reported demand for children, we use a wide array of measurements, summarized in

[30] We exclude the variable that captures pregnancy after the intervention because it is very similar to the pregnancy at endline variable. Including such a variable in the index has no measurable effect on the coefficients.

an index variable that is meant to capture spouses' joint demand. Treated husbands report a negative and statistically significant shift in the demand index Appendix (table A4, column 1), which is not observed when the wife is treated. In particular, treated husbands report lower likelihood of wanting another child (column 2) and lower likelihood of believing that their wife wants another child (column 4) or that she wants more children than them (column 5). While we do not observe statistically significant effects of treatment on demand for or reported use of contraceptives at endline (Appendix table A5), use of modern contraceptives is quite high in our sample (68%), so changes in usage are unlikely to be detectable on the extensive margin. Indeed, this finding is consistent with what found in Ashraf et al. (2014), who document how an increase in modern contraceptive take-up leads to improved mental health, but has no effect on fertility or birth spacing. Point estimates on reported intensity of use are positive and suggestive of contraceptive use becoming more consistent between baseline and endline.

5.3 Transfers and wellbeing

Our model predicts that providing information on maternal health costs should differentially affect the transfers received by women within the marriage depending on who the recipient of the information is. In particular, we would expect that the presence of asymmetric information within the household may lead to a breakdown in contracting and a decline in transfers towards the woman when she is treated. We explore this hypothesis by examining the effects of the maternal mortality curriculum on transfers made to the wife by her husband. We focus on the husband's reports (table 5).

As expected, husbands whose wives are treated report being 13pp less likely to have made a gift to the wife in the past month (column 2), leading to a decline in the value of gift made to the wife equal to 40% of the mean of the control group (column 3), while we observe no difference in reported domestic violence (column 4). Overall, in line with prediction 3 of our model, the transfers index shifts in a negative and statistically significant way (column 1). We do not detect a positive shift of transfers in favor of women when their husbands are treated. We can rule out that the effect of treating husbands and that of treating wives is the same (p-values equal to 0.001 for the index, and 0.002 in column 2 and 0.024 in column 3 for the components).[31]

[31] Data from the wife's reports of transfers received are consistent with a reduction in transfers, but the measure is substantially more noisy and we cannot distinguish the effect of treating the husband from that of treating the wife (Appendix table A9).

Table 5: Transfers made to the wife

	(1) Transfers Index	(2) Any Gift in past month	(3) Value of gifts past month	(4) Times hit wife last month
Husband Treated (β_H)	0.010	0.017	-9.286	-0.023
	(0.073)	(0.052)	(16.470)	(0.038)
	[0.888]	[0.754]	[0.574]	[0.553]
Wife Treated (β_W)	-0.176	-0.129	-37.914	-0.000
	(0.068)	(0.058)	(14.915)	(0.043)
	[0.011]	[0.027]	[0.013]	[0.996]
Stratification Variables	Yes	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes	Yes
F-test p-value (β_H=β_W)	0.001	0.002	0.024	0.539
Mean of Control Group		0.490	93.830	0.080
Observations	502	502	502	502

Notes: SE clustered at the meeting level in parentheses. P-values in brackets. Index variable in column 1 is the mean of all standardized variables in columns 2-3 and the opposite of the variable in column 4. Stratifying control variables include if couple has children, wife over 35, wife thinks that husband wants another child later, wife thinks husband does not want another child, husband does not know of women who died at childbirth, block size, and baseline data present. Demographic control variables include wife age, husband age, wife education, husband education, number of children, age of last child born before meeting, wife is actively trying to get pregnant, baseline contraceptive use, and household weekly income.

Finally, to investigate the effect of treatment on wellbeing, we examine four different measures of self-reported marital and personal satisfaction, together with an index variable that combines them all. We find that treated husbands report more closeness to their wife (Table 6, column 2), greater marital and sexual happiness (columns 3 and 4), but no significant change in life satisfaction. Overall, the index variable shifts positively and significantly (column 1). Other subgroups do not exhibit consistent shifts, except on the marital happiness variable, which points to a positive shift in all subgroups with the exception of treated wives.

5.4 Heterogeneity analysis

Following our model, we examine how maternal health cost information generates differential responses in pregnancy by the relative risk faced by the wife and by the husband's demand for children. These dimensions of heterogeneity are not randomly assigned, and hence may correlate with other household characteristics. They may, however, provide a useful validation of our model.

Table 6: Spousal closeness and satisfaction

	(1) Wellbeing Index	(2) IOS Scale	(3) Happy with marriage	(4) Satisfied with sex life	(5) Satisfied with life
H Respondent × H Treated (δ_H^h)	0.142	0.262	0.063	0.051	0.003
	(0.070)	(0.132)	(0.037)	(0.038)	(0.057)
	[0.045]	[0.051]	[0.088]	[0.182]	[0.953]
H Respondent × W Treated (δ_W^h)	0.102	0.160	0.076	0.037	-0.002
	(0.073)	(0.165)	(0.038)	(0.038)	(0.055)
	[0.166]	[0.335]	[0.050]	[0.334]	[0.969]
W Respondent × H Treated (δ_H^w)	0.034	0.065	0.072	-0.007	-0.032
	(0.071)	(0.178)	(0.038)	(0.040)	(0.043)
	[0.636]	[0.715]	[0.061]	[0.867]	[0.463]
W Respondent × W Treated (δ_W^w)	-0.101	-0.079	-0.054	-0.083	-0.041
	(0.078)	(0.181)	(0.046)	(0.048)	(0.048)
	[0.197]	[0.663]	[0.237]	[0.088]	[0.400]
Stratification Variables	Yes	Yes	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes	Yes	Yes
H Respondent Interactions	Yes	Yes	Yes	Yes	Yes
F-test p-values:					
Direct vs. spillover effect on husband (δ_H^h=δ_W^h)	0.544	0.395	0.688	0.657	0.922
Direct vs. spillover effect on wife (δ_W^w=δ_H^w)	0.115	0.427	0.004	0.133	0.855
Symmetry of intra-hh spillover effects (δ_H^w=δ_W^h)	0.517	0.700	0.931	0.385	0.678
Direct treatment effects (δ_H^h=δ_W^w)	0.024	0.135	0.039	0.016	0.566
Mean of Control Group for H		5.630	0.750	0.790	0.650
Mean of Control Group for W		6.060	0.810	0.830	0.530
Observations	1050	1017	1017	1017	1050

Notes: SE clustered at the meeting level in parentheses. P-values in brackets. Index variable in column 1 is the mean of all standardized variables in columns 2-5. Stratifying control variables include if couple has children, wife over 35, wife thinks that husband wants another child later, wife thinks husband does not want another child, husband does not know of women who died at childbirth, block size, and baseline data present. Demographic control variables include wife age, husband age, wife education, husband education, number of children, age of last child born before meeting, wife is actively trying to get pregnant, baseline contraceptive use, and household weekly income. Each control variable and the constant are also interacted with a dummy for the husband being the respondent.

5.4.1 By risk status at baseline

Our model predicts that high-risk households would respond more to information about maternal health costs (prediction 5). To examine whether this is the case, we use two variables that we purposefully collected for the entire intervention sample, including the subsample for which baseline data is unavailable: whether the woman is over 35 (a stratification variable) and her history of complications. We combine these two measures into a risk type dummy: a woman is defined as high risk type if the wife is higher than 35 years old (also a stratification variable) or has experienced birth/pregnancy complications before. Overall, we find that treatment effects on fertility are concentrated in the high-risk subgroup and that, when the husband is treated, we can detect a statistically significant difference between the high-risk and the low-risk subgroups (p-value 0.085, table 7). In Appendix tables A11 and A12, we show similar patterns when considering the two components of the index separately.

The reduction in transfers when the wife is treated, for both high risk and low risk women, is coherent with the theory: since only a pooling equilibrium exists, when transfers stop, they stop for all type of women. When the husband is treated, the theory predicts transfers should increase, especially for high risk women, unless the treatment has a direct effect on δ, the weight the husband puts on the health of the wife. Since in Table 6 we see that that the husband appears to report more closeness to the wife, the husband may need to compensate the wife less for the spousal difference in demand for children, and this explains the decrease in tranfers.

Table 7: Heterogeneity by relative risk

	(1) Fertility Index	(2) Transfers Index
Husband Treated × Low Risk (β_H^1)	-0.096	0.080
	(0.085)	(0.086)
	[0.264]	[0.357]
Husband Treated × High Risk (β_H^2)	-0.317	-0.194
	(0.114)	(0.155)
	[0.007]	[0.213]
Wife Treated × Low Risk (β_W^1)	-0.041	-0.131
	(0.090)	(0.085)
	[0.646]	[0.128]
Wife Treated × High Risk (β_W^2)	-0.214	-0.297
	(0.123)	(0.147)
	[0.085]	[0.047]
Stratification Variables	Yes	Yes
Demographic Controls	Yes	Yes
F-test p-value Low Risk H=W (β_H^1=β_W^1)	0.488	0.000
F-test p-value High Risk H=W (β_H^2=β_W^2)	0.305	0.503
F-test p-value H Low=High Risk (β_H^1=β_H^2)	0.085	0.138
F-test p-value W Low=High Risk (β_W^1=β_W^2)	0.228	0.362
Observations	534	498

Notes: SE clustered at the meeting level in parentheses. P-values in brackets. Stratifying control variables include if couple has children, wife over 35, wife thinks that husband wants another child later, wife thinks husband does not want another child, husband does not know of women who died at childbirth, block size, and baseline data present. Demographic control variables include wife age, husband age, wife education, husband education, number of children, age of last child born before meeting, wife is actively trying to get pregnant, baseline contraceptive use, and household weekly income.

5.4.2 By man's demand for children at baseline

Another set of implications of our model examine heterogeneity by men's demand for children. In table 8, we examine the heterogeneity of treatment effects on this dimension. We stratified treatment assignment on whether the husband wants another child within 1 year, after 1 year or not at all, and consider each group separately. In line with prediction 6 of our model, significant declines in the fertility index occur in households in which husbands want no more children and, only when the wife is treated, want children later. Households with low demand for children by the husband are more likely to reduce fertility when they receive maternal health information when the wife receives information about maternal health cost (the p-value for the test equality of treatment effects of wife's information session between a household with a man who wants a child right away and a household with a man who wants no more children is equal to 0.065). Moreover, within the subsample in which the husband wants a child as soon as possible, providing information to wives has no effect on fertility. The p-value of the test that compares the effect of treating husbands to the effects of treating wives within this subgroup is equal to 0.111. In the subgroup in which the husband wants another child but not as soon as possible, the p-value is equal to 0.116. Only in the subgroup in which the husband want no more children, it appears that treating the wife and treating her husband has the same effect on the fertility index (p-value equal to 0.809).

To study the diffusion of information within the household and hence understand the roots of these fertility effects, we focus on *untreated* respondents and examine how their beliefs shift in response to their spouse's treatment status (table 9). Using the index in the ladder scale questions as dependent variable, we find that the subgroup of households in which the husbands wants a child as soon as possible drives the asymmetry in the spillover effect of information within the household: in this subgroup, we can rule out that the spillover between spouses are the same (p-value 0.045). Also, it is husbands who want a child as soon as possible whose beliefs exhibit the smallest (negative) response to the wife's treatment status (p-value of comparison with men who want no more children is 0.116), supporting the hypothesis of a reaction to the wife's perceived exaggeration.

As predicted, the heterogeneity effects with respect to transfers mirrors the effects for fertility when α^H is high: even though the effects are not significant, transfers increase only when the husband is treated. When α^H is low, transfers significantly decrease when the wife is treated, as

Table 8: Heterogeneity of effects on indices by the husband's demand for children

	(1) Fertility Index	(2) Transfers Index
Husband Treated × H Wants Kids Now (β_H^1)	-0.105	0.093
	(0.166)	(0.257)
	[0.531]	[0.719]
Husband Treated × H Wants Kids Later (β_H^2)	-0.244	0.124
	(0.149)	(0.236)
	[0.104]	[0.601]
Husband Treated × H Wants Kids Never (β_H^3)	-0.262	-0.066
	(0.108)	(0.117)
	[0.018]	[0.574]
Wife Treated × H Wants Kids Now (β_W^1)	0.168	-0.210
	(0.188)	(0.178)
	[0.374]	[0.241]
Wife Treated × H Wants Kids Later (β_W^2)	-0.070	-0.061
	(0.167)	(0.205)
	[0.677]	[0.767]
Wife Treated × H Wants Kids Never (β_W^3)	-0.285	-0.230
	(0.117)	(0.104)
	[0.017]	[0.029]
Stratification Variables	Yes	Yes
Demographic Controls	Yes	Yes
F-test p-value Now H=W (β_H^1=β_W^1)	0.111	0.255
F-test p-value Later H=W (β_H^2=β_W^2)	0.116	0.205
F-test p-value Never H=W (β_H^3=β_W^3)	0.809	0.038
F test p-value H Now=Never (β_H^1=β_H^3)	0.474	0.607
F test p-value W Now=Never (β_W^1=β_W^3)	0.065	0.923
Observations	440	410

Notes: SE clustered at the meeting level in parentheses. P-values in brackets. Stratifying control variables include if couple has children, wife over 35, wife thinks that husband wants another child later, wife thinks husband does not want another child, husband does not know of women who died at childbirth, block size, and baseline data present. Demographic control variables include wife age, husband age, wife education, husband education, number of children, age of last child born before meeting, wife is actively trying to get pregnant, baseline contraceptive use, and household weekly income.

predicted by the theory; when the husband is treated, the effect is ambiguous, as transfers are expected to increase when the husband wants more children then the wife, and decrease when he wants less children then her.

