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Family planning campaigns on television and contraceptive use in India

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Abstract

Objective: The paper examines the association between viewing family planning campaigns on television and being aware, improved intention to use, and current usage of modern contraceptives in India.

Data: The study uses detailed data of the currently married women from the current round of the National Family Health Survey.

Methods: We use the instrumental variable approach, propensity score matching method, besides the ordinary least square regression technique to estimate the association between viewing family planning campaigns on television and knowledge, intention to use, and current usage among the currently married women.

Conclusion: The overall results suggest that currently married women who have seen family planning campaigns on television in the last few months are more likely to know, have a higher intention to use and use modern family planning methods. The effectiveness gets amplified when exposure to such campaigns is complemented with motivation provided by frontline health workers.

KEYWORDS
contraceptive usage, family planning, mass-media, television

Highlights

- We examine the role of mass-media campaigns via television on family planning behaviour in India

- Our findings suggest that these campaigns increase the likelihood of being aware and usage of modern family planning methods
- Exposure to such campaigns has more impact on the uptake of female sterilisation than the usage of pills and condoms
- Family planning campaigns on television must be complemented by direct motivation to utilise the modern methods through frontline health workers

1 | INTRODUCTION

With a population of about 1.3 billion, India is currently the second-most populous country in the world but is expected to surpass the population of China by 2024. This is a three-fold increase from the 1950 level, and it is predicted to become home to about 17% of the world's population by the year 2050, with a total population of 1.6 billion.[1] The high fertility rate measured in terms of live births per woman has often been cited as one of the most important causes of such a rise in population. An increase of this extent has put immense pressure on the country's resources, captured in terms of poor macro-economic indicators such as low per capita gross domestic product, high incidence of poverty, and food insecurity. To be specific, India is ranked 126th in per capita GDP at PPP[2] despite being one of the world's largest economies according to World Bank estimates.[3] In addition to improving the country's macroeconomic conditions, the adoption of family planning methods also reduces the incidence of unintended pregnancies, need for unsafe abortions and eventually improves maternal and child health and overall well-being.

India was the first country to have launched a National Programme for Family Planning in 1952. Since then, the governments have introduced several new policies, and many among them have transformed over the years to control population growth and stabilise the population by promoting reproductive health, mainly via widespread contraceptive use. During the 1980s, many family planning programs were implemented and extended to rural areas through a network of primary health centres and sub-centres. All India Hospitals Post-partum programs at the district and sub-district level hospitals, reorganization of primary health care facilities in urban slum areas, reservation of a specific number of hospital beds for tubal ligature operations, and renovation and remodelling of the intrauterine device (IUD) are some other programs that were implemented under the Seventh Five-Year Plan between 1985 and 1990. In the 1990s, India also tried to control population growth by promoting women's education, following the recommendations of the United Nations Conference on Population, held in Cairo. National Population Policy of 2000, National Health Mission of 2013, and National Health Policy of 2017 are some of the more recent government measures to control population growth by promoting contraceptive use and reproductive health. Interestingly, both the central and state governments have spent millions on radio and television campaigns to raise awareness and promote the relevance of family planning via the use of opinion leaders and role models (such as movie actors and actresses). Therefore, unsurprisingly, India's fertility rate has been declining steadily over the years and more than halved from 4.97 in 1975-1980 to 2.3 between 2015 and 2020.[1]

India is currently among the few countries with a near replacement-level fertility rate despite having lower per-capita income than other more developed countries with replacement-level fertility rates.[4] The lower fertility rate in India and that in Bangladesh, Indonesia and Iran has been achieved undoubtedly through strong family planning programs undertaken by the governments.[5-7] However, although the country's average total fertility rate is 2.3 live births per woman, there is wide variation across states. It is above 3.0 in Uttar Pradesh, Bihar, and Madhya Pradesh, and below replacement level in Maharashtra and West Bengal, and the four southernmost states.[4] Despite serious efforts, about half of India's districts still have fertility rates of 3 or more live births per woman,[8] which is a matter of great concern for researchers and policymakers and motivates the current paper. The intra-state variation in fertility

outcomes has also been recognized by the government.[9] In this context, we examine the role of family planning campaigns via family planning with special focus on those broadcasted via television.

Mass-media campaigns have also been found to improve awareness and affect behaviour across a wide range of health activities such as smoking,[10-14] drinking,[15] combating obesity,[16,17] understanding stroke symptoms,[18] preventing HIV/AIDS,[19] and health in general.[20,21] Focussing on the strength of television as a medium of communication, Magnus, et. al.[22] have showed that banning television advertisements related to energy-dense, nutrient-deficient foods, and beverages during children's peak viewing time in Australia could prevent abrupt changes in their body mass index and affect their disability-adjusted life years. Television advertisements induce children to consume high-fat and high-sugar food and beverages more vis-à-vis nutrient-rich foods. Robinson, et. al.[23] have reported that health programs that combined free distribution of health-related products with raising awareness among the targeted beneficiaries via media campaigns significantly reduced risky health behaviour among the masses, captured in terms of condom use and prevalence of smoking.

Several papers have shown that media helps raise public awareness across a wide range of activities. Besley, et. al.[24,25] have found that the government has a greater incentive to be responsive when electorates are better informed through mass-media. Stromberg[26,27] has showed that if informed voters receive favourable policies, mass-media intervention may affect government policy formation since mass-media provide the information voters eventually use to decide whom to vote. Stromberg[26] has found that television was more effective than radio in raising government funding for programs used by the poor and rural voters. Francken, et. al.[28] devising a comparative analysis, have found that television campaigns are more effective than newspaper and poster campaigns in reducing corruption in Madagascar.

We particularly focus on television as it is considered an essential medium for reaching out to the masses. Also about half of the households in India possess television compared to only 5.9% households possessing radio. Moreover, both central and state governments frequently use prominent movie actors and actresses in television campaigns to promote and diffuse relevant information related to hygiene, family planning, and reproductive health. Besides, we believe that television is more appealing to the audience as it has both visible and audible aspects and can therefore be used as an effective medium for the transmission of information.

The current paper contributes to the literature by extending on three different dimensions. Firstly, we aim to estimate the association of viewing television broadcasts related to family planning within the last few months with the knowledge (or awareness) of modern family planning methods, attitude towards its use, and actual contraceptive usage using rigorous empirical methodologies. Secondly, we also look into detail the association of watching family planning campaigns on television and the usage of various modern family planning methods separately—namely, female sterilisation, male sterilisation, usage of birth control pills, and condoms. Finally, we examine the effect of exposure to additional sources of information with the awareness, intention and usage of modern family planning methods.

