The Paradox of Declining Fertility and Declining Contraceptive Use in India

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Abstract:

Comparison of data from India's National Family Health Survey waves 3 and 4, conducted in 2005-6 and 2015-16 respectively, document a puzzling trend. Fertility has declined rapidly between the two surveys but instead of increasing, contraceptive use has also declined. Analysis of data in this paper suggests that massive expansion of sample size from over 100,000 household to over 600,000 households may have led to deterioration in data quality, particularly for contraceptive use. These results point to the dangers of expecting survey data to provide estimates of demographic trends for policy purposes at highly disaggregated geographic levels. It is also possible that a changing method-mix from permanent to temporary methods may require less public interview setting to avoid increasing measurement error in contraceptive use over time.

1 Puzzle of Declining Contraceptive Use

Much awaited results from National Family Health Survey round 4 of 2015-2016 (International Institute for Population Sciences (IIPS) and ICF 2017) bring important data for planning and policy evaluation but they also present some puzzles. Total Fertility Rate (TFR) declined substantially between 2005-2006 when NFHS-3 was conducted (International Institute for Population Sciences and Macro International 2007) and 2015-2016 from 2.68 (95% CI: 2.62 – 2.74) to 2.18 (2.16 – 2.20) and is currently just above the replacement level of fertility of 2.1 children per women. However, over the same period, current contraceptive use declined from 56.3% (95% CI: 55.7% - 57.0%) to 53.5% (53.3% - 53.8%).

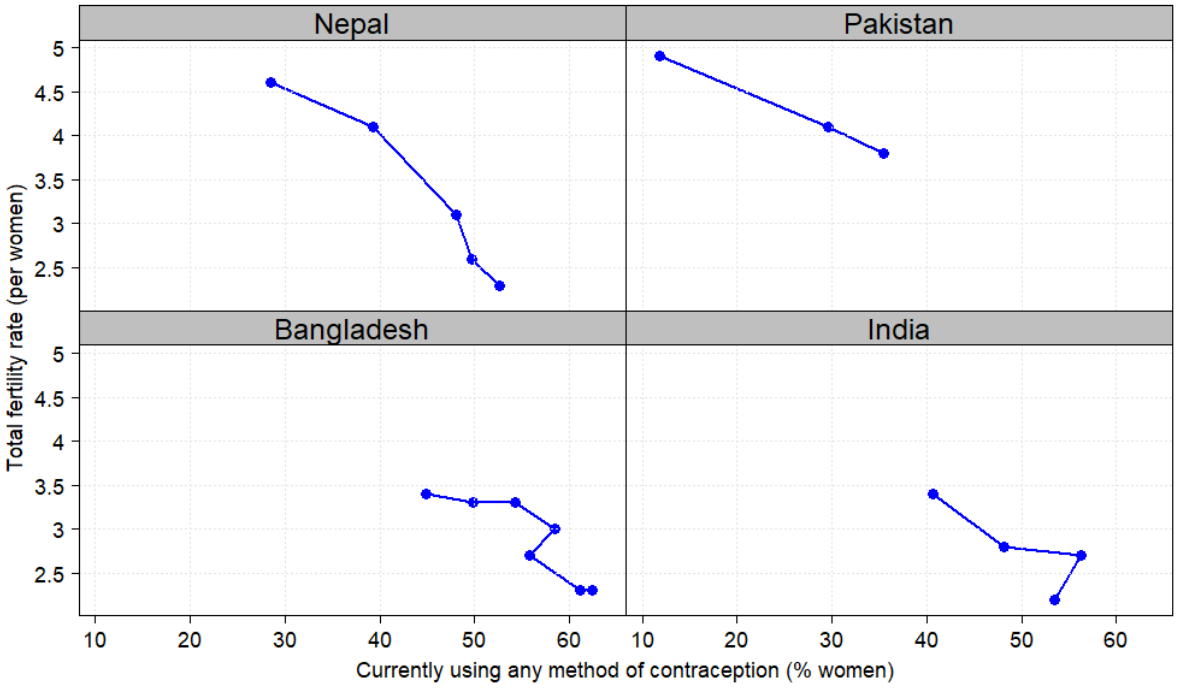

Figure 1 Plot of total fertility rate against contraceptive use prevalence in four countries across DHS surveys. Number of DHS surveys varies across countries, hence, the difference in number of data points.

