

Female Infertility in India: Causes, Treatment and Fertility Impairment in High Prevalence Districts

Introduction

Infertility or the inability to produce a live birth after adequate sexual exposure without the use of contraception can affect both men and women.¹ According to the World Health Organization (WHO), most infertile couples around the world suffer from primary infertility, which means that the woman has never conceived. On the other hand, secondary infertility may occur at any time in a woman's life after the first pregnancy.² Infertility has been a neglected area of research when compared to research on fertility. In 1994, the Program of Action of the International Conference on Population and Development (ICPD) in Cairo, provided more explicit recognition of infertility as a health priority.³

Globally between 50 to 80 million couples at some point in their reproductive lives suffer from infertility problems.⁴ Infertility situation in developing countries is quite different from the situation in the developed countries.⁵ Apart from the anatomical, genetic, endocrinological, and immunological problems, a considerable proportion of women suffers from preventable problems such as sexually transmitted infections, postpartum infections, post-abortion infection, previous contraceptive complications, tubal damage, polycystic ovary syndrome (PCOS), pelvic inflammatory diseases (PIDs) etc.^{3,4,5,6,7}

It is estimated that around 13-19 million couples are expected to be infertile in India at a given point of time.⁸ Some previously unknown obstetric threats for secondary infertility like the early age of first pregnancy, a history of no prenatal care during the last pregnancy, unwanted pregnancies, and stillbirths, infections acquired during the previous delivery, and HIV and other STIs are found strongly associated with secondary infertility.^{7,8,9} It is evident that a prevalence of infertility above the level of 5% suggests preventable or treatable causes.¹⁰ Hence, the first priority should always be prevention rather than cure. The prevention is especially vital in developing countries where the majority of cases are the result of unsafe delivery or unsafe abortion and STIs.¹¹

With this backdrop, the present study has attempted to focus the current infertility situation in India and its states, and to explore the risk factors for infertility among women in the districts with high infertility prevalence in India. The study also endeavours to find out the treatment seeking behaviour of women for their infertility problem and the effect of infertility on fertility based on recent available national level data.

Methods

Data and sample

The study used the data from the third round of District Level Household and Facility Survey (DLHS-3) which had adopted a multi-stage stratified systematic sampling design.^{12,13} For the first time, a separate module was designated on infertility in this round of DLHS.¹³

The prevalence of ever had infertility (primary, secondary and current) problem was calculated for all the states and union territories (UTs) of India for the sample of 548582 currently married women (20-49 years), (excluding UTs, the sample is 532100). Furthermore, top fifteen districts ranked according to the prevalence of infertility were selected for analysis to explore other risk factors of infertility among women. Special attention was paid to these fifteen high prevalence districts and the analyses were based on 14995 currently married women (20-49 years), married for at least two years.

Variables

The indicators used in the study were divided into predictor and outcome variables. The predictor variables were mainly socioeconomic characteristics of women. Other predictor variables were symptoms of RTIs, STIs, and menstruation-related problems. The outcome variables were primarily ever experienced primary, secondary and current infertility, infertility treatment and mean children ever born (MCEB) (Table 1).

Table 1 Indicators Used for Currently Married Women (20-49years) with ≥ 2 years of Marital Duration, India, 2007-08

| Indicators | Definition | Unit of Measure | Period |
|--|---|-------------------------------------|---------------------------------|
| <i>Infertility</i> | | | |
| Ever had infertility | Ever had/have difficulty in getting pregnant | Per hundred currently married women | Entire reproductive span |
| Ever had primary infertility | Ever had/have a problem in getting pregnant for the first time | Per hundred currently married women | Entire reproductive span |
| Ever had secondary infertility | Ever had/have difficulty in conceiving for the second time (after one abortion/stillbirth/live birth) | Per hundred currently married women | Entire reproductive span |
| Currently infertility | Without children and experienced a problem in conceiving for the first time | Per hundred currently married women | Entire reproductive span |
| <i>Fertility</i> | | | |
| Mean children ever born (MCEB) | Mean number of live birth delivered by a woman or a number of children born alive to a woman | Total live birth per women | Entire reproductive span |
| <i>Reproductive morbidity</i> | | | |
| Abnormal vaginal discharge | Experienced abnormal vaginal discharge | Per hundred currently married women | Last three months of the survey |
| Any symptoms of RTIs/STIs ¹ | Reported symptoms of any RTIs/STIs | Per hundred currently married women | Last three months of the survey |
| Any menstruation problem ² | Reported symptoms of any menstrual related problems | Per hundred currently married women | Last three months of the survey |