2 | METHODS

In this section of the paper, we provide an overview of the regression model that we use to estimate the association of family planning advertisements broadcasted on television with awareness, intention to use among non-users and actual usage of modern family planning methods in general and uptake of specific methods such as male or female sterilisation, usage of birth control pills and condoms in particular. We restrict our analysis only to currently married women in the 15-49 age group. To isolate the effect of such television campaigns, we control for other factors that may also determine these outcome variables. That is, we estimate the following econometric model as presented in Equation (1):

$$y_{ihd} = \alpha + \beta TV_{ihd} + \vartheta X_{ihd} + \gamma Z_{hd} + \delta_d + \varepsilon_{ihd} \quad (1)$$

where, y_{ihd} is the outcome variable, which captures individual *i* (from household *h*) and residing in district *d*'s response to questions related to their knowledge, intention to use, and take-up of modern family planning methods. TV_{ihd} is a dummy variable that takes a value of 1 if the currently married woman aged 15-49 years has seen family planning campaigns on television in the last few months and 0 otherwise. We are particularly interested in the sign and magnitude of the coefficient β associated with the television (mass-media) variable, TV_{ihd}. X_{ihd} is a vector of individual-level characteristics such as age (in years), adjusted age-squared, education, and employment status; while Z_{hd} is a vector of household-level characteristics that also matter for the outcome variables such as household size, number of eligible women in the household, number of children aged below five years, wealth index, region of residence (rural or urban), gender of the household head, caste category (General vs. disadvantaged social classes [The disadvantaged castes are Scheduled castes (SC), Scheduled tribes (ST), and Other backward classes (OBC).]) and religion of the household (Hindu, Muslim, Christian, or Others [Others in terms of religion refer to Sikh, Buddhist/Neo-Buddhist, Jain, Jewish, Parsi/Zoroastrian, or no religion.]). We have additionally controlled for whether the women had received family planning advice directly from the front-line workers. δ_d represents the unobserved district-specific characteristics such as cultural and traditional norms that might influence the outcome variables as well as our primary variable of interest. Controlling for district-fixed effects allows us better identify the association between the variables. Finally, ε_{ihs} is the idiosyncratic error term, which is nonsystematic and varies across individuals. All standard errors have been clustered at the household unit level.

Equation (1) allows us to estimate the relationship between watching family planning advertisements on television and awareness, intention to use, and utilization of modern family planning methods, conditional on other explanatory variables. In the first instance, this involves running a series of ordinary least squares (OLS) regressions with each of the outcome variables as the dependent variable, used one at a time, and seeing family planning campaigns on television in the last few months included as the variable of interest.

Next, we introduce a number of alternative methodologies to check the robustness of our results. Since the respondents who have or have not seen family planning campaigns only on TV are not randomly assigned, we introduce a robustness check to consolidate our findings. As a first alternative methodology, we calculate the estimates only on a subgroup of individuals, for whom individuals with similar individual and household characteristics are available in the comparison group. We use the Propensity Score Matching (PSM) method that matches individuals based on their initial set of observable characteristics. The method has been used widely in studies involving impact evaluation.[29-33] The propensity score for each woman is estimated using a standard logit model that regresses the incidence of seeing or not seeing FP campaigns only of TV on a set of individual and household level variables that might influence the women's chances of seeing FP campaigns only of TV. Those women who have seen and those who have not are then matched based on these propensity scores. We use the nearest neighbour (NN) matching estimator and consider 5 nearest neighbours for comparison. However, there may still exist unobservable traits like the progressive nature of certain women that might induce them to not only watch FP campaigns only on TV but also make them aware, intend and utilise the modern contraception methods.

To control potential endogeneity problems, where specific unobserved characteristics such as individual personality or neighbourhood traits may lend certain women to be more eager to watch television, we also present the third set of estimates. This alternative strategy allows us to estimate the association of broadcasting family planning advertisements on television with the outcome variables of interest after eliminating the endogeneity problem and "netting out" the effect of other individual and household level characteristics. Therefore, towards this end, we adopt the instrumental variable approach,[34-37] where we use *regularity in watching television among the other women in the village* as an instrument for the incidence of watching family planning campaigns on television in the last few months. Respondents were asked, "Do you watch television every day, at least once a week, less than once a week, or not at all?" The response is coded as 0 if 'not at all', 1 if 'less than once a week', 2 if 'at least once a week', and 3 if 'every day'. We calculate the average frequency (leaving out the concerned respondent) of watching television among the other women in the village using the above variable.

We believe that women residing in villages, in which watching television frequently is a norm, are more likely to watch modern family planning methods on television. The channel through which watching television among other women influences the concerned respondent is that the neighbours might ask them to accompany while viewing specific television broadcasts, and the family planning advertisements might have popped up in the intervals. Another channel could be the neighbours who may directly discuss the family planning advertisements broadcasted via television. Watching television together at a neighbour or friend's home is common in India.[38,39] Jensen and Oster[39] have shown that there are positive spillover effects of viewing television on the status of women especially in their attitude towards acceptability of beating and son preference. The spillover effects move the gender attitudes of the individuals in the rural areas (where few households possess television compared to urban areas) much closer to those in urban areas.

Regularity in watching television among the other women in the village is uncorrelated with unobserved characteristics captured in the error term to a large extent. It is unlikely that the women residing in villages, where other women regularly watch television, view television intending to watch campaigns and advertisements, and hence we do not expect there to be any reverse causality in effect. Regularity in watching television has also been an instrument in a similar context.[34] We argue that the neighbourhood effect of watching television among the other women in villages is a better instrument as it is exogenous primarily to our model specification.