As Figure 1 shows, this anomalous result places the most recent NFHS in India at variance with experiences of its neighbors, Nepal, Pakistan, and Bangladesh as well as its own historical experience of the first three NFHS surveys of 1992-93, 1989-99, and 2005-2006. For Nepal and Pakistan, there is a natural pattern, prevalence of contraceptive use increased over time and with increase in contraceptive use, TFR declines. Bangladesh, however, experienced a decline in contraceptive use between 2004 and 2007 in traditional methods but not in modern methods.

Examination of state level trends in changes in fertility and contraceptive use in Figure 2 add to this puzzle. Here we have arranged the states in decreasing order of change in contraceptive use prevalence between NFHS-4 (2015-16) and NFHS-3 (2005-06). The percentage of women (currently married or in union) in the age group of 15-49 currently using any method of contraception has declined in NFHS-4 for all but the first 10 states, as for the remaining 19 states the points fall below the red-dotted zero line. While TFR has uniformly declined in all states with the exception of Andhra Pradesh,[1] trends in contraceptive use are less consistent.

[1] The exception of Andhra Pradesh is perhaps because Andhra Pradesh is a newly defined geographical region during NFHS-4 compared to the state Andhra Pradesh in 2005-06 which included Telangana at that time.

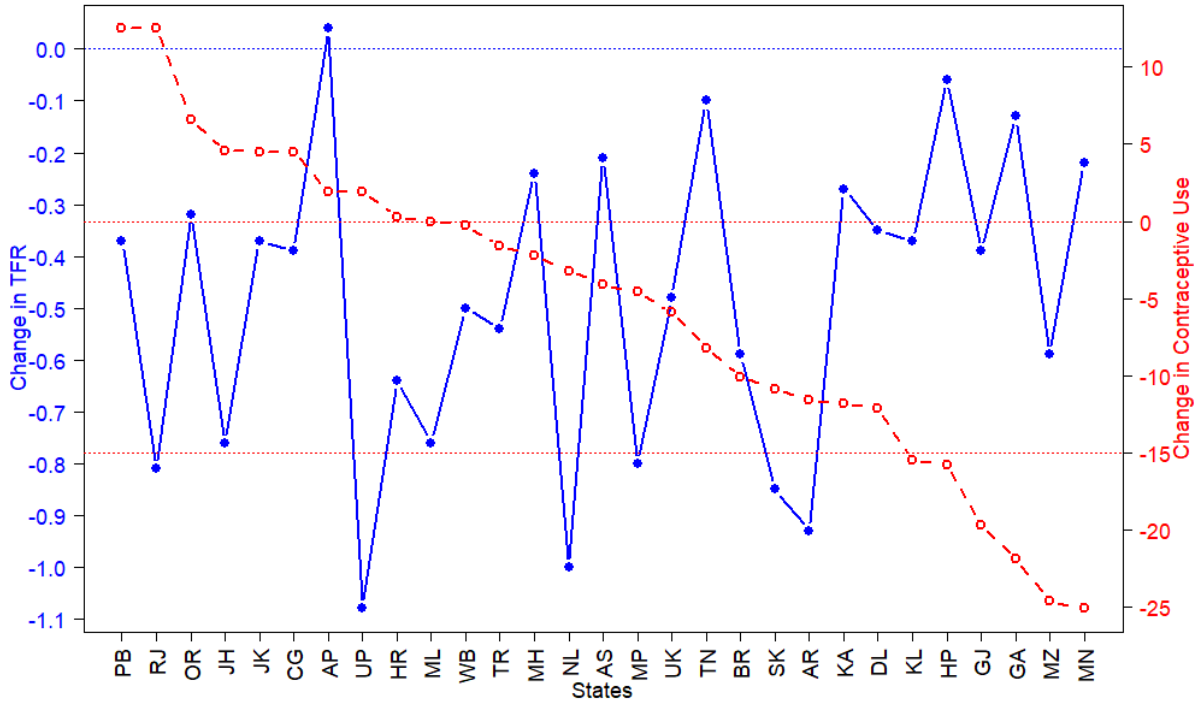

Figure 2 Change in TFR (in blue, left axis) and change in prevalence of contraceptive use (in red, right axis) between NFHS-4 (2015-16) and NFHS-3 (2005-06) across 29 states in India. States are arranged in decreasing order of change in contraceptive use. Change is defined as NFHS-4 estimates minus NFHS-3 estimates.