Note: ¹Symptoms of RTIs/STIs include Itching or irritation of vulva, boils/ulcers/warts around vulva, pain in lower abdomen not related to menses, pain during urination or defecation, swelling in the groin, painful blister-like lesions in and around vagina, a low backache, pain during sexual intercourse, spotting after sexual intercourse etc.

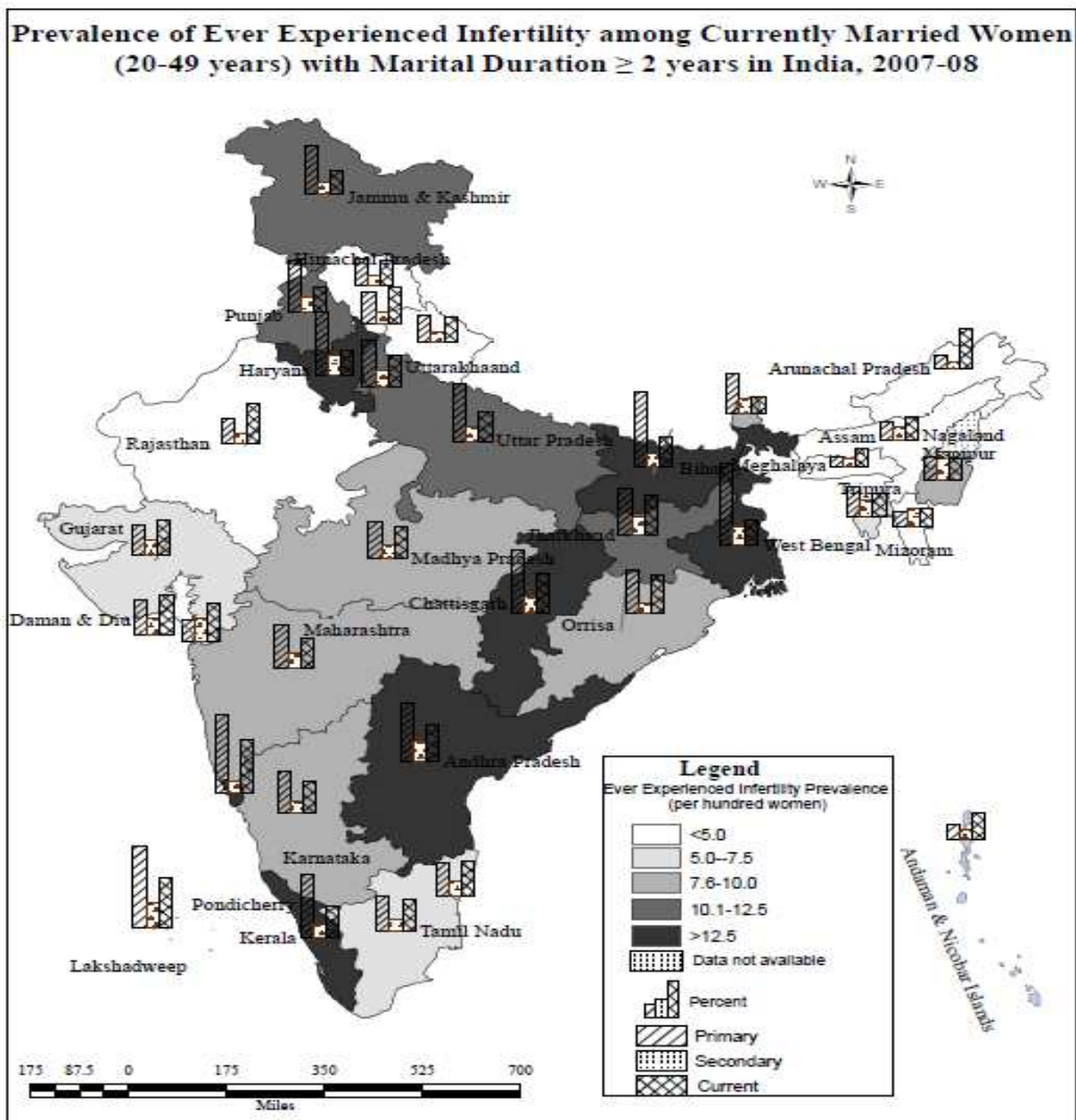
²Symptoms of any menstruation related problems include No periods, Painful periods, Frequent/short period, Frequent/short period, Prolonged bleeding, Scanty bleeding, Intermenstrual bleeding, Blood clots etc.

