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Saswata Ghosh*

Abstract

The present study tries to explore post-sterilization regret in an underdeveloped region in the state of West Bengal, India. Although the state of West Bengal has witnessed fertility transition during the recent past and the adoption of female sterilization has increased substantially, the level of infant and child mortality remained at a high level, particularly among the marginalized. Data of 766 sterilization users belonging to 45 villages of Birbhum district of West Bengal were collected in a small-scale research study. Multivariate binary logit regressions were used to identify the socio-demographic characteristics associated with post-sterilization regret.Women who have living children of both sexes and have participated in decision making regarding sterilization were significantly less likely to report regret, while those who had an incidence of child loss, reported post-sterilization health problems,did not have informed choice before sterilization and belonging to marginalized communities were more likely to report post-sterilization regret.

Introduction

Female sterilization is still the most widely used contraceptive method in the world. Globally, out of 661 million couples of reproductive age who were using any modern contraceptive method during the last decade, 223 million were using female sterilization alone (United Nations 2009). Female sterilization is the most common method in the countries of Asia, Northern America and Latin America (ibid). Since sterilization is a permanent method of contraception which cannot easily be reversed, decision regarding sterilization should be made after

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careful thought and after having been informed about its irreversibility (Petta et al. 1995; Ramanathan and Mishra 2000). In terms of outcomes, although it was observed that most sterilization users report satisfaction with the procedure and having experienced a little or no change in their sexual activity or marital relationship, about 10% of sterilized women worldwide reported to be dissatisfied or had regret (Singh et al. 2012; Ramanathan and Mishra 2000; Gray 1996; Vieira and Ford 1996; Henshaw and Singh 1986).

During the post-Emergency era of Indian family welfare programme, contraceptive method acceptance shifted from male sterilization to female sterilization due to variety of reasons such as development of new technique (such as laparoscopy) of female sterilization; delusion and apprehension about the side effects of vasectomy (such as weakness, loss of strength and libido); and emphasis on women-centred policies and programmes (such as Reproductive and Child Health programme) (National Population Stabilization Fund 2007). It is worth noting that although method-specific contraceptive targets were abolished in 1996 and Community Need Assessment Approach was introduced (Srinivasan 1998); numerous national level surveys demonstrated the dominance of female sterilization in India's family planning programme. According to the most recent District Level Household Survey (DLHS), carried out during 2007-08, 34% of currently married women have adopted female sterilization and the percentage remained almost at the same level compared with DLHS conducted during 2002-04. However, third round of National Family Health Survey conducted during 2005-06 revealed three percentage points increase of female sterilization from 1998-99 among currently married women in India (37% during 2005-06 as against 34% during 1998-99).The survey also revealed that during 2005-06, the overall contraceptive prevalence was 56%, and out of which 66% of users reported female sterilization as their current contraceptive method.

The state of West Bengal of India, which is one of the populous states, located in the eastern part of the country. The state is one of the middle ranking states in terms of human development

indicators with large population. Like the states of southern India, West Bengal has also witnessed fertility transition in the recent past. The total fertility rate (TFR) of West Bengal was 1.7 in 2011 with rural and urban TFR were 1.9 and 1.3 respectively (RGI 2013). Like other Indian states, women of West Bengal are generally encouraged to marry early and complete childbearing soon after the marriage. Once women achieve their desired family size, they adopt sterilization soon. Thus, typically, sterilization tends to occur at an early age and median age at sterilization has been declining from 1990s (IIPS 1995; IIPS and ORC Macro 2000; IIPS and Macro International 2007). In West Bengal, the median age of sterilization was 26 in 1992-93, which declined to 24.6 in 2005-06. Säävälä (1999) argued that lower age of sterilization could be related to women's autonomy within the family – a woman who have completed childbearing becomes 'matriarch' of the family, thus reducing the mother-in-law's role in the family.

At this juncture one can argue that early age at sterilization combined with low fertility could result in post-sterilization regret. National level surveys conducted during last two decades in India have revealed that not more than 5% of sterilized women did express post-sterilization regret (Ramanathan and Mishra 2000; Singh et al. 2012). Post-sterilization regret in Brazil, which has one of the highest sterilization rates in the world, was found to be 15-20% (Schmidt et al. 2000; Nervo et al. 2000; Hillis et al.1998).

Studies have also tried to investigate differences with respect to the socio-demographic, economic and cultural characteristics of clients who have reported post-sterilization regret. These studies have found that those who adopted sterilization at an early age (Schmidt et al. 2000; Curtis et al. 2006;Jamieson 2007; Malhotra et al. 2007), had fewer number of living children, particularly only had girl children (Loaiza 1995; Schmidt et al. 2000; Kim et al. 1997; Malhotra et al. 2007) and, experienced child loss (Ramanathan and Mishra 2000; Kim et al. 1997; Machado et al. 2005; Ludermir et al. 2009) were significantly more likely to report post-sterilization regret amongst sterilization acceptors. Further, characteristics related to service delivery

such as low quality follow-up services found to be associated with higher reporting of post-sterilization regret (Ramanathan and Mishra 2000; Zavier and Nair 1998; Zavier and Padmadas 2000). Studies have also observed that women who were involved in decision making regarding their sterilization were less likely to report regret (Malhotra et al. 2007; Ludermir et al. 2009). Additionally, external pressure from clinicians was found to be associated with regret in United States (ACOG 2003).

