The Media or the Message? Experimental Evidence on Mass Media and Contraception in Burkina Faso[1]

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Abstract

Using a two-level randomized experiment covering 5 million people in Burkina Faso, we examine the impact on family planning knowledge and behavior of both general exposure to mass media (800 women receive radios in status quo areas) and an intensive evidence-based family planning campaign (8 of 16 radios receive the campaign and 800 women receive radios in campaign areas). Women receiving radios in status quo areas reduce contraception use by 5.2 percentage points. This negative effect is concentrated among those who wanted fewer children, consistent with mass media increasing social pressure to conform to modal behavior in the media market, which in this case is not to use contraception. In contrast, receiving a radio in campaign areas increases contraception use by 5.8 percentage points. Comparing all women in campaign vs noncampaign areas we find contraception use is 5.9 percentage points higher, births 10% lower, misperceptions about contraception lower, and reported welfare 0.27 standard deviations higher in campaign areas. Fertility preferences remain unchanged. We estimate the scale up of the campaign nationwide cost US$7.7 per additional user of contraception, making it a highly cost-effective intervention.

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Introduction

A sharp divergence in the fertility rates of high and low growth developing counties is changing the geography of poverty. If demographic and growth trends persist, 87 percent of extreme poverty will be in sub-Saharan Africa by 2030 and progress against extreme poverty will almost come to a halt (World Bank 2018). West Africa is the epicenter of these trends with the highest fertility and some of the deepest poverty in the world.[2] High fertility is not simply a matter of preferences: a quarter of women of reproductive age in sub-Saharan Africa want to stop or delay childbearing but do not use contraception (Family Planning, 2020). While falling child mortality and increasing female education have been shown to reduce fertility, they tend to change behavior only with a long lag. Cost-effective, scalable, fast acting approaches to help women achieve the lower fertility they desire are therefore needed to support women's welfare and have the potential to influence the dynamics of poverty more generally.

Mass media has been shown to be a powerful and relatively cheap driver of beliefs, attitudes, and action particularly in the political realm and mainly through quasi experimental studies (Adena et al 2015, DellaVigna and Kaplan 2007, and Yanagizawa-Drott 2014). Simply having access to mass media is associated with lower fertility and more liberal gender views, (Jensen and Oster 2009).

In parallel, a large experimental literature shows targeted health messages can change consequential behaviors. While in a standard economics framework, information only influences aggregate behavior if there is a systematic over or under estimation of costs and benefits (Dupas and Miguel 2017, Gong 2015) behavioral economics suggests additional pathways through increased salience (without changing knowledge) and reminders (Kremer et al. 2019, Bertrand et al. 2010, Mullainathan et al. 2008). The health behavior literature suggests messaging is most effective for those where costs and benefits are initially relatively equally balanced (Kremer and Glennerster, 2011), and when messaging provides

[2] Nigeria recently overtook India as the country with the largest number of people in extreme poverty (World Bank, 2020).

information that is new (Dupas 2011), is individually tailored (Jalan and Somanathan 2008), provided in an entertaining way (Bernard et al. 2015, Banerjee et al. 2015, and Banerjee et al. 2019), is delivered by a trusted source, or increases salience (Alsan and Eichmeyer 2021, Kumkale et al. 2010). This literature provides a blueprint for health messages that could be conveyed through mass media but was mainly tested in specially organized sessions with high attention and strong salience and very little of this work is on family planning (a recent exception is Athey et al. 2021). The mass nature of mass media makes it hard to test the effectiveness of different types of health messaging in the crowded information environment with a distracted audience typical of mass media consumption (DellaVigna and La Ferrara, 2015).

We use a two-level randomized trial in Burkina Faso to study the impact on family planning of introducing general mass media to households with very low levels of exposure and a specific intensive mass media campaign designed to incorporate the lessons from the behavior change literature. Radios were given to 1,550 women in 1,400 randomly selected households who had no radio at baseline. Half were in broadcast range of radio stations randomly selected to receive an intensive family planning radio campaign and half were in areas not covered by the campaign. This provides individual-level exogenous variation in exposure to general local radio programming (noncampaign areas) and access to the campaign.

Eight of 16 geographically and linguistically distinct community FM radio stations were selected to receive a media campaign designed by Development Media International (DMI).[3] The sample stations reached an estimated 5.1 million people or a quarter of the population of Burkina Faso. Prior to the DMI campaign stations broadcast a mix of music, information and call-in shows and government and NGO behavior changes messages, with most content being created locally and predominantly presented by men. The campaign lasted two and half years and consisted of one-minute and thirty second radio spots broadcast ten times a day (with new spots each week) and three one-hour interactive phone-in shows a week.

[3] Head et al. (2015) describe the media landscape of Burkina Faso and its suitability for a cluster randomized experiment.

It used trusted voices to fill specific knowledge gaps identified through formative research, presented messages in an entertaining way, and made sure family planning was salient. The campaign replaced 17% of radio peak listening time with new (often female presented) content, mainly crowding-out debates and call-in shows.

We collect two waves of survey data with 7,500 women (both those with and without radios at baseline) and 461 clinics, as well as monthly administrative data on the number of contraceptives distributed by all clinics located in the study areas.

Receiving a radio in noncampaign areas led to a fall in contraceptive prevalence rate (mCPR, our primary outcome) by 5.2 percentage points or -16% (p-value=0.039).[4] Three factors help explain these results. First, while exposure to family planning messaging in noncampaign areas increased by 19 percentage points, these messages were not well aligned with behavior change principles and did not effectively counter misinformation about contraception. Second, while local community radios did not have an anti-family planning agenda (all radio stations were willing to broadcast the campaign) they are very male dominated (women host/speak roughly 8 percent of peak listening time). In addition, through call-in shows (x% of peak time), they provide a platform for conservative views which are prevalent in the community. We find some evidence that owning a radio in noncampaign areas shifted women to more conservative gender norms, although it did not increase their desired fertility. Finally, households that want fewer children and are more pro-family planning may have felt additional pressure to act in line with the behavior of their peers. Previous literature has stressed the role of mass media in changing behavior by exposing more conservative rural households to the habits and norms of urban educated communities (La Ferrara et al. 2012, Jensen and Oster 2009) and of liberal content developers (Cheung 2012) although Bengtsson et al. (2013) find exposure to Catholic radio reduces trust in condoms in Uganda. In our context, mass media may make salient that most local women do not use contraception and put pressure on women to align with the modal behavior

[4] The study design and the primary and secondary outcomes were pre-registered on AEA social science registry (socialscienceregistry.org) with the ID: AEARCTR-0000892 and on clinicalTrials.gov with the ID: NCT02714686.

in their media market. As with a second order belief mechanism, learning about the views and behavior of others can change behavior without changing preferences (Bursztyn et al. 2020). Consistent with the idea that mass media pressurizes women to conform, we find women who want fewer children than the median experience particularly large falls in mCPR (-7 percentage points), without changing their desired number of children. Men appear to be particularly vulnerable to this pressure with very large falls in mCPR (-22 percentage points) in households where men make the decisions on contraception. We find no evidence that community radio spreads disinformation.

In campaign areas, the negative impact of radio access on mCPR was more than compensated for by the DMI campaign. Receiving a radio in campaign areas increased mCPR by 5.8 percentage points (+17.5%, p-value=0.031). Overall, women in campaign areas were 5.9 percentage points more likely to use modern contraception (p-value=0.046) than those in noncampaign areas, a 20% increase relative to the control group rate of 29.5%. The impact is driven by women who already had a radio when the campaign started (+7.7 percentage points or +26%, p-value=0.007). Clinic surveys show a 32% increase in family planning consultations in clinics operating within 50 kilometers of campaign radio stations.[5] Administrative data show 11% more injectables and 21% more pills were distributed in campaign areas.

In campaign areas, increased knowledge and a decline in misconceptions about the potential side effects of modern methods appear to explain the increase in mCPR. Fertility preferences do not change. Women in campaign areas were 9 percentage points (35%) less likely to say modern contraceptive methods can make a woman sterile. Attitudes toward family planning improved: women were 7.8 percentage points (14%) more likely to say that "women should control the number of children they have during their lifetime". We find the campaign makes women

[5] Compared to the control group, the number of family planning consultations increased by 45% in October 2019 and 19% in November 2019, our two reference months. Contraception is free in Burkina Faso in November and thus an important month for distribution.

substitute away from less reliable sources of information on family planning (other women in the community) to more reliable (radio) sources.

The media campaign was most effective for women using contraception before the campaign (many are not using it consistently), reporting unmet need for contraception, and with more information and positive attitudes toward family planning to begin with. Our findings are consistent with a human capital model of behavior in which women start out with biased beliefs which they update in response to the campaign: those for whom costs and benefits are most closely matched initially are most likely to change behavior. They are also consistent with a behavioral model in which the campaign increases the salience of contraception for those already convinced of its benefits but for whom attention is a barrier to consistent use. We find no support for the prediction of Bayesian belief models that those with least information initially are most likely to be persuaded by information campaigns (Ackerberg 2003). On a practical level, our results suggest that, despite low rates of mCPR use, there are many women close to the margin of contraception use in Burkina Faso and that they, rather than those with entrenched opposition to contraception, are good targets for mass media campaigns.

Finally, we find some evidence that increased contraception use led to reduced fertility. Using baseline characteristics to predict uptake of contraception we find a 3.4 percentage point fall in births in the last year among the 25% of women most likely to increase contraception in response to the campaign. Thus, while increased contraceptive use does lead to offsetting behaviors in our sample, including an increase in sexual activity, the net effect is a reduction in fertility.

As the campaign changed beliefs rather than preferences, corrected misinformation, and mainly changed behavior among women with unmet need, this program is likely to be welfare improving (DellaVigna and Gentzkow, 2010).[6] We find a large impact on an index of self-assessed health and well-being (0.27 standard deviation).

[6] This is true independent of whether convincing women to have fewer children is welfare improving.

We estimate that at least 37,000 additional women were using modern contraception because of the pilot mass media campaign, suggesting an annual cost per additional woman using modern contraception in the pilot of US$ 42.5. Under reasonable assumptions, this annual cost dropped to US$ 7.7 when the media campaign was scaled nationwide.[7] We estimate this scale-up lead to 225,000 additional women using modern contraception in Burkina Faso and roughly 10,000 fewer births a year. While rigorous data on the cost per Couple-Year Protection (CYP) achieved through other approaches is limited, estimates range from US$30 to US$60 (IRC 2016, Shade et al. 2013, Dulli et al. 2016, Rosen et al. 2019).[8]

In addition to the literature on how general access to mass media impacts family planning and the literature on delivering specific health messages through mass media discussed above, our paper is also related to the literature on why women may not use family planning despite the large health and economic returns and an expressed desire not to get pregnant (see Silva and Tenreyro 2017 for a review). Ease of access (Miller 2010), gender norms, and different fertility preferences between men and women (Ashraf et al. 2014) contribute to unmet need (McQueston et al. 2012, Sedgh et al. 2007). Evidence on how to cost-effectively increase contraceptive uptake remains scarce (see Zakiyah et al. 2016 for a review). Our paper identifies a potentially cost-effective, easy to scale intervention to promote modern contraception uptake. It highlights the importance of information barriers on potential side effects of modern methods and that many women with positive views on family planning can be encouraged to use modern contraception more consistently

Most closely related to our work is Kasteng et al. (2018), the only other RCT to our knowledge which test the impact of a health behavior mass media campaign under conditions that are representative of the way people typically access media.[9]

[7] The campaign was scaled up nationally in January 2019 when the preliminary results from this study became available.

[8] IRC (2016) is noncausal and simply tries to cost provision of family planning through IRC programmes. Shade et al (2013) and Dulli at al (2016) have a small number of clusters and Rosen et al. (2019) is a modelling exercise.

[9] In Bernard et al. (2015), Banerjee et al. (2015) and Banerjee et al. (2019), study participants in the treatment group were invited to screening sites to watch an *edutainment* movie.

They find a significant effect in clinic but not household data on care-seeking for childhood illness and no impact on their primary outcome of child mortality.[10] Uniquely, our paper simultaneously randomly varies exposure to mass media at a micro (household) level and the content of mass media at a macro (radio station) level. Consistent with Banerjee et al. (2019), we find information (delivered in an engaging way) is a key channel for behavior change.

The rest of this paper proceeds as follows. Section 1 provides background on access to mass media and family planning in Burkina Faso, Section 2 provides details on the experiment design and Section 3 outlines the implementation of the radio distribution intervention and the mass media campaign. Section 4 describes the data and empirical strategy, Section 5 provides results on primary outcomes and an analysis of mechanisms at work while Section 6 discusses the cost-effectiveness of the media campaign. Section 7 concludes and outlines policy implications.

1. Context

1.1. Access to Mass Media and Local Radio Stations in Burkina Faso

While community radio is a major source of information for many in the developing world (La Ferrara 2016), Burkina Faso has a particularly localized, radio-dominated media environment. Radio penetration is high: 68% of households nationally own a radio and 56% of the population listens to the radio at least once a week (*The DHS Program* 2010). In contrast only 25% watch TV at least once a week. Data from our study area suggests the average woman listens to the radio 3.2 hours a week. National stations primarily broadcast in French (spoken by less than 20% of people in rural areas) while local radios broadcast in local languages and have the largest audience (54% of our study population name the study radio station as one they often listen to).

[10] Kasteng et al. (2018) randomise 14 radio stations into a child survival campaign run by Development Media International. Using clinic level data, they find an increase in care-seeking for childhood disease though no change in household reports of behavior or on child survival.

Local radio stations rarely have explicit social agendas, and all were willing to broadcast the family planning campaign. However, their limited resources mean they fill airtime with messaging provided by others, music, and call-in shows. Before the campaign, news shows (both local and national), music, and debate and call-in shows, each represent around a quarter of total airtime at 27%, 24%, and 23% respectively (see appendix table A1 and section 4 for a description of the data). The remaining quarter is split between behavior changes programs (mainly on health and education) (13%), programs taken from national radios (11%), and religious shows (3%). Station records also show that community radio content is mainly presented by men, with women speaking only 22% of the time.

Women survey data suggests their radio consumption follows a similar pattern: among women who listen regularly to the radio, 67% listen to news shows, 55% to music programs, 54% to debate and call-in shows, 51% to behavior changes programs, and 20% to religious programs.

While most behavior change programs carry progressive values on family planning and contraception, in this context they rarely follow behavior change principles, instead telling households where they can receive contraception and reminding them when free contracepting week is (facts most will already know).[11] In contrast, call-in shows, debates, and religious programs are likely to reflect the social attitudes of the local community. Qualitative interviews with local radio stations directors report that conservative gender attitudes are regularly expressed on the radio either during debates or call-in shows. If mass media provides a mechanism for learning about, or making more salient, the preferences and actions of others in society it could lead to a reduction or increase in mCPR depending on the reference group portrayed in the mass media.

1.2. Fertility and Modern Contraception

Burkina Faso is one of a band of high fertility Sahelian countries in West Africa whose population has doubled in the last 25 years. At the start of the campaign, it

[11] Behavior changes programs are mostly co-organized with the Ministry of Health and often involve community health workers.

had a total fertility rate of 5.4 children born to each woman, an mCPR of 21.5% and 24.2% of women had an unmet need for contraception (PMA2020, 2016). Similar fertility, mCPR rates, and unmet need can be found in many low-income settings in Africa.[12]

The desire for large families, and male control over a woman's fertility is thought to have its roots in African societies lineage-based systems suggesting information may not be sufficient to change these attitudes.[13]

This suggests mass media and mass media campaigns are most likely to change behavior if they: address a widely held misconception; target those who are close to indifferent; have high intensity and are delivered in an entertaining way. Messages to promote contraception will only be effective if women can access contraception.

2. Experimental Design

To estimate the impact of access to status quo mass media, we distributed radios to a random subset of women who did not have access to radios in non-campaign areas in 2017. Using our baseline survey data, we identified 1,444 households (1,633 women) in noncampaign areas who had no radio in the household and randomly allocated 50% to receive a radio.[14]

To measure the impact of the radio campaign, we ran a clustered randomized design implemented at the radio station level as well as an individual level

[12] Rates are similar for most countries in Africa for which similar high quality PMA2020 data is available: Ivory-Coast (fertility rate of 4.8, mCPR of 21.8%, and unmet need of 25.1%), Ethiopia (4.5, 27% and 16%), Ghana (4, 21.7% and 23.5%), Niger (7.1, 19% and 21%), Nigeria (5.5, 15% and 20%), and Uganda (5.2, 28% and 24%).

[13] In the literature in demography, Caldwell and Caldwell (1987) argue that many traditional religious belief systems in Sub-Saharan Africa (such as the cult of the ancestors) are pronatalist and centered on the continuation of the family line. Continued fertility is associated with virtue and wealth while reproductive failure, family planning and contraception are associated with punishment and evil. Bongaarts and Casterline (2013) find that the ideal family size in Sub-Saharan Africa is higher than in other part of the world, even when controlling for development level. It provides some empirical support for the idea that the fertility transition might be slower in Africa and family planning policies less effective.

[14] The randomization was conducted in the office using STATA and was stratified on the following variables: village, using modern contraception at baseline, and ever attended formal education.

experiment giving radios to those without radios in campaign areas. Sixteen local radio stations were randomly allocated between a treatment group (eight stations) where the media campaign took place and a control group (eight stations) where regular programming continued. These 16 stations were selected because of their large audience and very localized coverage areas, which reduces the risk that someone in a control area listens to a radio station in the treatment group. All radio stations contacted for the study agreed to broadcast the campaign if selected into the treatment group. Figure 1 shows a map of Burkina Faso with the estimated broadcast coverage areas of the 16 radio stations. The few small areas where coverage overlaps were excluded from the study. While Burkina Faso is uniquely suited to an RCT on radio campaigns, 16 is the maximum number of stations with sufficiently distinct coverage areas and high market penetration to include in the RCT (Head et al. 2015). Of the 1,343 households found to have no radio at baseline in campaign areas, half received radios for all the women in those households.

A small number of clusters creates two challenges: there is a reasonably high probability that balance across treatment and control clusters will not be achieved by random chance (Kasteng et al. 2018, who ran a previous radio station RCT in Burkina Faso encountered this problem); and statistical power is low. To address these two issues, we used pairwise randomization stratified on baseline levels of our primary outcome (mCPR).[15] We also selected our study sample in each cluster so that it was representative (on key characteristics) of the entire sample rather than representative of the cluster. This reduced the chance of being unbalanced between treatment and control, reduced variation, and thus boosted statistical power (for more detail see section 5). In planning our stratification, we prioritized balance on the women's survey over balance on administrative data.

The two-level randomized design allows us first to measure the impact of increasing exposure to mass media in areas where regular programming continued as usual, for households with no radio at baseline. It also provides two different

[15] The randomization was conducted in the office using STATA.

identification strategies to measure the impact of DMI radio campaign: by comparing women who received a radio to women who did not in campaign areas, and by comparing all women living in campaign areas with those in noncampaign areas. Only the second strategy faces the challenge of few clusters.