Statistical analyses

The study used simple bivariate and multivariate techniques to analyze the data. Chi-square (χ^2) test was used to show the significance level of the bivariate association. Logistic regression analysis was applied to show the multivariate association and to analyze the effect of selected socio-economic factors on the prevalence of ever had infertility among women. The odds ratio (i.e. OR) was used to interpret the regression coefficient. The statistical package SPSS (version 20) was used to perform all the statistical analyses.

Results

State and regional pattern of infertility in India



In India, the prevalence of infertility problem ever experienced by currently married women was 8.8%, of which 6.7% women had ever experienced primary infertility and 2.1% women had ever experienced secondary infertility. The prevalence of currently infertile women was 4.6%.

Figure 1 shows the regional concentration of the high prevalence of infertility (Eastern India), whereas in the states of the west (such as Rajasthan, Gujarat etc.), and the north (Assam, Meghalaya, Arunachal Pradesh etc.) a low prevalence of infertility was found. In the central Indian states (Madhya Pradesh, Maharashtra etc.) a moderate (7-10%) rate of infertility prevalence was observed. Among all the states, West Bengal had the highest prevalence (14.8%) of infertility ever experienced by women. In the states like Bihar, Goa, Haryana, Chhattisgarh, Kerala, Andhra Pradesh and Uttar Pradesh infertility prevalence was found above 10%.

Infertility in the districts with high prevalence

The prevalence of infertility was estimated for all the districts of India. Among all the districts, top fifteen high prevalence districts were selected for this study (Table 2). The prevalence of currently infertile women was 5%, whereas, the percentage of women who ever had experienced primary and secondary infertility was 15% and 3.1% respectively. Most of the districts with high infertility prevalence were concentrated in the eastern zone of India and were spread over the states like Bihar (5 districts), West Bengal (4 districts) and Chhattisgarh (3 districts). Among the fifteen selected districts, Banka of Bihar had the highest percentage of women who ever had infertility (22.8%) in India. Whereas, Raigarh district of Chhattisgarh from the same zone had the highest percentage of women who were currently infertile (7.8%), and had a high prevalence of ever experienced primary infertility (14.7%) among women (Table 2).

(Table 2 here)

Distribution and prevalence of infertility by background characteristics of women in the districts with high prevalence

In the selected districts, the problem of infertility was found considerably higher among women from the disadvantaged and backward communities. The prevalence of ever experienced infertility problem was found significantly higher (OR=1.19, $p<0.05$) among scheduled tribe (STs) women, than among women from other castes. Moreover, the prevalence of ever experienced infertility was found higher (about 19%) among women who had their consummation of marriage at the age below 18 years. Infertility prevalence was also found higher among rural women (about 19%) than among urban women (about 13%). Women with marital duration more than five years were more likely to experience infertility problem as compared to women with marital duration less than five years (OR=1.43, $p<0.01$). Women who were illiterate (OR=1.40, $p<0.01$) and with a lower level of education (OR=1.30, $p<0.05$) and belonged to the lowest wealth quintile (OR=1.33, $p<0.05$), were

more likely to experience infertility problem. Further, Muslim women were found significantly less likely to experience infertility problem as compared to women from other religions (Table 3 here).