Additionally, we introduce hierarchical linear modelling[40-44] (HLM) to check the robustness of the parameter estimates. We use a hierarchical linear model with random intercept and a level 2 (district) covariate. Towards this end, we estimate the following model:

$$\text{Level1}(\text{individual}): y_{id} = \beta_{0d} + \Upsilon_{10}\text{TV}_{id} + \Upsilon_{20}X_{id} + \varepsilon_{id} \tag{2}$$

$$\text{Level2}(\text{district}): \beta_{0d} = \Upsilon_{00} + \Upsilon_{01}\text{PTV}_{d} + \delta_{0d} \tag{3}$$

Here, y_{id} in level 1 represents the family planning behaviour of individual i residing in district d, TV_{id} denotes whether individual i has seen FP campaigns on TV, β_{0d} denotes the mean outcome for individuals in district d, Υ_{10} denotes the differential effect of seeing FP campaigns on TV in district d, and Υ_{20} denotes a vector of effects due to the other explanatory variables (X_{id}) in district d and ε_{id} denotes individual i's deviation from the mean outcome in the district (d) in which she resides.

In level 2, Υ_{00} denotes the grand mean; PTV_d denotes the proportion of women who have seen family planning campaigns on TV in district d, Υ_{01} denotes the differential effect of proportion of women who have seen family planning campaigns on TV and δ_{0d} denotes the deviation of district-level mean from the grand mean.

The above two equations have been combined to estimate the following mixed model:

$$y_{id} = \Upsilon_{00} + \Upsilon_{01}\text{PTV}_{d} + \Upsilon_{10}TV_{id} + \delta_{0d} + \varepsilon_{id} \tag{4}$$

The dataset used in this paper for our analysis is derived from the current round of the National Family Health Survey conducted in India during 2015-2016. The NFHS-4 survey covered about 601,509 households from 29 states and 7 union territories in India. We have a sample of 699,686 women aged 15-49 years of whom 499,627 are currently married as against—married but gauna not performed, widowed, divorced, separated, deserted or never married. Among the sample of currently married women 212,188 have heard about FP methods either only from television or have not come across such campaigns. We have a final sample size of 201,230 currently married women after adjusting for the missing values and outliers in the control variables (For caste, we have left those respondents who did not know the caste of the household. For employment status and FP advice received, we have adjusted the missing observations by creating an indicator for the missing observations.). We use the data related to modern contraceptive awareness, intention to use, and actual usage from women questionnaire for currently married women only, while detailed information about the household and its members was derived from the household questionnaire.

TABLE 1 Descriptive statistics

Variables of interest	Observations	Mean	Std. Dev.	Min	Max
Aware of modern FP methods	201,230	0.976	0.153	0.00	1.00
Intends to use modern FP methods	105,324	0.152	0.359	0.00	1.00
Currently uses modern FP methods	201,230	0.420	0.494	0.00	1.00
Incidence of female sterilisation	182,703	0.361	0.480	0.00	1.00
Incidence of male sterilisation	117,603	0.007	0.081	0.00	1.00
Usage of birth control pills	124,130	0.059	0.235	0.00	1.00
Usage of condoms	124,071	0.058	0.234	0.00	1.00
Seen FP only on television	201,230	0.268	0.443	0.00	1.00
Regularity in watching television among other women in the village	201,230	1.723	0.889	0.00	3.00

Note: *Aware of modern FP methods* is a dummy variable that takes a value of 1 if the respondent knows about modern family planning methods and 0 otherwise. *Intends to use modern FP methods* is a dummy variable that takes the value 1 if she intends to use modern FP methods later and 0 otherwise. *Currently uses modern FP methods* is a dummy variable that takes a value of 1 if the respondent uses modern methods and 0 otherwise.

We use the binary response to the following question "In the last few months have you seen anything about family planning on television" as the variable of interest—*Seen FP dummy*. We consider three outcome variables in our analysis to capture these women's exposure to modern family planning methods—family planning and contraceptive awareness, the intention of using the modern family planning methods among non-users, and actual utilization of those methods by the respondent. The *Aware dummy* is coded as 1 if the respondent knows about modern family planning methods such as female or male sterilisation, contraceptive pills, and condoms and 0 if she knows about folkloric, traditional, or no method. Similarly, the *Intends to use* variable takes the value of 1 if she is currently a non-user but intends to use modern family methods in the next 12 months or later and 0 if the respondent does not intend to use modern methods. The *Current usage* variable, on the other hand, is coded 1 if the respondent is currently using modern methods and 0 if she is using traditional methods or non-user of any family planning methods. Next, we focus on the usage of different modern family planning methods separately, that is, the incidence of female sterilisation, male sterilisation, utilization of contraceptive pills and condoms. Finally, we estimate the effect of hearing family planning information from multiple sources.

3 | RESULTS

We start this section by presenting the descriptive statistics for the outcome variables, variable of interest and instrument are presented in Table 1. 26.8% of the sample respondents have seen FP campaigns in TV in the last three months. We find that 97.6% of the respondents are aware whereas only 15.2% non-users intend to use and only two out of five currently married women in the 15-49 years age group in India currently use modern family planning methods. It is to be noted that female sterilisation (tubectomy) appears to be the most preferred method with 36.1% prevalence compared to only 0.7%, 5.8% and 5.9% for the usage of male sterilisation (vasectomy), condom and pill use respectively. The summary of possession of mass-media, exposure to multiple source of information and other explanatory variables are presented in Table A1 in the Appendix. Figures 1 and 2 display the variation in awareness, intention to use, and actual utilization of modern family planning methods based on having seen family planning campaigns only on television versus not having seen them at all.

Next, we report the baseline regression results estimated using Equation (1). The estimated coefficients reported in Table 2, to begin with, illustrate the association between watching anything about family planning on television and various outcome variables as discussed earlier. The OLS results presented in Panel A of Table 2 suggest that the