3. Program Implementation

3.1. Radio Distribution

The 1,557 women (in 1,397 households) who did not have a radio at baseline and were randomly identified by the research team to receive a radio in both campaign and noncampaign areas were tracked by DMI employees. 1,130 were found and presented with a radio between March and June 2017. The impact of radio distribution is therefore measured after 1.5 years. Of those targeted to receive a radio, 28% did not receive it. During this period of the year, many women travel to other villages where they have fields and are growing crops and absence from the village was the main reason women did not receive radios. The radios offered by DMI use solar energy to enable regular use even though most women in the sample don't have access to electricity and may lack money to buy batteries. These radios are relatively cheap (US$ 13), which leaves little room for any meaningful direct income effect one-and-a-half years after the distribution.

To encourage women to keep the radio for themselves, they were told that DMI would come back after some time to their village, and women who still had their radio would be eligible for a lottery for a small cash prize (around US$ 3.5). The lotteries were organized following the endline. Ninety five percent of women who received a radio and were successfully interviewed during the endline still had their radio: 62% of radios were still functioning properly (conditional on women having the radio).

3.2. The Radio Mass Media Campaign

The mass media campaign was implemented by DMI,[16] a non-governmental international organization specialized in TV and radio mass media campaigns. It followed the "*Saturation +*" approach developed by DMI (see Murray et al. 2015, for additional details):

- Saturation: Broadcasting messages 10 times per day on market-leading radio stations, using 90-second spots in local languages. In addition, broadcasting three regular one-hour interactive phone-in programs per week.
- Science: Use qualitative research to understand the values, motivations and information gaps of the target audience through formative research, pre-testing, feedback research and regular visits to rural villages in all areas targeted by the program.
- Stories: stories are designed to craft the emotional climax of the moment of decision where protagonists must either overcome the obstacles or revise their goals. They are focused on crucial barriers to behavior change, as identified by formative research.

The campaign thus reflected the key findings from behavior science: saturation coverage ensured high levels of salience; qualitative research ensured programing provide information not already known to listeners and on which they could act; and the stories presented information in an entertaining way which has been found to help absorb information (Banerjee et al. 2019).

Most radio stations broadcast from 6am until 11pm or 119h per week. DMI content was broadcasted for 4h45min per week representing just 4% of total content. However, DMI broadcast most of its content during the 4 hours of peak listening times early in the morning and in the evenings which represent the overwhelming majority of listener time.[17] DMI content represents 17% of peak listening time.

Comparing radio content before and after the campaign (based on station logs) shows that airtime on behavior changes programs focusing on women health

[16] https://www.developmentmedia.net

[17] At baseline, 73% of women listening regularly to the radio declared listening to the radio in the evening and 29% early in the morning. Only 8% and 12% declared listening to the radio at noon and in the afternoon respectively.

and family planning more than tripled from 3% to 11% of total peak airtime (figure 2).[18] The DMI campaign primarily crowded out debates and call-in shows which decreased from 19% to 11% of peak time content. Most content is presented by men but the proportion of peak time during which women present increased from 20% to 27% with the campaign (see appendix Table A1 for more details).

The main potential barriers to modern contraception uptake identified by DMI's formative research included information on the different modern methods available in this context (implants, injectables, condoms and pills), concerns about side effects and misconceptions about infertility caused by modern contraceptives, information on the health and economic benefits of birth spacing, gender norms and the idea that family planning is a joint responsibility in a relationship. Examples of stories used during the campaign are available on DMI's website.[19]

The mass media campaign was launched in June 2016 and lasted until December 2018. To limit the incidence of power outages, the 8 radio stations in the treatment group also received new solar systems so they could broadcast with no interruption. In one cluster in the north of the country, the campaign had to be stopped after 6 months for security reasons. This cluster was kept in the study sample and all analysis was intent to treat.

4. Data and Empirical Strategy

Four sources of quantitative data are used to assess impact: radio station logs, survey data on women, surveys of clinics close to the women in our survey, and administrative data on all clinics located in the study areas.[20] Appendix figure A1 presents the timeline of program implementation and data collection.

4.1. Radio Logs

[18] This data does not include DMI's short spots (1h45min per week in total) broadcasted during and in-between other programs.
[19] https://www.developmentmedia.net/burkina-faso-family-planning-rct.html
[20] In addition, qualitative data were regularly collected before and during the implementation of the program for monitoring purposes and to inform quantitative questionnaire design.

Study radio stations provided detailed logs on programming during a typical week, before and during the DMI campaign. Noncampaign stations provided information on their standard program schedule for the study period (2016-2018). One campaign radio station stopped working with DMI (due to security concerns) and did not provide data. We classified all content into the following categories: local and national news shows, music, debates and call-in shows, behavior changes programs, programs taken from national radio, and religious shows. For a third of the data, program logs were not sufficient or not available and radio staff made the classification. The distinction between debates, call-in shows and behavior change programs can be blurry as some debates and call-in shows are related to health and education, while some behavior change programs involve interactions with listeners. We defined behavior change programs as programs designed explicitly to change some behavior. When a program could be classified as belonging to two different categories, each category was allocated 50% of the program duration (see appendix 1 for details). Radio stations also provided information on the gender of the person presenting each program.

4.2. Survey data

The sampling strategy for our women's survey was designed to ensure balance and maximize statistical power with a small number of clusters. First, we randomly selected 16 villages per cluster (252 villages in total) among all villages with less than 1,500 inhabitants, located between 5 and 50 kilometers from our sample radio stations, not connected to the electricity grid, and within 5 kilometers from a health center. The objective was to select villages where television access is limited (no electricity) and thus radio listenership high, and where supply of modern contraceptive was not a major barrier to use. While we lost some external validity by selecting rural villages near clinics, our survey data is still representative of 1.4 million inhabitants or 7.5% of the total population of Burkina Faso in 2018 according to census data. As discussed below, our administrative data is more representative.

Second, we selected 7,515 women in these villages in a way that makes our 16 clusters as similar as possible on key characteristics. To do that, we created strata of women with and without education and with and without radio access and sampled women within each cluster proportionally to their share in the overall sample population.[21] This involved over-sampling educated women in clusters with few educated women and under-sampling educated women in clusters with many educated women. We used a similar strategy to harmonize average distances to a health center across clusters in our sample. As a result, our 16 clusters look more similar in our final women sample than in our initial listing survey sample. Appendix 2 provides more details on sampling and shows graphically how averages of three key characteristics (distance to clinic, education and radio access) were *smoothed* by this strategy.[22]

We surveyed all clinics "officially" in charge of the 252 villages sampled for the women survey as well as any clinic identified by village chiefs or respondents: a total of 461 clinics. The external validity of this sample is slightly stronger than that of the women's survey because it includes women who live more than 5 miles from the clinic and some living in urban areas.

Baseline survey data on the 7,515 women, 252 villages and 461 clinics were collected in April-June 2016. A follow-up survey took place in November-December 2018. The follow-up rate is 89.5% for the women's survey and 97.6% for the clinic survey.[23] These rates are statistically indistinguishable in control and treatment areas (appendix Table A2). Because of security concerns, 11.5% of endline surveys had to be conducted by phone (balanced by treatment and control).

At baseline, women in our sample were on average 30 years old, 83% were married, 20% had ever been to school and 47% were generating income (Table 1, column 5). Women lived on average 4.5 kilometers from a health center and 23%

[21] We used data from a household listing survey implemented before our baseline survey.
[22] We find similar results when we reweight our data to account for this sampling strategy (see appendix Table A3).
[23] Due to increased security concerns in 2018 in the northern and eastern parts of Burkina Faso, it was not possible to send surveyors to 32 villages in the sample. In these villages shorter interviews focusing on the most important outcomes were conducted over the phone. 11.5% of women and 5% of clinics were surveyed over the phone. These rates are similar in treatment and control groups.

were using modern contraception. This is close to the average found in the nationally representative PMA2020 survey conducted in 2015 (21.5%). Women using a modern contraceptive relied primarily on implants (11%), injectables (8%) and oral pills (2%). All other methods taken together represented less than 1%. Women with no radio in their household at baseline have similar age, marital status, number of pregnancies and distance to the nearest clinic than those who had access to a radio. There are however slightly (and significantly) less likely to use contraception (22% against 25%), to have ever attended formal school (17.5% against 20%) and to generate income (43% against 47%).

Observable characteristics are well balanced on the post-attrition sample across all the different treatment and control groups (Table 1).

4.3. Administrative Data

We use monthly administrative data provided by the Ministry of Health in Burkina Faso for the period January 2014-December 2018. This data comes from monthly reports sent from all clinics to health districts and contains monthly counts of six methods of contraception sold in health centers (male condoms, female condoms, implants, injectables, intrauterine devices, and pills). We analyze data from all health centers located within the estimated broadcast area (50 kilometers) of each study radio station. This generated a sample size of 838 health centers (461 of which overlap with our clinic survey sample) with data for 60 months. The external validity of this sample is stronger than that of the survey sample because it includes health centers located in urban areas and rural villages with electricity. According to census data, 5.1 million people in 2018 were living in areas covered by our administrative data or 27% of the total population of Burkina Faso.

In line with our pre-analysis plan, we show results for implants, injectables and pills (less than 1 percent of women reported using another modern method). However, implants are mainly provided through NGOs rather than clinics[24] and we therefore focus in our analysis of clinic data on injectables and pills. Before the

[24] NGOs offering family planning services (including implants) are operating near 58% of the clinics in our survey sample.

program started, health centers in our sample were distributing an average of 25 injectables, 15 packs of oral pills and 6 implants every month.

4.4. Empirical Strategy

To estimate the impact of receiving a radio in both noncampaign and campaign areas, we estimate the following equation, on the sample of women eligible for the radio distribution intervention (i.e. women who had no radio at baseline):

$$Y_{i,h,t=1} = b_0 + b_1 Radio_i + X_i' + \epsilon_{i,h,t=1} \quad (1)$$

where $Y_{i,h,t=1}$ is the outcome of woman *i* in household *h* measured at the follow-up survey and $Radio_i$ an indicator for being assigned to the radio distribution intervention. b_1 is the coefficient of interest and gives the impact of been assigned to the radio distribution intervention. We cluster the standard errors at the household level (at which the radio intervention was randomized). We estimate equation (1) separately for women living in noncampaign and campaign areas.

To analyze the impact of the mass media campaign within our women and clinics survey samples, we use the following specification:

$$Y_{i,j,t=1} = \beta_0 + \beta_1 Treat_i + X_i' + \epsilon_{i,j,t=1} \quad (2)$$

where $Y_{i,j,t=1}$ is the outcome variable of women (or clinic) *i* living (or operating) in cluster *j* measured at the follow up survey ($t = 1$), $Treat_i$ is an indicator for being assigned to the treatment group and X_i' a vector of control variables. X_i' includes strata dummy variables (one dummy variable for each pair of clusters used for the randomization) and a dummy variable equal to 1 if the data were collected over the phone (instead of in-person). $\epsilon_{i,j,t=1}$ is the error term clustered at the radio station level. β_1 is our coefficient of interest and gives the effect of living in an area

assigned to receive the mass media campaign. To account for the small number of clusters, we implement the wild bootstrap procedure proposed by Cameron et al. (2008) with 2,000 replications to calculate p-values of the test $\beta_1 = 0$. For women survey data, we estimate equation (2) separately for the whole sample and for women who had access to a radio in their household at baseline.

As a robustness check, we also estimate equations (1) and (2) with additional control variables selected using the post-double selection lasso approach of Belloni et al. (2014). This approach uses a disciplined way of selecting baseline control variables that are strong predictors of both future outcomes and treatment status, which can improve precision and help account for imbalances due to chance or caused by selective attrition. Since the results (available in appendix table A4) are virtually identical and the precision not significantly better, we stick to our original plan and focus on results from estimations of equations (1) and (2).

Finally, to estimate the impact of the media campaign on the number of contraceptives distributed using monthly administrative clinic data, we use a difference-in-difference strategy with clinic and time fixed effects. This specification takes advantage of the high-frequency dimension of the database which spans 60 months and starts 2.5 year before the program took place:

$$Y_{i,j,t} = \propto_0 + \propto_1 Treat_i * Post_t + c_i + \tau_i + \epsilon_{i,j,t} \quad (3)$$

where $Y_{i,j,t}$ is the outcome variable for clinic *i* in time *t* in cluster *j*. $Treat_i$ takes the value 1 if the clinic is located within 50 km of a radio station assigned to treatment and 0 if the clinic is located within 50 km of a control radio station. $Post_t$ takes the value 1 in all time periods after the start of the mass media campaigns (April 2016 onward), c_i are clinic fixed effects, and τ_i are time-period fixed effects. The standard errors, $\epsilon_{i,j,t}$, are clustered at the radio station level. $\propto_1$ is our coefficient of interest and provides the average intent-to-treat estimate of the treatment effect. P-values of the test $\propto_1 = 0$ are calculated using wild bootstrap with 2000 replications.

5. Results

5.1. First Stage: Did the Radio Distribution and Media Campaign Reach Targeted Women?

The endline women's survey shows the radio distribution and campaign reached targeted women (Table 2). In noncampaign areas, 55% of women had access to a radio in their household, 87% often listened to the radio (an average of 2 hours a week), and 60% listened regularly to the study radio station.[25] The radio distribution intervention doubled the chance that there was a radio in the household from 32 to 68 percent in noncampaign areas and from 34 to 68 percent in campaign areas. The chance a woman had her own radio increased even more: from 4 to 56 percent in noncampaign areas and 1 to 64 percent in campaign areas. On average, women who received radios reported listening to the radio over an hour more per week in both campaign and noncampaign areas roughly doubling their exposure to mass media.

For those not receiving a radio as part of the experiment, the media campaign had no effect on radio access, radio ownership, amount of time spent listening to the radio or the likelihood a woman listened regularly to the study radio station (Table 2, column 6). The media campaign did change the type of programs women listened to. The share of women who listened to a behavior change program on the radio in the last week increased from 13% to 23% in campaign areas (p-value = 0.005[26]), the likelihood a woman had ever heard of family planning on the radio or had heard of family planning in the last month rose from 76% to 97% (p-value = 0.02) and 63% to 80% (p-value=0.003) respectively. Consistent with our data on radio content, we find negative (but not significant) point estimates on the share of women who listened to debates and call-in shows (-2.2 percentage points), to music (-5 percentage points), and to religious programs (-2.2 percentage points) in the last week. Even in noncampaign areas, a large share of women regularly heard of family

[25] Many women did not know the name of the radios they are listening to. This is therefore likely a lower bound of the real share of women listening to the study radio station.
[26] When applicable, all reported p-values are computed using the wild bootstrap procedure.

planning on the radio suggesting the main effect of DMI's media campaign was on the intensive margin (i.e. listening more often) as well as the quality of the programming, rather than on the extensive one (ever hearing family planning content).

5.2. Impact of Accessing Mass Media on Information, Behavior and Preferences

Those who received a radio in noncampaign areas reduced their modern contraceptive prevalence rate (mCPR, our primary prespecified outcome)[27] by 5.2 percentage points (p-value=0.039, Figure 3) compared to women who did not receive a radio. The use of implants fell particularly sharply (Table 3, column 2).

La Ferrara (2016) points to two channels by which access to mass media could change behaviors: providing information/misinformation which could change believes and by changing preferences/attitudes. We pre-registered six families of outcomes measuring knowledge, attitudes and perception of family planning and contraception, and calculated standardized z-scores for each family following the methodology in Kling et al. (2007).[28] Coefficients are then measured in percentage of the control group (all women in noncampaign areas) standard deviation (see appendix 1 for the definition of all variables included in the indexes).

Despite being more likely to have heard about family planning on the radio and to have listened to behavior change programs (an increase of 19 and 17.5 percentage points respectively, Table 2), radio distribution in noncampaign area did not change results for our knowledge indexes: knowledge about family planning or knowledge of different methods (Table 4, column 2). On the flip side, greater access to mass media, including call-in shows, did not increase the level of misinformation

[27] Our primary pre-specified outcomes include total contraception use (modern and effective traditional methods) as well as mCPR. We focus on mCPR because this outcome is more widely used in the family planning literature and very few women in our context report using a traditional method. Results on total contraception use are similar and also presented in Table 3.

[28] All indexes use a list of pre-specified variables re-coded so that more positive values mean more knowledge or more positive attitudes. We created a z-score for each variable by subtracting the mean and dividing by the standard deviation of the variable in the control group. Finally, we compute the average of all variables composing the index and standardize this average using the mean and standard deviation of the control group.

in the community. For example, the number of women who believe contraception can make a woman sterile remained unchanged.

The status quo radio messaging on family planning may not have led to more contraceptive use because it did not conform to what we know about effective behavior change communications: it did not use entertainment and drama as a way to help people absorb messages and it did not provide new information or tackle misperceptions.[29] Instead, it mainly provided information about weeks when contraception was free, information that most women already knew.[30]

Access to mass media in noncampaign areas did not change the index on family planning attitudes, including the attitude to birth spacing or desired number of children (Table 4, column 2). Women who received radios in noncampaign areas did report less liberal gender attitudes — for example, women were 3.6 percentage points (5%) more likely to agree with the statement that "*a man is superior to a woman*" and 4.6 percentage points (17%) more likely to agree with the statement "*Boys should have more opportunities and resources for education than girls*" — although the result does not survive multiple hypothesis testing (q-value=0.14). There was no change in an index of women's empowerment which measured working outside the home and decision making within the family.

5.2.1. Why did giving radios in noncampaign areas reduced contraception use?

Unlike the catholic stations studied by Bengtsson et al. (2013) or *Fox News* studied by DellaVigna and Kaplan (2007), the community radio stations in the study did not have a conservative, anti-family planning agenda: all noncampaign radio stations agreed to host the DMI program after the end of the study. The finding that

[29] Unlike some other governments, the Government of Burkina Faso at the time was a strong proponent of promoting access to family planning as outlined in the Ouagadougou Partnership https://partenariatouaga.org.

[30] According to radio station directors, most of the official communication on family planning in noncampaign areas is concentrated around the two weeks of free contraception (one in April/May and one in November every year) and focuses on informing women about where they could find free contraceptives during these two weeks. The advantages of family planning and the pros and cons of each method are rarely discussed on control stations.

belief in misinformation did not rise with access to community radio supports this view. However, men dominate programming in these stations and 17% of peak time content in control radio stations was call-in shows and debates in which the norms and views of the local community were voiced. Qualitative interviews with station managers revealed that contraception would come up in these debates and call-in shows and radio hosts reported feeling ill-equipped to respond to questions and debate about contraception.

Previous literature showing positive effects of mass media on family planning has stressed the role of "innovation" whereby less educated, poorer, rural women are exposed to more progressive norms of urban educated media consumers (La Ferrara et al. 2012) or progressive content providers (Cheung 2012). If local community radio simply reflects the norms of the society it serves, it is likely to provide less "innovation" of this kind. Indeed, by making the modal behavior of a community more salient, it can change behavior of those diverging from the mode. With 68 percent of the community not using contraception, converging to the mode in our case would lead to a reduction in contraception. In other words, the same mechanism of convergence to the modal behavior of in the media market could explain the increases in contraception observed in previous studies of mass media access and our results.