Gujarat, for example, documented a decline of 0.39 in its TFR, but it also shows a sharp decline in prevalence of contraceptive use (19.7 percentage points) while neighbouring Maharashtra documents TFR decline of 0.22 with only a slight decrease in proportion of women using contraception (2.2 percentage points). Rajasthan recorded substantial TFR decline of 0.81 along with proportion of women using contraception increased by 12.5 percentage points (one of the largest in the country), which makes more sense intuitively. Along with Gujarat, states like Kerala, Himachal Pradesh, Goa, Mizoram and Manipur also show more than 15 percentage points decline in contraception use in NFHS-4 relative to NFHS-3 estimates, whereas for all these states TFR has also declined during the same period. Thus, at a state level fertility decline and decrease in contraceptive use show little correlation. As a matter of fact, based on NFHS-3 state-level estimates, the correlation between TFR and contraceptive use prevalence was negative 0.82 which is only moderate during NFHS-4 (negative 0.59).

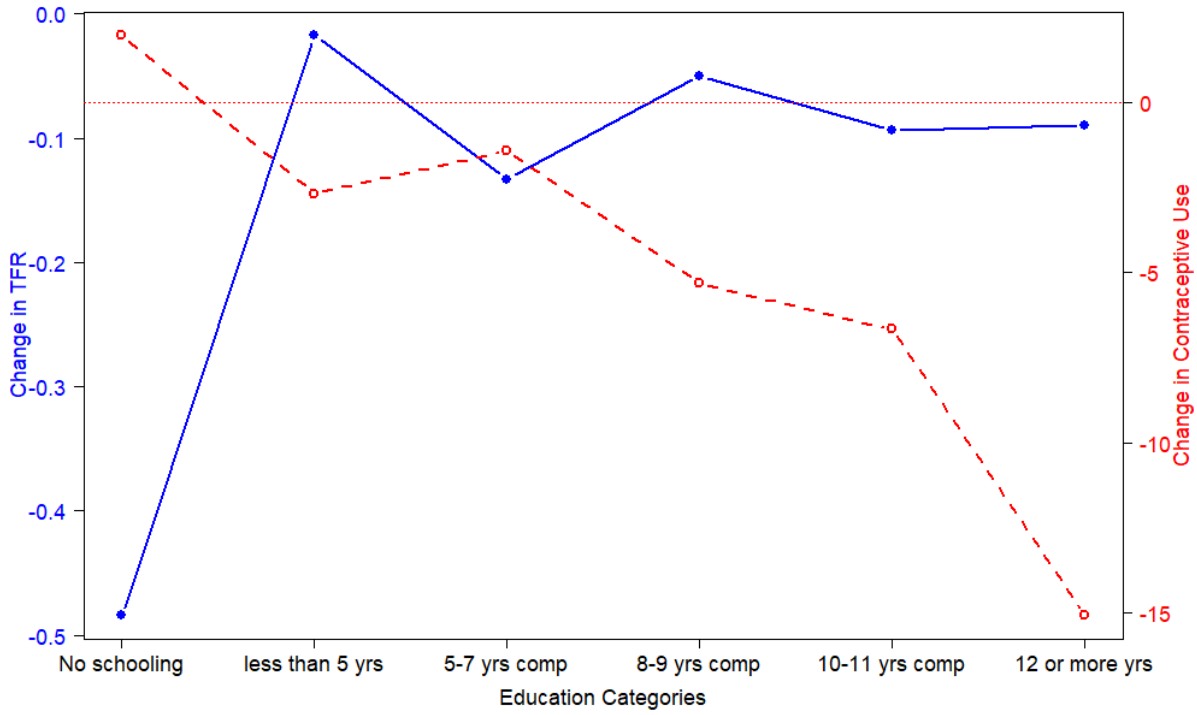

Figure 3 Change in TFR (in blue, left axis) and change in prevalence of contraceptive use (in red, right axis) between NFHS-4 (2015-16) and NFHS-3 (2005-06) across women's education categories in India. Change is defined as NFHS-4 estimates minus NFHS-3 estimates.

This puzzle is even more striking when we look at the pattern of contraceptive use by women's education. As Figure 3 indicates, between NFHS-4 and NFHS-3, TFR declined significantly for the no schooling category whereas contraceptive use has increased only marginally (slightly above the red-dotted zero line) for this category of women. For the remaining five education categories, reduction in TFR is not as drastic as for the no schooling category women, perhaps because the TFR was on the lower end to begin with. For women belonging to these five education categories, prevalence of contraceptive use has declined steadily. Interestingly, much of the decline in contraceptive use seems to have occurred among women with 12 or more years of education.