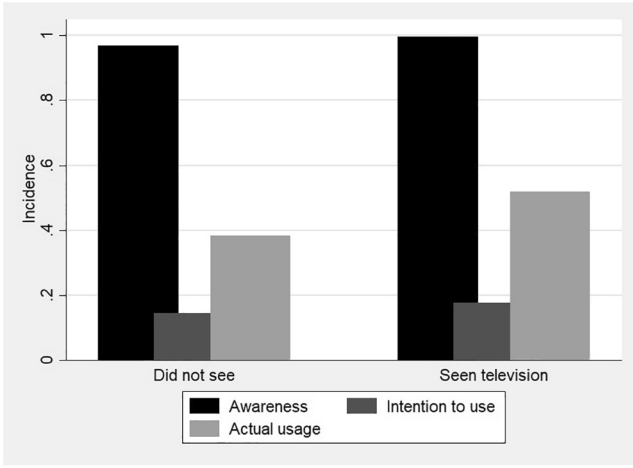

FIGURE 1 Differences in outcomes by the incidence of watching FP on TV

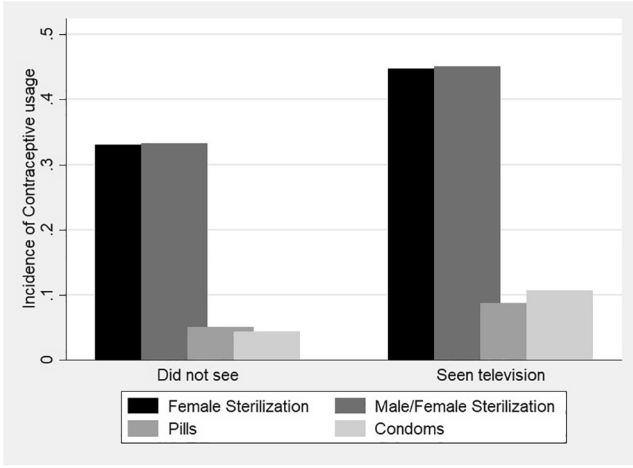

FIGURE 2 Differences in Contraceptive Usage by the incidence of watching FP on TV

currently married women in the 15-49 age group who have seen about family planning on television in the last few months are 1.2 percentage points (pp) more likely to be aware of modern family planning methods. Intention to use among non-users and actual usage of modern family planning methods is also 1.0 pp and 3.3 pp higher for women who have seen such campaigns on television vis-à-vis those who have not seen them. The regression results with full set controls are presented in Appendix Table A2. The OLS results, however, provides only a lower bound on the effect size that we discuss in detail while discussing our instrumental variable estimates.

The results from the two alternative methodologies, discussed in the methods section above, are reported in the following two consecutive panels. The PSM results reported in Panel B of Table 2 show that the estimates are identical to OLS. Our OLS results are thus robust to the use of the PSM strategy. The balancing test for the matching variables presented in Appendix Table A3 shows the bias in the individual and household variables for those who have seen family planning only on TV and those who have not are well within 5% and are also statistically insignificant. We use the bounding approach proposed by Rosenbaum[45] to check the sensitivity of the estimated results with deviations from the assumption of conditional independence or unconfoundedness. The Mantel-Haenszel statistic used for binary outcome variables for awareness, intention to use and current usage are reported in Panels A-C in

TABLE 2 Baseline regression results

	Aware	Intends to use	Current usage
Panel A: OLS estimates			
Seen FP on TV	0.012***	0.010***	0.033***
	(0.001)	(0.003)	(0.003)
Mean	0.969	0.145	0.384
No of observations	201,230	105,324	201,230
R-squared	0.090	0.123	0.230
Panel B: PSM estimates			
Seen FP on TV	0.012***	0.010***	0.033***
	(0.001)	(0.003)	(0.003)
Mean	0.969	0.145	0.384
No of observations	200,154	104,876	200,154
R-squared	0.090	0.124	0.231
Panel C: IV estimates			
Seen FP on TV	0.121***	0.153***	0.380***
	(0.008)	(0.024)	(0.020)
Mean	0.969	0.145	0.384
No of observations	201,230	105,324	201,230
F-stat	4721	13,927	78,594

Note: *Aware* is a dummy variable that takes a value of 1 if the respondent knows about modern methods of family planning and 0 otherwise. *Intends to use* is a dummy variable that takes the value 1 if the respondent is a non-user but intends to use modern FP methods in the next 12 months or later and 0 otherwise. *Current usage* is also a dummy variable that takes a value of 1 if the respondent uses modern methods and 0 otherwise. *Seen FP on TV dummy*, takes a value of 1 if she has seen family planning campaigns only on television in the last few months and 0 otherwise. In each of the PSM regressions, we have controlled for age, adjusted age-squared (age squared divided by 100), level of education, employment status, caste category (General, SC, ST or OBC), religion category (Hindu, Muslim, Christian or other religions), wealth index, household size, number of children aged below five years, number of eligible women in the household, region of residence (rural or urban), gender of household head, if the respondent has received family planning advice during the last three months of pregnancy from frontline workers such as ANM, lady health visitor, ASHA, Anganwadi worker, or other community health workers; and district-specific fixed effects in all regressions. The common support for PSM is based on age, education (illiterate or literate), caste category (General, SC, ST or OBC), religion (Hindu or non-Hindu) wealth index, and if the respondent has received family planning advice during the last three months of pregnancy from frontline workers such as ANM, lady health visitor, ASHA, Anganwadi worker, or other community health workers. Means refer to the mean of the dependent variable if the respondent has not seen family planning campaigns on television in the last few months. The difference in the number of observations for the OLS and PSM strategy is because of the individuals who are out of the sample based on matching on observable individual and household level characteristics. Clustered standard errors around the household unit are reported in parentheses ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Appendix Table A4 respectively. We find that in the absence of hidden bias, that is, where $\Gamma = 1$, Q_{MH} test statistic provides strong evidence that seeing FP campaigns on TV improves awareness, intention and current usage. The bounds for the significance levels of Q^{+}_{MH} and Q^{-}_{MH} statistics shows that the estimates are insensitive to a bias that would deviate the chances of seeing FP campaigns on TV for awareness and current usage of modern FP methods. For intention to use, we find that the significance level for Q^{+}_{MH} statistics falls initially, becomes insignificant for $\Gamma = 1.30$ and $\Gamma = 1.35$, and increases thereafter, which suggests a possible negative treatment effect.[46]

The IV estimates, reported in Panel C of Table 2, provide an upper bound on the effect size of association between the outcome variables and watching family planning campaigns on television in the last few months. A probable reason for the higher magnitude of the IV estimates might be measurement error in the outcome variables

of interest. Awareness, intention, and current usage of modern family planning methods are prone to be affected by social desirability bias. Secondly, the IV estimates capture the effect only on the compliers, that is, the women who would not have come to know about the family planning campaigns on television had they not been informed or influenced to watch them by their neighbours.

Watching family planning campaigns on television results in a 12.1 pp, 15.3 pp, and 38.0 pp higher chance of being aware, improved intention among non-users, and using modern family planning methods. The first stage regression results presented in Panel A in Appendix Table A5 confirm that *regularity in watching television among the other women in the village* is a good instrument for *Seen FP on TV dummy*. The IV model is exactly identified as we use only one exogenous instrument (apart from the pre-determined control variables) for the endogenous variable of interest. The endogeneity test results for the IV model presented in Panel B in Appendix Table A5 shows that *Seen FP on TV dummy* is endogenous.