Other reasons of regret cited in the literature include change in marital status, perceived side-effects and health changes, and contraceptive failure (Loaiza 1995; Thapa and Friedman 1998; Vieira and Ford 1996). Further, regret from the loss of fertility or perceived loss of interest in sexual relations following sterilization has also been found (Vieira and Ford 1996). Some studies have also revealed that women who did not attain higher education as well as did not participate in wage earning sector activities outside home tend to report post-sterilization regret compared to their respective counterparts (McGonigle and Huggins 1990).

It is worth noting that studies on post-sterilization regret in India are limited. Some studies were conducted on nationally representative sample surveys focussing only the role of demographic variables such as age at sterilization, year since sterilization, incidence of child loss and issues related to quality of care (for example, Singh et al. 2012; Ramanathan and Mishra 2000), while small-scale studies (for example, Zavier and Nair 1998; Malhotra et al. 2007) did not adequately focus post-sterilization regret among socially disadvantageous communities, particularly in the context of low fertility. Understanding post-sterilization regret among them is necessary, since adoption of female sterilization was found to be higher among them (IIPS and Macro International 2007). According to the third round of DLHS conducted during 2007-08 revealed that about 46% of SCs and 33% STs had adopted female sterilization against 28% of upper caste Hindu women. It is possible that being unaware of modern temporary methods and possible side-effects of sterilization or its irreversibility, they perhaps prefer sterilization and even accept it. Pradhan and Ram (2009) have

argued that due to poor quality of family planning services and lack of informed choice, female sterilization as a family planning measure in India poses questions that require pressing consideration in the broader context of individual freedom and human ethics.

Given this context, the overall objective of the present study is to examine post-sterilization regret among marginalized communities living in rural areas of an underdeveloped district in the state of West Bengal, India. It was hypothesized that those acceptors of sterilization who have both sons and daughters are less likely to report post-sterilization regret compared to those having children of single sex. Further, it was also hypothesized that any experience of child loss as well as incidence of perceived health problem after sterilization are positively associated with post-sterilization regret. Furthermore, it was hypothesized that participation in decision making regarding sterilization and informed choice before sterilization could reduce post-sterilization regret even after controlling other confounders. Lastly, it was also hypothesized that post-sterilization regret would be higher among women belonging to marginalized communities compared to forward caste Hindu.

Materials and Methods

Study Setting

Birbhum district is one of the typical backward districts of West Bengal. Although ethnically the people are proportionately heterogeneous, a large proportion of the population belongs to socially marginalized sections of the society. According to 2001 Census of India, 29.5 percent were scheduled caste, 6.7 percent were scheduled tribe and 35.1 percent were Muslim. Moreover, more than 90 percent of the population lives in the rural areas and earn their livelihood through agriculture, mining and quarrying, and related activities (Census of India 2001). A few key indicators of the study district, and the state of West Bengal, are presented in Table 1.

Table 1: Profile of the study district (Birbhum) vis-à-vis state (West Bengal)

Characteristics	Birbhum	West Bengal
Population (in '000)$	3,502	91,347
Population/KM2$	771	1029
Overall sex ratio$	956	947
Child sex ratio (0-6 years)$	952	949
% of SC to total population*	29.5	23.0
% of ST to total population*	6.7	5.5
% of Muslim to total population*	35.1	25.2
Male literacy (%)$	77.4	82.7
Female literacy (%)$	64.1	71.2
Literacy among SC (%)*	45.7	59.0
Literacy among ST (%)*	31.2	43.4
Institutional delivery (%)@	48.7	49.2
Current contraceptive use (%)@	74.8	72.7
Mothers who had at least three antenatal check-ups for the last birth (%)@	59.1	67.0
Mothers who received postnatal care within two days of delivery for their last birth (%)@	41.8	56.9

*Sources: $ Provisional population total, Census 2011; *Census 2001; @ District level household survey (DLHS)-3, 2007-08.*

Data

The data used in the present study is a part of the larger study on improving health status of women and institutional delivery of public reproductive health services in rural West Bengal, India conducted by the Institute of Development Studies Kolkata (IDSK) in collaboration with Rosa Luxemburg Stiftung, Berlin during 2012. The study was conducted in the rural settings in Birbhum district.