{Table 3 here}

Table 2 Infertility prevalence among currently married (20-49 years) women with marital duration of ≥ 2 years in Indian states and selected high prevalence districts, 2007-08

| States/Districts | Ever experienced infertility (%) | | | Currently infertile (%) | Women (n) |
|---------------------|----------------------------------|---------|-----------|-------------------------|-----------|
| | Total | Primary | Secondary | | |
| <i>States</i> | 8.8 | 6.7 | 2.1 | 4.6 | 532100 |
| Jammu & Kashmir | 9.0 | 7.1 | 1.9 | 3.5 | 13564 |
| Himachal Pradesh | 5.2 | 3.8 | 1.3 | 3.5 | 8917 |
| Punjab | 9.5 | 7.5 | 2.0 | 3.6 | 18375 |
| Uttarakhand | 5.4 | 3.8 | 1.5 | 3.7 | 11166 |
| Haryana | 12.0 | 9.2 | 2.8 | 3.6 | 18304 |
| Rajasthan | 5.2 | 3.8 | 1.4 | 6.0 | 35701 |
| Uttar Pradesh | 10.8 | 8.5 | 2.2 | 4.6 | 74327 |
| Bihar | 13.3 | 11.3 | 2.0 | 4.6 | 39157 |
| Sikkim | 8.0 | 5.8 | 2.1 | 2.4 | 3781 |
| Arunachal Pradesh | 3.1 | 2.1 | 1.1 | 5.8 | 12666 |
| Manipur | 7.4 | 3.3 | 4.1 | 3.1 | 7922 |
| Mizoram | 5.0 | 2.4 | 2.7 | 2.8 | 6281 |
| Tripura | 6.7 | 4.3 | 2.4 | 3.1 | 3467 |
| Meghalaya | 2.6 | 1.4 | 1.0 | 2.5 | 5546 |
| Assam | 5.0 | 2.8 | 2.1 | 3.6 | 25508 |
| West Bengal | 14.8 | 12.1 | 2.6 | 3.5 | 18250 |
| Jharkhand | 9.8 | 7.1 | 2.8 | 6.0 | 23341 |
| Orissa | 7.9 | 6.4 | 1.5 | 5.7 | 24144 |
| Chhattisgarh | 11.9 | 9.5 | 2.4 | 5.8 | 15513 |
| Madhya Pradesh | 7.3 | 5.3 | 2.0 | 4.8 | 40662 |
| Gujarat | 6.7 | 4.4 | 2.3 | 5.2 | 21252 |
| Maharashtra | 8.5 | 6.4 | 2.1 | 4.4 | 28869 |
| Andhra Pradesh | 11.6 | 8.7 | 2.9 | 5.4 | 18056 |
| Karnataka | 8.0 | 6.2 | 1.8 | 4.7 | 22601 |
| Goa | 13.7 | 11.7 | 1.9 | 7.7 | 1246 |
| Kerala | 11.1 | 9.1 | 2.0 | 4.4 | 10823 |
| Tamil Nadu | 6.9 | 5.2 | 1.6 | 4.8 | 22661 |
| <i>15 Districts</i> | 18.1 | 15.0 | 3.1 | 5.0 | 14995 |
| Bihar | | | | | |
| Banka | 22.8 | 21.0 | 1.7 | 4.3 | 834 |
| Nawada | 18.7 | 16.9 | 1.8 | 5.8 | 1123 |
| Gaya | 18.1 | 15.4 | 2.6 | 4.8 | 1041 |
| Sheikhpura | 18.0 | 15.4 | 2.5 | 4.6 | 1089 |
| Purba Champaran | 17.8 | 14.2 | 3.6 | 5.6 | 1184 |
| Munger | 17.1 | 13.1 | 4.0 | 4.4 | 871 |
| West Bengal | | | | | |
| Dakshin Dinajpur | 20.8 | 16.4 | 4.4 | 3.8 | 812 |
| Maldah | 19.3 | 13.9 | 5.4 | 3.7 | 1030 |
| Purab Medinipur | 17.8 | 15.9 | 1.9 | 2.1 | 1009 |
| Paschim Medinipur | 16.9 | 14.8 | 2.2 | 2.6 | 974 |
| Chhattisgarh | | | | | |
| Koriya | 17.6 | 13.7 | 3.9 | 6.3 | 964 |
| Korba | 17.3 | 13.8 | 3.5 | 7.0 | 1015 |
| Raigarh | 16.8 | 14.7 | 2.0 | 7.8 | 950 |
| Uttar Pradesh | | | | | |
| Sitapur | 16.9 | 13.5 | 3.4 | 5.6 | 1256 |
| Andhra Pradesh | | | | | |
| Nalgonda | 16.9 | 13.9 | 3.0 | 5.3 | 843 |