Table 9: Symmetry of knowledge spillovers index on untreated spouses by the husband's demand

	(1)
	Beliefs Index spillover
Wife respondent: Husband Treated × H Wants Kids Now (δ_H^{w1})	0.200
	(0.142)
	[0.162]
Wife respondent: Husband Treated × H Wants Kids Later (δ_H^{w2})	0.078
	(0.101)
	[0.440]
Wife respondent: Husband Treated × H Wants Kids Never (δ_H^{w3})	-0.048
	(0.074)
	[0.517]
Husband respondent: Wife Treated × H Wants Kids Now (δ_W^{h1})	-0.214
	(0.134)
	[0.115]
Husband respondent: Wife Treated × H Wants Kids Later (δ_W^{h2})	0.002
	(0.126)
	[0.985]
Husband respondent: Wife Treated × H Wants Kids Never (δ_W^{h3})	-0.072
	(0.077)
	[0.356]
Stratification Variables	Yes
Demographic Controls	Yes
H Respondent Interactions	Yes
F-test p-value Now H=W (δ_H^{w1}=δ_W^{h1})	0.045
F-test p-value Later H=W (δ_H^{w2}=δ_W^{h2})	0.622
F-test p-value Never H=W (δ_H^{w3}=δ_W^{h3})	0.831
F test p-value H Now=Never (δ_H^{w1}=δ_H^{w3})	0.116
F test p-value W Now=Never (δ_W^{h1}=δ_W^{h3})	0.366
Observations	560

Notes: SE clustered at the meeting level in parentheses. P-values in brackets. Index variable in column 1 is the mean of all standardized variables in columns 2-3 and the opposite of the variable in column 4. Stratifying control variables include if couple has children, wife over 35, wife thinks that husband wants another child later, wife thinks husband does not want another child, husband does not know of women who died at childbirth, block size, and baseline data present. Demographic control variables include wife age, husband age, wife education, husband education, number of children, age of last child born before meeting, wife is actively trying to get pregnant, baseline contraceptive use, and household weekly income.

5.5 Robustness checks

In the main specification, we have selected a small set of controls, that are held fixed in all of the analysis. To further limit the discretion in the choice of control, we perform post double selection LASSO to select control variables (Belloni, Chernozhukov and Hansen, 2014).

The results of this exercise for all of our main dependent variables are reported in Appendix tables A13 and A14. The qualitative and quantitative implications of our analysis are broadly unchanged, but coefficients become more precise in some instances.

6 Concluding remarks

In an intervention in which men or women in Lusaka (Zambia) receive information about maternal mortality and morbidity risk, we find that information substantially affects behavior, and that the effects on participants' beliefs and on household outcomes differ depending on who receives the information in a household. In particular, treated men and their wives update their beliefs over the risk factors of maternal health complications in response to the intervention. The same happens to treated women, but not to their husband. When men are treated, communication about reproductive health, self-reported spousal closeness and marital satisfaction all increase. When women are treated, we see no change in these outcomes, and transfers in their favor from the husband decline. Moreover, while pregnancy declines over the following year among all couples, only when women are treated is the fertility reduction accompanied by a significant decline in material transfers from husbands to wives.

These findings are consistent with a model in which limits to effective communication about maternal mortality and morbidity risk affects the wellbeing in the household. The model can explain what we find in our baseline data: women, in general, have more accurate knowledge of the risk factors for maternal mortality compared to men, even within the same household. Because of conflict of interest, as well as other barriers to communication such as the stigma associated with maternal mortality in many parts of Africa, women face a personal cost in protecting their health by reducing or spacing births. Hence, there may be significant gains to interventions that target men as the recipients of maternal health information campaigns, which are currently rare and typically take place after conception (Tokhi et al., 2018).

In a domain where separate spheres are important, in that women are more likely to learn about a phenomenon than men (or viceversa), it may be difficult for the information to spread within the household, and hence public intervention may be particularly important. Such domains may arise not only with maternal health, but also child health (Björkman Nyqvist and Jayachandran, 2017), investments in children's human capital, and other important household decisions whose costs or benefits, in many contexts, are observed or borne primarily by one household member, but influence the decision making of the entire household.

These findings inform the policy debate on male involvement in family planning. Our results indicate that involving men in reproductive health can be an effective tool to reduce unmet need for family planning, when interventions can fill specific intra-household gaps in communication. Indeed, we find that the reduction in fertility that we experimentally induce by providing information to men is not inferior to the one generated by giving it to women. The effect we document is of the same order of magnitude of other household-level interventions which have been shown to reduce pregnancy such as Ashraf, Field and Lee (2014). However, unlike the latter study, this effect is accompanied, only when the husband is treated, by an improvement in the marital surplus, instead of a worsening, as measured by greater marital satisfaction, communication, and closeness. As reducing unmet need for family planning in Sub-Saharan Africa becomes an increasingly debated policy goal, finding strategies to decrease excess male demand for children while enhancing family unity, rather than exacerbating existing conflict within the household, will be critical.

A simple policy intervention is to educate couples together. While our model would predict that similar updating would occur from educating men alone versus a husband and a wife together (because knowledge provided to men spreads more easily to the wife), we cannot assess how much of the effect we see is due to men learning this information on maternal health information together with other men around them, rather than other couples around them (or solely with their wife). We leave this to future research.

More generally, this paper reveals how gender differences can be exacerbated by information frictions, creating greater polarization and enabling significant inefficiencies to arise. Overcoming the information frictions breaks this cycle. In our setting, treating men directly leads to updating of information for both spouses, a greater alignment in fertility demand, reduced fertility and greater marital satisfaction. In a world in which there is often pressure from donor organizations for sub-Saharan African country governments, in particular, to promote family planning, our paper describes a "family-centric" approach that does not sacrifice intra-household happiness to advance health policy goals.

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Maternal Mortality Risk and
Spousal Differences in the Demand for Children

Appendix - For Online Publication

Nava Ashraf, Erica Field, Alessandra Voena, Roberta Ziparo

A Appendix Tables and Figures

A.1 Tables

Table A1: Fertility and Family Planning in the Baseline Sample

	Women	Men	Diff. SE	p-value
Living children	2.598	2.890	(0.089)	[0.001]
Ideal number of children	4.188	4.426	(0.082)	[0.004]
Likelihood of having another child	6.490	6.171	(0.192)	[0.096]
Want another child (dummy)	0.714	0.658	(0.026)	[0.028]
Diff in ideal and current number of children	1.584	1.553	(0.084)	[0.716]
Fraction contrac. methods believed to be bad for health	0.172	0.383	(0.013)	[0.000]
Fraction contrac. methods believed to lower fecundity	0.170	0.310	(0.013)	[0.000]
Agrees that contrac. help women be unfaithful	0.376	0.579	(0.026)	[0.000]
Total observations	714	714		

Notes: Baseline survey collected in the Fall of 2014. Wording of all questions in Appendix D.

Table A2: Regression: Communication, Maternal Health Knowledge and Husband's Desired Fertility

	Husband wants another child now	Husband wants no more children	N
Wife ever comm about comp risk (W)	-0.11	0.13	555
	(0.06)	(0.05)	
Wife ever comm about comp risk (H)	-0.12	0.04	554
	(0.04)	(0.04)	
Comm broke bc hus not interested	-0.02	-0.05	242
	(0.05)	(0.05)	
Hus understand if told abt risks	-0.22	0.2	548
	(0.10)	(0.07)	
Time to recover (m)	-2.29	5.43	552
	(2.13)	(2.03)	
Prob of comp if preg immediately	-0.16	-0.27	557
	(0.25)	(0.23)	
Prob of comp if preg 12m after	-0.03	0.63	557
	(0.26)	(0.23)	
Prob of comp if preg 24m after	0.12	0.32	556
	(0.23)	(0.22)	
Correct on age	0.01	-0.03	556
	(0.04)	(0.03)	
Correct on parity	-0.05	-0.00	554
	(0.05)	(0.04)	

Notes: Data from the baseline survey in the Fall of 2014. Dependent variables are in the left column.

Table A3: Pregnancy and fertility (husband's reports)

	(1)	(2)	(3)
	Fertility Index	Currently Pregnant	Likelihood Have More Kids
Husband Treated (β_H)	-0.172	-0.053	-0.597
	(0.072)	(0.029)	(0.311)
	[0.020]	[0.070]	[0.058]
Wife Treated (β_W)	-0.107	-0.037	-0.359
	(0.079)	(0.032)	(0.295)
	[0.177]	[0.243]	[0.228]
Stratification Variables	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes
F-test p-value (β_H=β_W)	0.392	0.614	0.446
Mean of Control Group	0.105	0.120	5.890
Observations	516	498	516

Notes: SE clustered at the meeting level in parentheses. P-values in brackets. Index variable in column 1 is the mean of all standardized variables in columns 2 and 3. Stratifying control variables include if couple has children, wife over 35, wife thinks that husband wants another child later, wife thinks husband does not want another child, husband does not know of women who died at childbirth, block size, and baseline data present. Demographic control variables include wife age, husband age, wife education, husband education, number of children, age of last child born before meeting, wife is actively trying to get pregnant, baseline contraceptive use, and household weekly income.

Table A4: Demand for children

	(1)	(2)	(3)	(4)	(5)
	Demand Index	Want another child	Wants another child within 2yrs	Believes Spouse Wants another kid	Believes Spouse Wants More than self
H Respondent× H Treated (δ_H^h)	-0.199	-0.073	-0.064	-0.131	-0.079
	(0.051)	(0.039)	(0.050)	(0.035)	(0.039)
	[0.000]	[0.063]	[0.198]	[0.000]	[0.048]
H Respondent × W Treated (δ_W^h)	-0.035	0.020	-0.032	-0.037	-0.009
	(0.063)	(0.036)	(0.050)	(0.040)	(0.045)
	[0.583]	[0.574]	[0.520]	[0.358]	[0.836]
W Respondent × H Treated (δ_H^w)	0.033	-0.016	0.018	-0.013	0.067
	(0.073)	(0.040)	(0.053)	(0.044)	(0.054)
	[0.652]	[0.685]	[0.737]	[0.760]	[0.222]
W Respondent × W Treated (δ_W^w)	0.016	0.033	-0.027	0.017	-0.001
	(0.065)	(0.038)	(0.049)	(0.038)	(0.054)
	[0.805]	[0.380]	[0.587]	[0.662]	[0.992]
Stratification Variables	Yes	Yes	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes	Yes	Yes
H Respondent Interactions	Yes	Yes	Yes	Yes	Yes
F-test p-values:					
Direct vs. spillover effect on husband (δ_H^h=δ_W^h)	0.013	0.011	0.507	0.034	0.095
Direct vs. spillover effect on wife (δ_W^w=δ_H^w)	0.787	0.301	0.399	0.435	0.148
Symmetry of intra-hh spillover effects (δ_H^w=δ_W^h)	0.473	0.501	0.453	0.669	0.303
Direct treatment effects (δ_H^h=δ_W^w)	0.007	0.050	0.555	0.001	0.264
Mean of Control Group for H	0.085	0.700	0.290	0.730	0.240
Mean of Control Group for W	-0.015	0.670	0.360	0.750	0.230
Observations	1050	1050	1050	1018	1050

Notes: SE clustered at the meeting level in parentheses. P-values in brackets. Index variable in column 1 is the mean of all standardized variables in columns 2,3,5 and the opposite of the variable in column 4. Stratifying control variables include if couple has children, wife over 35, wife thinks that husband wants another child later, wife thinks husband does not want another child, husband does not know of women who died at childbirth, block size, and baseline data present. Demographic control variables include wife age, husband age, wife education, husband education, number of children, age of last child born before meeting, wife is actively trying to get pregnant, baseline contraceptive use, and household weekly income. Each control variable and the constant are also interacted with a dummy for the husband being the respondent.

Table A5: Demand for and use of contraceptives

	(1) WTP contrac. at intervention	(2) Contrac. use Index	(3) Using modern contrac.	(4) Using trad. contrac.	(5) Consistent use of contrac.	(6) Any sex	(7) Times sex using contrac. past week	(8) Unprotected sex
Husband Treated (β_H)	0.231	0.050	-0.018	-0.026	0.039	0.002	0.014	-0.027
	(0.528)	(0.061)	(0.049)	(0.038)	(0.030)	(0.041)	(0.045)	(0.041)
	[0.663]	[0.415]	[0.710]	[0.492]	[0.185]	[0.968]	[0.763]	[0.509]
Wife Treated (β_W)		0.035	-0.022	0.013	0.015	-0.024	0.047	-0.051
		(0.053)	(0.050)	(0.040)	(0.032)	(0.045)	(0.045)	(0.039)
		[0.514]	[0.668]	[0.737]	[0.655]	[0.602]	[0.296]	[0.202]
Stratification Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-test p-value (β_H=β_W)		0.798	0.951	0.330	0.402	0.534	0.502	0.558
Mean of Control Group	9.310		0.680	0.150	0.930	0.830	0.740	0.230
Observations	533	534	534	534	354	515	420	515

Notes: SE clustered at the meeting level in parentheses. P-values in brackets. The husband's WTP variable was collected right after the intervention, before men had a chance to meet their wife and potentially learn from them about their treatment status. Hence, the control arm ad the *Wife Treated* arm are merged. Index variable in column 2 is the mean of all standardized variables in columns 3, 5, 7 and the opposite of the variables in columns 4, 6 and 8. Stratifying control variables include if couple has children, wife over 35, wife thinks that husband wants another child later, wife thinks husband does not want another child, husband does not know of women who died at childbirth, block size, and baseline data present. Demographic control variables include wife age, husband age, wife education, husband education, number of children, age of last child born before meeting, wife is actively trying to get pregnant, baseline contraceptive use, and household weekly income.