A multistage sampling design was adopted in selecting respondents.At the first stage, proportion of non-agricultural labourer was used as sampling stratification frame. Three blocks, namely, Saithia, Mohammed Bazar and Suri-I which have the lowest, medium and highest proportions of non-agricultural labourers according to 2001 Census were selected for the study. Since data on the family size, number of girls in a family etc. are not available at the village or even at the block level, at the second stage, 15 villages were selected by probability proportional to size (PPS) sampling from each block. A rapid houselisting exercise was conducted in each of the 45 selected villages. In order to maintain the variations in the exposure to the length of childbearing period among currently married women, the respondents were divided according to their age - 15-24 years representing younger, 25-34 years representing middle aged and 35-44 years representing older at the next stage of stratification. At the final stage, from each selected village 30 respondents, who are currently married, non-menopausal, not pregnant at the time of survey or did not deliver a baby within 6 months preceding the survey (lactational amenoria period), were selected through simple random sampling on the basis of proportional representation of their age. Thus, the targeted sample size was 1,350. Of this, finally, 1,348 currently married respondents were selected and interviewed in the study. However, the present study was confined to 766 women, who reported female sterilization as their current contraceptive method.

Data were collected between February, 2012 and April, 2012. A team comprising five investigators and one supervisor in each block (15 investigators and three supervisors in total) were sufficiently trained to collect data from each selected respondent through door-to-door visit. The supervisors were responsible for coordination and to monitor data collection activity for quality control. Necessary permission was obtained from the local administration before undertaking the study. Informed consent was obtained from the study participants before data collection and the collected individual data were kept confidential.

Sample weights were calculated in order to provide block level estimates of the various indicators. The calculation of weight combines two weights, viz., village weight i.e. inverse of selection probability of a village within a block and individual weight i.e. inverse of selection probability of an individual of a particular age-group in a particular village.

Analytical Model

To identify the predictor variables associated with post-sterilization regret, multivariate binary logit models were used. Primary outcome variable in the analyses was created from the question '*do you have any regret after sterilization*?', which was asked in the survey among sterilization acceptors and dichotomous in nature.

Predictor variables used in the multivariate binary logit models in order to test their significant association with post-sterilization regret are presented in Table 2. The variables primarily fall into six main categories: main predictor variables associated with post-sterilization regret – based on which study hypotheses were created; additional predictor variables associated with post-sterilization regret; individual level variables; socio-religious category; other household level variables, and place of residence (administrative blocks). As information on household income or expenditure was not directly asked in the survey, the wealth index has been calculated by using factor analysis and has been taken as the proxy for household economic status. The wealth index consists of the following household and economic characteristics: type of house, toilet facility, source of lightning, main fuel for cooking, source of drinking water, use of separate room for cooking, ownership of house, ownership of agricultural land, ownership of irrigated land, ownership of livestock and ownership of durable goods. On the basis of the composite score related to these characteristics, the household wealth has been divided into poorest, poorer, middle, richer and richest. Besides, caste and religion have been pooled together to form a single categorical variable and categorized as Scheduled caste Hindu, Scheduled tribe Hindu, forward caste Hindu and, Muslims/other minorities. The variable 'mass media

exposure' has been created from four variables, namely, 'reads newspaper or magazine at least once a week', 'listens to the radio at least once in a week', 'watches television at least once a week', 'visits the cinema/theatre at least one a month'. If women are exposed to any one of these, they have been classified as 'exposed to mass media of any sort'.

Table 2: Variables tested for significant association with post-sterilization regret in multivariate binary logit regression models 1-6

Model 1: **Main predictor variables associated with post-sterilization regret:** sex composition of children (only daughters, only sons, both sons and daughters); experience of child loss(no loss, 1 or more loss); involved in decision of sterilization(self/jointly with husband, only husband, others); informed about modern temporary methods (no, yes); reported self-perceived health problems after sterilization (no, yes).
Model 2: **Model 1 + additional predictor variables associated with post-sterilization regret**: age at sterilization(<20, 20-24, 25 & more); years since sterilization(<2 years, 2-5 years, >5 years); informed about inability of child bearing after sterilization (no, yes); sterilization is the first contraceptive method (no, yes); place of sterilization (public, private)
Model 3: **Model 2 + individual level variables**: parity at sterilization (<=2, >=3); educational attainment (not-literate, primary, secondary or high); working for cash (no, yes); exposure to mass media of any sort (exposed, non-exposed)
Model 4: Model 3 + socio-religious category (scheduled caste Hindu, scheduled tribe Hindu, forward caste Hindu, Muslims/other minorities)
Model 5: Model 4+ other household level control variables: type of house (nuclear, non-nuclear); wealth quintiles (poor, middle, rich)
Model 6: Model 5 + administrative blocks (Md. Bazaar, Suri 1, Sainthia)

Altogether six models were estimated. Model 1 included main predictor variables, namely, sex composition of living children, experience of child loss, participating in decision making of sterilization, whether informed about temporary modern methods before sterilization, and reported any self-perceived health problem after sterilization. This allowed a test of whether there were differences in the likelihood of reporting post-sterilization regret across these characteristics. In the similar way, Model 2 included other predictor variables which could be associated with post-sterilization regret in addition to the variables described in Model 1. Model 3 introduced individual level variables in addition to the variables mentioned in Model 1 and Model 2. Model 4 included socio-religious category to test whether women belonging to marginalized communities would report regret more compared to forward caste Hindu women. Model 5 incorporated other household level variables in addition to the variables of Model 4. Model 6, which is the final model in the analyses included place of residence (administrative blocks) variable, was tested, adding to the variables already included in the earlier models. In brief, the relations between various models are as follows:

- Model 1 – main predictor variables associated with post-sterilization regret
- Model 2 – Model 1+ additional predictor variables associated with post-sterilization regret
- Model 3 –Model 2+ individual level variables
- Model 4 – Model 3 + socio-religious category
- Model 5 – Model 4 + other household level variables, and
- Model 6 – Model 5 + administrative blocks.