Table 3 Distribution of women who are currently married (20-49 years), with marital duration of ≥ 2 years, ever had experienced infertility problem by their characteristics in the selected high prevalence districts, India, 2007-08

| Characteristics | Distribution of women ever experienced infertility | | Total Women(n) | Ever had infertility problem | |
|---|--|-------------|----------------|------------------------------|-------------|
| | Percentage | Number | | Prevalence (%) | Exp β |
| <i>Current age (years)</i> | | | | | |
| 20 to 24 [®] | 19.4 | 518 | 3100 | 17.1 | 1.00 |
| 25 to 29 | 21.2 | 567 | 3287 | 17.3 | 0.89 |
| 30 to 34 | 18.5 | 514 | 2768 | 18.3 | 0.94 |
| 35 to 39 | 16.5 | 452 | 2483 | 18.0 | 0.91 |
| 40 to 44 | 13.9 | 360 | 1935 | 19.6 | 0.92 |
| 45 to 49 | 10.5 | 280 | 1422 | 20.1 | 0.99 |
| <i>Age at consummation (years)</i> | | | | | |
| Below 18 | 67.7 | 1823 | 9515 | 19.3 | 1.07 |
| 18 and above [®] | 32.3 | 868 | 5480 | 16.0 | 1.00 |
| <i>Marital duration (years)</i> | | | | | |
| Below 5 [®] | 5.0 | 136 | 1158 | 11.9 | 1.0 |
| 5 to 9 | 17.5 | 468 | 2767 | 17.1 | 1.43** |
| 10 to 14 | 20.5 | 549 | 2964 | 18.5 | 1.61*** |
| Above 15 | 57.0 | 1538 | 8106 | 19.1 | 1.59** |
| <i>Education Level(completed years)</i> | | | | | |
| Illiterate/not educated | 63.7 | 1717 | 8510 | 20.0 | 1.40** |
| Less than 5 | 12.3 | 325 | 1785 | 18.7 | 1.30* |
| 5 to 9 | 17.1 | 466 | 3151 | 14.7 | 1.10 |
| Above 10 [®] | 6.8 | 183 | 1549 | 11.9 | 1.00 |
| <i>Residence</i> | | | | | |
| Rural | 90.4 | 2421 | 12994 | 18.8 | 1.16 |
| Urban [®] | 9.6 | 270 | 2001 | 13.2 | 1.00 |
| <i>Religion</i> | | | | | |
| Hindu [®] | 89.9 | 2439 | 13400 | 18.3 | 1.00 |
| Muslim | 9.5 | 236 | 1509 | 16.2 | 0.81* |
| Others | 0.6 | 16 | 86 | 19.3 | 1.11 |
| <i>Caste</i> | | | | | |
| Scheduled Caste | 21.8 | 595 | 3350 | 17.9 | 0.88 |
| Scheduled Tribe | 14.3 | 390 | 1731 | 22.9 | 1.19* |
| Other Backward Classes | 40.9 | 1110 | 6177 | 17.8 | 0.97 |
| Other [®] | 23.0 | 596 | 3737 | 16.6 | 1.00 |
| <i>Wealth index</i> | | | | | |
| Poorest | 34.2 | 928 | 4450 | 21.0 | 1.33* |
| Second | 29.6 | 793 | 4257 | 18.8 | 1.21 |
| Middle | 19.5 | 522 | 2934 | 17.9 | 1.23 |
| Fourth | 11.2 | 287 | 2028 | 15.0 | 1.02 |
| Richest [®] | 5.5 | 161 | 1326 | 11.3 | 1.00 |
| Total | 100.0 | 2691 | 14995 | 18.1 | |

Note: [®] Reference category, Significance level: ***p<0.001; **p<0.01, *p<0.05

Causes of infertility in the districts with high prevalence

Symptoms of STIs/RTIs

The prevalence of abnormal vaginal discharge among all currently married women was 15.6%, but the percentage was much higher for women who ever had primary infertility (17%) and secondary

infertility (18%). The symptoms of itching or irritation over vulva was higher among women who ever had infertility, ever had primary and secondary infertility (above 7%), and among currently infertile women (6%) as compared to all women (5.6%). Among currently infertile women, spotting after sexual intercourse (0.9%) was observed slightly higher than among other women. A considerable percentage of women (above 14%) who ever had an infertility problem, experienced symptoms of a low backache. Percentage of women experienced a low backache was seen lower among all women (12.5%) as compared to women with ever experienced infertility problem (Table 4).