We find that the effect of seeing FP campaigns via television on family planning behaviour is also robust to the use of hierarchical linear modelling. We observe that the likelihood of being aware and current usage of modern FP methods tend to be more positive in districts with higher share of women who have seen FP campaigns on TV. For every percentage increase in women exposed (to FP campaigns on TV), awareness about modern contraceptives increases by 9.5 pp. The level 2 variance component (l_{00}) remains statistically significant across all FP outcomes. We find that the effect of seeing FP campaigns on TV remains significant (and nearly similar in magnitude to our OLS and PSM estimates) even after accounting for district-level mean outcomes that in turn (level 2) depend on the proportion of women who have seen FP campaigns via television in each district. The results are reported in Appendix Table A6.

It has been observed that NFHS-4 survey has under-estimated contraceptive use specifically the prevalence of sterilisation in a number of states. The district-specific fixed effects included in the regressions would capture the underutilisation specific to certain states and would not affect the estimates of seeing family planning campaigns on the outcome variables. Again, since sterilisation is for life, most of the women using sterilisation at the time of the survey would have been sterilised several years before the survey so could not have been influenced by recent TV messages. If the measurement error in the dependent variable is uncorrelated with the independent variables, that is, not systematically distributed, we get unbiased OLS estimates. Error in variable of interest, however, poses greater threat. One probable source is the recall bias, that is, people who use family planning or are about to do so may be more likely to recall a family planning message. In such classical errors in variable model, the measurement error in the variable of interest creates an endogeneity bias in the OLS model and the OLS estimate is negatively biased if the true estimate is positive (attenuation bias). In such cases, the IV strategy is preferred as it provides consistent estimates. Even in non-classical measurement (additive) error models, IV estimates are consistent if the instruments are only correlated with the true endogenous regressor and not with any of the measurement errors in the model. IV estimator also has the advantage that it cures the selection bias problem.

In case of measurement error in the binary regressor (seen FP campaigns on TV), the error is always negatively correlated with the true variable. The OLS estimate will be attenuated because some women (who are aware, intend to use or currently using modern FP methods) might report to have not seen FP campaigns on TV (due to shame or uneasiness) while some women (who are unaware, does not intend to use or currently not using any modern FP methods) report to have seen FP campaigns on TV. Even IV strategy does not yield a consistent estimate here. The measurement error can only be either 1 or 0 (when seen FP campaigns on TV = 1), or 1 or 0 (when seen FP campaigns on TV = 0). Thus, the measurement error in two mis-measured variables will be positively correlated. The bias, in IV estimate, depends only on the misclassification rates in the exposure variable (seen FP campaigns on TV), which is the endogenous regressor. Greater misclassification in the instrument leads to smaller first stage coefficient making the IV estimate biased upward. In such cases, OLS and IV estimates are used as bounding limits for the true coefficient.[47]

Further, when we re-estimate Equation (1) using the usage of the different modern contraceptive methods as the outcome variable (used one at a time), we find that seeing family planning campaigns on television is associated with a significantly higher incidence of female sterilisation, and more utilization of pills and condoms. These estimates are reported in Table 3. From the OLS estimates reported in Panel A in Table 3, we find that respondents with exposure

TABLE 3 Regression results for the usage of specific family planning methods

	Female sterilisation	Male sterilisation	Usage of pills	Usage of condoms
Panel A: OLS estimates				
Seen FP on TV	0.027***	−0.001	0.011***	0.014***
	(0.002)	(0.001)	(0.002)	(0.002)
Mean	0.330	0.006	0.050	0.044
No of observations	182,703	117,603	124,130	124,071
R-squared	0.302	0.113	0.151	0.127
Panel B: PSM estimates				
Seen FP on TV	0.027***	−0.001	0.012***	0.013***
	(0.002)	(0.001)	(0.002)	(0.002)
Mean	0.330	0.006	0.050	0.044
No of observations	181,763	117,084	123,565	123,490
R-squared	0.302	0.113	0.152	0.126
Panel C: IV estimates				
Seen FP on TV	0.345***	0.010**	0.073***	0.108***
	(0.020)	(0.004)	(0.014)	(0.013)
Mean	0.330	0.006	0.050	0.044
No of observations	182,703	117,603	124,130	124,071
F-stat	103,617	907	8763	8061

Note: *Female sterilisation* is a binary variable that takes a value of 1 if female sterilisation has been used by the respondent to delay/avoid pregnancy and 0 if some traditional technique or nothing is used. *Male sterilisation* is a binary variable that takes 1 if male sterilisation is used to delay/avoid pregnancy and 0 if some traditional technique or nothing is used. *Usage of pills*, on the other hand, takes a value of 1 if birth control pills are used by the respondent to delay/avoid pregnancy and 0 if some traditional technique or nothing is used. *Usage of condoms* takes the value of 1 if a condom is used to delay/avoid pregnancy and 0 if some traditional technique or nothing is used. In each of the PSM regressions, we have controlled for age, adjusted age-squared (age squared divided by 100), level of education, employment status, caste category (General, SC, ST or OBC), religion category (Hindu, Muslim, Christian or other religions), wealth index, household size, number of children aged below five years, number of eligible women in the household, region of residence (rural or urban), gender of household head, if the respondent has received family planning advice during the last three months of pregnancy from frontline workers such as ANM, lady health visitor, ASHA, Anganwadi worker, or other community health workers; and district-specific fixed effects in all regressions. The common support for PSM is based on age, education (illiterate or literate), caste category (General, SC, ST or OBC), religion (Hindu or non-Hindu) wealth index, and if the respondent has received family planning advice during the last three months of pregnancy from frontline workers such as ANM, lady health visitor, ASHA, Anganwadi worker, or other community health workers. Means refer to the mean of the dependent variable if the respondent has not seen family planning campaigns on television in the last few months. The difference in the number of observations between the OLS and PSM strategy is because of the individuals who are out of the sample based on matching on observable individual and household level characteristics. Clustered standard errors around the household unit are reported in parentheses ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

to such campaigns via television are 2.7 pp more likely to have undergone sterilisation themselves. Male sterilisation, on the other hand, has no significant association. Actual usage of birth control pills and condom use is also 1.1 pp and 1.4 pp higher, respectively, among those who have seen about FP on TV vis-à-vis their other counterparts. The OLS estimates, however, provide lower bounds to the effect size. Again, the PSM results presented in Panel B of Table 3 show our OLS estimates are robust, whereby we find the exactly identical estimates except for pills, which increases only slightly to 1.2 pp, and usage of condoms, which reduces only slightly to 1.3 pp. The IV estimates reported in Panel C of Table 3 provide the upper bounds of the effect size. Therefore, the overall results presented in Tables 2 and 3 suggest that seeing about family planning on TV is positively and significantly related to being aware, improved