Table A6: Risk factors

	(1) Months to recover	(2) Adv. Age is Risk Factor	(3) High Parity is Risk Factor	(4) Low Spacing is Risk Factor	(5) Correct on age vignette	(6) Correct on parity vignette
H Respondent × H Treated (δ_H^h)	1.090	0.086	0.050	0.064	0.050	0.044
	(1.889)	(0.053)	(0.037)	(0.038)	(0.041)	(0.033)
	[0.566]	[0.106]	[0.172]	[0.093]	[0.223]	[0.181]
H Respondent × W Treated (δ_W^h)	-3.856	0.040	0.060	0.019	-0.062	-0.069
	(1.674)	(0.052)	(0.035)	(0.034)	(0.038)	(0.043)
	[0.024]	[0.439]	[0.093]	[0.563]	[0.109]	[0.114]
W Respondent × H Treated (δ_H^w)	7.752	0.030	-0.040	0.039	0.024	0.030
	(3.069)	(0.049)	(0.039)	(0.044)	(0.028)	(0.032)
	[0.013]	[0.542]	[0.298]	[0.385]	[0.387]	[0.345]
W Respondent × W Treated (δ_W^w)	1.352	0.073	0.042	0.084	0.016	0.022
	(1.842)	(0.054)	(0.046)	(0.054)	(0.030)	(0.026)
	[0.465]	[0.179]	[0.359]	[0.125]	[0.590]	[0.407]
Stratification Variables	Yes	Yes	Yes	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes
H Respondent Interactions	Yes	Yes	Yes	Yes	Yes	Yes
F-test p-values:						
Direct vs. spillover effect on husband (δ_H^h=δ_W^h)	0.006	0.349	0.772	0.235	0.009	0.009
Direct vs. spillover effect on wife (δ_W^w=δ_H^w)	0.039	0.439	0.061	0.367	0.749	0.789
Symmetry of intra-hh spillover effects (δ_H^w=δ_W^h)	0.001	0.880	0.046	0.746	0.081	0.070
Direct treatment effects (δ_H^h=δ_W^w)	0.921	0.864	0.881	0.778	0.519	0.596
Mean of Control Group for H	28.850	0.230	0.080	0.090	0.830	0.840
Mean of Control Group for W	36.220	0.350	0.260	0.300	0.910	0.870
Observations	1050	1049	1049	1049	1050	1050

Notes: SE clustered at the meeting level in parentheses. P-values in brackets. Stratifying control variables include if couple has children, wife over 35, wife thinks that husband wants another child later, wife thinks husband does not want another child, husband does not know of women who died at childbirth, block size, and baseline data present. Demographic control variables include wife age, husband age, wife education, husband education, number of children, age of last child born before meeting, wife is actively trying to get pregnant, baseline contraceptive use, and household weekly income. Each control variable and the constant are also interacted with a dummy for the husband being the respondent.

Table A7: Likelihood scale

	(1) Younger than 40	(2) Older than 40	(3) Fewer than 4 kids	(4) More than 4 kids	(5) 2-yrs. spacing	(6) No spacing	(7) Wife risk
H Respondent × H Treated (δ_H^h)	-0.195	0.399	-0.164	0.064	0.056	0.085	-0.085
	(0.239)	(0.204)	(0.198)	(0.182)	(0.248)	(0.262)	(0.217)
	[0.416]	[0.053]	[0.409]	[0.726]	[0.823]	[0.747]	[0.695]
H Respondent × W Treated (δ_W^h)	-0.188	-0.131	-0.477	-0.215	-0.582	-0.054	0.298
	(0.224)	(0.232)	(0.191)	(0.224)	(0.233)	(0.265)	(0.292)
	[0.403]	[0.573]	[0.014]	[0.340]	[0.014]	[0.840]	[0.310]
W Respondent × H Treated (δ_H^w)	-0.218	0.465	0.088	-0.101	0.134	0.061	-0.025
	(0.215)	(0.222)	(0.248)	(0.241)	(0.289)	(0.213)	(0.299)
	[0.312]	[0.039]	[0.724]	[0.675]	[0.644]	[0.774]	[0.933]
W Respondent × W Treated (δ_W^w)	-0.015	0.407	0.357	0.295	0.258	0.163	-0.097
	(0.243)	(0.232)	(0.273)	(0.251)	(0.314)	(0.252)	(0.375)
	[0.952]	[0.082]	[0.194]	[0.243]	[0.413]	[0.520]	[0.797]
Stratification Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
H Respondent Interactions	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-test p-values:							
Direct vs. spillover effect on husband (δ_H^h=δ_W^h)	0.976	0.018	0.136	0.188	0.001	0.579	0.194
Direct vs. spillover effect on wife (δ_W^w=δ_H^w)	0.410	0.771	0.272	0.075	0.653	0.662	0.831
Symmetry of intra-hh spillover effects (δ_H^w=δ_W^h)	0.931	0.051	0.086	0.728	0.071	0.733	0.432
Direct treatment effects (δ_H^h=δ_W^w)	0.629	0.979	0.140	0.453	0.628	0.828	0.979
Mean of Control Group for H	3.760	7.810	3.340	6.440	3.840	7.470	4.360
Mean of Control Group for W	4.150	7.400	3.950	6.450	3.670	7.770	4.210
Observations	1050	1048	1050	1048	1050	1048	1034

Notes: SE clustered at the meeting level in parentheses. P-values in brackets. Stratifying control variables include if couple has children, wife over 35, wife thinks that husband wants another child later, wife thinks husband does not want another child, husband does not know of women who died at childbirth, block size, and baseline data present. Demographic control variables include wife age, husband age, wife education, husband education, number of children, age of last child born before meeting, wife is actively trying to get pregnant, baseline contraceptive use, and household weekly income. Each control variable and the constant are also interacted with a dummy for the husband being the respondent.

Table A8: Communication

	(1) Comm. Index	(2) Comm. MM risk	(3) Partner comm. MM risk	(4) Agreement on contrac. Use	(5) Tried Convince Partner.	(6) Partner Changed Resp's mind
H Respondent × H Treated (δ_H^h)	0.198	0.130	0.077	0.072	0.030	0.051
	(0.073)	(0.052)	(0.044)	(0.033)	(0.029)	(0.030)
	[0.008]	[0.015]	[0.084]	[0.030]	[0.300]	[0.090]
H Respondent × W Treated (δ_W^h)	0.041	-0.031	-0.033	0.020	0.027	0.046
	(0.071)	(0.059)	(0.052)	(0.028)	(0.026)	(0.028)
	[0.563]	[0.603]	[0.529]	[0.475]	[0.307]	[0.098]
W Respondent × H Treated (δ_H^w)	0.047	-0.020	-0.026	0.044	0.009	0.022
	(0.062)	(0.051)	(0.055)	(0.027)	(0.017)	(0.019)
	[0.454]	[0.693]	[0.641]	[0.104]	[0.616]	[0.252]
W Respondent × W Treated (δ_W^w)	0.071	-0.020	0.019	0.029	0.016	0.031
	(0.064)	(0.050)	(0.048)	(0.024)	(0.018)	(0.021)
	[0.265]	[0.684]	[0.689]	[0.227]	[0.352]	[0.136]
Stratification Variables	Yes	Yes	Yes	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes
H Respondent Interactions	Yes	Yes	Yes	Yes	Yes	Yes
F-test p-values:						
Direct vs. spillover effect on husband (δ_H^h=δ_W^h)	0.051	0.001	0.016	0.155	0.921	0.874
Direct vs. spillover effect on wife (δ_W^w=δ_H^w)	0.656	0.995	0.373	0.590	0.684	0.675
Symmetry of intra-hh spillover effects (δ_H^w=δ_W^h)	0.950	0.880	0.923	0.556	0.569	0.494
Direct treatment effects (δ_H^h=δ_W^w)	0.164	0.019	0.345	0.303	0.689	0.595
Mean of Control Group for H		0.420	0.710	0.040	0.020	0.020
Mean of Control Group for W		0.480	0.460	0.050	0.050	0.050
Observations	1050	1049	1047	1046	1046	1046

Notes: SE clustered at the meeting level in parentheses. P-values in brackets. Stratifying control variables include if couple has children, wife over 35, wife thinks that husband wants another child later, wife thinks husband does not want another child, husband does not know of women who died at childbirth, block size, and baseline data present. Demographic control variables include wife age, husband age, wife education, husband education, number of children, age of last child born before meeting, wife is actively trying to get pregnant, baseline contraceptive use, and household weekly income. Each control variable and the constant are also interacted with a dummy for the husband being the respondent.

Table A9: Transfers (wife's reports)

	(1) Transfers Index	(2) Any Gift in past month	(3) Value of gifts past month	(4) Times hit wife last month
Husband Treated (β_H)	-0.084	0.001	-35.375	0.023
	(0.088)	(0.054)	(25.401)	(0.095)
	[0.347]	[0.989]	[0.167]	[0.813]
Wife Treated (β_W)	-0.068	-0.033	-29.757	-0.038
	(0.080)	(0.055)	(20.766)	(0.086)
	[0.397]	[0.549]	[0.156]	[0.660]
Stratification Variables	Yes	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes	Yes
F-test p-value (β_H=β_W)	0.795	0.571	0.603	0.318
Mean of Control Group		0.420	79.010	0.150
Observations	515	515	515	515

Notes: SE clustered at the meeting level in parentheses. P-values in brackets. Index variable in column 1 is the mean of all standardized variables in columns 2-3 and the opposite of the variable in column 4. Stratifying control variables include if couple has children, wife over 35, wife thinks that husband wants another child later, wife thinks husband does not want another child, husband does not know of women who died at childbirth, block size, and baseline data present. Demographic control variables include wife age, husband age, wife education, husband education, number of children, age of last child born before meeting, wife is actively trying to get pregnant, baseline contraceptive use, and household weekly income.

Table A10: Heterogeneity of effects on demand indices by maternal health risk

	(1) Demand Index (H)	(2) Demand Index (W)
Husband Treated × Low Risk (β_H^1)	-0.178	0.084
	(0.058)	(0.076)
	[0.003]	[0.275]
Husband Treated × High Risk (β_H^2)	-0.247	-0.099
	(0.121)	(0.143)
	[0.045]	[0.488]
Wife Treated × Low Risk (β_W^1)	-0.006	0.051
	(0.080)	(0.073)
	[0.936]	[0.488]
Wife Treated × High Risk (β_W^2)	-0.118	-0.070
	(0.113)	(0.119)
	[0.300]	[0.558]
Stratification Variables	Yes	Yes
Demographic Controls	Yes	Yes
F-test p-value Low Risk H=W (β_H^1=β_W^1)	0.034	0.610
F-test p-value High Risk H=W (β_H^2=β_W^2)	0.280	0.839
F-test p-value H Low=High Risk (β_H^1=β_H^2)	0.632	0.227
F-test p-value W Low=High Risk (β_W^1=β_W^2)	0.448	0.367
Observations	516	534

Notes: SE clustered at the meeting level in parentheses. P-values in brackets. Stratifying control variables include if couple has children, wife over 35, wife thinks that husband wants another child later, wife thinks husband does not want another child, husband does not know of women who died at childbirth, block size, and baseline data present. Demographic control variables include wife age, husband age, wife education, husband education, number of children, age of last child born before meeting, wife is actively trying to get pregnant, baseline contraceptive use, and household weekly income.

Table A11: Heterogeneity by age

	(1) Fertility Index	(2) Transfers Index
Husband Treated × Wife Below 35 (β_H^1)	-0.134	0.077
	(0.086)	(0.081)
	[0.124]	[0.344]
Husband Treated × Wife Over 35 (β_H^2)	-0.270	-0.350
	(0.159)	(0.228)
	[0.093]	[0.128]
Wife Treated × Wife Below 35 (β_W^1)	-0.064	-0.142
	(0.090)	(0.079)
	[0.480]	[0.074]
Wife Treated × Wife Over 35 (β_W^2)	-0.217	-0.365
	(0.143)	(0.177)
	[0.132]	[0.043]
Stratification Variables	Yes	Yes
Demographic Controls	Yes	Yes
F-test p-value Below H=W (β_H^1=β_W^1)	0.386	0.000
F-test p-value Above H=W (β_H^2=β_W^2)	0.672	0.948
F test p-value H Below=Above (β_H^1=β_H^2)	0.465	0.093
F test p-value W Below=Above (β_W^1=β_W^2)	0.389	0.285
Observations	534	498

Notes: SE clustered at the meeting level in parentheses. P-values in brackets. Stratifying control variables include if couple has children, wife over 35, wife thinks that husband wants another child later, wife thinks husband does not want another child, husband does not know of women who died at childbirth, block size, and baseline data present. Demographic control variables include wife age, husband age, wife education, husband education, number of children, age of last child born before meeting, wife is actively trying to get pregnant, baseline contraceptive use, and household weekly income.

Table A12: Heterogeneity by history of complications

	(1) Fertility Index	(2) Transfers Index
Husband Treated × No Hist. of Comp. (β_H^1)	-0.104	0.007
	(0.079)	(0.076)
	[0.191]	[0.924]
Husband Treated × Hist. of Comp. (β_H^2)	-0.496	0.002
	(0.182)	(0.224)
	[0.008]	[0.993]
Wife Treated × No Hist. of Comp. (β_W^1)	-0.055	-0.181
	(0.079)	(0.074)
	[0.491]	[0.017]
Wife Treated × Hist. of Comp. (β_W^2)	-0.340	-0.128
	(0.202)	(0.219)
	[0.095]	[0.562]
Stratification Variables	Yes	Yes
Demographic Controls	Yes	Yes
F-test p-value No Comp. H=W (β_H^1=β_W^1)	0.485	0.000
F-test p-value Comp. H=W (β_H^2=β_W^2)	0.346	0.611
F-test p-value H No Comp.=Comp. (β_H^1=β_H^2)	0.041	0.982
F-test p-value W No Comp.=Comp. (β_W^1=β_W^2)	0.157	0.825
Observations	531	495

Notes: SE clustered at the meeting level in parentheses. P-values in brackets. Stratifying control variables include if couple has children, wife over 35, wife thinks that husband wants another child later, wife thinks husband does not want another child, husband does not know of women who died at childbirth, block size, and baseline data present. Demographic control variables include wife age, husband age, wife education, husband education, number of children, age of last child born before meeting, wife is actively trying to get pregnant, baseline contraceptive use, and household weekly income.

Table A13: LASSO: Household-level indices

	(1) Fertility Index	(2) Transfers Index
Husband Treated (β_H)	-0.133	-0.011
	(0.076)	(0.073)
	[0.077]	[0.877]
Wife Treated (β_W)	-0.117	-0.210
	(0.076)	(0.068)
	[0.122]	[0.002]
F-test p-value (β_H=β_W)	0.814	0.000
Observations	534	502

Notes: SE clustered at the meeting level in parentheses. P-values in brackets. Stratifying control variables include if couple has children, wife over 35, wife thinks that husband wants another child later, wife thinks husband does not want another child, husband does not know of women who died at childbirth, block size, and baseline data present.