Consistent with this hypothesis, women whose ideal number of children is below median at baseline — ie those out of line with community norms — see a large fall in the use of contraception (-6.8 percentage points, Table 5 column 2). Those with above median preferences see no significant change (the difference between the two groups is significant). With no change in fertility preferences, greater exposure to community radio appears to put pressure on those wanting to control their fertility to not act on that desire.[31] There is evidence that men are particularly susceptible to this with mCPR falling 22 percentage points in those households where men made contraceptive decisions at baseline compared to

[31] Women with unmet need at baseline who received a radio experience a 9.4 percentage point fall in mCPR compared to their equivalents who did not receive a radio.

households where women decide where mCPR fell 2 percentage points (p=0.07, Appendix Table A5).

There is some evidence that access to mass media went further than simply coordinating listeners onto modal behavior. Gender attitude scores became more conservative not just for those above median at baseline but across the board (although as mentioned above the deterioration does not survive multiple hypothesis testing). This may be explained in part by the male dominance of radio content—with 83% of peak airtime hosted by men (this falls to 73% in campaign areas). In addition, in qualitative interviews, directors of radio stations in noncampaign areas explained that radio call-in shows and debates provided a platform for and amplified conservative gender attitudes found in some parts of the population with, for example, callers expressing negative attitudes towards women who use contraception. Thus, even though radio stations did not have an explicit conservative agenda they appear to have reinforced patriarchal views common in the community. This may have reinforced the pressure on women who wanted to control their fertility in campaign areas not to act on this preference and on men not to permit them to.

5.3. Impact of Mass Media Campaign on mCPR

5.3.1. Women survey Data

Figure 3 presents results for three comparisons that allow us to assess the impact of the mass media campaign on mCPR. We compare those who did and did not receive a radio in campaign areas; all women in campaign vs all women in noncampaign area; and women with radios at baseline in campaign and noncampaign areas. All three provide consistent results. Women living in areas targeted by the media campaign who received a radio, were 5.8 percentage points (p-value=0.030) more likely to adopt a modern method relative to women who did not receive a radio. The DMI campaign was therefore able to overcome the negative

impact of mass media in general in this context and generate an increase in contraceptive use.[32]

When we compare outcomes in campaign and noncampaign areas for the whole sample, we find the mass media campaign increased mCPR, by 5.9 percentage points (intention to treat estimate, p-value=0.046). This corresponds to an increase of 20% relative to the control group mCPR of 29.5%. The point estimates for each individual method are positive (and imprecise) suggesting that change in behavior is spread across several methods (Table 3, column 6). We find similar results on the share of women willing to use modern contraception in the future or who used a modern method during their last sexual intercourse and when we include effective traditional methods (abstinence, rhythm, and withdrawal). The impact is thus driven by an increase in contraception use and not a substitution away from other forms of contraception.

As expected, the impact is larger (although not significantly) on the sub-population of women who already had a radio at baseline (Figure 3) for whom the prevalence rate of modern contraception increased from 29.1% to 36.8% (p-value=0.007). There is no significant impact on those without a radio at baseline suggesting limited spillovers (bars 1 and 3 of Figure 3).

The negative impact of the radio distribution in noncampaign areas and the positive treatment effect of the mass media campaign took place at a time when mCPR was rising rapidly: from 23% in the baseline survey to 29.5% in the endline survey. This finding is consistent with data from the nationally representative survey PMA2020, which finds an increase of mCPR from 21.5% in 2016 to 27.3% in 2018 (30.7% for women in union). Other countries in sub-Saharan Africa in the PMA 2020 sample experienced similar increased in mCPR during the same period (see discussion in section 6.4).

[32] Receiving a radio in noncampaign areas reduces contraception use by 5.2ppt while the impact of the campaign (as estimated by comparing campaign and noncampaign areas) is to increase contraception for those with a radio by 7.7ppt. Adding the two coefficients suggests the combined effect of receiving a radio in campaign areas would be +2.5ppt which is within the confidence interval of the experimentally estimated effect of the combined intervention of giving a radio and receiving the intervention.

5.3.2. Clinic Survey and Administrative Data

Clinic level data on the number of family planning consultations and the number of modern contraceptives distributed provides a validity check on women's self-reported contraception use from surveys. To account for the large number of zeros and large outliers in the administrative data,[33] we implement three (preregistered) strategies. First, in all specifications, we top-coded our outcomes at the 99th percentile. Second, in some specifications we use logarithmic (for family planning consultations) and inverse hyperbolic sine (IHS) transformations of the outcomes (for contraceptives distribution).[34] Finally, we smooth the highly variable administrative data by using quarterly and six-month averages as our outcome variable. This smoothing addresses the concern that several months-worth of contraceptives are reported at one time with zeros reported for other months.

Both clinic survey and administrative data give results that are consistent with a large impact of the mass media campaign on modern contraception uptake (Table 6). Using clinic survey data (Panel A), we find the campaign increased the average number of family planning consultations from 31 to 45 in October (p-value=0.048) and from 60 to 71 in November 2018 (p-value=0.203).[35] The number of injectables distributed in October increased from 27.5 to 39 (p-value=0.198) and the number of pills from 16.3 to 32 (p-value=0.094). We find similar results using the

[33] The administrative data contains a high proportion of zeros across all contraceptive methods. Most of the time, these zeros represent no activity or contraceptive distribution during the month. But it some cases, zeros can also correspond to missing values if the clinic did not file a report or the district did not enter the data. Anecdotal evidence also suggests that because these data are gathered on a quarterly basis, some districts sometimes allocate all the contraceptives distributed during the quarter to one month only and report zero for the two other months. In addition, this data includes large range of values for contraceptives sold, high variation from one month to another and some extreme outliers. This likely reflects variation in size of clinic, variation in price (there are two weeks every year when all contraception is free), and possible variability of contraceptive distribution.

[34] The IHS transformation is defined by $IHS = \log\left(y + (y^2 + 1)^{\frac{1}{2}}\right)$. This technique helps address data that includes observations with many high values but still allows for zeros. This transformation is approximately equal to $\log(2y)$ or $\log(2) + \log(y)$ and can be interpreted as a logarithmic dependent variable. Since writing our pre-analysis plan the technique has become less popular because it is hard to interpret results but we include results for completeness.

[35] November is a special month in this context because it includes the week of free contraception. Many contraceptives are distributed during this week. Clinic registers are often incomplete in November as many clinics record contraceptives distributed during the week of free contraception in separate registers.

administrative data (Panel B).[36] Health centers located in treatment areas distributed on average 2.6 more injectables (+11%, p-value=0.02) and 3 more oral pills (+21%, p-value=0.2) per month in our preferred specification using data aggregated quarterly. Appendix figure A3 provides graphical evidence supporting the parallel trends assumption for injectable and oral pills. P-values for the test that all pre-treatment period dummies are jointly equal to zero are 0.389 and 0.693 for injectables and oral pills respectively.

The impact for implants is positive and imprecise in both survey and administrative data. Administering implants require specialized personnel and implants are therefore usually distributed by NGOs and thus not included in clinic registers. NGOs, operate near 71% of the clinics of the control group according to our survey data and 65% of clinics in treatment areas (p-value of the difference = 0.128). Marie Stopes International, the main distributor of implants in Burkina Faso may have targeted control areas because they had lower contraceptive uptake. This would bias down our estimate of the campaign impact.[37]

Finally, very few clinics in our survey sample were out of stock of contraceptives in the two months before the survey (1.2% were out of stock of pills, 1.7% of injectables and 2.7% of implants)[38] with no significant difference between campaign and noncampaign areas. This suggests increased demand, rather than a supply response is driving our results.

5.4. Mechanisms for Media Campaign Impact

5.4.1. Is the Media Campaign Changing Beliefs or Preferences?

A mass media campaign could change behaviors through two key mechanisms: providing information which changes beliefs or by changing attitudes/preferences

[36] The coefficient using administrative data is smaller but not significantly different from that found using data from the women's survey.

[37] Discussion with Marie Stopes International Burkina Faso suggests they were initially differentially targeting our control areas. Once they learned about the study, they agreed to work similarly in both treatment and control areas.

[38] This is consistent with PMA 2020 surveys which find that the supply of contraceptive is not a first order issue in most regions of Burkina Faso.

(La Ferrara 2016). Distinguishing these mechanisms is critical for drawing welfare conclusions (DellaVigna and Gentzkow 2010). We study mechanisms using six pre-registered standardized indexes measuring knowledge, attitudes and perception of family planning and contraception (defined in section 5.2 and detailed in appendix 1).

The mass media campaign increased the knowledge of contraception index by 0.29 standard deviation (p-value=0.000) in our radio station level specification (Table 4, column 6). This result is driven by a large reduction in the share of women believing modern contraception can make a woman sterile (from 26% to 17%, p-values=0.002) or cause sickness (from 38% to 30%, p-value=0.016). Women in treatment areas are also more likely to have ever heard of injectable and oral pill methods. Not only does the media campaign provide reliable evidence on contraception delivered in an entertaining way and from trusted sources, there is some evidence that it substituted for other sources of information on family planning. We find a 24.5 percentage point increase in the number of women citing the radio as a source of information on contraception and a 9.5 percentage point decline in those citing other women in the village as a main source of information on contraception in campaign areas (Table A5). The low reliance on other women for contraceptive knowledge in campaign areas helps explain our result that there was no spillover of the campaign onto women without a radio in campaign areas. The campaign also improved attitudes toward family planning, driven by increases in the share of women who think that "women should control the number of children they have during their lifetime" (from 55% to 63%).

Changes in fertility norms and attitudes toward contraception were small and not significant including on questions such as "it's embarrassing to buy a contraceptive", "using a contraceptive is a sign of not trusting your partner", as well as on women's or husband's (as declared by the women) ideal number of children and time between two births.

We find no significant impact of the campaign on other pre-specified secondary endpoints (indexes of gender attitudes and women's empowerment) or an index of domestic violence. Those given a radio in campaign areas do not

become more conservative in their gender attitudes, possibly because many of the call in shows that can express conservative values are squeezed out of prime time by DMI programming. Data from the radio distribution experiment in campaign areas (Table 4 column 4) and from women who had a radio at baseline (column 8) provide additional evidence that knowledge about contraception is the main mechanism through which the mass media campaign impacted behavior. Both show strong changes in the family planning knowledge index (0.133 and 0.31 respectively) and no changes in fertility preferences.

5.4.2. Who changes behavior in response to communication campaigns and what can that tell us about models of persuasion?

Human capital models suggest that people adopt a health technology, such as contraception, if the net present value of expected benefits outweigh the expected costs. Communication only increases adoption if it changes beliefs of expected benefits or costs (for example by reducing the perceived likelihood of negative side effects of contraception) and in a direction that increases net benefits. Those most likely to change behavior are those who were close to the margin of adoption before the intervention. Inconsistent adopters are likely to be at this margin.

In Bayesian belief models, the consumer's level of certainty about their priors matters: the weaker the priors the more weight is given to credible new information and thus the more likely communication is to impact behavior. Under these models, communication is most effective in persuading those with least knowledge of a product including those who have never used it before (Ackerberg 2001, 2003 and Dupas 2014). Bayesian models also capture the importance of credibility of messenger: priors are updated more if the messenger is credible.

In behavioral models, mass media can persuade people to change behavior even if they do not change their beliefs or their preferences (DellaVigna and Gentzkow 2010, Mullainathan et al. 2008). Reminders and increases in salience can lead people to adopt a behavior they want to adopt but undertake only inconsistently because of constraints on their attention. While there is empirical evidence that

preferences are malleable, we do not discuss these models here because we find no evidence of changes in preferences in our context.

We examine these alternative hypotheses by estimating equations (1) and (2) separately for women with different baseline characteristics on five dimensions: use of contraception, age, level of information on modern contraception, desired fertility and who in the household decides on contraception use.[39]

We find strong evidence for inconsistent use of contraception (Table 5, column 6). Nearly half (48%) of women who were using modern contraception at baseline are no longer using it at endline suggesting these women are close to indifferent about adoption. The media campaign was especially effective on these women, increasing the modern contraception prevalence rate from 48% to 61% (p-value=0.000). We find lower but sizable impacts on women who declared unmet need for contraception at baseline (increased from 28% to 33%, p-value=0.005) but no effect on women who declared no unmet needs at baseline. Combined with the finding that the campaign increases the accuracy of beliefs (by addressing misconceptions that contraception caused sterility for example), this suggests the program was welfare improving, whether or not we take a stand on the welfare benefits of increasing women's preference for contraception.

The evidence of inconsistency in contraceptive use and the large program impact on women who were using contraception at baseline is also consistent with a model of limited attention where women want to use contraception but forget and the campaign increases the salience of contraception. The structure of the campaign—with frequent messages over 2.5 years and the focus on engaging programming—was well adapted to influence behavior through this mechanism. The salience mechanism does not require a change in beliefs of the kind observed in this study. However, it is plausible that the two are complements: that a change in beliefs has more impact on behavior if it is more salient and/or delivered in a

[39] Alternatively, we could have looked at impact heterogeneity by interacting the heterogeneity variable with the treatment dummy in equation (1) and (2) in a simple regression. This method gives similar results. We choose our method because it allows us to keep the same table format.

more engaging way: Bidwell et al. (2020) find supportive evidence for this hypothesis.

The media campaign impact was also larger for women older than 22 years old at baseline and for women who had more information on contraception (from 35% to 43%, p-value=0.063) and who wanted fewer children (from 31% to 38%, p-value=0.08) to begin with. Impact on women younger than 22, women who had less information on contraception, and who wanted more children are much smaller and not statistically significant. These women had less unmet needs at baseline (38% of women under 22 years old at baseline had unmet needs compared with 48% of women older than 22). These findings are inconsistent with the prediction of some Bayesian belief models that information campaigns are most likely to change behavior for those with least information about a product (Ackerberg 2003).

5.5. Does increased use of modern contraceptive methods change fertility and well-being?

We examine the impact of the campaign on fertility (Table 7). Childbirth has the benefit of being a more objective outcome than self-reported contraceptive use, but it is less frequently observed and thus we have limited statistical power to detect changes. Examining the impact on fertility also allows us to check that increased use of contraception is not offset by the impact of other changes of behavior (e.g. reduced abstinence).

Consistent with the effect on modern contraception uptake, we find a negative point estimate for the media campaign impact on the share of women who gave birth in the 12 months preceding the endline survey (from 17.4% to 16.1%, p-value=0.38). This negative impact is slightly larger and (marginally) significant (from 17.4% to 15.9%, p-value=0.06) when we control for baseline covariates selected using double lasso (appendix Table A4). We also find larger and significant effects among women who saw the largest increase in mCPR as a result of the program as predicted by baseline characteristics using a causal forest methodology

(Athey et al. 2019).[40] Women in the top 25% of predicted effect on contraception were 3.4 percentage points (p-value=0.038) less likely to give birth in the last 12 months (Table 7, panel B).[41]

Given the low statistical power for this outcome we did not prespecify fertility as a primary outcome nor did we prespecify looking at fertility by predicted impact of the media campaign on contraception. This 10% reduction in fertility in the overall sample is consistent with the level of correlation between contraceptive prevalence and fertility identified in the demographic literature (Bongaarts 2017).[42]

Consistent with the idea that there was some substitution in ways of controlling fertility, we also find a positive impact on the share of women who had sex in the last 3 months which increased from 50% to 59%, (p-value =0.125, not prespecified). Lower fertility among those with unmet need for contraception, and increased sexual activity are consistent with an increase on a pre-specified index of self-assessed health and well-being (0.258 standard deviation, p-value =0.008). This last result is consistent with the program being welfare improving.

5.6. Robustness to Adjustment for Multiple Hypothesis Testing

To guard against the danger of over rejection of the null hypothesis from multiple hypothesis testing, we prespecified a single primary outcome (mCPR). However, in examining mechanisms and secondary impacts we simultaneously examine the impact of the mass media campaign on 10 (pre-specified) indexes (nine in Table 4 and one in Table 7). We correct p-values for multiple hypothesis testing using the false discovery rate control method introduced by Benjamini et al. (2006) and described in Anderson (2008). Our results for our indexes of "knowledge of

[40] First, we split the sample in two and use the first half as a training sample to predict individual effects for the second half of the sample. Second, we do the opposite and predict individual effect for the first half of the sample using the second half as a training sample (this way we get a predicted individual effect for all our sample. Third, we repeat the first two steps five times with different random splits. Finally, we take the average predicted effect over these five splits and take the top 25% larger effect.

[41] We also find (marginally) significant effects among women aged 22 to 49 (from 15.7% to 14.2%, p-value =0.094), a population who saw a large increase in mCPR as seen in the previous subsection.

[42] Using the relationship between contraceptive prevalence and fertility identified in Bongaarts (2017) for sub-Saharan Africa, an increase in contraceptive prevalence from 29.5% to 35.4% should correlate with a reduction in fertility from 4.82 to 4.36, a 9.3% reduction.

contraceptive methods", "attitudes towards family planning" and "self-assessed health and well-being" are robust to false discovery rate adjustment (Table A6) (q-values are equal to 0.001, 0.07 and 0.063 respectively).

6. Cost-Effectiveness

We examine the cost-effectiveness of the pilot (which reached 5 million people) and estimate the cost-effectiveness of a nationwide scale-up to 39 local radio stations under various assumptions. A nationwide scale-up started in January 2019 after preliminary results of this study became available. [43] We conclude this section by comparing the cost-effectiveness of this intervention to alternative approaches evaluated in other contexts.

6.1. Media Campaign Costs

Campaign implementation costs are calculated using data provided by DMI. We convert all expenses to expenses in the year of analysis (2018).[44] For the pilot program, this data represents actual expenses made by DMI. The total cost of the pilot program was US$ 3.1 million. To estimate the total cost in case of a national scale-up, we use the budget and total amount of money that DMI received from its donors to fund the scale-up of the program across Burkina Faso. We estimate that a national scale up would cost US$ 3.4 million. These cost estimates do not account for the additional costs incurred by the Burkinabe Ministry of Health (including additional contraceptives and additional time spent by health workers counseling women).[45] The Guttmacher Institute (2017) estimates the cost of supplies were $3.5

[43] While the format of the radio campaign changed slightly (with fewer interactive shows) when taken to national scale, DMI reacted to the results in this paper that information was a key mechanism by reintroducing the interactive segments at no additional cost.
[44] See https://www.povertyactionlab.org/research-resources/cost-effectiveness for more details on our cost-effectiveness analysis methodology.
[45] According to the Guttmacher Institute (2017), the Ministry of Health in Burkina Faso spend US$ 18 million on family planning services in annually, or around US$ 14.22 per woman using modern contraception.

per woman per year, which we add as an additional marginal cost to our cost-effectiveness calculations.

6.2. Number of Women Using Modern Contraception because of the Campaign

A key challenge is that our measure of the program impact is only valid on the population on which our survey data is representative. As described in Section (4.2), this data is representative of women living in villages with fewer than 1,500 inhabitants, with no electricity, located between 5 and 50 kilometers of the local radio station town and within 5 kilometers of a health center. Using national population census data,[46] we estimate that in 2018, approximately 177,000 women of reproductive age were living in a village reached by the radio campaign and for which our survey data are representative. Using the same data, we estimate that around 448,000 women of reproductive age were also reached by the media campaign but were living in villages or towns for which our survey data are not representative.