TABLE 4 Effectiveness of alternative sources of family planning methods

Variables of interest	Aware	Intends to use	Current usage
Exposure to mass-media (Ref: Radio)			
Radio + Print	0.004***	0.012*	−0.006
	(0.001)	(0.007)	(0.007)
Radio + Print + TV	0.005***	0.015***	0.013***
	(0.001)	(0.005)	(0.005)
Radio + Print + TV + FLW	0.007***	0.007	0.025***
	(0.001)	(0.008)	(0.007)
No of observations	76,635	40,073	76,635
R-squared	0.030	0.122	0.206

Note: See footnote of Table 1. We have controlled for age, adjusted age-squared (age squared divided by 100), level of education, employment status, caste category, religion category, wealth index, household size, number of children aged below five years, number of eligible women, region of residence, gender of household head and district-specific fixed effects in all regressions presented in this table. FLW means frontline workers such as ANM, lady health visitor, ASHA, Anganwadi worker, or other community health worker and captures if the respondent has received family planning advice during the last three months of pregnancy from frontline workers and 0 otherwise. Each of the four categories considered here has been constructed as follows: Radio means received information from radio only, whereas Radio + Print refers to receiving information from the radio as well as newspapers, and so on in a progressive or cumulative manner. Clustered standard errors around the household unit are reported in parentheses ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

intention among non-users, and actual usages of modern family planning methods, such as female sterilisation and usage of pills and condoms. The results reported in Tables 2 and 3 capture the pure effect of seeing FP campaigns only on television compared to the cumulative effects presented next in Table 4.

Next, to examine the differential effect of family planning information from multiple sources, we re-estimate Equation (1), but instead of using the TV_{ihd} as the variable of interest, we include four separate source categories in the same Equation in a progressive or cumulative manner. With the reference category being heard about family planning methods only from radio, we consider hearing it from both radios and being aware via a print medium such as newspaper, magazine, wall-painting, and posters as the second category. In addition, we include awareness from radio, print, and television as the third category. Finally, awareness via radio, print, television, and also having been advised by the frontline workers like ASHA workers, nurses, doctors, and other health personals has been included in the extended version of Equation (1) as the fourth category. The summary statistics for progressive media are presented in Appendix Table A1 and regression results for the extended model are presented in Table 4. The results suggest that information inflow from different media sources has a cumulative positive association with respondents' awareness about, intention to use, and actual utilization of modern family planning methods. Surprisingly, the increase in the coefficient from the third to the fourth category (for the overall usage variable) is quite large in magnitude, suggesting that the family planning information they receive from mass-media such as TV gets further strengthened when they are directly motivated by the health personals (also referred to as FLW. [FLW refers to frontline workers such as Auxiliary nurse midwife (ANM), lady health visitor, Accredited Social Health Activist (ASHA), Anganwadi worker, or other community health workers.]), as is evident from the third column in Table 4 that reports that actual usage of contraceptives increases by about 1.2 pp—from 1.3 pp to 2.5 pp.

4 | DISCUSSION

Policymakers and social scientists have often focussed on increasing the availability and accessibility of modern contraceptives to improve contraceptive utilization in less developed countries such as Ethiopia, Haiti, and Pakistan.[48-51] Only recently have some scholars stressed the importance of family planning counselling and information as a channel to improve the utilization of modern contraceptives.[52,53] Sato et. al.[53] find that in Tanzania where almost 45% of the women do not use modern contraceptives, distance to health facility is positively associated with regular usage of condom, and suggest improved counselling to stop discontinuation. Our paper adds to this literature by providing new evidence that awareness can increase the utilization of various modern contraceptive methods. Family planning campaigns on television must be backed by direct motivation to utilise modern contraceptives through frontline health workers. The central and the state governments should allocate a substantial budget towards creating mass awareness through television, besides addressing the availability and accessibility concerns. State and local governments should simultaneously increase the number of frontline health workers responsible for counselling and motivating women to utilise modern family planning methods.

We find robust evidence that spreading family planning information via campaigns on television significantly raises awareness about contraception usage, improves intention to use among non-users, and positively affects utilization of various modern family planning methods, ranging from female and male sterilization to usage of contraceptive pills and condoms. The results presented indicate a strong and significant positive association, particularly in contraception usage via increased female sterilization incidence. The OLS and PSM estimates are, however, insignificant for male sterilization. This suggests that female sterilization is more acceptable than male sterilization, possibly due to the social and cultural context that puts a value on manhood in a male-dominated, patriarchal society like India, even though female sterilization is a more complex procedure compared to male sterilization. We also find evidence that the efficacy of family planning and contraceptive usage information spread via television campaigns has more of an effect on actual usage when women are directly reached and motivated to use such family planning methods by frontline health workers.

5 | CONCLUSION

Mass-media campaigns broadcasted via television improves overall family planning behaviour and practices. The likelihood of usage of modern contraceptives improves drastically if the mass-media campaigns are complemented by motivation from frontline health workers. We recommend the government and private manufacturers of various modern contraceptives to advertise and promote the modern family planning methods more aggressively through television alongside providing door-to-door motivation by health workers.

Our paper's findings should be interpreted with caution as they show the existence of a direct and positive association of the family planning campaigns on television and improved awareness, intention, and utilization of modern family planning methods. A time dimension in the data would have indicated whether or how many respondents had seen family planning campaigns on television before using the modern contraceptives. The absence of time variable has led us to interpret the coefficients as associative and not causal. The associative relation, however, is robust to the use of alternative estimation strategies. The effect size is bounded by the OLS and IV estimates. We have certain limitations regarding the data we use. Since the questions on mass-media campaigns related to family planning methods were introduced for the first time in 2015 within the purview of NHFS data, we have a single round of cross-section data to justify our results. Besides, we expect social desirability bias and recall bias in the self-reported responses to the awareness, intention, and current usage questions.