Table A14: LASSO: Individual-level indices

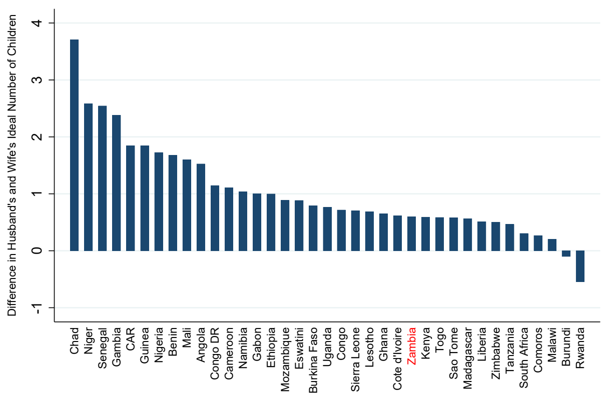
	(1) Risk factors Index	(2) Ladder Index	(3) Beliefs Index (1) & (2)	(4) Wellbeing Index
H Respondent × H Treated (δ_H^h)	0.175	0.017	0.090	0.129
	(0.064)	(0.058)	(0.039)	(0.086)
	[0.006]	[0.762]	[0.021]	[0.134]
H Respondent × W Treated (δ_W^h)	0.004	-0.116	-0.060	0.060
	(0.062)	(0.059)	(0.037)	(0.073)
	[0.944]	[0.051]	[0.107]	[0.411]
W Respondent × H Treated (δ_H^w)	0.098	-0.000	0.048	0.064
	(0.057)	(0.049)	(0.042)	(0.081)
	[0.086]	[0.994]	[0.251]	[0.433]
W Respondent × W Treated (δ_W^w)	0.151	0.097	0.125	-0.139
	(0.059)	(0.060)	(0.049)	(0.077)
	[0.011]	[0.107]	[0.011]	[0.072]
F-test p-values:				
Direct vs. spillover effect on husband (δ_H^h=δ_W^h)	0.001	0.023	0.000	0.386
Direct vs. spillover effect on wife (δ_W^w=δ_H^w)	0.384	0.089	0.115	0.019
Symmetry of intra-hh spillover effects (δ_H^w=δ_W^h)	0.248	0.148	0.060	0.970
Direct treatment effects (δ_H^h=δ_W^w)	0.764	0.345	0.574	0.018
Observations	1050	1050	1050	1050

Notes: SE clustered at the meeting level in parentheses. P-values in brackets. Stratifying control variables include if couple has children, wife over 35, wife thinks that husband wants another child later, wife thinks husband does not want another child, husband does not know of women who died at childbirth, block size, and baseline data present.

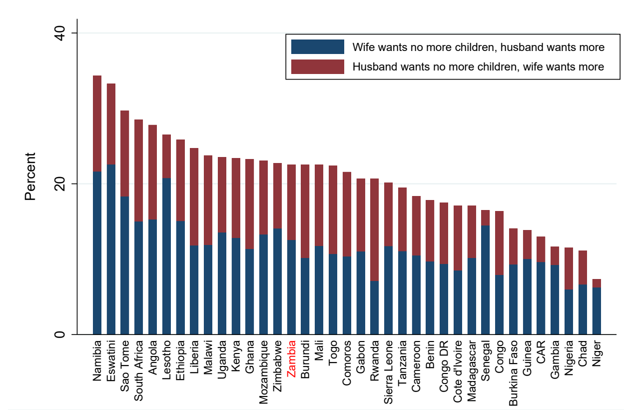
A.2 Figures

Figure A1: Spousal Disagreement in Ideal Fertility in Sub-Saharan Africa

(a) Difference in Reported Ideal Fertility between Husband and Wife



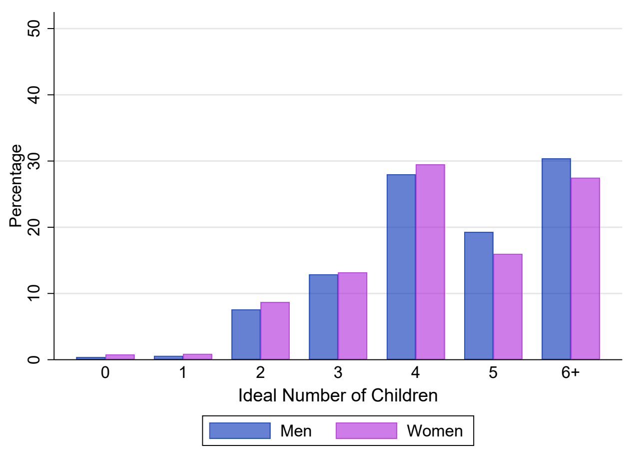
(b) Fraction of Couples that Disagrees over Having Another Child



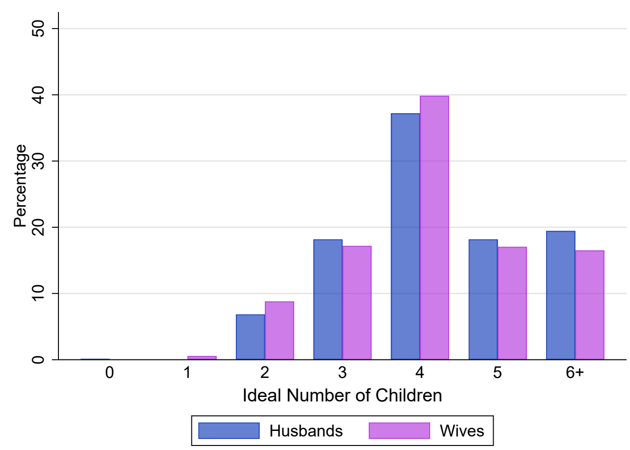
Notes: Data from the most recent waves of Demographic and Health Surveys. Polygamous couples are excluded from each sample for which such information is available.

Figure A2: Ideal Number of Children in the DHS and in the Baseline Survey

(a) DHS



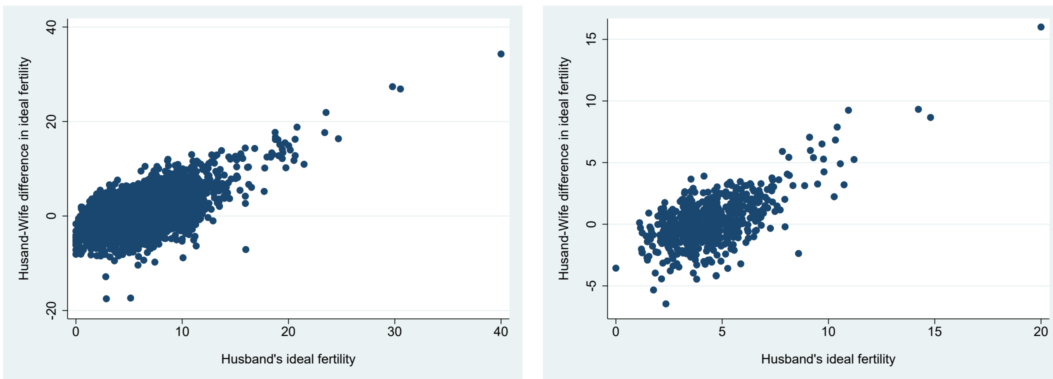
(b) Baseline Survey



Notes: Left-hand side bar graph summarizes means of men and women for DHS 2013-2014 data; right-hand side bar graph summarizes means of husbands and wives in our sample.

Figure A3: Spousal Difference in Ideal Fertility vs. Husband's Ideal Fertility

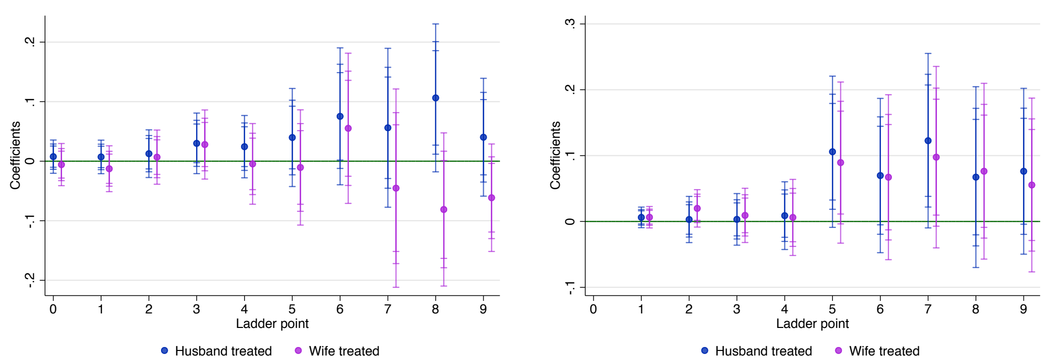
(a) Zambia DHS 2014 (b) Baseline Sample



Notes: The outliers with husband's ideal fertility greater than 50 are dropped in all the DHS data.

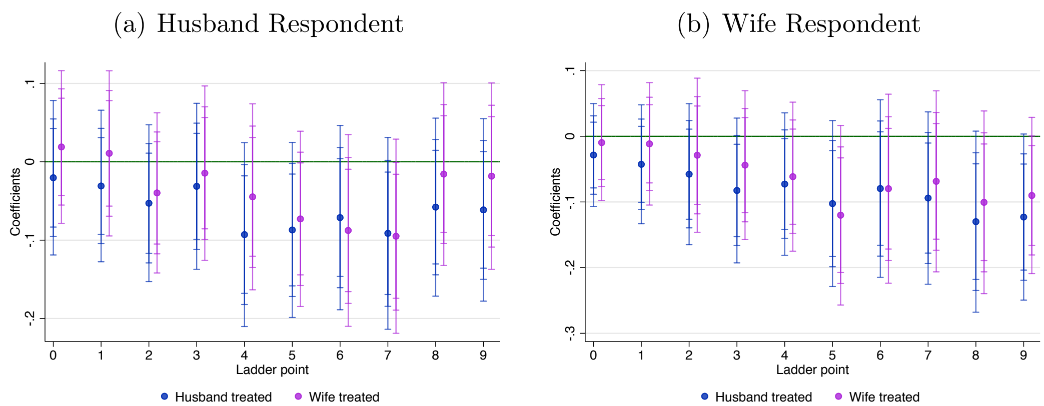
Figure A4: Effect on Assessed Likelihood of Complication - Woman over 40

(a) Husband Respondent (b) Wife Respondent



Notes: The figure depicts the effect of the intervention on the assessed likelihood of having pregnancy complications, as expressed by a ladder from 0 to 10, for an hypothetical women who is older than 40 years old. The respondents are the husband (left) and wife (right). The different colors indicate which spouse was treated.

Figure A5: Effect on Assessed Likelihood of Having Another Child



Notes: The figure depicts the effect of the intervention on the assessed likelihood of having another child, as expressed by a ladder from 0 to 10. Each dot corresponds to the coefficient associated with treatment status (*Husband treated* or *Wife Treated* in a linear probability model regression where the dependent variable equals 1 if the ladder point is greater or equal to the value on the horizontal axis, and 0 otherwise).

B Theoretical Appendix

B.1 Both spouses uninformed with bias: computations

We study the case in which both spouses have a biased perception of the distribution of the health cost with mean θ^G. The structure of the game is the same as before.

Privately Optimal Fertility Given the new assumption on the distribution of the maternal health cost, the optimal fertility of the wife is now equal to:

$$n_b^W = argmax \int_0^1 [-(\alpha^W - \theta - n)^2] f^G(\theta) d\theta = \alpha^W - \theta^G$$

and that of the husband:

$$n_b^H = argmax \int_0^1 [-(\alpha^H - \delta\theta - n)^2] f^G(\theta) d\theta = \alpha^H - \delta\theta^G$$

The structure of the game is the same as before. The game is solved by backward induction.

Equilibrium transfers and number of children Given the wife's preferences, the mapping between transfers and fertility is as follows:

$$n(t) = \begin{matrix} n_b^W & if & \int_0^1 [-(\alpha^W - \theta - n_{Bt}^H)^2] f^G(\theta) d\theta + t < \int_0^1 [-(\theta^G - \theta)^2] f^G(\theta) d\theta \\ n_{Bt}^H & if & \int_0^1 [-(\alpha^W - \theta - n_{Bt}^H)^2] f^G(\theta) d\theta + t \geq \int_0^1 [-(\theta^G - \theta)^2] f^G(\theta) d\theta \end{matrix}$$

Maximising the husband utility function with transfers, we have: $n_{Bt}^H = \frac{n_b^H + \gamma(n_b^W)}{1+\gamma}$ that corresponds to the minimum level of transfers that compensate the wife for her utility loss is equal to: $t_{MIN} = \left(\frac{\alpha^H - \alpha^W}{1+\gamma} + \frac{(\delta+\gamma)\theta^G}{1+\gamma}\right)^2 - 2\left(\frac{\alpha^H - \alpha^W}{1+\gamma} + \frac{(\delta+\gamma)}{1+\gamma}\right)\theta^G + (\theta^G)^2$.

Let us define the husband indirect utility with transfers as:

$$IU(n_{Bt}^H) = \int_0^1 [-(\alpha^H - \delta\theta - n_{Bt}^H)^2] f^G(\theta)\theta - \gamma t_{MIN}$$

and the husband indirect utility without transfers as

$$IU(n_b^H) = \int_0^1 [-(\alpha^H - \delta\theta_j - \alpha^W + \theta^G)^2] f^G(\theta) d\theta = -(\alpha^H - \alpha^W + \theta^G)^2 - \delta^2\sigma^G + 2\delta(\alpha^H - \alpha^W + \theta^G)\theta^G$$

As before, the husband finds optimal to implement this transfers to the wife if his expected utility is higher with transfers than without, that is if $IU(n^H_{Bt}) > IU(n^H_b)$. This difference is equal to:

$$\Delta = \frac{\left(\frac{\alpha^H - \alpha^W}{\theta^G} + (1+\delta)\right)^2 (\theta^G)^2}{1+\gamma} > 0.$$

Since, even with biased beliefs, this condition is always satisfied so the optimal fertility in equilibrium is equal to $n^*_B = \frac{n^H_b + \gamma(n^W_b)}{1+\gamma}$.

B.2 Effect of the intervention: propositions and lemmas

B.2.1 Wife treated with information

When the wife is treated, she is the one getting a perfectly informative signal on her cost realization.