2 Possible Explanations

2.1 Structural Changes in Contraceptive Method Mix

How do we explain this anomaly? One explanation might be that the nature of contraception in India has changed with greater reliance on abortion than contraception. This explanation would be consistent with one of the most thorough studies of incidence of abortion in India conducted by a team of Indian and international researchers (Singh et al. 2018). This study found that incidence of abortion is substantial – as many as 1.56 crore

abortions in India in 2015 -- with a majority of 73% taking place outside a facility using medical abortifacients. However, the same study also found that incidence of abortion in India is on par with that in her South Asian neighbours Pakistan, Nepal and Bangladesh, neither of whom have experienced a decline in contraceptive use.

Changing method mix may be associated with changes in family dynamics through which contraception decisions are made, resulting in relatively covert use of contraception by women that they may be unwilling to reveal in semi-public interviews. Decisions about sterilization are made by the family as a whole and may be easy to disclose in similar interview setting. Use of emergency contraception, pills or condoms, on the other hand, may be hidden from the rest of the family and may not be disclosed without considerable privacy. However, there are some anomalies in data that are not consistent with this explanation. According to NFHS-4 estimates, use of female sterilization has declined by 1.3 percentage points relative to NFHS-3 estimates but use of pills and condoms has increased.

Moreover, as Figure 4 shows, the decline in contraceptive use seems to be located among women at higher parities, those with 3 and 4 or more children, with at least one son. We would expect these groups to be more likely to use sterilization rather than abortion and their reported contraceptive use is likely to be less affected by changing method mix than that of women at lower parities.

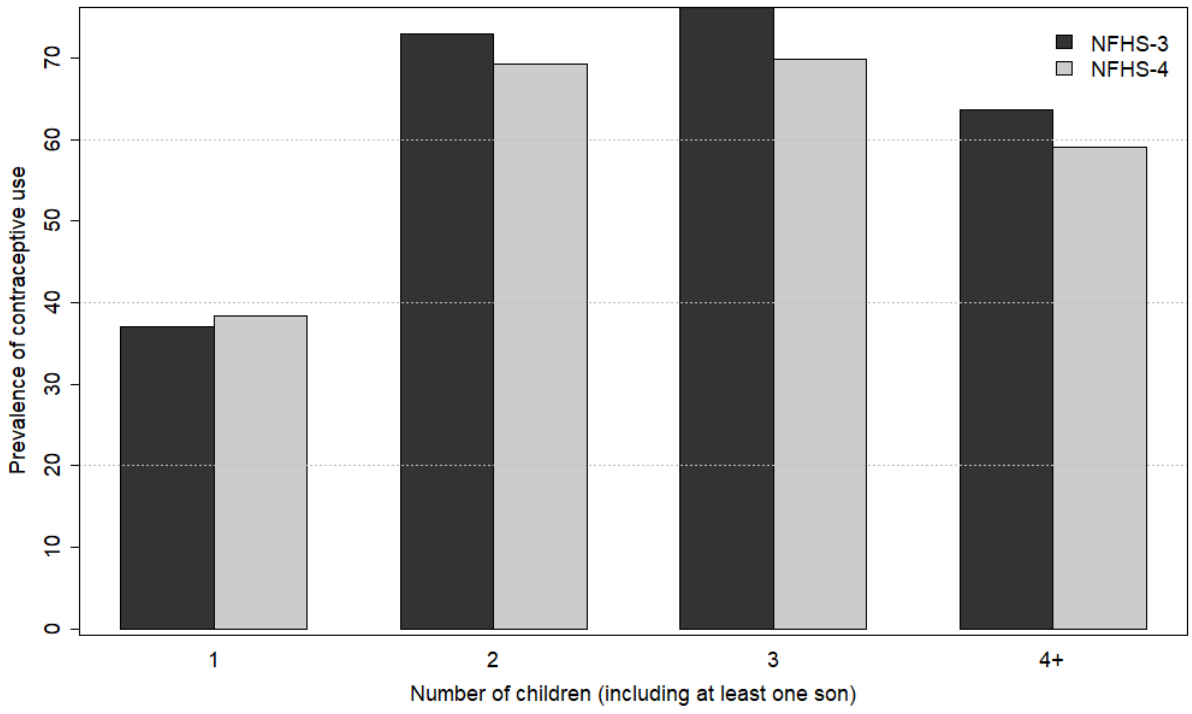

Figure 4 Percentage of married women with at least one son using contraceptive methods during NFHS-3 (2005-06) and NFHS-4 (2015-16) across parity