In future, researchers may conduct a well-planned primary survey to capture the perception and awareness of both women and men about the usefulness and availability of modern contraceptives. The impact of men's exposure to FP advertisements would be of interest to many, including policymakers and social scientists. Besides, researchers

can observe the respondents over a period of time and note the change in their exposure to FP messages on TV and their response in terms of awareness, intention, and utilization that would help draw a causal inference regarding the impact of seeing FP messages via TV on the respondents' family planning behaviour. A randomized control trial would also be helpful to draw a causal inference regarding the impact of exposure to FP campaigns on TV by comparing the effect on the treatment and the control groups.

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CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

ETHICS STATEMENT

This analysis was based on the National Family Health Survey data from India available in the public domain. The data can be downloaded from https://dhsprogram.com/what-we-do/survey/survey-display-355.cfm. The study conducted a secondary analysis with no identifiable information on survey respondents.

DATA AVAILABILITY STATEMENT

This analysis was based on the National Family Health Survey data from India available in the public domain: https://dhsprogram.com/what-we-do/survey/survey-display-355.cfm.

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APPENDIX

TABLE A1 Descriptive statistics

Variables of interest	Observations	Mean	Std. Dev.	Min	Max
Household has television	195,143	0.525	0.499	0.00	1.00
Household has radio	195,143	0.059	0.236	0.00	1.00
Exposure to mass-media (Ref: Radio)					
Radio + Print	76,635	0.087	0.282	0.00	1.00
Radio + Print + TV	76,635	0.605	0.489	0.00	1.00
Radio + Print + TV + FLW	76,635	0.112	0.316	0.00	1.00
Received FP advice (Ref: Missing)					
No	201,230	0.070	0.255	0.00	1.00
Yes	201,230	0.090	0.287	0.00	1.00
Caste (Ref: General)					
SC	201,230	0.203	0.402	0.00	1.00
ST	201,230	0.232	0.422	0.00	1.00
OBC	201,230	0.402	0.490	0.00	1.00
Age (in years)	201,230	33.452	8.650	15.00	49.00
Adjusted-age-squared	201,230	11.938	5.869	2.25	24.01
Wealth index (Ref: Poorest)					
Poorer	201,230	0.262	0.439	0.00	1.00
Middle	201,230	0.204	0.403	0.00	1.00
Richer	201,230	0.145	0.352	0.00	1.00
Richest	201,230	0.086	0.281	0.00	1.00
Employed (Ref: Missing)					
No	201,230	0.108	0.311	0.00	1.00
Yes	201,230	0.056	0.230	0.00	1.00
Household size	201,230	5.827	2.660	1.00	41.00
Number of children below 5 years	201,230	0.768	0.990	0.00	9.00
Number of eligible women	201,230	1.613	0.885	1.00	12.00
Education (Ref: Illiterate)					
Primary	201,230	0.167	0.373	0.00	1.00
Secondary	201,230	0.287	0.452	0.00	1.00
Higher	201,230	0.024	0.152	0.00	1.00
Urban locality (Ref: Rural)	201,230	0.184	0.388	0.00	1.00
Religion (Ref: Hindu)					
Muslim	201,230	0.113	0.316	0.00	1.00
Christian	201,230	0.083	0.275	0.00	1.00
Others	201,230	0.048	0.214	0.00	1.00
Female head (Ref: Male)	201,230	0.099	0.299	0.00	1.00

Note: Received FP advice is Yes if the respondent has received family planning advice during the last three months of pregnancy from frontline workers such as ANM, lady health visitor, ASHA, Anganwadi worker, or other community health worker; and No otherwise. Others in terms of religion refer to Sikh, Buddhist/Neo-Buddhist, Jain, Jewish, Parsi/Zoroastrian, or no religion.

TABLE A2 Regression results with the full set of controls

Variables of interest	Aware	Intends to use	Current usage
Seen FP on TV	0.012***	0.010***	0.033***
	(0.001)	(0.003)	(0.003)
Family planning advice received (Ref: Missing)			
No	0.008***	0.002	−0.047***
	(0.001)	(0.005)	(0.004)
Yes	0.014***	−0.011***	−0.001
	(0.001)	(0.004)	(0.004)
Caste (Ref: General)			
SC	0.003***	0.006	−0.013***
	(0.001)	(0.004)	(0.004)
ST	−0.005***	0.000	−0.052***
	(0.002)	(0.005)	(0.004)
OBC	0.001	−0.002	−0.001
	(0.001)	(0.004)	(0.003)
Age (in years)	0.007***	−0.018***	0.079***
	(0.000)	(0.001)	(0.001)
Adjusted age squared	−0.009***	0.011***	−0.101***
	(0.001)	(0.001)	(0.001)
Wealth index (Ref: Poorest)			
Poorer	0.011***	−0.001	0.035***
	(0.001)	(0.003)	(0.003)
Middle	0.013***	0.007*	0.052***
	(0.001)	(0.004)	(0.003)
Richer	0.015***	0.011**	0.057***
	(0.001)	(0.004)	(0.004)
Richest	0.014***	0.027***	0.054***
	(0.002)	(0.006)	(0.005)
Unemployed	0.005***	0.004	0.005
	(0.001)	(0.004)	(0.003)
Employed	0.013***	0.022***	0.054***
	(0.001)	(0.005)	(0.004)
Household size	0.000*	−0.003***	0.017***
	(0.000)	(0.001)	(0.001)
Number of children below the age of five	−0.000	−0.013***	−0.030***
	(0.001)	(0.001)	(0.001)
Number of eligible women	−0.002***	0.007***	−0.039***
	(0.001)	(0.002)	(0.002)

(Continues)

TABLE A2 (Continued)

Variables of interest	Aware	Intends to use	Current usage
Education (Ref: Illiterate)			
Primary	0.008***	0.005	0.008***
	(0.001)	(0.003)	(0.003)
Secondary	0.015***	0.007**	−0.025***
	(0.001)	(0.003)	(0.003)
Higher	0.018***	0.023***	−0.110***
	(0.002)	(0.008)	(0.007)
Urban region of residence (Ref: Rural)	0.004***	−0.001	−0.009***
	(0.001)	(0.003)	(0.003)
Religion (Ref: Hindu)			
Muslim	−0.003***	−0.027***	−0.124***
	(0.001)	(0.004)	(0.004)
Christian	0.000	0.004	−0.016**
	(0.003)	(0.007)	(0.007)
Others	−0.007***	−0.004	−0.018***
	(0.002)	(0.007)	(0.006)
Gender of head of family (Ref: Male)	−0.001	0.003	−0.029***
	(0.001)	(0.004)	(0.003)
Constant	0.871***	0.606***	−0.995***
	(0.007)	(0.055)	(0.058)
District fixed effects	Yes	Yes	Yes
No of observations	201,230	105,324	201,230
R-squared	0.090	0.123	0.230

Note: Clustered standard errors around the household unit are reported in parentheses ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Others in terms of religion refer to Sikh, Buddhist/Neo-Buddhist, Jain, Jewish, Parsi/Zoroastrian, or no religion.