Estimating the models in this way allow to test the significance of the association of main predictor variables and socio-religious category with post-sterilization regret after controlling for a wide range of other confounding factors. Moreover, this also allowed the identification of factors that reduced the significance of the variable of interest in each model, hence enabling the

identification of variables which are associated with the main predictor variables, and post-sterilization regret among women.

Data were analyzed using Stata Release 11. To obtain the basic socio-demographic characteristics of samples, descriptive statistics were produced. The differences in reporting post-sterilization regret in relation to main predictor variables were examined through bivariate analysis using Pearson's chi-square test of significance at $p<0.05$. The odd ratios produced by multivariate binary logit regression were used for interpretation. The model assumes that the effect of any of the predictor variables should be same regardless of the choice of category of the response variable. Only the significant variables with a two tailed P-value <0.05 are reported in the Table 5. Sample weights were used in every stage of analyses.

Results

Sample characteristics

The socio-demographic characteristics of the respondents are summarized in Table 3. In the study sites, more than half of the women and their husbands were more than 30 years and more than 40 years of age respectively. It may be interesting to note that although median age at marriage was found to be quite low (16 years for women and 22 years for their husbands), the mean number of children ever born was less than two. Nearly three-fourth of couples has one or two living children. It possibly implies that fertility transition has been taken place even in underdeveloped districts and among marginalized communities in West Bengal.

Table 3: Sample characteristics of surveyed respondents (N=1,348)

Characteristics	Percentage/ mean (range)	Characteristics	Percentage/ mean (range)
Respondent's age		Not-working for cash	54.8
<20	4.9	Currently working for cash	45.2
20-29	38.4	**Husband's work status**	
30+	56.7	Not-working for cash	16.9
Husband's age		Currently working for cash	83.1
<25	4.9	**Exposure to mass media of any sort**	
25-39	38.4	No/irregular	43.6
40+	56.7	Almost regular/regular	56.4
Median age at marriage among respondents (years)	16	**Mean exposure to family planning messages among respondents**	0.92 (0, 9)
Median age at marriage among husbands(years)	22	**Any inter-spousal communication regarding contraceptive use**	
Mean number of children ever born	1.99	No	8.0
Number of living children		Yes	92.0
No living children	4.7	**Type of family**	
1-2	76.7	Nuclear	63.0
3 or more	18.6	Non-nuclear	37.0
Respondent's educational attainment		**Socio-religious community**	
None	32.7	Hindu-Scheduled castes	40.2
Primary	24.6	Hindu-Scheduled tribes	16.1
Secondary	36.9	Hindu-Others	39.8
Higher	5.8	Muslims/other minorities	3.9
Husband's educational attainment		**Median distance to nearest public health facility (Km)**	2 (0,5)
None	26.5	**Availability of any grassroot level public health and family planning workers**	
Primary	17.6	No	17.8
Secondary	43.6	Yes	82.2
Higher	12.3	**Median age of first use of contraception (years)**	20
Respondent's work status		**Median age of sterilization (years)***	22

**Among sterilization users(N=766).*

It may be observed that nearly one-third of the respondents were non-literate, while one-fourth of their husbands were so. Further, more than half of the respondents were not engaged in any wage earning sector activities, while less than half of the women were exposed to mass media of any sort. To note, although mean exposure to family planning messages was very poor, inter-spousal communication regarding contraceptive use was very high. In compliance with all-India family norm a little more than six out of 10 households were nuclear. It may be noted that more than 60% of the respondents belong to marginalized communities comprising 40% SCs, 16% STs and 4% from minority community. It was also revealed that more than eight out of 10 villages do have grassroots level public health and family planning workers at the time of survey and also the median distance from nearest public health facility was just about 2 kilometres. It is important to observe that the median age of first use of contraception was low as well as the median age of sterilization.

Characteristics of sterilized women and their post-sterilization regret by selected characteristics

Characteristics of sterilized women as well as post-sterilization regret among them varied considerably across the categories of the variables of interest (Table 4). As revealed in low median age of sterilization, more than half of the sterilized women belonged to 20-24 years age group. More than 13% sterilized women experienced child loss in their life time. It is interesting to observe that among seven out of ten sterilized women, sterilization was the first method of contraception. It is quite disheartening to observe that only about 16% of sterilized women were informed about other temporary modern method before undergoing sterilization. Further, for nearly seven out of ten couples, husband decided about sterilization.