2.2 Data Quality Challenges

Alternatively, it is also possible that the data quality deteriorated between NFHS-3 and NFHS-4, resulting in greater measurement error in collection of contraceptive use information. The nature of the National Family Health Survey in India changed drastically between rounds 3 and 4. The following major changes are particularly relevant:

1. The mode of data collection has changed from paper and pencil interviewing to computer assisted personal interviewing (CAPI). This may have changed the type of interviewers deemed suitable for the role. A focus on computerized data entry during the interview process may have skewed interviewer recruitment towards more educated and younger candidates who may feel shy about posing questions regarding sexual behaviour and contraceptive use.
2. In order to obtain district level estimates for most of the survey indicators, the sample size was expanded from about 90,000 women to over 6,00,000 women. Moreover, the number of parameters on which information was being collected, particularly biomarkers, also expanded substantially. However, the number of data collection agencies capable of undertaking these complex surveys remains limited. As a result, tremendous supervision responsibility was placed on data collection agencies and supervisors from International Institute of Population Science (IIPS). This may have led to inadequate level of supervision and scrutiny than previous rounds of NFHS.
3. While personal supervision was augmented via 42 field check tables for completeness of reporting, age heaping and age displacement, sex ratios for children, patterns of height/length and contraceptive prevalence rates. The field check tables were based on contemporaneous tabulation of data being uploaded by the supervisors and any discrepancies were flagged and addressed. However, for variables for which no standardized data exist (e.g., contraceptive prevalence rates), field check tables may not be as useful in maintaining quality control as for variables in which discrepancies are easier to determine.

While it is not easy to distinguish between the relative importance of two potential explanations, first resting on a reluctance to reveal covert contraceptive use in semi-public interviews and the second, interviewer error and possibly inadequate supervision, we test for each of these explanations using NFHS-4 data.

3 Data

The 2015-16 National Family Health Survey (NFHS-4) is a nationally representative survey with a sample of 6,01,509 households being interviewed. In all the sample households, all women aged 15-49 were eligible to be interviewed in the survey.[2] In about 15 percent of the sampled households, all men aged 15-54 were eligible for the interview.[2]

NFHS-4 was designed to provide most of the key indicators for the country as a whole, for urban and rural areas separately, for each of the 29 states, for each of the seven union territories (UTs), for each of the 640 districts in the country at the time of the 2011 Census, and for urban and rural areas separately within districts where 30 to 70 percent of households live in urban or rural areas. Moreover, NFHS-4 was designed to provide information on sexual behaviour; HIV/AIDS knowledge, attitudes, and behaviour; and domestic violence only at the state level, while the HIV prevalence estimates for adult women and men are designed to be provided at the national level and for 11 groups of states/UTs. Details on NFHS-4 sampling design can be found elsewhere (International Institute for Population Sciences (IIPS) and ICF 2017).

Four survey questionnaires (Household Questionnaire, Woman's Questionnaire, Man's Questionnaire, and Biomarker Questionnaire) were canvassed in 17 local languages using Computer Assisted Personal Interviewing (CAPI) mode of data collection. About 14% of the sampled households was randomly selected to administer questions about gender and domestic violence against women. In accordance with the World Health Organization's guidelines (World Health Organization 2001), only one eligible woman per household was randomly selected for the module, and the module was not implemented if privacy could not be obtained. Out of total, 83,397 women selected for the domestic violence questions, for 4% women the module could not be successfully interviewed because of privacy concerns.

NFHS-4 fieldwork was conducted by 14 Field Agencies (FAs), and 7 laboratories conducted the HIV testing. Data collection was conducted in two phases (from 20 January 2015 to 4 December 2016) by 789 field teams. Each team consisted of one field supervisor, three female interviewers, one male interviewer, two health investigators, and a driver. The number of interviewing teams in each state varied according to the sample size. Female and male interviewers were assigned to interview respondents of the same sex.