(Table 4 here)

Table 4 Percentage of women, currently married (20-49 years) and with marital duration of ≥ 2 years, who reported of experiencing any of the symptoms of RTI/STIs, and any menstruation related problem and specific symptoms in the last three months prior to the survey among all women, women ever had infertility, ever had primary infertility, ever had secondary infertility and currently infertile in the selected districts, India, 2007-08

| <i>Symptoms/Problems</i> | <i>All women</i> | <i>Ever had infertility</i> | <i>Ever had primary infertility</i> | <i>Ever had secondary infertility</i> | <i>Currently infertile</i> |
|---|------------------|-----------------------------|-------------------------------------|---------------------------------------|----------------------------|
| <i>RTI/STIs</i> | | | | | |
| Abnormal vaginal discharge | 15.6 | 17.3 | 17.1 | 18.4 | 12.9 |
| Itching or irritation of vulva | 5.6 | 7.4 | 7.5 | 7.1 | 6.0 |
| Boils/ulcers/warts around vulva | 1.6 | 2.3 | 2.5 | 1.0 | 2.1 |
| Pain in lower abdomen not related to menses | 6.8 | 8.7 | 8.4 | 10.3 | 7.9 |
| Pain during urination or defecation | 4.0 | 5.5 | 5.3 | 6.4 | 4.6 |
| Swelling in the groin | 0.9 | 1.0 | 1.0 | 1.0 | 0.9 |
| Painful blister-like lesions in and around vagina | 0.4 | 0.4 | 0.5 | 0.2 | 0.0 |
| Low backache | 12.5 | 14.2 | 14.0 | 15.4 | 9.1 |
| Pain during sexual intercourse | 2.9 | 4.3 | 4.0 | 6.2 | 5.0 |
| Spotting after sexual intercourse | 0.3 | 0.4 | 0.4 | 0.3 | 0.9 |
| All women | 14995 | 2688 | 2245 | 443 | 745 |
| <i>Menstruation-Related</i> | | | | | |
| Any menstruation problems during last 3 months | 23.6 | 34.5 | 33.3 | 40.3 | 42.6 |
| No periods | 1.4 | 2.6 | 2.5 | 3.0 | 3.2 |
| Painful periods | 12.2 | 18.0 | 18.0 | 17.8 | 27.1 |
| Frequent/short period | 1.9 | 2.7 | 2.8 | 1.9 | 3.4 |
| Irregular period | 7.0 | 11.1 | 10.7 | 13.3 | 13.9 |
| Prolonged bleeding | 1.9 | 1.9 | 1.8 | 2.3 | 0.8 |
| Scanty bleeding | 6.4 | 10.5 | 9.8 | 13.6 | 12.0 |
| Intermenstrual bleeding | 1.2 | 1.7 | 1.6 | 2.3 | 1.4 |
| Blood clots | 4.0 | 6.1 | 5.3 | 10.1 | 7.1 |
| Women ¹ | 10749 | 1993 | 1664 | 329 | 565 |

Note: ¹Excludes pregnant, in amenorrhea, in menopause, had hysterectomy and never menstruated women

Symptoms of menstruation problems

About 35% women had experienced any menstruation related problems among women who ever had infertility in their entire reproductive span, whereas, for all women (23.6%), secondary infertile women (40.3%) and currently infertile women (43%) the prevalence was much higher. The symptoms of painful periods were seen considerably high (about 18%) among women who ever had an infertility problem. Percentage of women experienced painful periods was almost double among currently infertile women (27.1%) as compared to all women (12.2%). About 14% women, ever experienced secondary infertility and currently infertile, had an irregular period in last three months. The percentage of women experienced scanty bleeding was about 14% and 12% among women who had ever experienced secondary infertility and who were currently infertile respectively. The symptoms of blood clots were also found higher among women who ever had secondary infertility (10.1%) and among currently infertile women (7.1%) as compared to all women (4%). About 3% currently infertile women experienced no periods, whereas the prevalence was almost half among all women (1.4%).