It was revealed that about 9% of women have expressed any post-sterilization regret among those who adopted sterilization as a means of contraception. It seems that sex composition of living children was very much associated with regret after sterilization. It was found that only 2.2% of women expressed their regret if they have both son and daughter, while about

15% women reported such if they either have only sons or have only daughters. Similarly, women who had lost their children were more likely to report regret compared to those who did not lose any children. Further, women who were involved in decision making regarding their sterilization were less likely to report regret. Post-sterilization regret was substantially higher among women who reported any self-perceived health problem during post-sterilization period compared to those who did not report any health problem. Post-sterilization regret was also varied significantly according to age at sterilization and year since sterilization.

Table 4: Percentage distribution of sterilized women and percentage of women reporting post-sterilization regret by selected characteristics (N=766)

Characteristics	Percentage distribution	Post-sterilization regret (%)	Characteristics	Percentage distribution	Post-sterilization regret (%)
Sex composition of living children			**Age at sterilization**		
Only daughters	13.6	15.1	<20	19.8	9.0
Only sons	27.3	15.0	20-24	52.1	9.9
Both sons and daughters	59.1	2.2	25+	28.1	5.6
Experienced child loss			**Years since sterilization**		
No loss	86.7	7.8	10+	46.9	8.1
One or more loss	13.4	14.4	5-10	27.6	8.3
Informed about modern temporary methods			<5	25.6	10.3
No	84.1	8.5	**Whether sterilization is the first method of contraception**		
Yes	15.9	10.0	No	29.9	8.6
Decision regarding sterilization			Yes	70.1	8.7
Self/jointly with husband	27.7	7.7	**Place of sterilization**		
Husband alone	69.2	8.2	Public	94.0	8.7
Others	3.1	23.7	Private	6.0	8.0
Experienced health problems after sterilization			**Socio-religious category**		
No	81.3	7.2	Upper caste Hindu (ref.)	29.0	6.1
Yes	18.7	17.1	Scheduled caste Hindu	48.7	11.7
Informed about inability of childbearing			Scheduled tribe Hindu	12.9	5.2
No	12.4	10.4	Muslims/others	9.4	10.3
Yes	87.6	8.5	**Total**	—	**8.7**

Multivariate findings

Adjusted Odd ratios (AOR) with 95% confidence interval (CI) of multivariate binary logit regressions are presented in Table 5. Women who had both living sons and daughters were significantly less likely to report sterilization regret, while women who had only living sons were more likely to report sterilization regret (AOR = 0.12, 95% CI = 0.11, 0.13 for women had both sons and daughters and AOR = 1.32, 95% CI = 1.28, 1.37 for women had only sons) compared to the women who had only daughters even after controlling a range of socio-demographic, economic, cultural and place of residence variables in model 6. Any experience of child loss was also found to be significantly associated with reporting post-sterilization regret; those women who have experienced any child loss were significantly more likely to report regret compared to those who did not experience any child loss (AOR = 1.42, 95% CI = 1.37, 1.46) even after controlling a number of confounders in the final model (model 6). To note, information regarding modern temporary methods substantially declines the odds of reporting sterilization regret consistently only after controlling individual, household and spatial characteristics in models 4, 5 and 6 (AOR = 0.82, 95% CI = 0.78, 0.85 in model 6).

Participation in the decision regarding sterilization has been found to be one of the significant predictors of post-sterilization regret among respondents in the unadjusted models as well as even after controlling the range of predictors. Among those women whose husband or other family members or relatives took final decision regarding sterilization were significantly more likely to report regret compared to those who alone or along with husbands decided about sterilization (AOR = 1.23, 95% CI=1.20, 1.27 for husband's decision and AOR = 3.39, 95% CI = 3.22, 3.56 for others' decision in model 7). Further, experience of any perceived health problem after sterilization was found to be positively and significantly associated with regret after sterilization (AOR = 3.31, 95% CI = 3.19, 3.43).

Additionally, socio-religious identity was found to be significantly related with post-sterilization regret. It was observed that sterilized women belonging to SC Hindu households or Muslim

or other minority households were significantly more likely to report regret compared to forward caste Hindu, while sterilized women from ST Hindu community were less likely to report any regret compared to the same reference category even after controlling a number of potential confounders (AOR = 2.86, 95% CI = 2.76, 2.96 for SC Hindu women; AOR = 0.72, 95% CI = 0.67, 0.76 for ST Hindu women and AOR = 4.92, 95% CI = 4.51, 5.37 for women belonging to Muslim/other minority community).