Structure of household decision making The structure of the game is modified as now there is the possibility of a communication stage in which the wife can try to provide information about her health cost realization. The structure of the game is modified as follows:

1. The wife communicates about θ_j
2. The husband updates θ_j and offers $t(n^*_u)$ with commitment
3. The wife accept or refuses n^*_u
4. The husband pays $t(n^*_u)$

Again, the model is solved by backward induction.

Optimal Fertility and Transfers Given that the wife is informed, her privately optimal fertility is equal to the complete information case: $n^W_j = \alpha^W - \theta_j$, while that of the husband depends on his beliefs about θ_j, and is equal to $n^H_u = \alpha^H - \delta E_H[\theta_j]$, where $E_H[\theta_j]$ is the husband's posterior on the expected maternal health cost of the wife after communication takes place. Maximizing the husband's utility function with transfers, we have that equilibrium fertility with transfers is equal to $n^{Ht}_u = \frac{n^H_u + \gamma(\alpha^W - E_H[\theta_j])}{1+\gamma}$.

To understand when it is optimal for the husband to give a transfer to his wife, we need to study the communication game in the first stage.

Communication Studying information sharing by the wife and information updating by the husband, we have the following lemma.

Lemma 1. *When the wife perfectly observes the realization of θ_j, no perfectly informative communication occurs between her and her husband, unless preferences are aligned ($\alpha^H - \alpha^W = 0$ and $\delta > \frac{1-\gamma}{2}$). Under Assumption 1, transfers and fertility behave as follows:*

(i) For a given α^W, when α^H is high enough ($\alpha^H > A^{IC}$), transfers occur and fertility is based on the husband's optimal choice;

(i) otherwise, fertility follows the woman's optimum $n_j^* = \alpha^W - \theta_j$.

Proof. See Appendix B.3 ■

Studying the aggregate change in communication and fertility after the intervention when the wife is treated, we have the following result:

Proposition 1. *After the intervention, when the wife is treated, no perfectly informative communication occurs between her and her husband, unless preferences are aligned ($\alpha^H - \alpha^W = 0$ and $\delta > \frac{1-\gamma}{2}$). Under Assumption 1, when α^H is low, transfers and fertility decrease.*

Proof. See Appendix B.3 ■

B.2.2 Husband treated with information

In the husband treatment arm, the husband receives a perfectly informative signal.

Optimal actions when the husband is informed We now analyze the case in which the husband is perfectly informed about the cost realization and the wife is not. This corresponds to our intervention treatment, in which we provide precise information on maternal health to the husband, whenever the wife is not already perfectly informed herself.

The main difference with the case in which the wife has to communicate comes from the fact that the husband transmits information through the transfer he offers to the wife, and that he can get to his private optimum by offering the appropriate transfer. In other words, transfers can provide a signal of the health cost realization to the wife.

Structure of household decision making Again, the structure of the game is modified to account for the possibility of communication between husband and wife. The husband can provide information about the health cost realization θ_j to the wife. The structure of the game is as follows:

1. The husband offers $t(n(\theta_j), E_W[\theta_j])$ signaling θ_j
2. The wife updates about θ_j and accept or refuses $t(n(\theta_j), E_W[\theta_j])$
3. The husband pays $t(n^*)$

where $E_W[\theta_j]$ is the information the wife has after Bayesian updating occurs, based on the message of the husband.

The Bayesian Nash equilibrium of the game is such that the equilibrium fertility is determined by the offer of the husband, that also signals θ_j, and transfers are based on the posterior of the wife about θ_j.

Equilibrium transfers and number of children The equilibrium fertility that the husband asks when proposing the transfers to the wife is $n_v^{Ht} = \frac{n_h(m(\theta_j))+\gamma(\alpha^W - m(\theta_j))}{1+\gamma}$. This constitutes an informative signal of the cost realisation since the husband commits to pay transfers based on this fertility level.

Transfers are aligned to the wife's information set. When the wife has a posterior equal to $E_W[\theta_j]$, transfers are determined based on the fertility outcome and the wife receives $t = (\alpha^W - E_W[\theta_j] - n_v^{Ht})^2$, so that her level of indirect utility is equal to 0, her outside option.[32]

Communication To study information sharing by the husband and information updating by the wife, we have to understand the husband's incentives to truthfully report the maternal health cost θ_j.

As soon as some information transmission occurs, average fertility is affected as well. Communication, transfers and fertility are affected in the following way:

Proposition 2. *After the intervention, when the husband is treated, for δ sufficiently high and α^H sufficiently small, or for γ sufficiently low, informative communication about θ_j oc-*

[32]The husband always prefers to make a transfer since, without a transfer, fertility would coincide with the wife's ideal fertility in expectation $n^W = \alpha^W - E_W[\theta_j]$.

curs. Transfers increase and fertility decreases among households in which either α^H or γ are sufficiently low.

Proof. See Appendix B.3 ■

B.2.3 Asymmetrically informed households prior to the intervention

We now model what can arise from gendered spheres by assuming that there exist *asymmetrically informed* households, in which the wife knows the cost realization θ_j at the moment in which optimal fertility is chosen, while the husband does not observe the realization of the cost and believes the cost to be drawn from the a different distribution with mean θ^B.

The effect of the treating the wife in this type of household are the following: when the wife is already informed about her cost realisation, average ideal fertility of the wife is not affected by the intervention. Furthermore, neither communication nor realized fertility are affected by the treatment. When the husband is treated and the wife was ex-ante informed the effects of the intervention are the following: no information is transmitted between the husband and wife, fertility decreases only in households in which the ideal fertility of the husband is high, and transfers increase for all type of households. These effects are due to the fact that the intervention solve the asymmetry of information between the two spouses, allowing them to agree on transfers and realized fertility.

B.2.4 Cooperation among spouses and welfare

The utility of the two spouses, when transfers do not occur, is modified as follow:

$$U^H_{j,NC} = -\left(\alpha^H - \delta\theta_j - n\right)^2 - \xi^H_{j,NC}; \quad U^W_{j,NC} = \left(\alpha^W - \theta_j - n\right)^2 - \xi^W_{j,NC}$$

where $\xi^i_{j,NC}$ is the utility cost (mainly interpreted as a psychological cost) of each spouse of being in a non-cooperative situation in the household, and n is chosen by the wife to maximize her own utility. The addition of this utility cost implies that the total cost of disagreement is higher. This, in turn, affects the equilibrium indirect utility of the household when the wife is treated (only case in which actual disagreement occurs).

In particular, $\xi^W_{j,NC}$ reduces the equilibrium level of transfers by an equivalent amount, and increases the equilibrium number of children. This, the optimal message sent by the wife in the communication process is modified as well, and makes communication more difficult.

On the other side, $\xi^H_{j,NC}$ reduces the indirect utility of the husband when transfers do not take place, increasing the incentives of the husband to gives transfers under incomplete information. So transfers stop for a lower level of α^H.

When transfers stop, for $\xi^H_{j,NC}$ and $\xi^W_{j,NC}$ high enough, the household welfare is lower than before the intervention.

B.3 Proofs

Proof. Lemma 1

We look for Perfect Bayesian Equilibria in information transmission, transfers and fertility.

To study communication, we define $m(\theta_j)$ as the message sent by the wife. If the husband perfectly updates his information based on the message ($E_H[\theta_j] = m(\theta_j)$), we can compare the utility of the wife under truthful information transmission and any other message. Under truthful information transmission, the indirect utility of the wife is equal to 0. Under any other message, it is equal to:

$$IU^W_j = -\left(\frac{\alpha^W - \alpha^H + \delta m(\theta_j) + \gamma m(\theta_j)}{1+\gamma} - \theta_j\right)^2 + \left(\frac{\alpha^H - \alpha^W - \delta m(\theta_j) - \gamma m(\theta_j)}{1+\gamma} + m(\theta_j)\right)^2.$$

It is easy to show that for every θ_j, when $\alpha^H - \alpha^W > \frac{\gamma+\delta-(1-\delta)}{2}$ the optimal message is always equal to $m(\theta_j) = 1$; for $0 < \alpha^H - \alpha^W < \frac{\gamma+\delta-(1-\delta)}{2}$, the optimal message is equal to 1, for $\theta_j > \frac{\gamma+\delta-2(\alpha^H-\alpha^W)-(1-\delta)}{1+\gamma}$; instead, when $\alpha^H - \alpha^W < 0$, the optimal message is always equal to $m(\theta_j) = 0$, so full information transmission does not occur. If $1-\delta > \gamma+\delta$, no information is shared in equilibrium.

We now discuss optimal transfers when no information is transmitted: for transfers to occur for every possible θ_j, the husband needs to be ready to accept making higher transfers compared to when the wife is uformed.

We first show that no incentive compatible contract contingent on θ can exist in equilibrium. The wife accepts to adapt to the fertility of the husband if $t \geq (\alpha^W - \theta_j - n^{Ht}_u)^2$. Given the husband's posterior $E_H[\theta_j]$, the transfer offered to the wife would be $t = \left(\alpha^W - E_H[\theta_j] - \frac{n^H_u+\gamma(\alpha^W-E_H[\theta_j])}{1+\gamma}\right)^2$. This transfer would give a level of utility to the wife equal or greater than 0 (her outside option) only when $\theta_j \leq E_H[\theta_j]$, hence when the husband attributes a cost to the wife which is higher than the one she actually faces.

We then show that when contracts that include the highest edge of the distribution exist, given the husband's posterior $E_H[\theta_j]$, they exist for any other upper limit of the contract, θ^h. From what we just showed, we know that when the husband believes that θ_j belongs to a given interval $\left[\theta^l, \theta^h\right]$ with mean $\overline{\theta}(\theta^h)$, the only possible contracts that it is accepted by all θ_j in the interval is the one in which compensations occur based on the highest θ^h. If the husband propose a contract in which he compensate up to $\overline{\theta}(\theta^h)$ then the average θ_j accepting the contract will be $\overline{\theta}(\overline{\theta}) < \overline{\theta}(\theta^h)$. We show here that when α^H is high enough, so that including the highest θ_j is optimal, any other contract in which transfers are accepted up to an intermediate θ_j exists as well and are dominated by the one that include the highest θ_j. Let's consider the case in which transfers are accepted up to $\overline{\theta}(\theta^h)$. This means that the expected utility of the husband is the following:

$$\begin{gathered}\int_{\theta^l}^{\overline{\theta}(\theta^h)} \left[-\left(\alpha^H - \delta\theta_j - \tfrac{\alpha^H - \delta\overline{\theta}(\overline{\theta}) + \gamma\alpha^W - \gamma\overline{\theta}(\theta^h)}{1+\gamma}\right)^2 - \right. \\ \left. -\gamma\left(\alpha^W - \theta_j - \tfrac{\alpha^H - \delta\overline{\theta}(\overline{\theta}) + \gamma\alpha^W - \gamma\overline{\theta}(\theta^h)}{1+\gamma}\right)^2 f^G(\theta)d\theta - \right. \\ - \int_{\overline{\theta}(\theta^h)}^{\theta^h} [-(\alpha^H - \delta\theta_j - \alpha^W + \overline{\theta}(1))^2] f^G(\theta)d\theta\end{gathered}$$

that is dominated by a contract for which the expected utility is

$$\begin{gathered}\int_{\theta^l}^{\theta^h} \left[-\left(\alpha^H - \delta\theta_j - \tfrac{\alpha^H - \delta\overline{\theta}(\theta^h) + \gamma\alpha^W - \gamma\overline{\theta}(\theta^h)}{1+\gamma}\right)^2 - \right. \\ \left. -\gamma\left(\alpha^W - \theta_j - \tfrac{\alpha^H - \delta\overline{\theta}(\theta^h) + \gamma\alpha^W - \gamma\overline{\theta}(\theta^h)}{1+\gamma}\right)^2 f^G(\theta)d\theta \right.\end{gathered}$$

as long as transfers are convenient up to θ^h. This is due to the fact that, since the cost of transfers are increasing in θ_j, if they are optimal for the highest θ_j, they are optimal for the rest of the relevant interval.

Finally, we then show that for a sufficiently high $\alpha^H - \alpha^W > 0$, when no information transmission occurs, the husband finds optimal to make transfers compatible with the highest possible θ (we show that for $\theta = 1$). The optimal fertility and transfers for the husband, when providing incentives for $\theta = 1$ are determined maximizing:

$$n^H_{IC} = argmax \int_0^1 [-(\alpha^H - \delta\theta_j - n)^2 - \gamma(\alpha^W - 1 - n)^2] f^G(\theta)d\theta = \frac{\alpha^H - \delta\theta^G + \gamma\alpha^W - \gamma}{1+\gamma}$$

This gives an indirect utility to the husband equal to:

$$IU^h_{IC} = -\frac{\gamma(\alpha^H - \alpha^W)^2}{(1+\gamma)^2} - \frac{2\gamma(\alpha^H - \alpha^W)}{(1+\gamma)^2}((1+\gamma)(2-\delta\theta^G) - 2\delta\theta^G) + \frac{\delta^2(\theta^G)^2 - 2\gamma\delta\theta^G + \gamma}{1+\gamma} - \delta^2\sigma^G$$

Whether the husband decides to offer such a high level of transfer depends whether IU^h_{IC} is higher than the indirect utility of the husband with no transfers, $IU(n^H_b)$. Rearranging terms we get the following disequation:

$$\frac{(\alpha^H - \alpha^W)^2}{1+\gamma} - 2\left(\frac{\theta^G(1+\gamma+\delta) - 2\gamma}{(1+\gamma)}\right)(\alpha^H - \alpha^W) + \frac{\delta^2(\theta^G)^2 - 2\gamma\delta\theta^G + \gamma}{1+\gamma} - 2\delta(\theta^G)^2 > 0.$$

So transfers will happen for α^H bigger than

$$A^{IC} = \alpha^W + \theta^G(1+\gamma+\delta) - 2\gamma + \sqrt{(\theta^G(1+\gamma+\delta) - 2\gamma)^2 - \delta^2(\theta^G)^2 - 2\gamma\delta\theta^G + \gamma + 2\delta(\theta^G)^2(1+\gamma)^2}$$

and will stop otherwise. ■

Proof. Proposition 1

When the spouses had biased knowledge of the cost distribution, after the intervention, when the wife gets treated, the average ideal fertility of the wife moves from $\alpha^W - \theta^G$ to $\alpha^W - \theta^Z$. Furthermore, contracts break down (transfers stop) for $\alpha^H < A^{IC}$ and fertility in equilibrium is equal to the optimal fertility of the wife. (See proofs of Lemma 1).