When the program was scaled-up nationally, the number of radio stations broadcasting the campaign increased from 8 to 39. We use data on each radio broadcasting area (computed by DMI) to calculate that approximately 83% of the population of Burkina Faso is reached by the national campaign.[47] Using census data, we estimate that almost 1.2 million women of reproductive age are now reached in areas similar to our survey data and 2.6 million in other areas.

For women living in areas for which our survey data are representative, we can use our estimate of the program impact from our survey data (+5.9 percentage points). For other areas reached by the campaign, we must make additional assumptions about the impact of the program. We consider two different assumptions:

[46] We use projections of the 2018 population calculated using the 2006 national census.
[47] Figures A4 in the appendix shows a map of Burkina Faso with the estimated broadcasting areas covered by the 39 radio stations that are part of a national scale-up.

- Assumption 1: the program impact was the same everywhere (+5.9 percentage points). Under this assumption, the program increased the number of women using modern contraception by 37,000 in areas targeted by the pilot. This number increases to 225,000 with the national campaign.
- Assumption 2: the program had no impact in areas for which our survey sample is not representative. Under this assumption, the program increased the number of women using modern contraception by 10,000 in areas targeted by the pilot and by 70,000 with the national campaign. This assumption represents the most conservative assumption and a lower bound of the program cost-effectiveness.

Two pieces of data suggest that assumption 1 may be the most valid assumption (and indeed may underestimate impact and thus cost-effectiveness). First, we find larger impacts on women who had access to a radio, were using modern contraception at baseline, and had more information on modern contraception to begin with. Urban populations, which constitute a large share of the population for which we are seeking to extrapolate an effect, include women who have on average more access to a radio (56% of women in urban areas listen weekly to the radio against 41% in rural areas according to DHS, 2010), who are more likely to use modern contraception (44% in urban against 21% in rural according to PMA2020, 2016), and who have more information on contraception (72% in urban against 62% in rural have a good level of information on modern methods according to PMA2020, 2016).

Second, we can use administrative clinic data on contraceptive distribution to estimate the program impact in areas reached by a study radio station (within 50 km of a radio station), but which are not in the clinic survey sample (i.e. not used by women in the women survey sample). We have monthly data for 235 clinics of this type. Results for these (more urban) clinics are presented in the appendix Table A6 and are slightly larger than the results for the overall administrative data sample (Table 6). This provides additional support for assumption 1.

Finally, following the same logic, we can use our best estimate of the impact of the program on fertility (-1.5 percentage points) and estimate the number of (most likely undesired) births averted because of the campaign. We get between 1,630 and 1,050 births averted during the pilot program and between 10,000 and 6,500 for the nationwide campaign.

6.3. Annual Program Cost per Additional Woman using Modern Contraception

Using total program costs, population data and impact estimates, we can derive the cost per additional woman using contraception during the pilot study. Under our preferred assumption (assumption 1), the cost per additional woman using modern contraception was US$85 during the pilot study and drops to US$ 15.3 under the nationwide scale up. To compute the annual cost per additional woman using modern contraception, we assume the program had the same impact for two years (i.e. that the program started to have an impact after 6 months and then the same impact throughout the remaining two years). We can then divide the cost per additional woman using contraception during the pilot by two which gives an annual cost per additional woman using modern contraception of US$ 42.5 for the pilot study and US$ 7.7 for a national scale-up ($46 and $11.2 respectively if we include estimated cost of additional supply).

This assumption of rapid and sustained impact is motivated by administrative clinic data which shows the number of contraceptives distributed rose rapidly within a few months of the campaign start and was then relatively constant across the two years (see appendix figure A3).

If we assume that the reduction in births observed in the treatment group are unwanted births, under our preferred assumption, we get a cost per unwanted averted birth close to US$1,500 for the pilot and to US$260 for the national scale-up. However, these figures should be treated with caution as the coefficient on births averted as a large confidence interval.

6.4. How economically significant are the results on contraception and cost-effectiveness?

To benchmark our results, we compare them against results from evaluations of alternative approaches to increasing mCPR use, trends in the use of mCPR in Burkina Faso and other African economies, and the costs of supplying contraception in Burkina Faso.

Evidence on the cost-effectiveness of alternative approaches to promote mCPR, especially introduced at scale, is scarce. Integration of family services into other health services is among the most promising approaches tested. Shade et al. (2013) show that integrating family planning into HIV services in 12 clinics in Kenya significantly increased contraception use at a cost of US$65 per new user per year. Dulli et al. (2016) find that integrating family planning into immunization services in 7 clinics in Rwanda increased contraception use at a cost of US$32 per new user. The IRC (2016) estimated the average cost per couple year protection provided across four of their family planning programs was $47 (this study did not attempt to calculate impact or cost-effectiveness). The DMI campaign is more cost-effective than these alternatives when done at nationwide scale under our preferred assumption (US$7.7 per additional user) and under our most conservative assumption of no program effect in areas different from our survey data (US$ 24.7 per new user). The cost-effectiveness of the more limited pilot program is however comparable (US$ 42.5 per new user).

Data from nationally representative household surveys across Africa suggest the magnitude of the effect from the DMI campaign is large in comparison to trends in mCPR usage over time. (PMA 2020). MCPR increased an average of 4.1 percentage points each year in DMI treatment areas. By comparison, PMA 2020 data from various sub-Saharan African countries (including Burkina Faso), shows the average annual increase in mCPR during the same time period ranged between 0.4 and 2.8 percentage points (Figure 4). The treatment effect of the campaign is equivalent to 2.5 years of the improving trend in Burkina Faso (see appendix figure

A5), illustrating how an effective demand side intervention can complement and accelerate the impact of supply side provision.[48]

Finally, we benchmark the cost-effectiveness of this intervention against the cost of other (primarily supply side) family planning spending in Burkina Faso. The Guttmacher Institute (2017)[49] estimates that US$ 18 million is spent on family planning services in Burkina Faso annually, or approximately US$ 45 million over the 2.5 years of the campaign with an average cost per woman using modern contraception of US$ 14.22 per year. In comparison, the campaign increased contraception use (under our preferred assumption) at a cost of US$11.2 per year including the cost of contraceptives. This "marginal" cost is 21% lower than the above estimated average cost of US$14.22 (but assumes that health service implementation costs are fixed). The increased use of modern contraception brought about by the campaign, would not have been possible without sufficient supply-side family planning initiatives supplying the contraceptives, but mass media is a highly cost-effective add on.

6.5. How does the persuasion rate of this campaign compare to those of other mass media interventions?

The literature on media economics has developed a "persuasion rate" metric to gauge the magnitude of an effect and for comparability across different settings (DellaVigna and Gentzkow, 2010). It is defined as the ratio of (a) the difference in outcome between treatment and control and the product of (b) the share who haven't already adopted the behavior and (c) the difference in exposure to the campaign between treatment and control.

In our case, (a) is equal to the campaign impact (5.9%) and (b) to the share of women not using contraception in noncampaign areas (70.5%). For (c), we consider that the difference in exposure to the campaign is simply equal to the share of women who are often listening to the radio in campaign areas (89.5%). Indeed, even

[48] The time trend found in the PMA2020 survey for Burkina Faso is similar to the trend seen in our control data.
[49] See https://www.guttmacher.org/fact-sheet/adding-it-up-contraception-mnh-2017

if people living in noncampaign areas were exposed to some messaging on family planning, we think that the type of messages were fundamentally different from the DMI campaign in term of quality and intensity.

With those numbers, we get a persuasion rate of 9.4%, which is relatively large, but not out of line with other studies on the impact of mass media in other settings. DellaVigna and Kaplan (2007) find a persuasion rate of 11.6% for the effect of having access to *Fox News* on Republican party vote share, Enikolopov et al. (2010) find a persuasion rate of 7.7% for the effect of availability of an independent anti-Putin TV station on vote against Putin, and Gerber et al. (2009) find a persuasion rate of 19.5% for the effect of a free 10-week subscription to the Washington post on Democratic party vote share (see DellaVigna and Gentzkow, 2010 for a review).

7. Conclusion and Policy Implications

We provide experimental evidence that access to mass media can sharply reduce the use of contraception even when it increases exposure to government messaging which is pro family planning. While the direction of impact in our study contrasts with previous studies, it is consistent with a mechanism by which mass media makes more salient, and creates pressure to conform to, the behavior of the modal listener (who does not use contraception). However, this negative effect of mass media can be offset by a high-quality mass media public health campaign based on the lessons from behavioral science. The intensive, two-and-a-half-year campaign, delivered at scale, effectively challenged misconceptions about contraception and increased modern contraception use. We show that such campaigns can be many times more cost-effective than other effective family planning interventions. We provide evidence that lack of information (especially on side effects of contraceptives) is a constraint to contraception use in low education communities where fertility is high and there is an unmet need for contraception. This is true even though imbalances between the power of men and women over contraception decision making are not addressed. We demonstrate that the challenge of studying

mass media impact can be overcome (in some environments) with a multi layered randomization design which combines individual level randomization of access to radios with randomization at the radio station level.

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Figures

Figure 1: Research Design: a Two-level Randomized Experiment

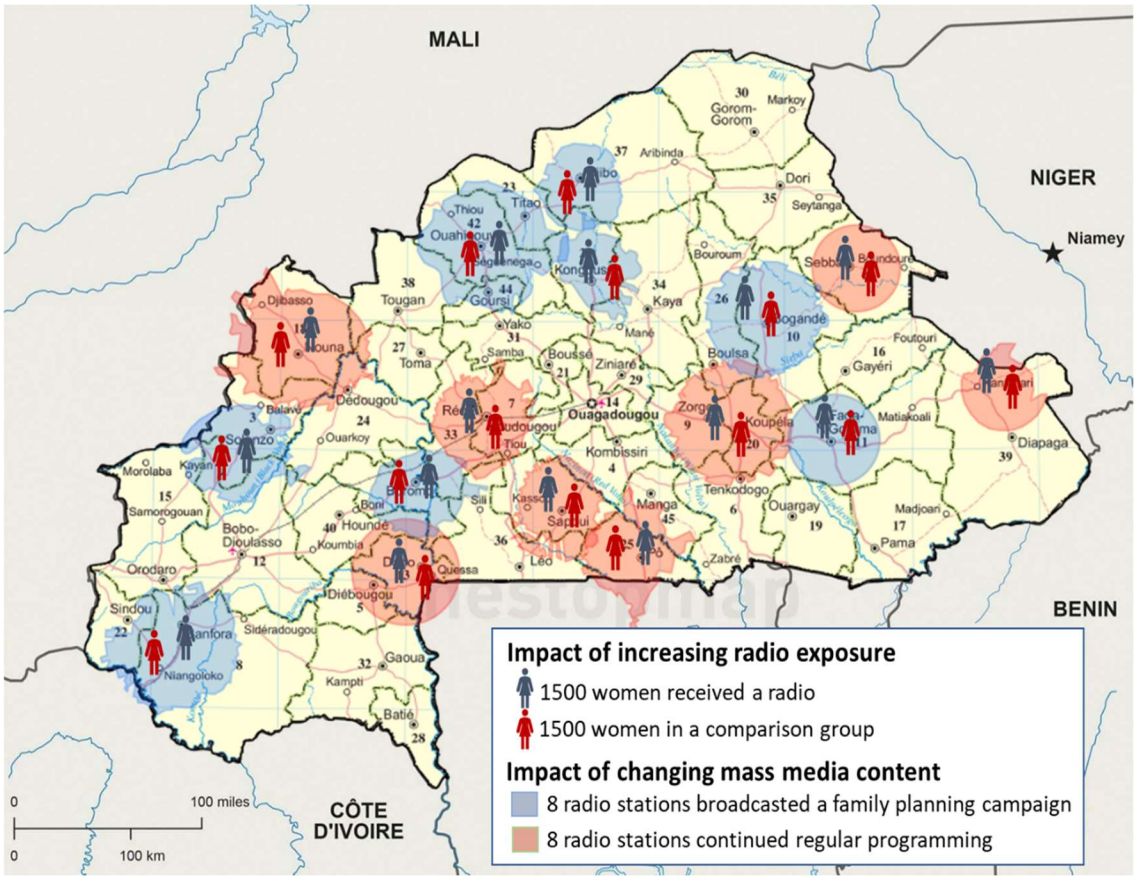
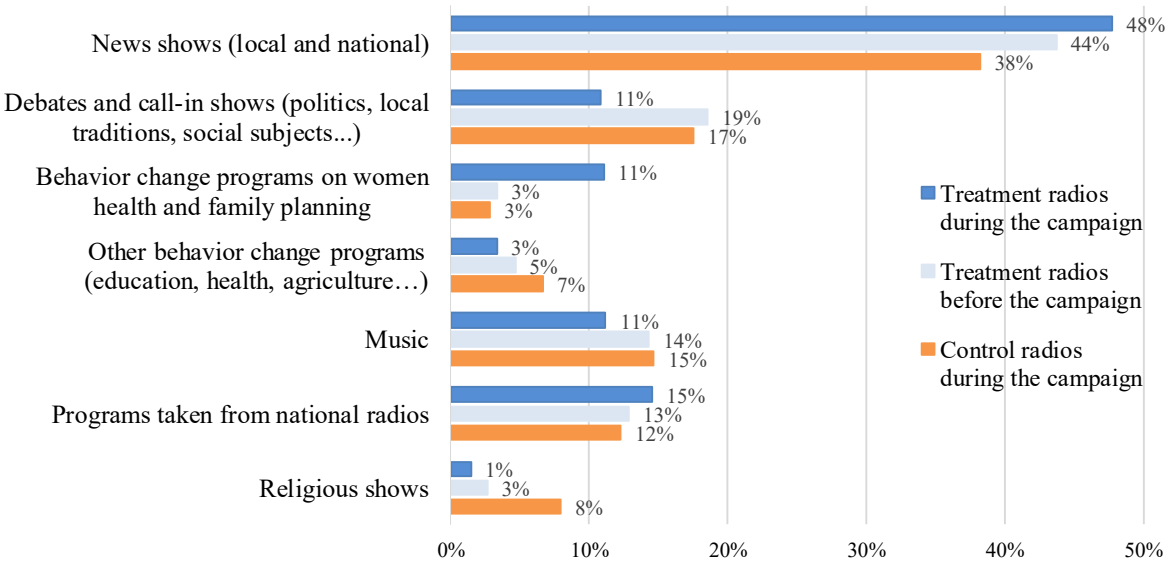


Figure 2: Radio Content during Peak Listening Time



Notes: 7 radio stations in campaign areas and 8 radio stations in noncampaign areas. Peak listening time includes one hour in the morning (7-8am) and 3 hours in the evening (6-9pm) when most people listen to the radio. It corresponds to a quarter of total airtime.

Figure 3: Impact on Modern Contraception Prevalence Rate (mCPR)

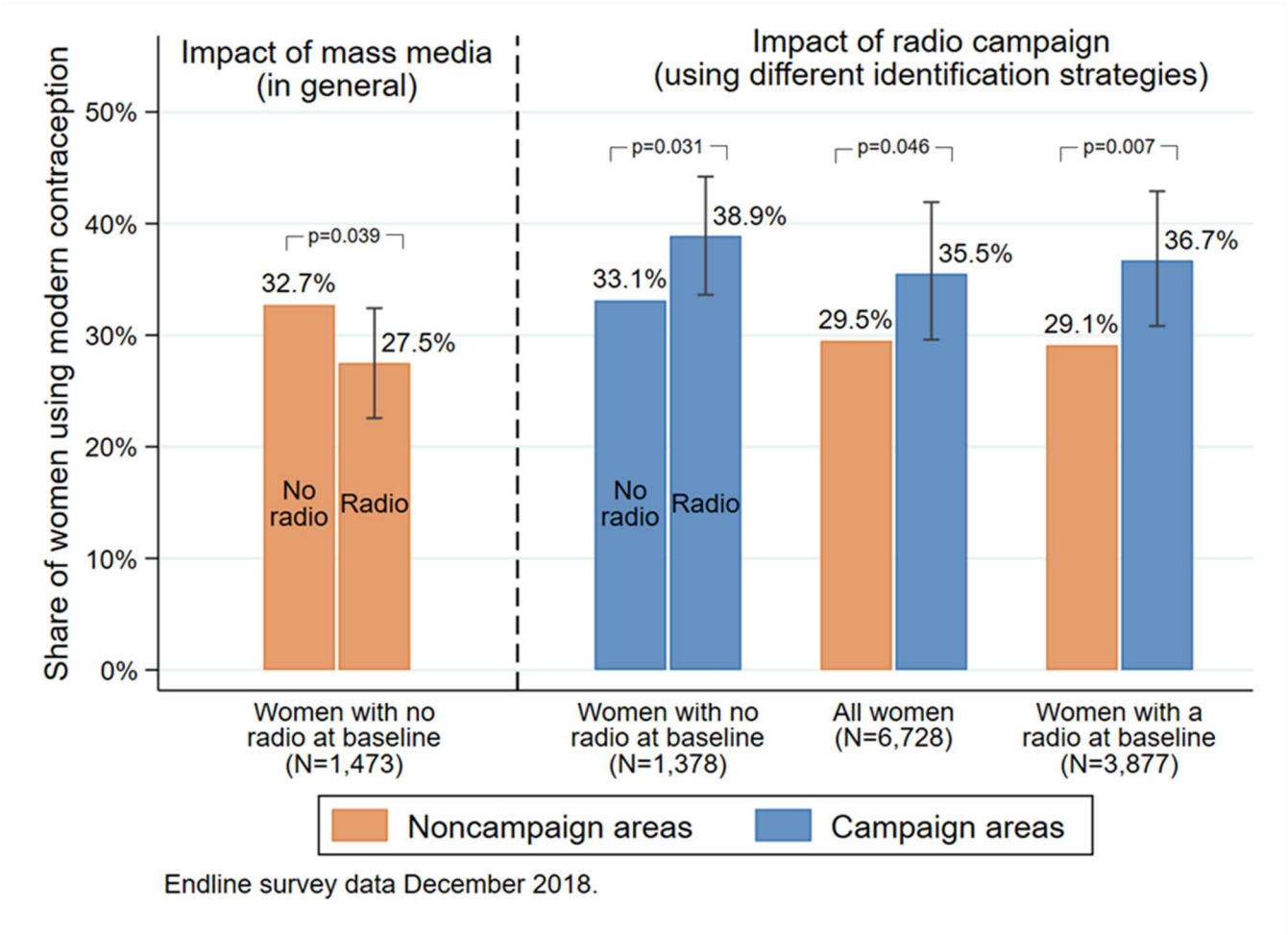
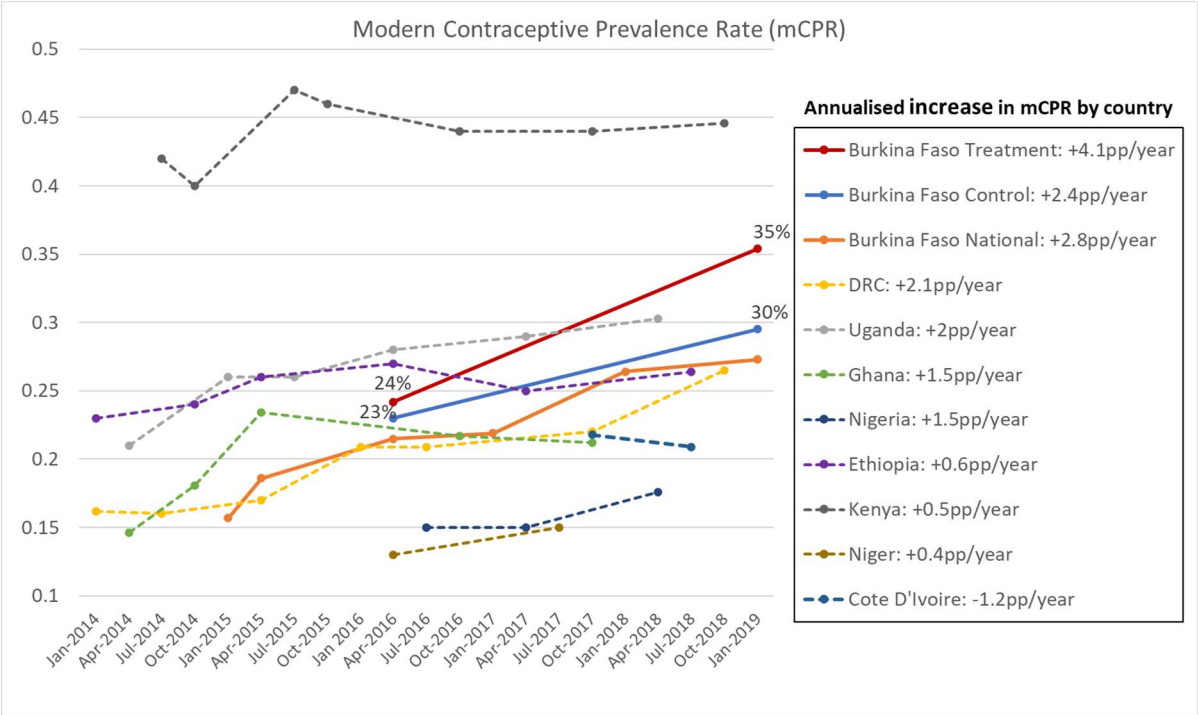


Figure 4: Comparing mCPR Trends to Other Countries in Africa



Notes: Survey data and data from PMA 2020.