TABLE A3 Balancing test for PSM

	Mean			*t*-test	
Variables of interest	Treated	Control	% Bias	t	p>|t|
Age	34.040	34.017	0.3	0.40	0.688
Education (Ref: Illiterate)					
Literate	0.550	0.555	−1.1	−1.62	0.105
Caste (Ref: General)					
SC	0.221	0.219	0.3	0.50	0.617
ST	0.155	0.156	−0.3	−0.57	0.572
OBC	0.429	0.428	0.2	0.26	0.795
Religion (Ref: Hindu)					
Non-hindu	0.200	0.195	1.2	1.83	0.067
Wealth index (Ref: Poorest)					
Poorer	0.242	0.242	0.000	0.01	0.989
Middle	0.282	0.284	−0.5	−0.75	0.454

TABLE A3 (Continued)

	Mean			*t*-test	
Variables of interest	**Treated**	**Control**	**% Bias**	**t**	**p>|t|**
Richer	0.229	0.229	−0.1	−0.13	0.895
Richest	0.136	0.134	0.8	1.02	0.309
FP advice received (Ref: Missing/no)					
Yes	0.088	0.085	0.900	1.31	0.189

TABLE A4 Mantel-Haenszel bounds

Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-
Panel A: Aware				
1.00	28.011	28.011	0.000	0.000
1.05	27.121	28.917	0.000	0.000
1.10	26.287	29.797	0.000	0.000
1.15	25.503	30.652	0.000	0.000
1.20	24.764	31.485	0.000	0.000
1.25	24.066	32.298	0.000	0.000
1.30	23.404	33.090	0.000	0.000
1.35	22.775	33.865	0.000	0.000
1.40	22.177	34.623	0.000	0.000
1.45	21.606	35.364	0.000	0.000
1.50	21.061	36.091	0.000	0.000
Panel B: Intend to use				
1.00	9.605	9.605	0.000	0.000
1.05	8.013	11.201	5.6e-16	0.000
1.10	6.498	12.727	4.1e-11	0.000
1.15	5.052	14.188	2.2e-07	0.000
1.20	3.669	15.591	0.000	0.000
1.25	2.343	16.941	0.010	0.000
1.30	1.070	18.242	0.142	0.000
1.35	0.123	19.498	0.451	0.000
1.40	1.303	20.712	0.096	0.000
1.45	2.442	21.887	0.007	0.000
1.50	3.543	23.026	0.000	0.000
Panel C: Current usage				
1.00	31.735	31.735	0.000	0.000
1.05	29.069	34.410	0.000	0.000
1.10	26.535	36.970	0.000	0.000
1.15	24.120	39.424	0.000	0.000
1.20	21.813	41.782	0.000	0.000
1.25	19.604	44.053	0.000	0.000
1.30	17.486	46.242	0.000	0.000

(Continues)

TABLE A4 (Continued)

Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-
1.35	15.451	48.357	0.000	0.000
1.40	13.492	50.403	0.000	0.000
1.45	11.605	52.384	0.000	0.000
1.50	9.782	54.306	0.000	0.000

Note: Gamma: odds of differential assignment due to unobserved factors; Q_mh+: Mantel-Haenszel statistic (assumption: overestimation of treatment effect); Q_mh-: Mantel-Haenszel statistic (assumption: underestimation of treatment effect); *p*_mh+: significance level (assumption: overestimation of treatment effect); p_mh-: significance level (assumption: underestimation of treatment effect)

TABLE A5 First-stage regression & endogeneity test results

Panel A: Seen FP on TV	Aware	Intends to use	Current usage
Regularity in watching TV among other women	0.103***	0.088***	0.103***
	(0.002)	(0.002)	(0.002)
No of observations	201,230	105,324	201,230
F-stat	3327.16	1482.52	3327.16
R-squared	0.216	0.215	0.216
Panel B: Endogeneity test	**Aware**	**Intends to use**	**Current usage**
Robust regression F	228.498***	36.353***	331.941***
	(0.000)	(0.000)	(0.000)
No of observations	201,230	105,324	201,230
Household clusters adjusted	184,346	97,760	184,346

Note: See footnote of Table 1. The estimated coefficients in Panel A are from the first stage regressions, where Seen FP on TV is the dependent variable and a regularity in watching television among other women in the village (used as the instrument) as the independent variable of interest. The F-stat suggests that this is a good instrument. In Panel B, we see that the F-statistics for the IV regressions are significant showing that *Seen FP on TV* is endogenous. Clustered standard errors around the household unit are reported in parentheses ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

TABLE A6 Baseline regression results: HLM estimates

		Aware	Intends to use	Current usage
Seen FP on TV	Υ_{10}	0.012***	0.011***	0.034***
		(0.001)	(0.003)	(0.002)
Prop. seen FP on TV	Υ_{01}	0.095***	0.052	1.087***
		(0.028)	(0.061)	(0.111)
Intercept	Υ_{00}	0.833***	0.604***	−1.101***
		(0.007)	(0.018)	(0.022)
Variance				
Between district	$\acute{I}_{00}$	0.001***	0.006***	0.023***
		(0.000)	(0.000)	(0.001)
Within district	σ^2	0.021***	0.114***	0.188***
		(0.000)	(0.000)	(0.001)
Number of observations		201,230	105,324	201,230
Number of groups		640	640	640
Log likelihood		100,506.98	−35,518.248	−118,623.92

Note: See footnote of Table 1. Standard errors are reported in parentheses ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.