When $\alpha^H > A^{IC}$, transfers move from t_{MIN} to $t_{IC} = (\alpha^W - 1 - n^H_{IC})$, with $t_{MIN} < t_{IC}$: the difference in transfers is equal to $\frac{(1-\delta)(1-\theta^Z)}{1+\gamma}$. Fertility moves to n^H_{IC}, with the reduction equal to $\frac{(\gamma+\delta)(1-\theta^Z)}{1+\gamma}$. ■

Proof. Proposition 2 We look for Perfect Bayesian Equilibria in transfers and fertility.

We define $m(\theta_j)$ as the message sent by the husband: the husband propose to the wife to compensate her utility loss for accepting a level of fertility equal to $n^H_I = \frac{\alpha^H + \gamma\alpha^W - (\delta+\gamma)m(\theta_j)}{1+\gamma}$. The wife updates her information based on the message so that her new posterior is equal to $(E_W[\theta_j] = f(m(\theta_j)))$. Thus, we can compare the utility of the husband under truthful information transmission and any other message. Under truthful information transmission the utility of the husband is equal to $IU(\theta_j) = -\frac{\gamma}{1+\gamma}\left[\alpha^H - \alpha^W + (1-\delta)\theta_j\right]^2$. Under any other message, it is equal to:

$$IU(m(\theta_j)) = -\left[\frac{\gamma\left(\alpha^H - \alpha^W + m(\theta_j)\right) + \delta m(\theta_j)}{1+\gamma} - \delta\theta_j\right]^2 - \gamma\left[\frac{\alpha^H - \alpha^W - (\delta+\gamma)m(\theta_j)}{1+\gamma} + f(m(\theta_j))\right]^2$$

.

We first show that communication is informative for sufficiently low level of γ and low conflict of preferences. Whether communication is informative or not, depends on whether for the husband is more costly to have an utility loss due to suboptimal fertility or due to higher transfers.

Separating equilibrium The husband compares $IU(\theta_j)$ with $IU(m(\theta_j))$. We study the optimal message, given the indirect utility of the husband. If $f(m(\theta_j)) = m(\theta_j)$, the first order condition when maximizing $IU(m(\theta_j))$ gives:

$$m^T(\theta_j) = \frac{(\delta^2 + \delta\gamma)\theta_j - \gamma(\alpha^H - \alpha^W)}{\delta^2 + \gamma}$$

.

For $\alpha^H - \alpha^W > \frac{\delta^2+\delta\gamma}{\gamma}$ or $\alpha^H - \alpha^W < -1$, the optimal message does not depend on the realization of θ_j and no informative communication occurs. Otherwise, $m^T(\theta_j) \leq \theta_j$. In particular, when γ is sufficiently close to zero, $m^T(\theta_j) = \theta_j$.

To show the existence of a general separating equilibrium, we derive a generic $f(m)$ and characterize the existence of a one-to-one belief function and a feasible message function $m^*(\theta_j)$ maximizing $IU(m(\theta_j))$.

To show the existence of a generic $f(m)$, we compute the FOC of $IU(m(\theta_j))$ with respect to $m(\theta_j)$ and derive the following beliefs solution:

$$f'(m) = \frac{\delta+\gamma}{1+\gamma} + \frac{\delta+\gamma}{\gamma(1+\gamma)} \frac{(1+\gamma)\delta f(m(\theta_j)) - \gamma(\alpha^H - \alpha^W) - \gamma(\delta+\gamma)m(\theta_j)}{\alpha^H - \alpha^W + (1+\gamma)f(m(\theta_j)) - (\delta+\gamma)m(\theta_j)}. \tag{3}$$

The inverse of this belief function, given consistency ($f(m) = \theta_j$), implies the following ordinary differential equation:

$$m'(\theta_j) = \frac{\gamma[\alpha^H - \alpha^W + (1+\gamma)\theta_j - (\delta+\gamma)m(\theta_j)]}{(\delta+\gamma)^2[\theta_j - m(\theta_j)]}. \tag{4}$$

where $m'(\theta_j) > 0$ for $\theta_j > m(\theta_j)$ and $m'(\theta_j) < 1$ (implying that the solution is one-to-one and feasible) for $\gamma(\alpha^H - \alpha^W) < (\delta+\gamma)^2[\theta_j - m(\theta_j)] - \gamma[(1+\gamma)\theta_j - (\delta+\gamma)m(\theta_j)]$.

For a given level of α^W, when α^H or γ are low enough and δ high enough, this condition is satisfied. In particular, the necessary condition for this to hold is that $\delta^2 + 2\delta\gamma - \gamma < 0$ and that γ is sufficiently low for $m'' > 0$. Under these conditions, $f(m) = \theta_j$ and $m^*(\theta_j) \leq \theta_j$.

For $\theta_j \in (0, 1]$ the continuity and double differentiability of this message function ensures uniqueness implying that $m^*(\theta_j)$ is the only message solving the differential equation defined in 4. For $\theta_j = 0$, $m^*(\theta_j) = 0$. Equilibrium fertility is going to be $n^*(m^*(\theta_j)) = n_I^H(m^*(\theta_j))$.

Partition Equilibrium Here, we derive the conditions under which a partition equilibrium with partial information transmission occurs. That is we derive the conditions under which there exists at least one partition equilibrium of size $N = 2$.

For this to be the case, there should be at least one cost realization $\theta_j \in (0, 1)$, given the knowledge of the wife, is indifferent between belonging to the highest or the lowest intervals of the cost distribution, that are $[0, \theta_j]$ and $[\theta_j, 1]$. For this to be true, it must be that:

$$-\left[\frac{\gamma\left(\alpha^H-\alpha^W\right)+(\gamma+\delta)\beta^W\theta_j}{1+\gamma}-\delta\theta_j\right]^2-\gamma\left[\frac{\alpha^H-\alpha^W+(1-\delta)\beta^W\theta_j}{1+\gamma}\right]^2=$$
$$-\left[\frac{\gamma\left(\alpha^H-\alpha^W\right)+(\gamma+\delta)((1-\beta^W)\theta_j+\beta^W)}{1+\gamma}-\delta\theta_j\right]^2-\gamma\left[\frac{\alpha^H-\alpha^W+(1-\delta)((1-\beta^W)\theta_j+\beta^W)}{1+\gamma}\right]^2.$$

For $\gamma\left(\alpha^H - \alpha^W\right)$ sufficiently small, we have that the LHS is bigger than the RHS when $\theta_j = 0$, and the reverse is true when $\theta_j = 1$. Since both are monotonically increasing in $\theta_j = 1$, it must be that there exists a level of θ_j for which this indifference condition holds. Furthermore, when this θ_j exists, since $\beta^W < \beta^Z$, $E^W(\theta) > \beta^W$ and fertility decreases.

When only the partition equilibria exist, the most informative equilibrium is selected through the NITS criterion (Chen, Kartik and Sobel, 2007). When the separating equilibrium exists, the Intuitive Criterion applies for selecting the most informative equilibrium (Cho and Kreps, 1987).

Equilibrium fertility and transfers For a given α^W, when α^H or γ are low enough information transmission occurs: as shown before, equilibrium fertility is going to be $n^*(m^*(\theta_j)) = n_I^H(m^*(\theta_j))$.

Transfers are based on the information set of the woman. Due to the fact that knowledge converges to the true distribution, transfers increases given the update in knowledge and the fact that the husband sets optimal fertility on a θ_j equal or lower than the realized one: $\theta_j - \frac{(\gamma+\delta)m^*(\theta_j)}{1+\gamma} > m^*(\theta_j) - \frac{(\gamma+\delta)m^*(\theta_j)}{1+\gamma}$ for all $m^*(\theta_j) \leq \theta_j$. Also, due to the fact that knowledge converges to the true distribution (implying that $|m(\theta - j) - \theta_j|$ decreases) and that transfers increase and that the husband prefer to transmit information, optimal husband fertility decreases.

When δ increases, fertility decreases and transfers decreases as well.

■

Proof. Prediction 1 Results follow directly form the proofs of proposition 1 and proposition 2. ■

Proof. Prediction 2 We define α^H as being high when $\alpha^H > \alpha^W + A^{IC}$. Given the results of proposition 1 and proposition 2, starting from the same ex ante knowledge of the woman cost, we consider changes in fertility either when the wife or the husband is treated:

- both spouses uninformed and α^H high: fertility decreases only when the husband is treated and δ is low. It moves from $n_b^{Ht} = \frac{n_b^H + \gamma n_b^W}{1+\gamma}$ to $n^*(m^*(\theta_j))$
- both spouses uninformed and α^H low: fertility decreases both when the wife and the husband are treated. For the wife, it moves to her preferred level of utility. For the husband, it is going to be either equal to $n^*(m^*(\theta_j))$.
- wife informed and α^H high: fertility moves when the husband is treated. Fertility moves to n_j^{Ht}.
- wife informed and α^H low: fertility moves only when the husband is treated. Fertility increase to n_j^{Ht}.

■

Proof. Prediction 3 We define α^H as being high when $\alpha^H > \alpha^W + A^{IC}$. Given the results of proposition 1 and proposition 2, starting from the same ex ante knowledge of the woman cost, we consider changes in transfers either when the wife or the husband is treated:

- both spouses uninformed and α^H high: slight increase in transfers when the husband is treated (and γ is sufficiently low), slight increase when the wife is treated. When the husband is treated and γ is sufficiently low transfers move to $t = (\frac{\alpha^H - m(\theta_j) - \alpha^W + E_W[\theta_j])}{1+\gamma})^2$, implying a higher level of transfers since transfers are increasing in $E[\theta_j]$. When the wife is treated transfers move to $t_{IC} = (\alpha^W - 1 - n^H_{IC})$.

- both spouses uninformed and α^H low: when the husband is treated, transfers adapt to an increase information in the couple and transfers increase.
- wife informed and α^H high: no change when the wife is treated, slight decrease when the husband is treated. When the husband is treated, transfers move from t_{IC} to t_{min}.
- wife informed and α^H low: no change when the wife is treated, transfers increases only when the husband is treated. When the husband is treated, transfers move from zero to t_{min}.

■

Proof. Prediction 4 See proof of prediction 3.

When the wife is treated, welfare decreases when transfers decrease: this is due to the fact that, the welfare of the wife increases from her IU of when she is not informed and she receive transfers $(-\theta_G^2)$ to 0, while that of the husband decreases. Since the change in the utility of the husband (see Δ in B.1) is always bigger than $-\theta_G^2$, total welfare decreases. This is even more true when the decrease in transfers encompasses a welfare utility loss (see B.2.4): in this case the IU of both spouses can decrease.

When the husband is treated, knowledge increases for both spouses and transfers do not change on the extensive margin so total household welfare increases. ■

Proof. Prediction 5 For a given level of α^H, we consider the cost as being high when $\theta_j > \theta^Z$ When θ_j is high, providing information to a spouse will move optimal fertility downwards. When θ_j is low, providing information to a spouse will move optimal fertility upwards for $\theta_j < \theta^G$ and downwards $\theta^G < \theta_j \leq \theta^Z$ ■

Proof. Prediction 6 See proof of prediction 2. When communication does not occur, fertility moves less than when communication occurs. ■

B.4 Alternative functional forms

An alternative functional form for the preferences of the husband and of the wife is the following:

$$U_j^H = -\left(\alpha^H - n\right)^2 - 2\delta\theta_j^H n - \gamma t$$

$$U_j^W = -\left(\alpha^W - n\right)^2 - 2\theta_j n + t$$

With this preferences, spouses' individual optimal fertility is unchanged. The equilibrium fertility with transfers and complete information is now:

$$n_j^{Ht} = \alpha^H + \gamma\alpha^W - \delta\theta_j - \gamma\theta_j$$

while when both spouses are uninformed:

$$n_b^{Ht} = \alpha^H + \gamma\alpha^W - \delta\theta_j^G - \gamma\theta_j^G$$

As before, when information is symmetric for both spouses, transfers are always optimal.

B.4.1 Only the wife is informed

To study communication when only the wife is informed, let's define her indirect utility, given transfers and fertility, as follow:

$$\begin{gathered}
V^{Wt} = -\left(\left(1-\gamma\right)\alpha^W - \alpha^H + \left(\delta+\gamma\right)m(\theta_j)\right)^2 - 2\theta_j\left(\alpha^H + \gamma\alpha^W - \delta m(\theta_j) - (\theta_j)\right) + \\
+\left(\left(1-\gamma\right)\alpha^W - \alpha^H + \left(\delta+\gamma\right)m(\theta_j)\right)^2 + 2m(\theta_j)\left(\alpha^H + \gamma\alpha^W - \delta m(\theta_j) - (\theta_j)\right) + \\
+m(\theta_j)^2 - 2m(\theta_j)\alpha^W \\
= \\
-2\theta_j\left(\alpha^H + \gamma\alpha^W\right) - 2\left(\delta+\gamma\right)m(\theta_j)\left(m(\theta_j) - \theta_j\right) + 2m(\theta_j)\alpha^H + m(\theta_j)^2
\end{gathered}$$

Maximizing this, we find the optimal message:

$$m(\theta_j)^{Wt} = \frac{\alpha^H + (\delta+\gamma)\theta_j}{1 - 2(\delta+\gamma)}$$

from which it follows immediately that no communication occurs if $\alpha^H > 1 - 2\left(\delta+\gamma\right)$.