Table 1: Baseline Characteristics of Post-Attrition Women Sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Women with no radio at baseline				**All women**		**Women with a radio at baseline**	
	Noncampaign areas		Campaign areas					
	No radio Mean	Radio Mean P-value	No radio Mean	Radio Mean P-value	Control Mean	Treat. Mean P-value	Control Mean	Treat. Mean P-value
Currently using contraception[α]	21.7%	19.6%	22.4%	22.7%	23%	24.2%	24.8%	26%
		-		-		0.52		0.621
Want to use contraception in the future	68%	67%	68.1%	70.3%	69.4%	70.7%	70.9%	71.9%
		0.962		0.372		0.844		0.839
Current situation wrt. family planning:								
Unmet need for spacing	36.5%	36.9%	32.8%	33.7%	34.3%	33.1%	32.5%	31.8%
		0.869		0.673		0.727		0.871
Unmet need for limiting	10.6%	11.9%	13.3%	14.6%	11.8%	12.4%	12.2%	11.7%
		0.657		0.418		0.655		0.226
No unmet need	20.4%	19.5%	19.4%	17.1%	19.2%	17.1%	18.5%	16.6%
		0.36		0.313		0.633		0.698
Husband makes contraception decisions	24.7%	23.2%	20.4%	23.1%	24%	21.7%	24%	22.1%
		0.993		0.749		0.682		0.769
Distance to nearest Clinic	4.4	4.2	4.4	4.6	4.5	4.6	4.6	4.6
		0.214		0.959		0.686		0.931
Age	30.7	30.1	30.5	30.3	30.5	30.1	30.5	30
		0.273		0.786		0.63		0.288
Married	84.3%	81.5%	82.9%	82.2%	83.2%	84%	83.5%	84.7%
		0.087*		0.807		0.821		0.697
Total number of pregnancy	4.4	4	4.5	4.3	4.2	4.3	4.2	4.3
		0.003***		0.392		0.491		0.819
Ever attended formal school[α]	17.5%	19.6%	14.9%	15.9%	20%	18.3%	21.4%	20.3%
		-		-		0.381		0.751
Generate income	43.3%	43.4%	42.3%	41.5%	47.1%	45.1%	50.1%	48.4%
		0.985		0.727		0.865		0.822
Muslim	43.9%	43.6%	59.1%	54.1%	44%	59.2%	44.2%	58%
		0.781		0.02**		0.47		0.238
Catholic	25.7%	28%	19.2%	22.4%	29%	19.4%	30.9%	20%
		0.366		0.175		0.398		0.151
Protestant	11.7%	11.9%	10.4%	9.2%	10.8%	8.4%	9.8%	8%
		0.282		0.777		0.746		0.555
Traditional / animist	16.3%	15.4%	10.5%	13%	14.7%	11.9%	13.7%	12.8%
		0.919		0.14		0.768		0.911
Polygamous household	32.3%	30.9%	40.7%	40.8%	34.8%	43.2%	37.4%	46.3%
		0.873		0.904		0.162		0.18
Understand radio language	68%	66.7%	90.5%	90.5%	67.7%	86.2%	67.8%	86.9%
		0.455		0.953		0.192		0.332
Listen to the radio in the last week	10.8%	9.5%	11.6%	13.6%	29.3%	28%	45.1%	41.4%
		0.634		0.187		0.821		0.468
Has access to a radio in her household	0%	0%	0%	0%	55%	54.9%	100%	100%
		-		-		0.992		-
N total	734	739	692	686	3,328	3,400	1,829	1,866

Note: Baseline survey data, April 2016. Columns (2) and (4): P-values from OLS regressions of the outcome variables on a tequal to one for women randomly selected to receive a radio, controlling for strata fixed-effects with standards errors clustered at the household level. Columns (6) and (8): Pvalues computed using wild boostrap procedure from OLS regressions of the outcome variables on a dummy equal to one in campaign areas, controlling for strata fixed-effects and with standard errors clustered at the radio station level. α: variables used for stratifying the randomization of the radio distribution intervention. ***, **, * indicate statistical significance at 1, 5 and 10%

Table 2: Impact on Radio Ownership, Listenership and Content

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Impact of mass media		**Impact of mass media campaign**					
	Impact of radio distribution in noncampaign areas		Impact of radio distribution in campaign areas		Comparing campaign and noncampaign areas			
					All women		A radio at baseline	
	No radio Mean [SD]	Radio Coef. (SE)	No radio Mean [SD]	Radio Coef. (SE)	Control Mean [SD]	Treat. Coef. (SE)	Control Mean [SD]	Treat. Coef. (SE)
At least a radio in the household	0.324 [0.468]	0.356*** (0.027)	0.335 [0.472]	0.342*** (0.029)	0.553 [0.497]	0.016 (0.043)	0.603 [0.49]	0.028 (0.063)
Has her own personal radio	0.044 [0.204]	0.557*** (0.022)	0.012 [0.107]	0.643*** (0.021)	0.179 [0.383]	-0.027 (0.017)	0.066 [0.249]	-0.036*** (0.011)
Listen to the radio in the last 7 days	0.271 [0.445]	0.15*** (0.025)	0.201 [0.401]	0.265*** (0.027)	0.347 [0.476]	-0.021 (0.059)	0.357 [0.479]	-0.019 (0.055)
Amount of time listened to the radio in the last 7 days (hours)	1.368 [3.945]	1.172*** (0.273)	1.135 [3.932]	2.007*** (0.282)	2.006 [5.163]	-0.163 (0.324)	2.101 [5.522]	-0.46 (0.359)
Often listen to the radio	0.79 [0.407]	0.157*** (0.02)	0.819 [0.385]	0.135*** (0.019)	0.872 [0.334]	0.023 (0.026)	0.882 [0.323]	0.029 (0.025)
Often listen to the cluster radio station[α]	0.532 [0.499]	0.111*** (0.029)	0.552 [0.498]	0.107*** (0.024)	0.601 [0.49]	0.009 (0.155)	0.614 [0.487]	0.025 (0.166)
Listen at least once in the last week to :								
News shows	0.104 [0.305]	0.083*** (0.019)	0.1 [0.3]	0.158*** (0.022)	0.166 [0.372]	0.000 (0.023)	0.184 [0.388]	-0.004 (0.028)
Behavior change programs	0.079 [0.27]	0.075*** (0.018)	0.149 [0.356]	0.22*** (0.025)	0.133 [0.34]	0.097*** (0.01)	0.145 [0.352]	0.09*** (0.02)
Religious programs	0.04 [0.195]	0.041*** (0.013)	0.025 [0.155]	0.056*** (0.013)	0.065 [0.246]	-0.022 (0.017)	0.066 [0.249]	-0.024** (0.013)
Debates and call-in shows	0.095 [0.294]	0.103*** (0.019)	0.092 [0.29]	0.132*** (0.022)	0.165 [0.371]	-0.022 (0.046)	0.18 [0.384]	-0.029 (0.048)
Music	0.124 [0.33]	0.078*** (0.018)	0.072 [0.259]	0.105*** (0.02)	0.167 [0.373]	-0.05 (0.061)	0.177 [0.381]	-0.042 (0.051)
Ever heard of family planning on the radio	0.653 [0.476]	0.192*** (0.024)	0.821 [0.384]	0.116*** (0.019)	0.759 [0.428]	0.116*** (0.04)	0.772 [0.42]	0.116*** (0.042)
Heard of FP on the radio in the last week	0.091 [0.288]	0.029* (0.017)	0.155 [0.362]	0.189*** (0.025)	0.09 [0.287]	0.139*** (0.04)	0.084 [0.277]	0.141*** (0.043)
Heard of FP on the radio in the last month	0.529 [0.499]	0.214*** (0.027)	0.725 [0.447]	0.138*** (0.024)	0.633 [0.482]	0.17*** (0.054)	0.631 [0.483]	0.193*** (0.057)
N total	1,473		1,378		6,728		3,877	
N in-person survey	1,202		1,307		5,860		3,314	

Note: Endline women survey data, December 2018. Columns (2) and (4): coefficients and standard errors from OLS regressions of the outcome variables on a dummy equal to one for women randomly selected to receive a radio, controlling for strata fixed-effects. Standard errors are clustered at the household level. Columns (6) and (8): coefficients and standard errors from OLS regressions of the outcome variables on a dummy equal to one in campaign areas, controlling for strata fixed-effects. Standard errors are clustered at the radio station level and computed using wild boostrap procedure α: information only available in the in-person survey. ***, **, * indicate statistical significance at 1, 5 and 10%

Table 3: Impact on Modern Contraception Uptake: Women Survey Data

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Impact of mass media		**Impact of mass media campaign**					
	Impact of radio distribution in noncampaign areas		Impact of radio distribution in campaign areas		Comparing campaign and noncampaign areas			
					All women		A radio at baseline	
	No radio Mean [SD]	Radio Coef. (SE)	No radio Mean [SD]	Radio Coef. (SE)	Control Mean [SD]	Treat. Coef. (SE)	Control Mean [SD]	Treat. Coef. (SE)
Currently using modern contraception (mCPR)	0.327 [0.469]	-0.052** (0.025)	0.331 [0.471]	0.058** (0.027)	0.295 [0.456]	0.059** (0.03)	0.291 [0.454]	0.077*** (0.03)
Method used:								
Implant	0.199 [0.399]	-0.053** (0.021)	0.169 [0.375]	0.051** (0.022)	0.165 [0.371]	0.026 (0.024)	0.159 [0.365]	0.036 (0.025)
Injection	0.097 [0.296]	-0.001 (0.017)	0.132 [0.338]	0.004 (0.019)	0.107 [0.31]	0.026 (0.016)	0.113 [0.317]	0.026* (0.014)
Oral pills	0.031 [0.174]	-0.002 (0.009)	0.023 [0.15]	0.005 (0.009)	0.022 [0.146]	0.009 (0.007)	0.018 [0.133]	0.016 (0.01)
Wants to use contracept. in the future	0.756 [0.43]	-0.027 (0.025)	0.788 [0.409]	0.017 (0.025)	0.739 [0.439]	0.058 (0.036)	0.74 [0.439]	0.063* (0.034)
Used contraception at last sexual intercourse	0.296 [0.457]	-0.039 (0.025)	0.336 [0.473]	0.02 (0.027)	0.282 [0.45]	0.068** (0.034)	0.284 [0.451]	0.083** (0.037)
Currently using contraception incl. abstinence, rhythm and withdrawal	0.338 [0.473]	-0.052** (0.026)	0.331 [0.471]	0.06** (0.027)	0.304 [0.46]	0.053* (0.028)	0.298 [0.457]	0.073*** (0.028)
N total	1,473		1,378		6,728		3,877	

Note: Endline women survey data, December 2018. Columns (2) and (4): coefficients and standard errors from OLS regressions of the outcome variables on a dummy equal to one for women randomly selected to receive a radio, controlling for strata fixed-effects. Standard errors are clustered at the household level. Columns (6) and (8): coefficients and standard errors from OLS regressions of the outcome variables on a dummy equal to one in campaign areas, controlling for strata fixed-effects. Standard errors are clustered at the radio station level and computed using wild boostrap procedure. ***, **, * indicate statistical significance at 1, 5 and 10%

Table 4: Mechanisms: Impact on Information, Attitudes and Norms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Impact of mass media		**Impact of mass media campaign**					
	Impact of radio distribution in noncampaign areas		Impact of radio distribution in campaign areas		Comparing campaign and noncampaign areas			
					All women		A radio at baseline	
	No radio Mean [SD]	Radio Coef. (SE)	No radio Mean [SD]	Radio Coef. (SE)	Control Mean [SD]	Treat. Coef. (SE)	Control Mean [SD]	Treat. Coef. (SE)
Impact on information and knowledge:								
Index of knowledge of family planning$^{\alpha}$	-0.01 [0.997]	0.009 (0.06)	0.114 [1.081]	0.088 (0.06)	0 [1]	0.157 (0.171)	0.019 [1.009]	0.126 (0.152)
Index of knowledge of contraceptive methods	0.024 [0.968]	-0.016 (0.054)	0.207 [0.893]	0.133*** (0.049)	0 [1]	0.288*** (0.053)	-0.003 [1.02]	0.312*** (0.069)
Including:								
Modern contraceptive methods can make a woman sterile	0.258 [0.438]	-0.014 (0.023)	0.163 [0.37]	-0.003 (0.021)	0.259 [0.438]	-0.091*** (0.035)	0.263 [0.44]	-0.095** (0.04)
Modern contraceptive methods can cause sickness	0.343 [0.475]	0.031 (0.026)	0.301 [0.459]	-0.028 (0.026)	0.38 [0.486]	-0.085*** (0.034)	0.394 [0.489]	-0.091** (0.038)
Ever heard of implants$^{\alpha}$	0.867 [0.34]	-0.027 (0.023)	0.864 [0.343]	0.038* (0.02)	0.863 [0.344]	0.014 (0.028)	0.869 [0.338]	0.02 (0.033)
Ever heard of injectables$^{\alpha}$	0.791 [0.407]	-0.001 (0.026)	0.85 [0.357]	0.033 (0.021)	0.789 [0.408]	0.083** (0.033)	0.79 [0.408]	0.083** (0.036)
Ever heard of oral pills$^{\alpha}$	0.741 [0.439]	0.009 (0.027)	0.815 [0.389]	0.008 (0.023)	0.751 [0.432]	0.08** (0.039)	0.761 [0.426]	0.071 (0.041)
Impact on norms and attitudes:								
Index of attitudes towards family planning$^{\alpha}$	0.015 [0.922]	-0.047 (0.07)	0.13 [0.801]	0.026 (0.046)	0 [1]	0.128** (0.053)	0.014 [0.98]	0.097*** (0.033)
Including:								
Women should control the number of children they have during their lifetime$^{\alpha}$	0.506 [0.5]	0.012 (0.027)	0.634 [0.482]	0.037 (0.028)	0.547 [0.498]	0.078* (0.04)	0.575 [0.494]	0.066* (0.037)
Index of attitudes towards contraceptive methods	0.021 [0.989]	0.024 (0.056)	0.052 [0.964]	0.043 (0.055)	0 [1]	0.106 (0.115)	0.008 [0.988]	0.108 (0.125)
Index of women's perceptions of fertility and birth spacing	-0.024 [1.016]	-0.034 (0.054)	-0.087 [0.982]	0.135** (0.054)	0 [1]	-0.047 (0.16)	0.028 [0.997]	-0.072 (0.18)
Index of husband's perceptions of fertility and birth spacing$^{\alpha}$	0.063 [1.031]	-0.103 (0.07)	0.063 [1.04]	0.121* (0.063)	0 [1]	0.106 (0.137)	0.004 [0.986]	0.049 (0.154)
Impact on secondary outcomes:								
Index of gender attitudes (higher values for more positive attitudes)	0.01 [0.998]	-0.111** (0.051)	-0.243 [1.018]	0.023 (0.056)	0 [1]	-0.186 (0.208)	0.031 [0.996]	-0.184 (0.185)
Index of women empowerment$^{\alpha}$	0.078 [1.07]	0.067 (0.069)	-0.038 [0.985]	0.048 (0.057)	0 [1]	-0.054 (0.133)	-0.07 [0.924]	-0.082 (0.106)
Index of domestic violence (higher values for less domestic violence)$^{\alpha}$	-0.023 [1.012]	0.078 (0.065)	0.08 [0.966]	-0.092 (0.059)	0 [1]	0.078 (0.125)	-0.003 [0.985]	0.093 (0.134)
N total	1,473		1,378		6,728		3,877	
N in-person survey	1,202		1,307		5,860		3,314	

Note: Endline women survey data, December 2018. Columns (2) and (4): coefficients and standard errors from OLS regressions of the outcome variables on a dummy equal to one for women randomly selected to receive a radio, controlling for strata fixed-effects. Standard errors are clustered at the household level. Columns (6) and (8): coefficients and standard errors from OLS regressions of the outcome variables on a dummy equal to one in campaign areas, controlling for strata fixed-effects. Standard errors are clustered at the radio station level and computed using wild boostrap procedure. α: information only available in the in-person survey. See appendix 1 for the definition of indexes. ***, **, * indicate statistical significance at 1, 5 and 10%.

Table 5: Heterogeneity: Which Women Were the Most and Least Impacted?