Hence, findings show that the prevalence of any reproductive tract infections (RTIs), any sexually transmitted infections (STIs), and any menstrual problems was much higher among women who ever had infertility problem than among all women.

Infertility treatment and impact on fertility in the districts with high prevalence

The study shows that in the states like Bihar and Uttar Pradesh, MCEB was higher among all women (more than one) than the MCEB among women who ever had an infertility problem; although the percentage of women received, infertility treatment was above 80% in these states. On the contrary, in the selected districts of Chhattisgarh and Andhra Pradesh, the percentage of women sought treatment for infertility problem was below 70% and the performance of few districts, such as Korba (52.6%) and Koryia (55.9%) of Chhattisgarh (60.6%) and Gaya (78.1%) of Bihar (80.9%) in respect of treatment seeking for infertility was below the state level. Hence, in these districts, the MCEB among women who experienced infertility problem was considerably lower than the MCEB among all women (Table 5).

(Table 5 here)

Table 5 Treatment received for infertility problem and mean children ever born (CEB) among (20-49 years) currently married women with marital duration of ≥ 2 years in the selected high infertility prevalence districts and respective states, India, 2007-08

| States | Districts | Treatment received | | Women ever had infertility problem | | All women | |
|----------------|------------|------------------------------------|-----------|------------------------------------|-----------|-----------|-----------|
| | | Women ever experienced infertility | Women (n) | Mean CEB | Women (n) | Mean CEB | Women (n) |
| Uttar Pradesh | | 84.6 | 8022 | 2.48 | 8026 | 3.95 | 74327 |
| | Sitapur | 90.6 | 212 | 2.29 | 212 | 3.99 | 1256 |
| Bihar | | 80.9 | 5209 | 2.64 | 5209 | 3.82 | 39157 |
| | Purba | 82.5 | 215 | 2.71 | 215 | 3.80 | 1184 |
| | Champanan | 84.2 | 190 | 2.84 | 190 | 3.84 | 834 |
| | Banka | 91.3 | 146 | 2.78 | 146 | 3.71 | 871 |
| | Munger | 86.5 | 191 | 2.77 | 191 | 3.86 | 1089 |
| | Sheikhpura | 78.1 | 186 | 2.43 | 186 | 3.73 | 1041 |
| | Gaya | 82.4 | 217 | 2.88 | 217 | 3.65 | 1123 |
| West Bengal | | 82.2 | 2689 | 2.14 | 2689 | 2.71 | 18250 |
| | Nawada | 91.7 | 168 | 2.29 | 168 | 2.63 | 812 |
| | Dakshin | 85.6 | 198 | 2.25 | 198 | 3.16 | 1030 |
| | Dinajpur | 90.4 | 161 | 2.20 | 161 | 2.54 | 974 |
| | Maldah | 92.2 | 175 | 2.48 | 175 | 2.60 | 1009 |
| | Paschim | 60.6 | 1846 | 1.78 | 1846 | 3.16 | 15513 |
| | Medinipur | 55.9 | 170 | 2.08 | 170 | 3.10 | 964 |
| | Purab | 69.0 | 154 | 1.89 | 154 | 2.72 | 950 |
| | Medinipur | 52.6 | 176 | 2.13 | 176 | 3.13 | 1015 |
| Chhattisgarh | | 61.9 | 2075 | 1.62 | 2082 | 2.51 | 18056 |
| | Koriya | 62.1 | 129 | 2.07 | 129 | 2.68 | 843 |
| Andhra Pradesh | | | | | | | |
| | Nalgonda | | | | | | |

Discussion

Main findings of this study

In India, the prevalence of current infertility and infertility ever experienced by women is high particularly in the few states that are located in the Eastern zone. Moreover, all the high infertility prevalence districts belong to the four Eastern States (namely Uttar Pradesh, Bihar, West Bengal and Chhattisgarh). Hence, the regional concentration of infertility is unambiguous. There are few districts, like Korba and Raigarh of Chhattisgarh, where the prevalence of ever experienced primary infertility and current infertility is more than 7%, which indicates high demand for infertility care and reproductive health services. Further, districts (such as Purab Medinipur and Paschim Medinipur of West Bengal) with a high prevalence of ever experienced infertility (above 16%) and low prevalence of current infertility (below 3%) indicate utilization of infertility care i.e. women of these districts were successful in conceiving and undergone treatment or any curative mechanisms.