B.4.2 Only the husband is informed

Let's now the incentive of the husband to communicate. The indirect utility that he maximizes when he propose a contract and communicate about θ_j is:

$$V^{Ht} = -\left(-\gamma\alpha^W + (\delta+\gamma)\, m(\theta_j)\right)^2 - 2\delta\theta_j\left(\alpha^H + \gamma\alpha^W - (\delta+\gamma)\, m(\theta_j)\right) -$$
$$-\gamma\left[\left((1-\gamma)\,\alpha^W - \alpha^H + (\delta+\gamma)\, m(\theta_j)\right)^2 + 2\delta m(\theta_j)\left(\alpha^H + \gamma\alpha^W - \delta m(\theta_j) - \gamma m(\theta_j)\right) + \right.$$
$$\left. + m(\theta_j)^2 - 2m(\theta_j)\alpha^W\right.$$

In this case, the optimal message is:

$$m(\theta_j)^{Wt} = \frac{(\delta+\gamma)\delta\theta_j - (1-\delta-\gamma)\gamma(\alpha^H+\gamma\alpha^W)+\gamma\alpha^W}{(1+\gamma)(\delta+\gamma)^2+2\gamma(1-\delta-\gamma)}$$

B.5 Both spouses uninformed without bias

We now study optimal fertility for the type of household where the both the husband and the wife do not observe the realization of θ_j when deciding about the optimal contract. They only know the distribution of the maternal health cost. The structure of the game is the same as before.

Privately Optimal Fertility Given the incomplete information on the maternal health cost, we define the optimal fertility of the wife in isolation as:

$$n_I^W = argmax \int_0^1 [-(\alpha^W - \theta_j - n)^2] f^Z(\theta) d\theta_j = \alpha^W - \theta^Z$$

and that of the husband as:

$$n_I^H = argmax \int_0^1 [-(\alpha^H - \delta\theta_j - n)^2] f^Z(\theta) d\theta_j = \alpha^H - \delta\theta^Z$$

The structure of the game is the same as before. The game is solved by backward induction.

Equilibrium transfers and number of children Again, the wife declares her fertility strategy. In order to maximize her utility, she chooses:

$$n(t) = \begin{array}{lll} n_I^W & if & \int_0^1 [-(\alpha^W - \theta_j - n_{It}^H)^2] f^Z(\theta) d\theta_j + t < \int_0^1 [-(\theta^Z - \theta_j)^2] f^Z(\theta) d\theta_j \\ n_{It}^H & if & \int_0^1 [-(\alpha^W - \theta_j - n_{It}^H)^2] f^Z(\theta) d\theta_j + t \geq \int_0^1 [-(\theta^Z - \theta_j)^2] f^Z(\theta) d\theta_j \end{array}$$

Maximising the husband utility function with transfers, we have: $n_{It}^H = \frac{n_I^H + \gamma(n_I^W)}{1+\gamma}$.

Given the mapping strategy announced by the wife, this implies a minimum level of transfers equal to $t_{MIN} = (\alpha^W - n_{It}^H)^2 - (\alpha^W - n_{It}^H) - \sigma^Z$.

The husband finds optimal to implement this transfers to the wife if his expected utility is higher with transfers than without, that is if:

$$\int_0^1 [-(\alpha^H - \delta\theta_j - n_{It}^H)^2] f^Z(\theta) d\theta_j - \gamma t_{MIN} > \int_0^1 [-(\alpha^H - \delta\theta_j - \alpha^W + \theta^Z)^2] f^Z(\theta) d\theta_j$$

This condition is always satisfied so the optimal fertility in equilibrium is equal to $n_I^* = \frac{n_I^H + \gamma(n_I^W)}{1+\gamma}$.

C Scripts from the group meetings

"Good afternoon, my name is.... And my name is ... Today, we would like to talk to you about how to protect the health of your wife."

Maternal mortality treatment specific section (MM)

"Pregnancy is a very important part of a woman's life. In Zambia, health complications are very common among women who carry and deliver a child. Over the course of a lifetime, 1 out of 59 women in Zambia may die during pregnancy or delivery. Think about 59 women that you know from your community, like the ones in this figure. That means that 1 of them may die at childbirth and just 5826 will keep living. In Zambia, one woman dies every 4 hours due to complications during pregnancy or childbirth. A woman can experience health complications related to childbirth that would severely affect her health.

Mortality and complications are not a woman's fault. You may have heard that they happen to unfaithful women or to women whose husbands have unfaithful. The fact is that infidelity CAN lead to death–through sexually transmitted infections such as HIV. So being unfaithful can have bad health consequences. BUT the things that happen to women during pregnancy and childbirth are the result of medical and health issues, such as lack of appropriate health care before, during, and after delivery. This is why it is very important to attend a health facility for antenatal care, to deliver at a health facility and to seek the appropriate postnatal care.

Today you will hear about the way that pregnancy and childbirth affects a woman's body, and why this can lead to negative health effects and even death. Women who have many children already or who became pregnant right after having had a baby are exposed to an especially high risk because their bodies are more vulnerable.

Women in some other parts of Africa are less exposed to these complications. As you can see in this picture, for example, while 1 out of every 59 woman dies at childbirth in Zambia, in Botswana it is one in 230 and in South Africa it is 1 in 300. This means that women in Zambia are almost four times more at risk than women in Botswana and they are 6 times more at risk than women in South Africa. This is due to better health care and lower number of children per woman in South Africa. Women in these 3 countries are probably similar in their behavior in marriage, and yet they are exposed to very different risks! Now I will describe to you some causes of maternal mortality and health complications during pregnancy and childbirth.

You may have heard or seen that women get sick more often while they're pregnant than other times. There is a medical reason for this. Your body has a defense system against illness called the immune system. The immune system acts like an army, fighting off infection. To give you an example, HIV suppresses the immune system, which is why people with HIV become ill easily, or get other diseases such as TB. A baby is part you and part your wife, but it is its own person. This means that in order for a woman to carry the baby safely, her immune system has to stand down; The army that protects your wife from infection has to take a break, so that it doesn't hurt the baby by mistake. When your wife is pregnant, instead of a whole army, she only has one or two soldiers to protect her from infection. That's why women are especially vulnerable to diseases like malaria during pregnancy, and also many kinds of bacterial infections, such as respiratory infections. If not treated, these infections can kill the mother and harm the baby. 10,000 women die in Zambia every year due to malaria in pregnancy. Women who have chronic diseases and other long term conditions, such as anemia, HIV or hepatitis, may also be more likely to experience complications. This is sometimes because their immune system is already affected by the disease and cannot effectively support the woman while she's pregnant.

Every pregnancy is a risk. When your wife is pregnant, you can protect her health by practicing safe childbirth. That means that your wife should go for ante-natal care, including regular check-ups, and she should give birth in a health center.

Complications at childbirth can affect any woman. The more times your wife is pregnant, the more exposed she is to these risks. Additionally, pregnancy is particularly risky to certain groups of women, as I will explain to you now.

Young women under 18 years old who become pregnant face high health risks because their bodies may not be mature enough to handle the physical stress of pregnancy and childbirth. This woman in the picture is just a girl herself, and she is carrying a child. When it comes time to deliver, her body might not be big enough for the baby to fit well. This can cause obstructed labor, where the baby cannot fit through the mother's birth canal.

Sometimes, when this happens, the woman can get a tear in her birth canal called a fistula. Fistulas are tears between a woman's birth canal and the area where her urine or feces is supposed to go. You may have seen women in your community become outcasts because they cannot hold urine or feces due to fistula.

A trained health provider can help with these complications. Giving birth in a health centre is one way to avoid the worst consequences of obstructed labor and fistula. The best way for a young woman to prevent these complications is to delay her first pregnancy and wait for the right time before becoming pregnant.

As women grow older, their risk of complications increases.

Women over the age of 35 have a high risk of developing health problems and of dying because of childbirth.

The risk of death is 5 times larger for a woman who is over 35 than for a woman who is 20 years old.

Women over age 35 can have children, but they should take some more precautions. Let me give you an example: every time you cross the road here in Lusaka, there is a risk that a car or a bike can hurt you. But when there is more traffic, the risk increases. So, when there is a lot of traffic, you pay more attention when you cross, you wait more to cross the street, or you decide to stay on the same side of the road. Similarly, women over age 35 should consider their higher risk when deciding to have another child, and take the appropriate precautions.

Women who had many children are more exposed to complications if they have another child, because their body is tired after the effort of pregnancy, delivery and breastfeeding for each child. Look at the woman in this picture. She already has six children and now she is pregnant again. She is at high risk of complications. If something happens to her, who is going to take care of all her children? The risk of maternal death increases a lot for each birth after the fourth. With each birth, the mother's body becomes more tired and the uterus becomes weaker.

Women who just had a child are more exposed to complications if they have another one right away. This is because their body needs some time to recover from the previous pregnancy and delivery. Remember we talked about the army that protects your body from infection? That army has no time to rebuild if a woman has another baby right away. Look at the woman in this picture. She has a little child who is probably two, and another one who may be 9 or 8 months old and she is already pregnant! Her body must be very tired, which exposes her to a large risk of complications and death.

One common cause of complications and mortality is hemorrhage. This means that a woman loses a large amount of blood during pregnancy or after delivery. Such bleeding can cause the death of the mother, and is the number 1 killer of mothers in Zambia.

Let me give you one example of why a hemorrhage happens. This area where the baby lives is called the uterus, and the connection between the mother and the baby is the umbilical cord. During pregnancy, the baby is nourished through the mother's blood supply. A placenta grows in the uterus to nourish the baby and provide it with all the blood it needs. However, because there is so much blood flowing from the mother to the baby, you can see why the mother is at risk. As the baby comes out, the umbilical cord and the placenta comes with it. Some bleeding is natural when this happens. But in some cases, the uterus does not contract and blood begins to fill the space. In this example, the uterus has not returned to its original size and fails to compress blood flow, which can lead to serious bleeding. In these pictures, you can see the difference between a normal uterus after childbirth and a uterus that has not contracted., the uterus tears. This happens especially when women have had many babies before, or have recently had a baby. The uterus becomes scarred and weak, and is less likely to contract, or become smaller and stop additional bleeding. As a result, major bleeding can happen, and the mother can die.

A woman needs plenty of time to rest and recover between pregnancies to prevent hemorrhage in the first place. Once a women is pregnant, a healthcare provider can help deal with complications, including bleeding.

Infections are caused by germs that affect the human body. All of us are exposed to germs in everyday life, but after giving birth, women are weaker and thus have less defenses against these germs. After childbirth, women are especially subject to infections where the baby comes out, since there is bleeding in this area, and the woman may have been exposed to unclean conditions during delivery. Infections can give high fever and pain, and can cause the death of the mother. Giving birth in a health facility can help prevent infections.

Women who may be weak, because they have a disease or they have recently had a child, are more exposed to the risk of infections.

Spacing children appropriately, especially if the woman is at higher risk, is important to protect the health of mother and child. Contraceptives(family planning services), like those pictured here, allow you and your wife to decide how many children to have, when you want to have them and how much spacing you desire.

Using contraceptives to plan for the health and well-being of your family is called family planning. There are at least three reasons to use family planning.

If someone does not want to have a child at all at one point in time, for example young people who aren't ready for children, then family planning can help this person to not have children at that point.

Second, if a couple wants to limit the size of their family, then family planning can help control how many children they have. For example, a couple with five children may feel that they do not want a sixth child and can use family planning.

Third, a couple that wants to space children or decide when it is the best time to have a child would also use family planning, such as the couple in this picture with a new baby."

Common section (FP)

"Let us now talk about what family planning options are available at Chipata/ Chaisa Clinic.

There are several family planning methods. We will discuss the methods that are available for you at the clinic. Because there are so many methods, a couple can choose the method they are more comfortable with and that better fits their needs. A nurse can help you make the decision about what is the best method for you and your wife.

Let me explain to you a little bit about how family planning works. Pregnancy occurs when a sperm from a man and an egg from a woman join.

Male and female condoms create a barrier that prevents a man's sperm from contacting his partner, which means the sperm cannot get to the egg. This barrier prevents the woman from becoming pregnant and also prevents the transmission of STIs when used each time you have sex. In order to work properly, a new condom must be used for each intercourse. On the chart here, you can see male and female condoms.

Medicinal methods such as the pill prevent a woman from producing an egg (which is called ovulating). As a result, she will not get pregnant as long as she continues to use these methods, when they are used properly. They do not interfere with the couple's sexual intercourse. On the chart here you can see several medicinal methods, such as pills, Jadelle, the loop, and MyChoic.

The longest term method is sterilization which permanently stops people from having children and is an option if you have completed your family. Women can be sterilized, which prevents eggs from coming to the uterus permanently, or men can be sterilized, which prevents sperm from fertilizing an egg.

There are also certain natural methods of birth control such as the Lactational Amenorrhea method , commonly known as LAM, when a woman breastfeeds her baby exclusively after giving birth .This means that her baby does not drink anything besides breast milk. The act of breastfeeding naturally changes a woman's hormones so that she does not become pregnant. Like any other contraceptive method LAM is only effective when used correctly and very few women who use LAM correctly get pregnant (1 out of 100). However, a large proportion of women who use this method in the first 6 months get pregnant if they don't practice it correctly (2 out of 100). This method works for six months after delivery only if a woman: - Does not substitute other foods for breast milk meal. - Feeds her baby at-least every four hours during the day and every six hours at night. - Has not had her period since delivery. Keep in mind that breastfeeding does not protect you from sexually transmitted diseases. And also keep in mind that this method can only be relied on for six months after delivery after which you should start using birth control. Because this method requires much commitment the clinics also offer alternative methods such as installing s loop right after delivery. Other methods can be used but only six weeks after delivery and oral contraceptives (except Microloot) can only be used six months after delivery.

Remember, condoms are the only method that prevents the spread of HIV and other STIs. To effectively prevent these diseases and unwanted pregnancy, you may want to use condoms together with another family planning method.

The reason some people like to use another method plus condoms is because condoms have to be used every time correctly in order to work. These other methods can be taken before you have sex so that you know you are protected.

Now I want to talk to you about a few things that you may have heard regarding family planning. First, you may have heard that family planning can cause health problems in women.

Some methods of family planning do have mild side effects, but overall they are safe and effective. Side effects can include dizziness, headache, breast tenderness, nausea, and heavier-than-usual or lighter-than-usual periods. In the experience of the nurses at the clinic, most of these side effects go away over time. Only for few women will the side effects continue and be bad enough for her to need to switch methods. By talking to a nurse about what method is right for you, you'll find one that won't make your wife feel badly. If your wife does experience some side effects, a nurse can advise her on how to manage them or on whether she should switch methods.

Some people say that if a couple uses family planning, the wife will never be able to have children again.

Except for sterilization, all methods of family planning are reversible. Many people use them and then go back to having children, like the woman in this picture, who has decided it's time for a baby. If you decide to stop family planning, your wife's fertility will return shortly after, at which point she will be able to get pregnant again.