[2] who are usual members of the selected households or who spent the night before the survey in the selected households

For this paper, we considered the NFHS-4 women data file which includes 6,99,686 women in the age group of 15-49. Only currently married and non-pregnant women were included in the analysis, leading to a sample of 4,67,402 women in the age group of 15-49.

4 Dependent and Independent Variable of Interest

Our key outcome of interest is contraceptive use. This is a binary variable which takes on value 1 if the women is currently using any contraceptive method; 0 otherwise. Contraceptive method includes all modern and traditional method of contraception.

The primary independent variable is whether the contraceptive use information was collected in a private interview setting. This variable is not readily available, so we used a proxy variable based on a similar variable relevant in the context of administration of domestic violence module. For 58,891 women, the domestic violence module was administered with complete privacy. We can assume that for these women, the contraceptive use interviews were carried out in greater privacy and with greater opportunity to develop rapport between interviewers and women respondents. To study the association between contraceptive use and private interview setting, we control for other covariates which are known to be associated with the outcome of interest. These includes women's age (7 categories of interval 5 years), belongs to Scheduled Tribe or not, religion (dummy variables for Muslim and Sikh), highest level of education (4 categories- no education, primary, secondary, higher secondary), total number of children (0, 1, 2, 3, 4 or more), having at least one son or not, household wealth quintile, place of residence (urban or rural), state of residence (36 states/ UTs).

Another independent variable of interest is data quality as measured by interviewer performance and adequacy of supervision while collecting information on contraceptive use. We have defined unique supervisor ID based on agency code, district code and supervisor code within a district. Similarly unique interviewer ID was defined as nested within supervisor ID.

5 Statistical Analyses

We have examined differences in current use of contraception among currently married non-pregnant women by a number of covariates (as discussed in Section 4) to explore how contraceptive use differs between different groups. To investigate the impact of interview privacy on reported contraceptive use, we fit a multivariate logistic regression

model with contraceptive use status as the dependent variable and interview privacy, as defined in Section 4, as the key exposure variable. To estimate the impact of the key exposure variable, we have adjusted for state and place of residence, and basic socioeconomic and individual characteristics including the age of the respondent, number of living children, whether she has any son, her education level, caste, religion, and household wealth quintile.

We have used multilevel techniques to partition the variation in contraceptive use between the interviewer/ supervisor levels and individual levels. We fit two separate multilevel logistic regression models with a random intercept attributable to interviewer performance (I) and adequacy of supervision level (S). The random intercept is assumed to be independently and identically distributed with variance σ_I^2 and σ_S^2, respectively. In the multilevel model, we include all other covariates from the logistic regression model as the fixed part of the regression. The variance parameter σ_I^2 quantifies heterogeneity in contraceptive use information due to interviewer performances, after taking into account geographical location effect, socioeconomic and individual characteristics of women. We express the between-interviewer variance, σ_I^2, as a percentage of its contribution to the total variance. We have assumed an underlying standard logistic distribution for the binary dependent variable at the individual level, that allowed us to fix the total variance at $\sigma_I^2 + \frac{\pi^2}{3}$ (Snijders and Bosker 1999). Similar comments apply for the supervisor level random effect model. We conduct the descriptive analyses in R v.3.1.111 and used *MLwiN* (version 2.32) for fitting the multilevel models.

6 Results

Table 1 Results from a logistic regression model based on 4,67,402 currently married women who are not pregnant at the time of the interview: NFHS-4 (2015-16)

	Odds Ratio	95% LCL	95% UCL
(Intercept)	0.05	0.05	0.06
State fixed effects (results not presented)			
Area of residence (Ref: Urban)			
Rural	0.94	0.92	0.96
Age category (ref: 15-19 years)			
20-24	0.97	0.92	1.03
25-29	1.29	1.22	1.36
30-34	1.7	1.61	1.8
35-39	1.83	1.73	1.94

40-44	1.53	1.45	1.62
45-49	1.12	1.06	1.18
Scheduled Tribe	0.8	0.78	0.81
Muslim	0.58	0.57	0.6
Sikh	1.13	1.06	1.22
Highest educational category (Ref: No education)			
Primary	1.09	1.07	1.11
Secondary	1.06	1.04	1.08
Higher Secondary or more	1.03	1	1.07
Household wealth quintile (Ref: Poorest)			
Poorer	1.32	1.3	1.35
Middle	1.54	1.5	1.57
Richer	1.61	1.57	1.65
Richest	1.74	1.69	1.79
Number of living children (Ref: no children)			
One	3.62	3.47	3.76
Two	8.94	8.58	9.32
Three	11.15	10.68	11.64
Four or more	9.51	9.09	9.94
Having at least one son	1.74	1.71	1.77
Interview privacy	1.17	1.14	1.19