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Impact of mass media		**Impact of mass media campaign**					
	Impact of radio distribution in noncampaign areas		Impact of radio distribution in campaign areas		Comparing campaign and noncampaign areas			
					All women		A radio at baseline	
	No radio Mean [SD]	Radio Coef. (SE)	No radio Mean [SD]	Radio Coef. (SE)	Control Mean [SD]	Treat. Coef. (SE)	Control Mean [SD]	Treat. Coef. (SE)
Impact on mCPR by baseline status with respect to contraception:								
mCPR if using contraception at baseline (N=1,591)	0.491 [0.501]	-0.038 (0.076)	0.606 [0.49]	0.025 (0.07)	0.48 [0.5]	0.129*** (0.036)	0.47 [0.5]	0.136*** (0.026)
mCPR if declared unmet needs for contraception at baseline (N=3,082)	0.327 [0.47]	-0.094** (0.037)	0.304 [0.461]	0.059 (0.042)	0.272 [0.445]	0.054*** (0.019)	0.263 [0.441]	0.068*** (0.026)
mCPR if declared no unmet needs for contraception at baseline (N=2,075)	0.22 [0.415]	0.022 (0.044)	0.178 [0.383]	0.085* (0.049)	0.195 [0.396]	0.012 (0.039)	0.188 [0.391]	0.041 (0.044)
Impact on mCPR by baseline age group :								
mCPR if [15-22[years old at baseline (N=1,457)	0.222 [0.417]	0.036 (0.067)	0.224 [0.419]	0.042 (0.096)	0.25 [0.433]	-0.008 (0.043)	0.248 [0.432]	0.017 (0.046)
mCPR if [22-29[years old at baseline (N=1,615)	0.374 [0.485]	-0.098 (0.086)	0.444 [0.498]	0.112 (0.078)	0.347 [0.476]	0.08* (0.043)	0.341 [0.475]	0.09*** (0.035)
mCPR if [29-37[years old at baseline (N=1,770)	0.432 [0.497]	-0.138* (0.079)	0.447 [0.498]	-0.007 (0.081)	0.362 [0.481]	0.107*** (0.033)	0.35 [0.477]	0.144*** (0.03)
mCPR if [37-49[years old at baseline (N=1,886)	0.259 [0.439]	-0.08 (0.053)	0.194 [0.396]	0.072 (0.053)	0.225 [0.418]	0.047 (0.043)	0.228 [0.42]	0.059 (0.05)
Impact on mCPR by baseline knowledge of contraception :								
mCPR if index of knowledge of contraception **below median**	0.262 [0.44]	-0.032 (0.036)	0.225 [0.418]	0.127*** (0.045)	0.238 [0.426]	0.014 (0.031)	0.237 [0.425]	0.028 (0.038)
mCPR if index of knowledge of contraception **above median**	0.404 [0.491]	-0.087* (0.046)	0.417 [0.494]	0.023 (0.042)	0.352 [0.478]	0.078* (0.044)	0.337 [0.473]	0.098** (0.038)
Impact on mCPR by baseline fertility preferences								
mCPR if women's ideal number of children **above median**	0.31 [0.463]	-0.005 (0.05)	0.275 [0.448]	0.061 (0.056)	0.278 [0.448]	0.034 (0.03)	0.271 [0.445]	0.062** (0.029)
mCPR if women's ideal number of children **below median**	0.337 [0.473]	-0.068* (0.035)	0.365 [0.482]	0.062* (0.036)	0.306 [0.461]	0.075* (0.043)	0.302 [0.459]	0.085** (0.042)
Impact on mCPR by baseline contraception decisions maker								
mCPR if respondent was taking contraception decisions alone (N=1,407)	0.383 [0.488]	0.017 (0.097)	0.346 [0.478]	0.095 (0.104)	0.352 [0.478]	0.066** (0.03)	0.329 [0.471]	0.093** (0.038)
mCPR if husband was taking contraception decisions alone (N=1,460)	0.441 [0.498]	-0.22** (0.101)	0.422 [0.495]	0.063 (0.094)	0.369 [0.483]	0.046 (0.057)	0.356 [0.48]	0.075 (0.057)
mCPR if both were taking contraception decisions together (N=1,396)	0.421 [0.496]	-0.01 (0.095)	0.481 [0.501]	0.061 (0.103)	0.403 [0.491]	0.125*** (0.03)	0.402 [0.491]	0.129*** (0.034)
mCPR if had never though about contraception (N=1,704)	0.221 [0.416]	-0.11** (0.047)	0.226 [0.42]	-0.019 (0.059)	0.187 [0.39]	-0.003 (0.02)	0.188 [0.391]	-0.008 (0.02)
N total	1,473		1,378		6,728		3,877	

Note: Endline women survey data, December 2018. Columns (2) and (4): coefficients and standard errors from OLS regressions of the outcome variables on a dummy equal to one for women randomly selected to receive a radio, controlling for strata fixed-effects. Standard errors are clustered at the household level. Columns (6) and (8): coefficients and standard errors from OLS regressions of the outcome variables on a dummy equal to one in campaign areas, controlling for strata fixed-effects. Standard errors are clustered at the radio station level and computed using wild boostrap procedure. See appendix 1 for the definition of indexes. ***, **, * indicate statistical significance at 1, 5 and 10%.

Table 6: Impact of Media Campaign on Contraceptives Distribution: Administrative Clinic Data

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Number of FP consultations		**Implants distributed**		**Injectables distributed**		**Oral pills distributed**	
	Control Mean [SD]	Treat. Coef. (SE)	Control Mean [SD]	Treat. Coef. (SE)	Control Mean [SD]	Treat. Coef. (SE)	Control Mean [SD]	Treat. Coef. (SE)
Panel A: Clinic survey data								
October 2019: top coded at P99 (N= 401)	30.97	14**	3.61	2.4	27.52	11.17	16.31	15.68*
	[35.2]	(6.73)	[5.41]	(1.69)	[27.4]	(7.03)	[25.38]	(8.86)
October 2019: log/IHS Transformation (N= 401)	3.01	0.42**	1.4	0.32	3.53	0.4**	2.42	0.85*
	[0.97]	(0.14)	[1.11]	(0.42)	[1.1]	(0.19)	[1.69]	(0.44)
November 2019: top coded at P99 (N= 448)	60	11.39	12.88	-0.36	33.44	9.32	21.65	9.83
	[53.16]	(8.09)	[15.38]	(3.36)	[31.29]	(6.27)	[35.66]	(10.27)
November 2019: log/IHS Transformation (N= 448)	3.71	0.23**	2.47	-0.05	3.75	0.26	2.8	0.41
	[0.97]	(0.08)	[1.43]	(0.3)	[1.08]	(0.19)	[1.58]	(0.36)
Panel B: Administrative clinic data (panel data)								
Monthly data: top coded at P99 (N= 50,280)			5.59	0.57	24.36	2.5**	14.23	2.86
			[10]	(0.7)	[30.57]	(1.15)	[28.4]	(2.31)
Monthly data: IHS Transformation (N= 50,280)			1.45	0.12	2.87	0.1	1.94	0.1
			[1.41]	(0.12)	[1.78]	(0.1)	[1.79]	(0.08)
Quarterly data: top coded at P99 (N=17,598)			5.53	0.61	24.3	2.6**	14.17	3.03
			[7.74]	(0.67)	[28.37]	(1.12)	[25.22]	(2.39)
Six-months data: top coded at P99 (N= 9,218)			5.47	0.55	24.26	2.74**	14.13	3.24
			[7.08]	(0.65)	[27.85]	(1.09)	[24.34]	(2.42)

Note: Panel A and B: clinic survey data December 2018. Questions relative to October were not asked in the phone survey. Panel B: administrative data from the Ministry of Health on 838 health centers and 60 months. Columns (2), (4), (6) and (8): coefficients and standard errors from OLS regressions of the outcome variables on a dummy equal to one in campaign areas, controlling for strata fixed-effects. Regressions in Panel C also include time and clinic fixed effects. Standard errors are clustered at the radio station level and computed using wild boostrap procedure. ***, **, * indicate statistical significance at 1, 5 and 10%.

Table 7: Impact on Fertility, Sexual Activity and Well-being

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Impact of mass media		**Impact of mass media campaign**					
	Impact of radio distribution in noncampaign areas		Impact of radio distribution in campaign areas		Comparing campaign and noncampaign areas			
					All women		A radio at baseline	
	No radio Mean [SD]	Radio Coef. (SE)	No radio Mean [SD]	Radio Coef. (SE)	Control Mean [SD]	Treat. Coef. (SE)	Control Mean [SD]	Treat. Coef. (SE)
Panel A: All women (N=6,728)								
Gave birth in the last year	0.171	-0.011	0.171	-0.006	0.174	-0.013	0.177	-0.013
	[0.377]	(0.025)	[0.377]	(0.022)	[0.379]	(0.011)	[0.382]	(0.014)
Had sex in the last 3 months[α.]	0.506	-0.005	0.587	0.006	0.502	0.086	0.499	0.1
	[0.5]	(0.031)	[0.493]	(0.03)	[0.5]	(0.069)	[0.5]	(0.068)
Index of self-assessed health and well being	-0.131	-0.001	0.355	-0.052	0	0.269***	0.106	0.227**
	[1.042]	(0.05)	[0.896]	(0.049)	[1]	(0.113)	[0.953]	(0.108)
Panel B: Women in top 25% of predicted effect on contraception (N=1,682)								
Gave birth in the last year	0.183	-0.018	0.17	0.005	0.189	-0.034**	0.191	-0.037
	[0.388]	(0.069)	[0.377]	(0.052)	[0.391]	(0.022)	[0.394]	(0.022)
Had sex in the last 3 months[α.]	0.521	0.003	0.66	0.066	0.523	0.143*	0.526	0.172**
	[0.501]	(0.077)	[0.475]	(0.073)	[0.5]	(0.078)	[0.5]	(0.078)
Index of self-assessed health and well being	0.132	-0.011	0.325	-0.047	0.174	0.178	0.188	0.181
	[0.858]	(0.141)	[0.832]	(0.124)	[0.851]	(0.127)	[0.836]	(0.123)
Panel C: Women using contraception at baseline (N=1,449)								
Gave birth in the last year	0.154	0.086	0.216	-0.021	0.206	-0.021	0.219	-0.037*
	[0.362]	(0.068)	[0.413]	(0.053)	[0.405]	(0.025)	[0.414]	(0.022)
Had sex in the last 3 months[α.]	0.58	-0.028	0.682	0.044	0.587	0.123**	0.588	0.138**
	[0.495]	(0.079)	[0.467]	(0.07)	[0.493]	(0.057)	[0.493]	(0.062)
Index of self-assessed health and well being	-0.013	0.023	0.376	-0.073	0.093	0.251**	0.166	0.213*
	[0.946]	(0.131)	[0.861]	(0.116)	[0.968]	(0.117)	[0.951]	(0.121)
Panel D: Women [22-49[years old at baseline (N=4,685)								
Gave birth in the last year	0.142	0.008	0.142	0.002	0.157	-0.015*	0.162	-0.014
	[0.35]	(0.027)	[0.349]	(0.023)	[0.364]	(0.008)	[0.368]	(0.015)
Had sex in the last 3 months[α.]	0.505	-0.029	0.617	0.017	0.506	0.104	0.508	0.11*
	[0.5]	(0.035)	[0.486]	(0.034)	[0.5]	(0.066)	[0.5]	(0.066)
Index of self-assessed health and well being	-0.114	-0.003	0.317	-0.048	0.014	0.231**	0.096	0.195*
	[1.007]	(0.059)	[0.892]	(0.057)	[0.972]	(0.106)	[0.936]	(0.103)
N total	1,473		1,378		6,728		3,877	
N in-person survey	1,202		1,307		5,860		3,314	

Note: Endline women survey data, December 2018. Columns (2) and (4): coefficients and standard errors from OLS regressions of the outcome variables on a dummy equal to one for women randomly selected to receive a radio, controlling for strata fixed-effects. Standard errors are clustered at the household level. Columns (6) and (8): coefficients and standard errors from OLS regressions of the outcome variables on a dummy equal to one in campaign areas, controlling for strata fixed-effects. Standard errors are clustered at the radio station level and computed using wild boostrap procedure. α: information only available in the in-person survey. See appendix 1 for the definition of indexes. ***, **, * indicate statistical significance at 1, 5 and 10%.

Table 8: Cost-Effectiveness of Media Campaign

	(1)	(2)	(3)	(4)
	Pilot program (8 radio stations)		**Program scaled-up in all Burkina Faso**	
	Population similar to survey data	Other pop. reached in Treat. areas	Population similar to survey data	Other population
Program Costs: (in US$ in 2018)				
Total program Costs	$3 132 883		$3 454 392	
Incl. fixed costs	$2 794 959		$3 081 789	
Incl. variable costs	$337 924		$372 603	
Total population reached by the media campaign:				
Population in 2018 (projections using 2006 census)	760 834	1 923 448	5 082 070	11 311 704
Women of reproductive age (15-49) (23.3% of total)	177 274	448 163	1 184 122	2 635 627
Impact and Program Cost-effectiveness:				
Assumption 1: Same impact everywhere	5,9%	5,9%	5,9%	5,9%
Number of additional women using contraception	10 459	26 442	69 863	155 502
Additional women using contraception	36 901		225 365	
Total cost per extra women using modern contraceptior	$84,9		$15,3	
Anual cost per extra women using modern contraceptio	$42,5		$7,7	
Assumption 2: No impact in other population	5,9%	0,0%	5,9%	0,0%
Number of additional women using contraception	10 459	0	69 863	0
Additional women using contraception	10 459		69 863	
Total cost per extra women using modern contraceptior	$299,5		$49,4	
Anual cost per extra women using modern contraceptio	$149,8		$24,7	

Note: Cost data from DMI in 2018 US$. Population data from 2006 national census using projection calculated by the national statistical agency.