Medicinal family planning works by stopping the egg from coming to the uterus. However, once your wife stops using family planning, the egg will travel to the uterus, and she can get pregnant as usual. Let me give you an example: You know that when your wife is pregnant, she cannot get pregnant again at the same time. This is because her body knows not to send another egg while one baby is already growing. And yet, after she gives birth, she can get pregnant once again. This is the same way family planning works.

You may have heard that women who use family planning are free to sleep with other men and will become promiscuous.

This is not true - there is no evidence to support the idea that women who seek family planning change morally or misbehave. Men who do not discuss family planning with their wives may have these suspicions.

A woman's faithfulness does not change because she is using family planning.

In fact, a couple can use family planning in order to have the family size that a woman can take care of well, so that she will not become overburdened. If a family is of a manageable size and does not occupy all her time and energy, she may even have more time for her husband. Look at the woman in this picture, who is happily spending time with her husband.

Family planning is about helping you and your wife better manage your family together.

It is your responsibility as a man to take care of your family.

If you like, you can talk to your wife about what we discussed today, about family planning and about how you can help her and protect her by using contraceptives.

You and your wife can go together to talk to a nurse about family planning. A nurse will be able to answer questions about all your doubts and can help you find the best way to protect the health of your wife. "

D Questionnaire Wording of the Main Variables

Table D1: Main Outcomes and Corresponding Questions in the Survey

Dependent Variables	Correponding Questions in the Survey
Living children	How many living biological children do you have in total? (from all marriages)
Ideal number of children	Currently, if it were entirely up to you, what is the ideal total number of children you would like to have? (from all marriages)
Likelihood of having another child (Likelihood Have More Kids)	Pick the point on the ladder that reflects how likely you think it is that... you will have another child?
Want another child (dummy)	If it were completely up to you, would you like to have another child within the next year, after one year or not at all? Answer "within one year/after one year"
Diff in ideal and current number of children	Difference in Ideal number of children and Living children
Fraction contrac. methods believed to be bad for health	To the best of your knowledge, to what extent do you think these contraceptive methods are bad for a woman's health? a) Pill b) IUD c) Implants d) Injectables e) Female condom f) Male condom g) Female sterilization h) Male sterilization The fraction of answering "Very bad/Somewhat bad" for any of the method.
Fraction contrac. methods believed to lower fecundity	To what extent do you think these contraceptives decrease the ability of a woman to become pregnant once she wants to stop using them? a) Pill b) IUD c) Implants d) Injectables e) Female condom f) Male condom g) Female sterilization h) Male sterilization The fraction of answering "Somewhat/Very Much" for any of the method.

Agrees that contrac. help women be unfaithful	(Do you agree or disagree with the statement...) It's easier for a woman who uses contraceptives to be unfaithful to her husband.
Ideal space between children (m)	How much space is ideal to have between children? (month)
Months woman should give body to recover post-birthing (Months to recover)	How long do you feel it takes to recover before it is safe to become pregnant again? (if any time at all is needed)
Older women at higher risk of complications (Correct on age)	Imagine two women in your community, with the same physical and mental health that you have. They have the same number of children. Their last delivery was more than two years ago. Both are pregnant. The first is 40 years old. The second is 20. Everything else about them is the same. Which one do you think faces a bigger risk of dying from childbirth? Answer "The 40 year old".
Women with more kids at higher risk of complications (Correct on parity)	Imagine two woman in your community, with the same physical and mental health, the same age that you have . Their last delivery was more than two years ago. One had 6 children already. The other pregnant woman has had 2 children. They are currently pregnant. Everything else about them is the same. Which one do you think faces a bigger risk of complications in her pregnancy? Answer "The woman with 6 children".
Likelihood of complications if woman is younger than 40 (Younger than 40 scale)	Imagine a woman in your community, with the same physical and mental health that you have. She has 2 children. Her last delivery was more than two years ago. She is YOUNGER than 40. She is pregnant. Pick the point on the ladder that reflects how likely you think it is that... she would experience any complication?

Likelihood of complications if woman is older than 40 (Older than 40 scale)	Imagine a woman in your community, with the same physical and mental health that you have. She has 4 children. Her last delivery was more than two years ago. She is OLDER than 40. She is pregnant. Pick the point on the ladder that reflects how likely you think it is that… she would experience any complication?
Likelihood of complications if woman has less than 4 kids (Fewer than 4 kids scale)	Imagine a woman in your community, with the same physical and mental health, the same age that you have. Her last delivery was more than two years ago. She has LESS THAN 4 CHILDREN. She is pregnant. Pick the point on the ladder that reflects how likely you think it is that… she would experience any complication?
Likelihood of complications if woman has more than 4 kids (More than 4 kids scale)	Imagine a woman in your community, with the same physical and mental health, the same age that you have. Her last delivery was more than two years ago. She has MORE THAN 4 CHILDREN. She is pregnant. Pick the point on the ladder that reflects how likely you think it is that… she would experience any complication?
Likelihood of complications if woman gets pregnant 24 months after delivery (2-yrs. spacing scale)	Imagine a woman in your community, with the same physical and mental health, the same age and the same number of children that your wife has. She just delivered and got pregnant AFTER 24 MONTHS. Pick the point on the ladder that reflects how likely you think it is that… she would experience any complication?
Likelihood of complications if woman gets pregnant 12 months after delivery	Imagine a woman in your community, with the same physical and mental health, the same age and the same number of children that your wife has. She just delivered and got pregnant AFTER 12 MONTHS. Pick the point on the ladder that reflects how likely you think it is that… she would experience any complication?

Likelihood of complications if woman gets immediately pregnant (No spacing scale)	Imagine a woman in your community, with the same physical and mental health, the same age and the same number of children that you have. She just delivered and IMMEDIATELY got pregnant. Pick the point on the ladder that reflects how likely you think it is that... she would experience any complication?
Reports that infidelity increases risk of complications	What factors make women more at risk for complications during pregnancy and childbirth? Answer "Infidelity".
Relative infidelity weight (Infidelity weight)	Here on these cards are 3 possible factors from the previous question. Here are 30 buttons. Please divide these buttons between the cards according to how important each factor is in making women more at risk for complications during pregnancy and childbirth. a) Infidelity b) Overall health c) Not going for checkups or not delivering with a skilled birth assistant. The percentage of "Indidelity".
Past maternal and birth complications or difficulties	Have you/your wife ever experienced any complications or difficulty during pregnancy or childbirth?
Past maternal complications or difficulties	Have experienced maternal complications or difficulties.
Immediate family member died from complications	Have any of the following people experienced a complication (C), or died (D) during pregnancy or childbirth? a) Immediate family (mother, sister) b) Close relative (cousin, aunt, sister-in-law) c) Wife of close friend or close neighbor d) Distant friend or acquaintence Answer "Immediate family (mother, sister)".

Close relative died from complications	Have any of the following people experienced a complication (C), or died (D) during pregnancy or childbirth? a) Immediate family (mother, sister) b) Close relative (cousin, aunt, sister-in-law) c) Wife of close friend or close neighbor d) Distant friend or acquaintence Answer "Close relative (cousin, aunt, sister-in-law)".
Close friend died from complications	Have any of the following people experienced a complication (C), or died (D) during pregnancy or childbirth? a) Immediate family (mother, sister) b) Close relative (cousin, aunt, sister-in-law) c) Wife of close friend or close neighbor d) Distant friend or acquaintence Answer "Wife of close friend or close neighbor".
Distant friend died from complications	Have any of the following people experienced a complication (C), or died (D) during pregnancy or childbirth? a) Immediate family (mother, sister) b) Close relative (cousin, aunt, sister-in-law) c) Wife of close friend or close neighbor d) Distant friend or acquaintence Answer "Distant friend or acquaintence".
Communicated info about future possibility of complications	Have you/your wife ever conveyed any information about the possibility of complication in giving birth to your husband/you ?
Wife: Currently Pregnant	Are you currently pregnant?
Wife: Became Pregnant Post-Int.	Currently pregnant or gave birth at least 8 months after intervention (dummy)
Wife: Birth Spacing (mo)	Spacing between intervention and getting pregnant
Husband: WTP for voucher	Husband's Willingness To Pay for voucher

Wife: Using any contrac.	Have you ever used any of the following contraceptives? a) Pill b) IUD c) Implant d) Injectables e) Male condoms f) Female condoms g) Male sterilization h) Female sterilization i) LAM j) Rhythm/natural k) Withdrawal l) Others Answer "using it now" for any of the contraceptives.
Wife: Using modern contrac.	Have you ever used any of the following contraceptives? a) Pill b) IUD c) Implant d) Injectables e) Male condoms f) Female condoms g) Male sterilization h) Female sterilization i) LAM j) Rhythm/natural k) Withdrawal l) Others Answer "using it now" for any of the modern contraceptives (Pill, IUD, Implant, Injectables, Male condoms, Female condoms, Male sterilization and Female sterilization).
Wife: Consistently using any contrac. for contrac. users	When did you last use this method (ask only for the method currently being used)? Answer "using pills within last 6 days/currently wearing IUD/currently wearing Implants/taking Injections within 13 week/using Female condom within 30 days/using Male condom within 30 days".
Wife: Using trad. contrac.	Have you ever used any of the following contraceptives? a) Pill b) IUD c) Implant d) Injectables e) Male condoms f) Female condoms g) Male sterilization h) Female sterilization i) LAM j) Rhythm/natural k) Withdrawal l) Others Answer "using it now" for any of the traditional contraceptives (LAM, Rhythm/natural and Withdrawal).
Wife: Uses contrac. while partner unaware	Partner Ever Unaware you were using this method? Answer "yes" for pill/IUD/ Injectables/Female sterilization.

Wants More Kids	If it were completely up to you would you want to have another child?
Wants Ano. Kid in $<$ 2yrs	Do you want to have a child in less than 2 years or more than 2 years?
Believes Spouse Wants Ano. Kid	To the best of your knowledge, if it were completely up to her/him, would your partner want to have another child?
Believes Spouse Wants More Than Self	To the best of your knowledge, currently what is the ideal total number of children your husband would like to have? Currently, if it were entirely up to you, what is the ideal total number of children you would like to have? (from all marriages)
Believes Spouse Wants Less Than Self	To the best of your knowledge, currently what is the ideal total number of children your husband would like to have? Currently, if it were entirely up to you, what is the ideal total number of children you would like to have? (from all marriages)
Sex frequency past week	In the past seven days, how many times have you had sex with your husband?
Any sex	*Sex frequency past week* is greater than 0.
Times using contrac. past week	On how many of those times did you use birth control with your husband?
Proportion using contrac. past week	*Times using contrac. past week*/ *Sex frequency past week*
Unsafe Sex	A dummy equals 1 if there existed unprotected sex during past week

Comm. MM risk to partner	Have you ever conveyed any information about the possibility of complication in giving birth to your husband/wife ?
Partner comm. MM risk	Has your husband/wife ever conveyed to you any information about the possibility of complications in giving birth?
Agreement on contrac. Use	Do you and your husband/wife agree on whether to use contraceptives?
Tried Convince Partner Use contrac.	Did you ever attempt to convince your husband/wife to use contraceptives in your marriage?
Partner Changed Resp's Mind contrac. using	Did your husband/wife manage to change your mind and convince you to use contraceptives in your marriage?
Partner Tried to Convince Resp Use contrac.	Did your husband/wife ever attempt to convince you to use contraceptives in your marriage?
Any of the 3 Risk Factors	What factors make women more at risk for complications during pregnancy and childbirth? Answer any of Adv. Age/High Parity/Low Spacing as risk factor.
Wife comp. likelihood	Pick the point on the ladder that reflects how likely you think it is that... your wife would experience any complication, if she got pregnant right now?
Gifts to wife past month (dummy)	Have you given your wife any gifts in the past month?
Value of gifts last month	What would you say is the monetary value of the gifts you have given her in the past month?
Hit wife last month (freq.)	How many times have you been physically violent toward your wife in the last month?
Contrac. causes infidelity	(Do you agree or disagree with the statement...) It's easier for a woman who uses contraceptives to be unfaithful to her husband. Answer "Agree" or "Strongly agree".

Contrac.helps women decide no. of children by herself	(Do you agree or disagree with the statement...) A woman who uses contraceptives can decide how many children she can have without listening to her husband. Answer "Agree" or "Strongly agree".
Pills are bad for health	(Do you agree or disagree with the statement...) Being on the pill is bad for women's health. Answer "Agree" or "Strongly agree".
Happy with marriage	How happy are you with your marriage?
Satisfied with sex life	How happy are you with your sexual life in your marriage?
Satisfied with life	All things considered, how satisfied are you with your life as a whole these days?
Family Planing Causes Infidelity	What concerns do you have about family planning, if any? Answer "Causes infidelity".
Contrac. use leads to Infidelity	(Do you agree or disagree with the statement...) It's easier for a woman who uses contraceptives to be unfaithful to her husband.
Should confess Lover's name to avoid comp	(Do you agree or disagree with the statement...) In my community, women who have been unfaithful to their husband confess their lovers' names before delivering to avoid complications
Should not look at child/blood to avoid comp	(Do you agree or disagree with the statement...) In my community, women who have been unfaithful to their husband do not look at her child or at their blood when delivering
Infidelity increases risk of complications	What factors make women more at risk for complications during pregnancy and childbirth? Answer "Infidelity".

Agrees with superstition	(Do you agree or disagree with the statement...) Women who are unfaithful to their husbands are more likely to die at childbirth.
Infidelity index	Constructed from the answer of folowing questions: a) What concerns do you have about family planning, if any? Answer "Causes infidelity". b) (Do you agree or disagree with the statement...) It's easier for a woman who uses contraceptives to be unfaithful to her husband. c) (Do you agree or disagree with the statement...) In my community, women who have been unfaithful to their husband confess their lovers' names before delivering to avoid complications d) (Do you agree or disagree with the statement...) In my community, women who have been unfaithful to their husband do not look at her child or at their blood when delivering e) (Do you agree or disagree with the statement...) Women who are unfaithful to their husbands are more likely to die at childbirth. f) What factors make women more at risk for complications during pregnancy and childbirth? Answer "Infidelity".