Table 1 presents odds ratios and 95% confidence intervals (CI) from logistic regression with contraceptive use as the dependent variable. In the model, we have used state fixed effects in order to account for the supply side determinants of contraceptive use. This table shows that as one might expect, contraceptive use increases with age, wealth, number of children and presence of a son. It is lower in rural areas than in urban areas. Tribal women and women from Muslim community are less likely to use contraceptive. In general educated women are more likely to use contraception that uneducated women but this relationship is not consistently monotonic.

Most interesting result in this table is that women who were administered domestic violence module in a private interview setting are 1.17 times as likely to use contraception as those who were not administered the domestic violence module (either not selected or because of lack of privacy). Since selection of women for domestic violence questions was random, both segments should have similar levels of contraceptive use. The fact that domestic violence questions were administered under conditions of greater privacy, also seems to be associated with higher contraceptive use suggests that lack of privacy may be at least partially responsible for low reported contraceptive use.

Table 2 Between-interviewer (or supervisor) variances in contraceptive use: Results from a multilevel logistic regression model based on 4,67,402 currently married women who are not pregnant at the time of the interview: NFHS-4 (2015-16)

Model	Estimate of the variance component (SE)	Interviewer or supervisor level contributions to the total variances in contraceptive use
Multilevel logistic regression model 1: random effect at the level of interviewer	0.595 (0.017)	15.3%
Multilevel logistic regression model 2: random effect at the level of supervisor	0.33 (0.016)	9.1%

Table 2 reports results from the multilevel model. The results show that random coefficients for interviewers explain 15.3% of the variance in use of contraception above and beyond the differences explained by individual characteristics. If all interviewers were equally good at eliciting information and all supervisors were equally diligent in providing supervision, we should see no interviewer or supervisor effect and most of the explained variance should be associated with individual characteristics or unobserved differences between districts. However, results presented in Table 2 show that this is not the case. A substantial proportion of residual variance is explained by interviewer and supervisor effects. This suggests that some interviewers are better able to obtain information about contraceptive use than others and some supervisors ensure that their interview team is more efficient than that of others.

7 Discussion

In this paper we have examined the apparent paradox of declining fertility, measured by TFR, and declining contraceptive use as estimated by the most recent round of National Family Health Survey (NFHS-4). The pattern and trend in TFR seems to be consistent with other estimates (e.g., SRS 2016 estimates). Hence, our focus here is to understand the pattern and trend in prevalence of contraceptive use. We have documented a number of ways in which the observed decline in contraceptive use between NHFS-3 and NFHS-4 seems implausible. This observation is bolstered by the fact that Rajasthan the state in which the largest decline in contraceptive use has taken place, shows much higher contraceptive use statistics in surveys undertaken by PMA2020. Contraceptive use level in Rajasthan is 40% in

NFHS-4 while it is recorded to be 55% in PMA2020 (https://www.pma2020.org/pma2016rajasthan-r1-soi).

Results presented above show that both lack of privacy and poor quality of fieldwork and supervision may be responsible for low reports of contraceptive use. Since data on contraceptive use is vitally important to population policy, what can we learn from these observations? We would like to suggest that massive expansion of sample from about 1 lakh respondents to 6 lakh respondents imposes severe demands on survey supervision and ability to ensure privacy and may lead poor measurement of outcomes that are not easy to check. These challenges must be addressed if future large surveys, e.g. NFHS-5, are to be successful.

Moreover, we need to find innovative ways of data collection in order to improve reporting of sensitive issues like contraception use. Self-reports in the presence of an interviewer, and often other family members, are often affected by underreporting due to cultural barriers against talking about sensitive issues openly. A growing body of empirical data collected in the US shows that use of audio computer-assisted self-interviewing (ACASI) method that increases the privacy of the interview context can dramatically increase reports of sensitive and illegal behaviours (Turner et al. 1998). In a developing country setting, it was found that the majority of Zimbabwean women (86 %) preferred ACASI to interviewer mode in the context of a family planning survey. The reasons mentioned were related to increased confidentiality and privacy (Van de Wijgert et al. 2000). However, the ability to use ACASI and user preferences would depend on the level of education and technology literacy.

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