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Appendices Figures

Figure A1: Study Timeline

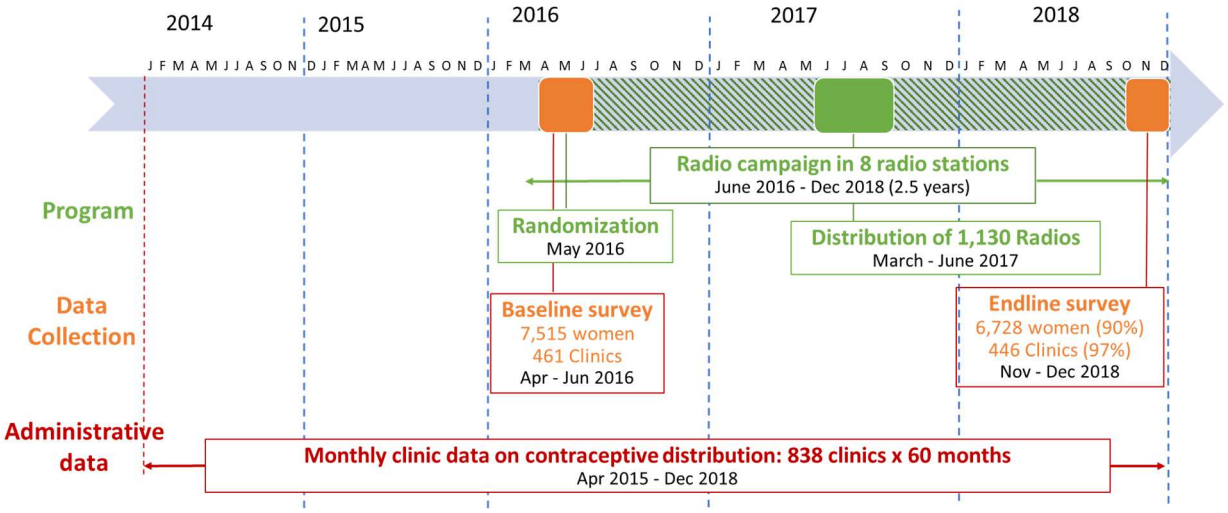


Figure A2: Sampling Strategy

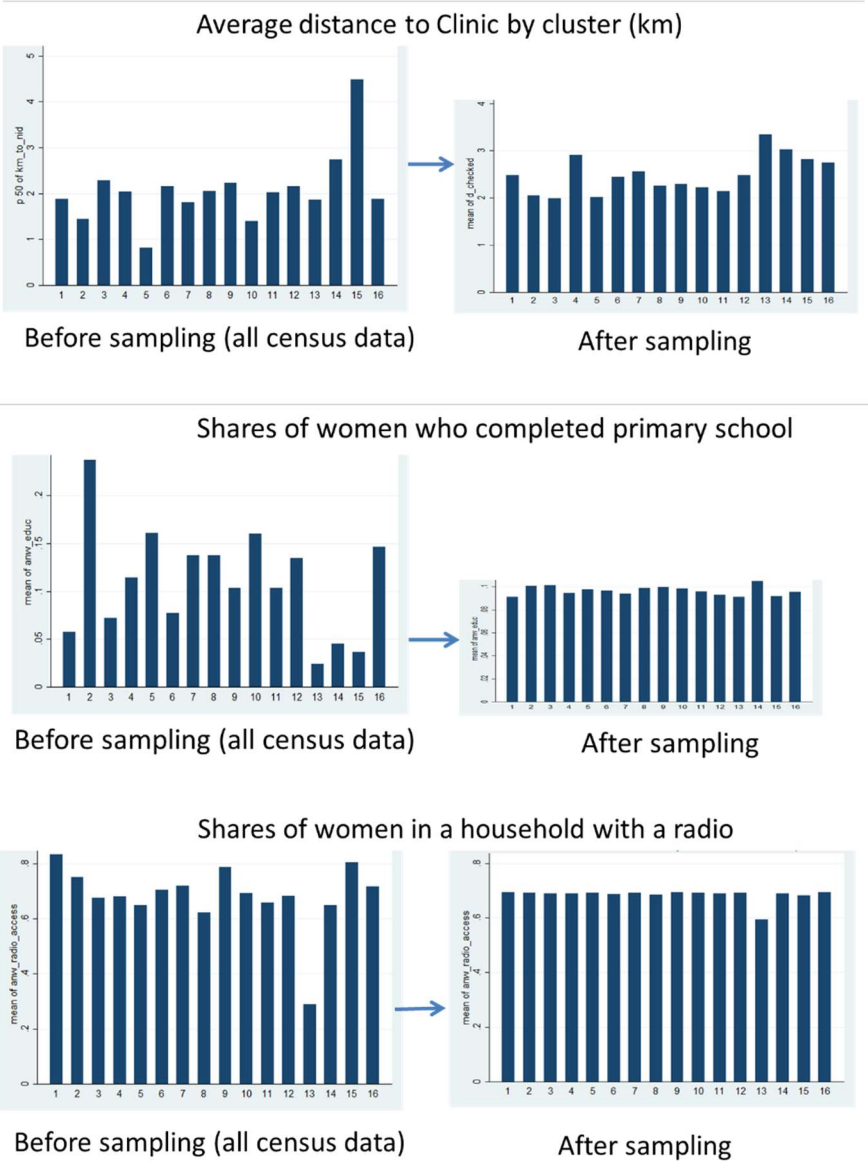
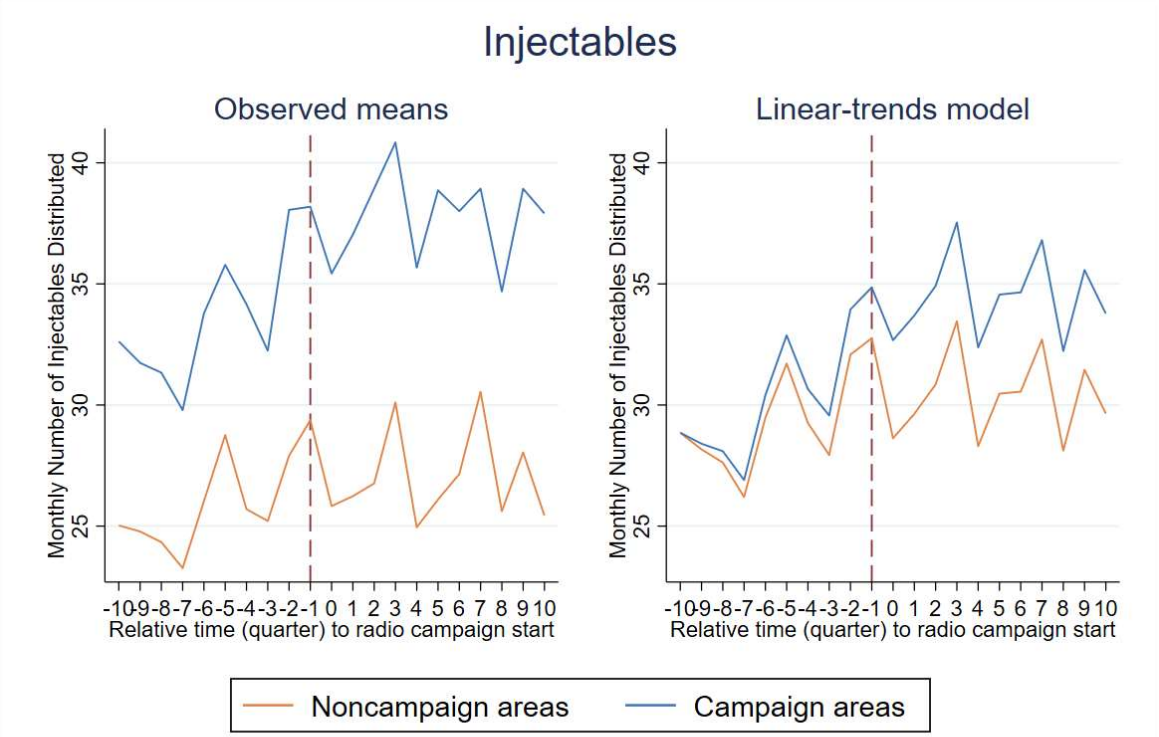
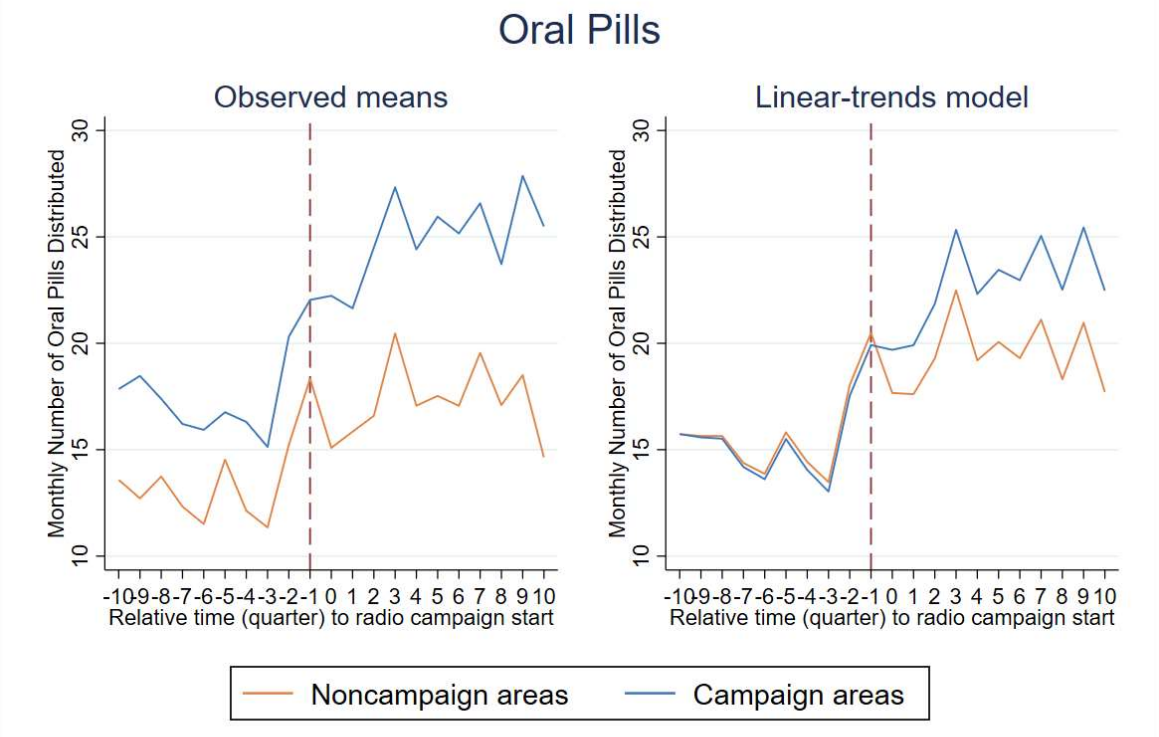


Figure A3: Impact on Injectables and Oral Pills Distribution (Quarterly Administrative Clinic Data)

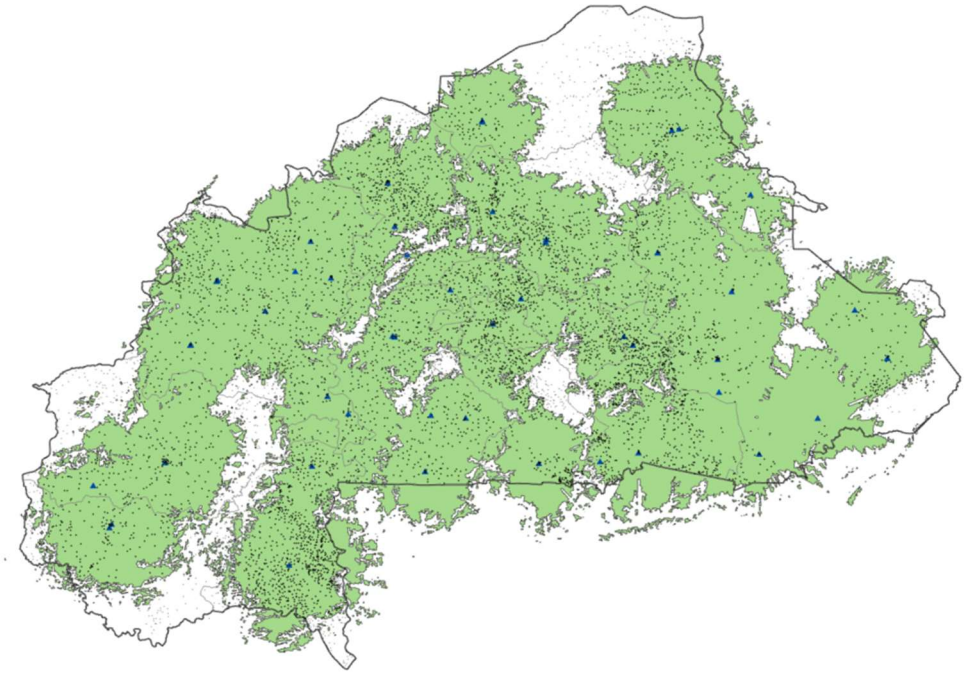


Administrative clinic data. N=15,708 (21 quarters x 758 clinics).
P-value parallel-trends test (pre-treatment periods) = 0.389.



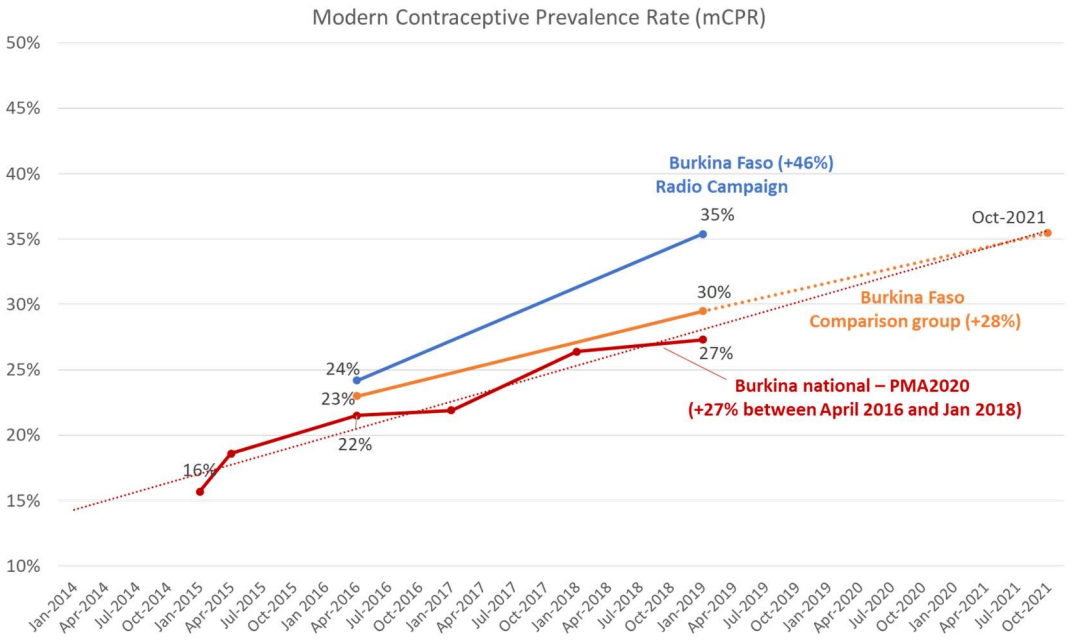
Administrative clinic data. N=15,708 (21 quarters x 758 clinics).
P-value parallel-trends test (pre-treatment periods) = 0.693.

Figure A4: Areas Reached by Radio Stations Involved in Program Scale-Up



Note: Using population census data, we estimate that 83% of the population is reached by a radio station involved in the program scale-up.

Figure A5: mCPR trends in Burkina Faso



Notes: Survey data and data from PMA 2020

Appendices Tables

Table A1: Radio Content Before and During the Campaign

	Control group (8 radio stations)				Treatment group (7 radio stations)								Campaign Effect				Campaign Effect			
	During the campaign (2016-18)				Before the campaign (2015)				During the campaign (2016-18)				Treat during - Treat before				Treat during - C during			
	Total airtime		Peak time		Total airtime		Peak time		Total airtime		Peak time		Total airtime		Peak time		Total airtime		Peak time	
	All	Share women	All	Share women	All	Share women	All	Share women	All	Share women	All	Share women	All	Share women	All	Share women	All	Share women	All	Share women
All programs	**100%**	**17%**	**26%**	**17%**	**100%**	**22%**	**25%**	**21%**	**100%**	**21%**	**24%**	**27%**	**0%**	**-1%**	**-1%**	**6%**	**0%**	**4%**	**-3%**	**9%**
News shows	**31%**	**7%**	**38%**	**11%**	**27%**	**8%**	**44%**	**14%**	**31%**	**8%**	**48%**	**17%**	**4%**	**0%**	**4%**	**3%**	**0%**	**1%**	**10%**	**6%**
Incl. national and international news	*18%*	*2%*	*17%*	*2%*	*14%*	*2%*	*19%*	*3%*	*18%*	*2%*	*21%*	*4%*	3%	0%	2%	1%	0%	0%	4%	2%
Incl. local news and events	*13%*	*5%*	*21%*	*9%*	*13%*	*6%*	*24%*	*11%*	*14%*	*5%*	*27%*	*13%*	1%	0%	2%	2%	0%	0%	6%	4%
Music	**22%**	**4%**	**15%**	**1%**	**24%**	**5%**	**14%**	**1%**	**22%**	**4%**	**11%**	**0%**	**-2%**	**0%**	**-3%**	**0%**	**0%**	**1%**	**-3%**	**0%**
Debate and call-in shows	**19%**	**1%**	**17%**	**0%**	**23%**	**5%**	**19%**	**3%**	**19%**	**3%**	**11%**	**2%**	**-4%**	**-2%**	**-8%**	**-1%**	**0%**	**2%**	**-7%**	**1%**
Behavior change programs	**12%**	**4%**	**10%**	**3%**	**13%**	**4%**	**8%**	**4%**	**16%**	**6%**	**14%**	**8%**	**3%**	**1%**	**6%**	**4%**	**4%**	**2%**	**5%**	**4%**
Incl. on women health and fam. plan.	*2%*	*1%*	*3%*	*2%*	*2%*	*1%*	*3%*	*2%*	*5%*	*3%*	*11%*	*7%*	3%	2%	8%	5%	3%	2%	8%	5%
Incl. programs on other topics	*10%*	*3%*	*7%*	*1%*	*11%*	*3%*	*5%*	*2%*	*11%*	*3%*	*3%*	*1%*	0%	0%	-1%	-1%	1%	0%	-3%	0%
Programs from national radios	**10%**	**1%**	**12%**	**2%**	**11%**	**0%**	**13%**	**0%**	**10%**	**0%**	**15%**	**0%**	**-1%**	**0%**	**2%**	**0%**	**0%**	**-1%**	**2%**	**-2%**
Religious shows	**6%**	**0%**	**8%**	**0%**	**3%**	**0%**	**3%**	**0%**	**3%**	**0%**	**1%**	**0%**	**0%**	**0%**	**-1%**	**0%**	**-3%**	**0%**	**-6%**	**0%**

Note: Data source: averages over all radio stations included in the study (except one) for normal weeks of broadcasting. DMI short (1.5 min) spots broadcasted 10 times a day are not classified as behavior change programs (but long format programs are). Data before the campaign were not available in the control group.

Table A2 : Attrition at Follow up Survey

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Impact of mass media		**Impact of mass media campaign**					
	Radio distribution in noncompaign areas		Radio distribution in campaign areas		All women		A radio at baseline	
	No radio Mean	Radio Mean P-value	No radio Mean	Radio Mean P-value	Control Mean	Treat. Mean P-value	Control Mean	Treat. Mean P-value
Surveyed	89.8%	90.6%	90.6%	92.6%	90.6%	88.5%	90.8%	89.3%
		0.877		0.384		0.783		0.773
Including:								
Surveyed in person	73.6%	73.7%	84.9%	88.8%	78.9%	77.1%	82.9%	78.7%
		0.993		0.056*		0.943		0.768
Surveyed by phone	16.3%	16.9%	5.6%	3.8%	11.7%	11.4%	7.9%	10.6%
		0.784		0.09*		0.986		0.806
N total	817	816	764	741	3 675	3 840	2 015	2 090

Note: Endline survey data, December 2018. Columns (2) and (4): P-values from OLS regressions of the outcome variables on a tequal to one for women randomly selected to receive a radio, controlling for strata fixed-effects with standards errors clustered at the household level. Columns (6) and (8): Pvalues computed using wild boostrap procedure from OLS regressions of the outcome variables on a dummy equal to one in campaign areas, controlling for strata fixed-effects and with standard errors clustered at the radio station level. ***, **, * indicate statistical significance at 1, 5 and 10%

Table A3: Robustness of Main Results to the Inclusion of Sampling Weights

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Impact of mass media		**Impact of mass media campaign**					
	Impact of radio distribution in noncampaign areas		Impact of radio distribution in campaign areas		Comparing campaign and noncampaign areas			
					All women		A radio at baseline	
	No radio Mean [SD]	Radio Coef. (SE)	No radio Mean [SD]	Radio Coef. (SE)	Control Mean [SD]	Treat. Coef. (SE)	Control Mean [SD]	Treat. Coef. (SE)
Impact on primary outcome:								
Currently using modern contraception (mCPR)	0.314 [0.464]	-0.067* (0.037)	0.324 [0.468]	0.113** (0.049)	0.289 [0.453]	0.066*** (0.019)	0.297 [0.457]	0.077*** (0.025)
Impact on information and knowledge:								
Index of knowledge of family planning$^{\alpha}$	-0.072 [1.039]	0.025 (0.091)	-0.091 [0.978]	0.262** (0.111)	0 [1]	0.036 (0.157)	0.036 [0.98]	0.017 (0.131)
Index of knowledge of contraceptive methods	0.016 [0.987]	-0.087 (0.084)	0.173 [0.945]	0.199* (0.109)	0 [1]	0.283*** (0.102)	-0.001 [1.006]	0.273*** (0.096)
Impact on norms and attitudes:								
Index of attitudes towards family planning$^{\alpha}$	0.003 [0.947]	0.000 (0.094)	0.09 [0.89]	0.029 (0.088)	0 [1]	0.14 (0.082)	-0.005 [1.026]	0.16** (0.072)
Index of attitudes towards contraceptive methods	-0.028 [1.014]	-0.01 (0.107)	-0.065 [1.025]	0.116 (0.115)	0 [1]	-0.083 (0.082)	0.031 [0.971]	-0.143 (0.131)
Index of women's perceptions of fertility and birth spacing	-0.003 [1.03]	-0.093 (0.089)	-0.131 [0.997]	0.264*** (0.095)	0 [1]	0.125 (0.206)	0.037 [0.995]	0.106 (0.233)
Index of husband's perceptions of fertility and birth spacing$^{\alpha}$	0.149 [1.106]	-0.211* (0.118)	0.057 [1.055]	0.326*** (0.126)	0 [1]	0.266 (0.233)	-0.013 [0.965]	0.23 (0.303)
Impact on secondary outcomes:								
Index of gender attitudes	0.005 [0.984]	-0.108 (0.077)	-0.322 [1.115]	0.096 (0.136)	0 [1]	-0.492 (0.176)	0.029 [1.002]	-0.457** (0.155)
Index of women empowerment$^{\alpha}$	0.068 [1.075]	0.108 (0.098)	0.409 [1.255]	0.361** (0.153)	0 [1]	0.187 (0.341)	-0.094 [0.888]	0.133 (0.202)
Index of domestic violence $^{\alpha}$	-0.126 [1.108]	0.151 (0.104)	-0.245 [1.144]	-0.073 (0.133)	0 [1]	0.035 (0.172)	0.037 [0.944]	0.071 (0.131)
Impact on fertitity and well-being:								
Gave birth in the last year	0.148 [0.355]	0.009 (0.034)	0.16 [0.367]	0.022 (0.053)	0.162 [0.369]	0.000 (0.017)	0.164 [0.371]	-0.014 (0.011)
Gave birth in the last year. Women using contraception at baseline only	0.17 [0.377]	0.062 (0.106)	0.161 [0.369]	-0.038 (0.094)	0.214 [0.41]	-0.024 (0.035)	0.214 [0.411]	-0.032 (0.04)
Gave birth in the last year. Women [22-49[only	0.119 [0.324]	0.031 (0.039)	0.144 [0.352]	0.022 (0.065)	0.153 [0.36]	-0.002 (0.021)	0.158 [0.365]	-0.023 (0.013)
Index of self-assessed health and well being	-0.056 [0.996]	-0.041 (0.084)	-0.118 [1.031]	0.105 (0.12)	0 [1]	0.147 (0.107)	0.077 [0.968]	0.065 (0.075)
N total	1,473		1,378		6,728		3,877	
N in-person survey	1,202		1,307		5,860		3,314	

Note: Endline women survey data, December 2018. Columns (2) and (4): coefficients and standard errors from OLS regressions of the outcome variables on a dummy equal to one for women randomly selected to receive a radio, controlling for strata fixed-effects. Standard errors are clustered at the household level. Columns (6) and (8): coefficients and standard errors from OLS regressions of the outcome variables on a dummy equal to one in campaign areas, controlling for strata fixed-effects. Standard errors are clustered at the radio station level and computed using wild boostrap procedure. α: information only available in the in-person survey. See appendix 1 for the definition of indexes. ***, **, * indicate statistical significance at 1, 5 and 10%.