Further, menstruation related problems are found much more severe among women currently experiencing infertility and among women who ever had experienced infertility problem as compared to menstruation problem experienced by all women in the focused districts. It is evident that symptoms of the menstrual disorder (such as excessive and clotted bleeding, irregular, infrequent and absence of menstrual bleeding, abdominal cramp etc.) are the indication of some gynecological morbidities, such as endometriosis, PCOS etc. which are also the risk factors for infertility.^{14,15} If the pathogenesis of these morbidities is known through early diagnosis, the risk of infertility can be avoided. Besides, a higher prevalence of abnormal vaginal discharge and other symptoms of STIs and RTIs is found among women who experienced infertility.^{13,16}

Infertility has a long-term effect on fertility.¹⁷ The high infertility rate in a population has a dampening effect on fertility and the rate of population growth.¹⁸ Similarly, the findings show that even in the high fertility state like Uttar Pradesh, fertility is less among women who experienced a problem in conceiving. In the selected districts where women received less treatment (below 70%) for their infertility problem, also have low MCEB as compared to women from the districts receiving infertility treatment more than 80%. Hence, it shows, apart from the fertility control measures, infertility problem among women and their treatment seeking behaviour can affect the fertility performance of women (i.e. MCEB).

What is already known on this topic

Maternal health starts with quality reproductive health care that includes pre-conception fertility care.¹⁹ Further, one of the targets of United Nation's 'Sustainable Development Goals' (SDG-3) is to ensure universal access to sexual and reproductive health care services by 2030.²⁰ In India, a country with a large population, government policies, and programs prioritize fertility control rather than infertility management. The demand for infertility medical services varies mostly by women's socioeconomic background in India.¹² Since disparities in access to treatment may lead to additional disparities in health and quality of life, it is, therefore, necessary to assess the overall impact of infertility in less-privileged groups.¹⁰ Although, owing to its very high cost and low success rate, curative treatment of infertility is inaccessible for most of the couples in India.^{8,11}

In Bihar and Chhattisgarh, more than 30% of the villages are located ten kilometers away from the public health centers and the existing health infrastructure does not meet the demand of the reproductive health services of women in these villages.¹³ Further, the WHO has recommended that infertility should be considered as a global health problem and expressed the need for assisted reproductive technology (ART) to be adapted in low-resource countries.²¹

What does this study add

In India, few districts are underperforming in respect of treatment received by women who experienced infertility. Poor infrastructure and inadequate health care services at the district level might be the main hindrance to providing proper reproductive health care to women, even after diagnosed with an infertility problem. Though India has made a commitment to comprehensive reproductive health service delivery, the lack of preventive and curative care for infertility has not been addressed much. Hence, state reproductive and child health care program can embrace the awareness and prevention of RTIs and STIs, to reduce the prevalence of secondary infertility in the high prevalence districts.

Focus on basic hygiene practices, low-cost preventive and curative advice and treatment of infertility also need to be integrated into National Health Mission (NHM).²² Early diagnosis, medical counseling and advice, and treatment can also be helpful to those women who have any symptoms of RTIs, STIs, and menstrual disorder. The role of the public sector in infertility management is extremely limited. Therefore, a public-private collaboration to increase funding options needs to be implemented.

Conclusions

The prevalence of infertility largely varies across the states and districts in India. In the selected districts, the problem of infertility is more common among women from the disadvantaged socio-economic background. The state authority can take an appropriate strategy to target the districts which are performing below the state level, to spread awareness and to provide reproductive health care services, especially to its underprivileged population. Moreover, proper monitoring, evaluation, and improvement of the existing maternal and reproductive health services at the district level should be prioritized to reduce the prevalence of secondary infertility.

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