Apart from these variables, age at sterilization, years since sterilization, informed about inability regarding child bearing, place of sterilization and, whether sterilization is the first contraceptive method have significant bearing upon reporting of post-sterilization regret as found in the present analyses as shown in the Table 5. For example, while higher age of sterilization (25 or more) was significantly less likely to be associated with post-sterilization regret, lesser years since sterilization (less than five) was significantly more likely to be associated with post-sterilization regret. Similarly, those who were informed about inability

Table 5: Adjusted odds ratios (AOR) (and 95% confidence intervals) from logit regressions identifying association between post-sterilization regret and selected characteristics (N=765)

Characteristics	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Sex composition of living children						
Only daughters (ref.)	1.00	1.00	1.00	1.00	1.00	1.00
Only sons	1.24 (1.21, 1.28)***	1.30 (1.26, 1.33)***	1.32 (1.28, 1.35)***	1.27 (1.24, 1.31)***	1.24 (1.20, 1.27)***	1.32 (1.28, 1.37)***
Both sons and daughters	0.14 (0.13, 0.15)***	0.14 (0.13, 0.15)***	0.14 (0.13, 0.16)***	0.13 (0.12, 0.14)***	0.12 (0.11, 0.13)***	0.12 (0.11, 0.13)***
Experienced child loss						
No (ref.)	1.00	1.00	1.00	1.00	1.00	1.00
One or more	1.68 (1.63, 1.73)***	1.78 (1.73, 1.83)***	1.52 (1.47, 1.56)***	1.45 (1.41, 1.50)***	1.31 (1.27, 1.34)***	1.42 (1.37, 1.46)***

Contd.

Characteristics	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Informed about modern temporary methods						
No (ref.)	1.00	1.00	1.00	1.00	1.00	1.00
Yes	1.01 (0.97, 1.04)	0.90 (0.86, 0.93)***	1.06 (1.02, 1.10)*	0.93 (0.89, 0.97)***	0.76 (0.73, 0.79)***	0.82 (0.78, 0.85)***
Decision regarding sterilization						
Self/jointly with husband (ref.)	1.00	1.00	1.00	1.00	1.00	1.00
Husband	1.07 (1.04, 1.10)***	1.29 (1.26, 1.33)***	1.13 (1.09, 1.16)***	1.13 (1.09, 1.16)***	1.01 (0.98, 1.04)	1.23 (1.20, 1.27)***
Others	3.26 (3.11, 3.42)***	3.87 (3.66, 4.08)***	3.24 (3.08, 3.41)***	3.14 (3.24, 3.59)***	2.49 (2.36, 2.62)***	3.39 (3.22, 3.56)***
Experienced health problems after sterilization						
No (ref.)	1.00	1.00	1.00	1.00	1.00	1.00
Yes	2.98 (2.90, 3.07)***	3.43 (3.32, 3.54)***	3.06 (2.96, 3.16)***	3.73 (3.61, 3.86)***	3.41 (3.29, 3.54)***	3.31 (3.19, 3.43)***
Additional variables associated with post-sterilization regret						
Age at sterilization						
<20 (ref.)		1.00	1.00	1.00	1.00	1.00
20-24		0.97 (0.94, 0.99)*	1.01 (0.98, 1.04)	1.04 (1.01, 1.07)*	1.19 (1.15, 1.22)***	1.10 (1.07, 1.13)***
25+		0.46 (0.44, 0.48)***	0.50 (0.48, 0.52)***	0.56 (0.54, 0.58)***	0.53 (0.51, 0.56)***	0.47 (0.45, 0.49)***
Years since sterilization						
10+ (ref.)		1.00	1.00	1.00	1.00	1.00
5-10		1.08 (1.04, 1.11)***	1.07 (1.03, 1.10)***	1.02 (0.99, 1.05)	0.99 (0.97, 1.03)	0.96 (0.92, 99)
<5		1.34 (1.30, 1.38)***	1.35 (1.31, 1.39)***	1.48 (1.43, 1.52)***	1.24 (1.20, 1.28)***	1.34 (1.30, 1.38)***
Informed about inability regarding childbearing						
No (ref.)		1.00	1.00	1.00	1.00	1.00
Yes		0.50 (0.48, 0.52)***	0.48 (0.45 0.50)***	0.50 (0.48, 0.52)***	0.54 (0.51, 0.56)***	0.45 (0.43, 0.47)***

Characteristics	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
First contraceptive method is sterilization						
No (ref.)		1.00	1.00	1.00	1.00	1.00
Yes		0.89 (0.87, 0.91)***	0.79 (0.77, 0.81)***	0.80 (0.78, 0.82)***	0.79 (0.76, 0.81)***	0.63 (0.61, 0.65)***
Place of sterilization						
Public (ref.)		1.00	1.00	1.00	1.00	1.00
Private		0.64 (0.60, 0.69)***	0.72 (0.67, 0.78)***	0.72 (0.66, 0.78)***	0.63 (0.58, 0.68)***	0.82 (0.76, 0.89)***
Socio-religious category						
Upper caste Hindu (ref.)				1.00	1.00	1.00
Scheduled caste Hindu				1.68 (1.63, 1.73)***	2.57 (2.48, 2.65)***	2.86 (2.76, 2.96)***
Scheduled tribe Hindu				0.56 (0.53, 0.60)***	0.78 (0.74, 0.83)***	0.72 (0.67, 0.76)***
Muslims/others				2.33 (2.18, 2.50)***	3.68 (3.40, 3.99)***	4.92 (4.51, 5.37)***
Control variables						
Individual level characteristics	No	No	Yes	Yes	Yes	Yes
Other household level characteristics	No	No	No	No	Yes	Yes
Administrative blocks	No	No	No	No	No	Yes

of conceiving a baby after sterilization or whose first contraceptive method was sterilization were significantly less likely to report any post-sterilization regret. It may also be noted that women, who had undergone sterilization operation in private facilities, were less likely to report post-sterilization regret possibly indicating better quality of care and follow-up services after sterilization compared to the public facilities.