Table A4: Robustness to Controlling for Baseline Covariates Selected using Post-Double-Selection Lasso

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Impact of mass media		**Impact of mass media campaign**					
	Impact of radio distribution in noncampaign areas		Impact of radio distribution in campaign areas		Comparing campaign and noncampaign areas			
					All women		A radio at baseline	
	No radio Mean [SD]	Radio Coef. (SE)	No radio Mean [SD]	Radio Coef. (SE)	Control Mean [SD]	Treat. Coef. (SE)	Control Mean [SD]	Treat. Coef. (SE)
Impact on primary outcome:								
Currently using modern contraception (mCPR)	0.327 [0.469]	-0.046** (0.023)	0.331 [0.471]	0.053** (0.024)	0.295 [0.456]	0.051** (0.021)	0.291 [0.454]	0.07*** (0.019)
Impact on information and knowledge:								
Index of knowledge of family planning$^{\alpha}$	-0.01 [0.997]	-0.021 (0.057)	0.114 [1.081]	0.086 (0.056)	0 [1]	0.085 (0.136)	0.019 [1.009]	0.052 (0.124)
Index of knowledge of contraceptive methods	0.024 [0.968]	-0.031 (0.051)	0.207 [0.893]	0.122*** (0.044)	0 [1]	0.26*** (0.042)	-0.003 [1.02]	0.302*** (0.055)
Impact on norms and attitudes:								
Index of attitudes towards family planning$^{\alpha}$	0.015 [0.922]	-0.075 (0.059)	0.13 [0.801]	0.03 (0.043)	0 [1]	0.108*** (0.045)	0.014 [0.98]	0.082*** (0.02)
Index of attitudes towards contraceptive methods	0.021 [0.989]	-0.052 (0.053)	0.052 [0.964]	0.029 (0.049)	0 [1]	0.076 (0.107)	0.008 [0.988]	0.098 (0.116)
Index of women's perceptions of fertility and birth spacing	-0.024 [1.016]	-0.028 (0.048)	-0.087 [0.982]	0.094** (0.048)	0 [1]	-0.078 (0.115)	0.028 [0.997]	-0.097 (0.118)
Index of husband's perceptions of fertility and birth spacing$^{\alpha}$	0.063 [1.031]	-0.109* (0.06)	0.063 [1.04]	0.053 (0.056)	0 [1]	0.063 (0.093)	0.004 [0.986]	-0.008 (0.093)
Impact on secondary outcomes:								
Index of gender attitudes (higher values for more positive attitudes)	0.01 [0.998]	-0.086* (0.05)	-0.243 [1.018]	0.025 (0.053)	0 [1]	-0.19 (0.211)	0.031 [0.996]	-0.18 (0.187)
Index of women empowerment$^{\alpha}$	0.078 [1.07]	0.026 (0.051)	-0.038 [0.985]	0.036 (0.045)	0 [1]	-0.026 (0.134)	-0.07 [0.924]	-0.052 (0.098)
Index of domestic violence (higher values for less domestic violence) $^{\alpha}$	-0.023 [1.012]	0.051 (0.057)	0.08 [0.966]	-0.022 (0.051)	0 [1]	0.029 (0.119)	-0.003 [0.985]	0.037 (0.135)
Impact on fertitity and well-being:								
Gave birth in the last year	0.171 [0.377]	-0.005 (0.021)	0.171 [0.377]	-0.016 (0.02)	0.174 [0.379]	-0.015* (0.009)	0.177 [0.382]	-0.017 (0.011)
Gave birth in the last year. Women using contraception at baseline only	0.154 [0.362]	0.078 (0.049)	0.216 [0.413]	-0.039 (0.046)	0.206 [0.405]	-0.044** (0.031)	0.219 [0.414]	-0.061** (0.036)
Gave birth in the last year. Women [22-49[only	0.142 [0.35]	0.018 (0.022)	0.142 [0.349]	-0.011 (0.021)	0.157 [0.364]	-0.018 (0.009)	0.162 [0.368]	-0.016 (0.016)
Index of self-assessed health and well being	-0.131 [1.042]	0.005 (0.045)	0.355 [0.896]	-0.06 (0.043)	0 [1]	0.252** (0.119)	0.106 [0.953]	0.212** (0.106)

Note: Endline women survey data, December 2018. Columns (2) and (4): coefficients and standard errors from OLS regressions of the outcome variables on a dummy equal to one for women randomly selected to receive a radio, controlling for strata fixed-effects. Standard errors are clustered at the household level. Columns (6) and (8): coefficients and standard errors from OLS regressions of the outcome variables on a dummy equal to one in campaign areas, controlling for strata fixed-effects. Standard errors are clustered at the radio station level and computed using wild boostrap procedure. α: information only available in the in-person survey. See appendix 1 for the definition of indexes. ***, **, * indicate statistical significance at 1, 5 and 10%.

Table A5: Impact on Secondary Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Impact of mass media		**Impact of mass media campaign**					
	Impact of radio distribution in noncampaign areas		Impact of radio distribution in campaign areas		Comparing campaign and noncampaign areas			
					All women		A radio at baseline	
	No radio Mean [SD]	Radio Coef. (SE)	No radio Mean [SD]	Radio Coef. (SE)	Control Mean [SD]	Treat. Coef. (SE)	Control Mean [SD]	Treat. Coef. (SE)
Persons from whom or places where the women have heard of the contraceptive methods she knows:								
Women in the same family and/or cowives	0.192 [0.395]	-0.045* (0.025)	0.09 [0.287]	-0.024 (0.018)	0.181 [0.385]	-0.119*** (0.024)	0.182 [0.386]	-0.117*** (0.028)
Women from the same village	0.179 [0.383]	-0.06*** (0.023)	0.087 [0.282]	-0.03* (0.017)	0.144 [0.351]	-0.095*** (0.031)	0.14 [0.347]	-0.093*** (0.033)
Men from the same household	0.009 [0.092]	0.002 (0.006)	0.011 [0.105]	-0.008 (0.005)	0.006 [0.078]	-0.002 (0.003)	0.004 [0.066]	0.000 (0.003)
Health workers	0.813 [0.39]	0.007 (0.025)	0.829 [0.377]	-0.002 (0.024)	0.833 [0.373]	-0.005 (0.026)	0.847 [0.36]	-0.022 (0.02)
Radio	0.316 [0.465]	0.065** (0.03)	0.56 [0.497]	0.148*** (0.028)	0.364 [0.481]	0.245*** (0.038)	0.375 [0.484]	0.237*** (0.039)
NGO	0.033 [0.179]	0.012 (0.01)	0.033 [0.178]	0.014 (0.011)	0.038 [0.191]	0.000 (0.009)	0.038 [0.192]	0.001 (0.012)
At school / with a teacher	0.01 [0.101]	0.014** (0.006)	0.014 [0.119]	-0.001 (0.005)	0.024 [0.154]	-0.003 (0.007)	0.03 [0.172]	-0.004 (0.008)
Who decides whether or not to use contraception:								
Respondent	0.213 [0.41]	0.016 (0.025)	0.181 [0.386]	0.035 (0.023)	0.206 [0.405]	-0.019 (0.089)	0.194 [0.396]	-0.016 (0.091)
Husband	0.336 [0.473]	-0.028 (0.029)	0.452 [0.498]	-0.001 (0.03)	0.338 [0.473]	0.141 (0.103)	0.351 [0.477]	0.122 (0.098)
Both decide together	0.25 [0.433]	-0.002 (0.027)	0.244 [0.43]	-0.021 (0.024)	0.248 [0.432]	-0.033 (0.059)	0.251 [0.434]	-0.02 (0.07)
Both never thought about it	0.201 [0.401]	0.013 (0.026)	0.119 [0.324]	-0.011 (0.021)	0.205 [0.404]	-0.092 (0.051)	0.2 [0.4]	-0.089 (0.054)
N in-person survey	1,202		1,307		5,860		3,314	

Note: Endline women survey data, December 2018. Columns (2) and (4): coefficients and standard errors from OLS regressions of the outcome variables on a dummy equal to one for women randomly selected to receive a radio, controlling for strata fixed-effects. Standard errors are clustered at the household level. Columns (6) and (8): coefficients and standard errors from OLS regressions of the outcome variables on a dummy equal to one in campaign areas, controlling for strata fixed-effects. Standard errors are clustered at the radio station level and computed using wild boostrap procedure. ***, **, * indicate statistical significance at 1, 5 and 10%

Table A6: Correction for Multiple Hypothesis Testing on Ten Pre-specified Indexes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Impact of mass media		**Impact of mass media campaign**					
	Impact of radio distribution in noncampaign areas		Impact of radio distribution in campaign areas		Comparing campaign and noncampaign areas			
					All women		A radio at baseline	
	No radio Mean [SD]	No Radio Coef. (SE) **Sharpened two-stage q-values**	No radio Mean [SD]	Radio Coef. (SE) **Sharpened two-stage q-values**	Control Mean [SD]	Coef. (SE) **Sharpened two-stage q-values**	Control Mean [SD]	Coef. (SE) **Sharpened two-stage q-values**
Impact on information and knowledge:								
Index of knowledge of family planning[α]	-0.01	0.009	0.114	0.088	0	0.157	0.019	0.126
	[0.997]	(0.06)	[1.081]	(0.06)	[1]	(0.171)	[1.009]	(0.152)
		1		**0.501**		**1**		**1**
Index of knowledge of contraceptive methods	0.024	-0.016	0.207	0.133***	0	0.288***	-0.003	0.312***
	[0.968]	(0.054)	[0.893]	(0.049)	[1]	(0.053)	[1.02]	(0.069)
		1		**0.063**		**0.001**		**0.001**
Impact on norms and attitudes:								
Index of attitudes towards family planning[α]	0.015	-0.047	0.13	0.026	0	0.128**	0.014	0.097***
	[0.922]	(0.07)	[0.801]	(0.046)	[1]	(0.053)	[0.98]	(0.033)
		1		**1**		**0.07**		**0.026**
Index of attitudes towards contraceptive methods	0.021	0.024	0.052	0.043	0	0.106	0.008	0.108
	[0.989]	(0.056)	[0.964]	(0.055)	[1]	(0.115)	[0.988]	(0.125)
		1		**1**		**1**		**1**
Index of women's perceptions of fertility and birth spacing	-0.024	-0.034	-0.087	0.135**	0	-0.047	0.028	-0.072
	[1.016]	(0.054)	[0.982]	(0.054)	[1]	(0.16)	[0.997]	(0.18)
		1		**0.07**		**1**		**1**
Index of husband's perceptions of fertility and birth spacing[α]	0.063	-0.103	0.063	0.121*	0	0.106	0.004	0.049
	[1.031]	(0.07)	[1.04]	(0.063)	[1]	(0.137)	[0.986]	(0.154)
		0.501		**0.204**		**1**		**1**
Impact on secondary outcomes:								
Index of gender attitudes	0.01	-0.111**	-0.243	0.023	0	-0.186	0.031	-0.184
	[0.998]	(0.051)	[1.018]	(0.056)	[1]	(0.208)	[0.996]	(0.185)
		0.141		**1**		**1**		**1**
Index of women empowerment[α]	0.078	0.067	-0.038	0.048	0	-0.054	-0.07	-0.082
	[1.07]	(0.069)	[0.985]	(0.057)	[1]	(0.133)	[0.924]	(0.106)
		1		**1**		**1**		**1**
Index of domestic violence [α]	-0.023	0.078	0.08	-0.092	0	0.078	-0.003	0.093
	[1.012]	(0.065)	[0.966]	(0.059)	[1]	(0.125)	[0.985]	(0.134)
		0.809		**0.468**		**1**		**1**
Index of self-assessed health and well being	-0.131	-0.001	0.355	-0.052	0	0.269***	0.106	0.227**
	[1.042]	(0.05)	[0.896]	(0.049)	[1]	(0.113)	[0.953]	(0.108)
		1		**1**		**0.063**		**0.143**

Note: Endline women survey data, December 2018. Sharpened two-stage q-values corrected for multiple hypothesis testing as described in Anderson (2008). α: information only available in the in-person survey. ***, **, * indicate statistical significance at 1, 5 and 10%

Table A7: Impact of Media Campaign in Areas Not Surveyed Using Administrative Data

	(1)	(2)	(3)	(4)	(5)	(6)
	Implants distributed		**Injectables distributed**		**Oral pills distributed**	
	Control Mean [SD]	Coef. (SE) P-value	Control Mean [SD]	Coef. (SE) P-value	Control Mean [SD]	Coef. (SE) P-value
Administrative clinic data: only clinics not in survey sample						
Monthly data: top codded at P99 (N= 10,575)	3.74	0.24	16.29	2.33	10.04	3.44
	[8.46]	(0.62)	[28.76]	(2.48)	[26.54]	(2.55)
Monthly data: IHS Transformation (N= 10,575)	1	0.03	2.01	0.04	1.34	0.1
	[1.33]	(0.17)	[1.93]	(0.3)	[1.72]	(0.18)
Quarterly data: top codded at P99 (N= 3,760)	3.68	0.27	16.24	2.49	9.96	3.54
	[6.81]	(0.6)	[27.13]	(2.51)	[23.87]	(2.68)
Six-Months data: top codded at P99 (N= 2,115)	3.64	0.3	16.23	2.78	9.92	3.82
	[6.37]	(0.56)	[26.83]	(2.54)	[23.1]	(2.77)

Note: Administrative data from the Ministry of Health on 838 health centers and 60 months. Columns (2), (4) and (6): coefficients and standard errors from OLS regressions of the outcome variables on a dummy equal to one in campaign areas, controlling for strata, time and clinic fixed effects. Standard errors are clustered at the radio station level and computed using wild boostrap procedure. ***, **, * indicate statistical significance at 1, 5 and 10%.

Appendix 1: Outcomes and variables definition

Radio content logs:

All radio programs were classified into the following categories:

Local information shows: information and communications on local news and events. Examples of programs: regional news, communications and timeline of local events…

National and international information shows: programs with national or international informational content. Examples of programs: Daily or weekly journals, press reviews, sport information.

Music: Examples of programs: Zouk Machine, Saturday night, live los salseros…

Debate and call-in shows: programs on politics, local traditions, social subjects, games, or sport with some interactions with auditors or local people (calls-in, direct interviews…). Examples of programs: debate on current affairs, talk shows, radio theatre, traditions among the Mooré…

Behavior changes programs on women health and family planning: program designed explicitly to change behaviors related to women health or family planning. Some of these programs are often created in partnership with the ministry of health, local health centers or NGOs. Examples of programs: Gender and development, mother and child health, DMI family planning program...

Other behavior changes programs: mainly on education (targeted on students), health, agriculture, and conflict prevention. Most of these programs are created in partnership with NGOs or government agencies. Examples of programs: health magazine, student time, program on road safety, program on agricultural transformation…

Program from national radios: these programs can be on any topic covered by national radios. According to our local partner, most content taken from national radio are information and debate shows.

Religious shows: Examples of programs: Friday's call to prayer for Muslim, Sunday worship service, programs discussing the Koran or the Bible, religious preach.

For two third of the programs, the classification was done by the research team using description of the program content provided by radio stations. For the remaining third, the classification was done by radio staffs.

Indexes used in the paper:

Standardized index of knowledge of family planning: percentage of women who know benefits of spacing births, percentage who know benefits of delaying the age of marriage for young girls.

Standardized index of knowledge of contraceptive methods: knowledge of the existence of different methods, rejection of misconceptions such as contraception causing sterility or sickness.

Standardized index of attitudes towards family planning: percentage of women who think it is acceptable to talk about family planning in public (radio, schools, posters, etc.), percentage who think that a woman should be able to control the number of children she has during her lifetime.

Standardized index of attitudes towards contraception: percentage of women who think that it is embarrassing to buy a contraceptive method, percentage who think that using contraceptive methods is a sign of not trusting their partner.

Standardized index of women's perceptions of fertility and birth spacing: Perception on the ideal age at first birth, perception on the ideal time lapse between first and second birth, perception on the ideal number of children in total.

Standardized index of partners' perceptions of fertility and birth spacing (as reported by women): Partners' perception on the ideal time lapse between first and second birth, partners' perception on the ideal number of children in total.

Standardized index of women's subjective health and well-being: percentage of women satisfied with their lives, percentage of women considering themselves healthy compared to other women in the village.

Standardized index of perceptions on gender norms: percentage of women who think that it is better to be a man than a woman, percentage who think that boys should have better access to resources in education, percentage who think that men must be more educated than their wives, percentage who think that men should have better access to consumption of meat and imported products.

Standardized index of women empowerment: percentage of women working or participating in a productive activity, percentage participating in decision-making when it comes to different household expenditures.

Standardized index of domestic violence and sexual harassment: percentage of women whose husbands get jealous when they walk to other men, don't allow them to see their female friends, insist on knowing where they are at any time of the day, ever threatened to harm them or their families, ever destroyed their personal objects, ever physically hurt them.

Appendix 2: Additional information on the sampling strategy

Our sampling strategy had two steps: selection of villages and selection of women within these villages.

Village selection:
The survey was conducted in a random sample of villages located between 5 and 50 kilometers from our sample radio stations, with less than 1,500 inhabitants, not on the electricity grid and within 5 kilometers from a health center. The objective was to identify villages where television access is limited (no electricity) and thus radio listenership high, and where supply of modern contraceptive was not a major barrier to use. Villages that met these criteria were initially identified by combining data from the 2006 National Census (for village population and electricity access), National Geographic Institute (for GPS coordinates and distance mapping) and Ministry of Health (for lists and locations of clinics). A total of 320 villages were randomly sampled from this list for a household listing. In total 48,513 women between the ages of 15 and 49 and living in 25,291 households were listed between January-March 2016. Using information from these surveys, we dropped 68 additional villages because we found they did not conform to our sampling criteria (49 villages were more than 5 km from a health clinic, 13 could access more than one of the study radio stations and 6 had very few inhabitants listening to the study radio station).

A household listing was conducted in a random 320 of these villages between January-March 2016. We ended up with a final study sample of 252 villages representative of around 1,400 villages where 1 million inhabitants were living in 2006 according to the national census (1.4 million in 2018 according to the national statistics agency projections). Thus, while we lost some external validity by selecting rural villages near clinics our survey data is still representative of a large population (around 7.5% of the total population of Burkina Faso).

Women selection:
We selected 7,515 women in these 252 villages in a way that makes our 16 clusters as similar as possible on key characteristics. We used listing survey data to create strata of women with and without education and with and without radio access and then sampled women within each cluster proportionally to their share in the overall sample population. Intuitively, this involved over-sampling educated women in clusters where there are few educated women and under-sampling educated women in clusters where many women are educated. Similarly, we harmonized average distances to a health center across clusters by taking different numbers of women from villages with different distances to clinics. As a result, we ended up with 16 clusters that look more similar in our final women sample than in our initial listing survey sample. Appendix Figure (A2) shows graphically how averages of three key characteristics (distance to clinic, education and radio access) were *smoothed* by this strategy.