Discussion

Although a *minority* section of women reported pot-sterilization regret in India as well as other developing countries, arguably they are not *insignificant minority* from the perspectives of reproductive right and broader context of human right. The Programme of Action adopted by 184 UN member states in Cairo Conference (International Conference Population and

Development, 1994) recognizes the importance of human rights in protecting and promoting reproductive health of women. Imperative to this approach is empowering women and protecting their human rights, particularly those relevant to reproductive health. Analysis of Para 72 of Programme of Action by Cook and Fathalla 1996 (p-115) regarding reproductive health implies that "people are able to have a satisfying and safe sex life and that they have the capability to reproduce and the freedom to decide if, when and how often to do so. Implicit in this condition is the right of men and women to be informed [about] and to have access to safe, effective, affordable and acceptable methods of family planning of their choice, as well as other methods of their choice for regulation of fertility which are not against the law, and the right of access to appropriate health-care services that will enable women to go safely through pregnancy and childbirth and provide couples with the best chance of having a healthy infant". It is quite clear from the above lines that study on post-sterilization regret is essential from the family planning programme perspective in order to improve delivery of family planning and reproductive health services.

The present findings regarding the predictors of post-sterilization regret need to be interpreted in light of socio-demographic, economic and cultural context of an underdeveloped region where majority of population belong to disadvantageous sections. The study found that post-sterilization regret was independently associated with sex composition of living children, experience of child loss, participation in decision making of sterilization, self-reported ill health after sterilization and, informed choice regarding modern temporary methods even after controlling other potential confounders.

It was observed that women who had only sons had higher odds of reporting regret compared to the women who had only daughter, while the reporting of regret was substantially lower for the women who had both sons as well as daughters. It is consistent with the earlier findings in the developing country set-up (Singh et al. 2012; Gray1996; Vieira and Ford 1996; Boring et al. 1988). It is important particularly amongst

marginalized communities in the context of low fertility, where women tend to perceive that although sons may take care of their economic needs, daughters will look after them during old age and thus look for a 'balance' of sexes in children (Pallikadavath and Wilson 2005).

As found in a number of studies in both the developing and developed countries, women who had an experience of child loss were more likely to report post-sterilization regret compared to those who did not (for example, Singh et al. 2012; Ramanathan and Mishra 2000; Machado et al. 2005; ACOG 2003). The present finding is important for the following two reasons. First, fertility transition have taken place in West Bengal as a whole even in the underdeveloped districts of the state (Guilmoto and Rajan 2013). It was found that among the study respondents the mean number of children ever born was less than two. Second, recent trends of infant mortality rates indicate that decline in infant mortality have stagnated at a relatively higher level in India as well as in West Bengal (RGI 2013). Thus, very low level of fertility combined with relatively higher level of infant mortality seems to be one of the very significant contextual issues for the adoption of sterilization and post-sterilization regret in the study population. Though data regarding deaths of offspring during post-sterilization period were not collected in the survey, as Singh et al. (2012) noted some women might have experienced child loss after adoption of sterilization. Reversal operations are not offered in the Indian public family welfare system at present and are only available in the private sector facilities involving substantial cost (Singh et al. 2012), which is often unaffordable for the poor and marginalized.

If a woman had negative attitudes towards sterilization before undergoing sterilization, then it is quite possible that she could have more negative subsequent feelings about sterilization. Further, she is also likely to be more negative if her husband or some other, rather than she dominated the decision making. Confirming to the findings of Miller et al. (1991), the present study also found that poor couple communication, dominance of the decision making by the woman's husband and conflict

with her husband during decision making are risk factors for regret among women. Arguably, such regret has a potential not only to develop depression and low self-esteem among women in future but these women also tend to report self-perceived health problems compared to other sterilized women. Earlier studies in the Indian context have shown that self-reported perceived health problems during post-sterilization period has been potentially linked with post-sterilization regret (Ramanathan and Mishra 2000). The present study has also found that even after controlling for a number of confounders, self-perceived health problems have independent effect in reporting post-sterilization regret.

Informed choice of different available modern temporary contraceptive methods was found to be one of the important predictors in our study. It has been found that informed choice to women before offering sterilization has been at the minimum over the decades as various national level surveys have pointed out (IIPS 1995; IIPS and ORC Macro 2000; IIPS and macro International 2007). The latest round of NFHS, 2005-06 suggests that in India among those women who were sterilized within five years preceding the survey, only about 24% of women were informed about temporary modern methods before sterilization (IIPS and Macro International 2007). As mentioned earlier, in the present study, who adopted sterilization only a minority of respondents were informed about modern temporary methods. It is important to note that National Population Policy, 2000 as well as National Health Policy, 2002 envisaged government's commitment to the provision of expanding contraceptive method choice in order to enable people to make voluntary and informed choices through offering a basket of modern temporary methods (Santhya 2003). At the same time, centrally sponsored incentive scheme to encourage eligible men and women for undergoing sterilization has been in place since 1991. The revised scheme of 2006 suggests that women opting for tubal ligation were eligible for Rs. 600 (USD 10) and men undergoing vasectomy were eligible for Rs. 1,100 (USD 19), to compensate for wages lost during recovery (Singh et al. 2012). Furthermore, grassroot level public health and family welfare workers are also entitled

for Rs. 200 (USD 3) for vasectomy and Rs. 150 (USD 2.5) for tubal ligation for counselling, motivating and providing follow-up visits to the sterilization acceptors (Government of India 2007). Under such an incentive structure for both the acceptors as well as the motivators, there is a high possibility that, the grassroot level public health workers could lure poor couples for undergoing sterilization by not offering alternative choices. Thus, it is imperative to understand that the increase in the female sterilization rates consistently over the decades, particularly during the recent past, combined with low level of informed choice could partly be attributed to incentive schemes of the governmental agencies.

Importantly, our finding suggests that women belonging to marginalized communities, particularly from SCs and Muslim or other minorities are more likely to report regret than others. Structural discrimination against these groups takes place in the Indian social system not only in the study area but also in other parts of India. They have low literacy rate, have meagre purchasing power, poor access to basic amenities, resources and entitlements and are often employed as casual labourer (Chatterjee and Sheoran 2007). Further, it was argued that lack of agency makes rural, poor, uneducated women the most avid consumers of the modern technology of sterilization at the cost of the modern, young, urban, rich and educated women who are more likely to use modern temporary methods or natural methods of family planning (Chattopadhyay 2007; Basu 2005). Further, Chattopadhyay (2007) argued that it is '.... state's tacit and sometimes not so tacit attempts at controlling the composition of the population by permanently disabling the reproductive potential of certain undesirables – the poor, the uneducated, the rural woman' (Chattopadhyay 2007: p-5).

It was noted in many earlier studies that separation and divorce are associated with post-sterilization regret in many societies (Vieira and Ford 1996; Hillis et al. 1999; Nervo et al. 2000; Ludermir 2009). However, data collected in the present study only pertain to the currently married women. Thus, due to unavailability of data we could not examine such association. Other limitations of the study must also be acknowledged. First,

the study is based on cross-sectional data at a single point of time, which ideally does not allow determining cause-effect relationship between post-sterilization regret and its causal factors. Prospective studies among users of sterilization could be useful to determine the direction of causation. Second, we could not include male sterilization in the present analyses since number of such cases was too small to analyse. Third, it is worth to mention here that we could not differentiate child loss before and after the sterilization because of data limitations. However, it should not influence our findings because there is hardly any reason to believe that women will report regret for sterilization when any of her child died before sterilization; these women still have the opportunity to replace her dead children (Singh et al. 2012). Finally, post-sterilization regret as well as perceived health problems after sterilization could not be validated externally since these data were self-reported and were not examined clinically. However, it may be noted that estimates obtained on various socio-demographic and economic indicators (including post-sterilization regret) from this data very much resemble national level surveys. Survey teams were adequately trained and quality control measures were satisfactorily ascertained as said earlier.

Experience of post-sterilization regret by women has critical implications for quality of services provided by the Indian family welfare programme. Marginalized communities living in underdeveloped rural regions are often deprived of information, amenities and opportunities, particularly which pertain to public health and family welfare (Ghosh and Saha 2013). Grassroot level public health workers must provide quality counselling to women who are opting for sterilization, particularly regarding its irreversibility as fertility desire could vary in changing circumstances. Our study found that among those who expressed regret, only half of them reported that they did not want any more children. Also, information must be provided about its possible side-effects. Public health workers must be sensitized enough to provide information regarding other alternative modern temporary methods and should advise mix of methods, particularly to the younger couples. The providers

must discourage adoption of permanent method among those women who have history of foetal wastage and child loss and encourage the usage of safe modern temporary methods. This is imperative for the marginalized communities due to their low uptake of antenatal, delivery and post-partum care combined with high prevalence of pregnancy wastage, infant and child mortality. Our data also suggests that more than six out of ten sterilizations were performed soon after the child birth. Family planning programme planners could also consider discouraging post-partum sterilization as done in many countries since women's decision for undergoing sterilization could be influenced by the process of child birth and immediate environment in hospital settings. Further, in order to reduce post-sterilization regret incentive schemes for acceptors as well as for motivators should be reviewed. There is need for greater commitment from the Indian state to deal with ethical and moral issues arising out of the sterilization as well as post-sterilization regret, particularly among poor and marginalized.

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