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Infertility Levels and its Age Pattern for Kerala, India: Analysis of Census of India, 2011 Data

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Abstract: Kerala has a below-replacement level fertility with a TFR of 1.8 in 2019-21. This consistent decline in fertility calls attention to the need for prevention and treatment for infertility. We therefore estimate the levels of infertility across the districts of Kerala using the Census of India 2011 and establish the level of fertility that may need to be bridged between the ages 30-34 and 45-49 using an index of infertility to demonstrate this potential demand.

Infertility was estimated for the 14 districts of Kerala using the expected proportion of women with TFR=0 applying the discrete analogue of the non-homogenous poisson process described by Pandey and Suchindran. Three estimates were computed using ASFR, ASMFR and proportion of women with '0' parity at age 45-49. The index of infertility captured the potential for reduction (or increase) in infertility below (or above) what is expected between the age groups 30-34 and 45-49.

Kerala's expected level of infertility was 6.1 percent among ever married women in 2011.There was just 30 percent reduction in infertility from what was expected, indicating that intervention aided reduction does not cover the whole. There is a potential demand for services to reduce infertility across the state.

Key words: Age specific fertility rates, Age specific marital fertility rates, Census of India 2011, Index for infertility, Infertility, Kerala

Introduction

Kerala, a southern state in India, had achieved replacement level fertility in the late 1980s and since then its Total Fertility Rate (TFR)has shown a steady decline. Currently the state is experiencing below -replacement level fertility with a TFR of 1.8 in 2019-21 (IIPS & ICF, 2020). The decline in TFR in Kerala has been attributed to the structural changes in the political economy and the improved investments in social sector and health. Particularly, improved education of women has helped in raising the age at marriage which helped in improved health care for children. The improved health care for children in turn has contributed to the increase in the number of surviving children, thereby making the couples adopt family planning methods. Although these are the possible reasons, the decline happened without the required conditions for demographic transition (Nair, 2010). The decline in TFR is reflected in the age-specific fertility decline with the largest decline in the ages above 35 years in the recent years, which has been attributed to the use of family planning measures (George, 2010). As a consequence of delayed childbearing, the fertility levels are affected due to biological reasons (Nargund, 2009) and this is reflected in the Age Specific Fertility Rates (ASFR). However, the improvements in contraceptive use and technologies for addressing infertility have also influenced the fertility regime.

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Kerala also has one of the best health care systems in the country (NITI Aayog, 2021), with a significant private sector participation in health care delivery including reproductive health care in Kerala (Kutty, 2000). From1983-93, Kerala had around 13% increase in the beds in the public sector whereas the growth was about 170 percent in the private sector(Baru,2006). The growth in the private sector for health care in general during the two decades following the initial introduction has been phenomenal. While the public sector grew at fairly low rates during the 1973-99 period, the private sector growth was 270 percent of what it started out as (Baru,2006). There is stagnation in the public health infrastructure in the state with negligible changes from 2013-14 to 2019, across all districts of Kerala. The average number of beds per unit in the public sector has also stagnated, indicating that no form of augmentation at least in the number of beds happened over this period(Directorate of Health Services, 2014;Directorate of Health Services, 2017-18;Kerala State Planning Board, 2019). The number of private sector units listed for the year 2016 is almost 10 times the number of facilities available in the public sector in the period 2019(Department of Economics and Statistics, 2017). This growth actually could have been in response to the demand for services which the public sector could not cope with. We see the relatively higher level of use of private hospitals in the state for ambulatory care when compared to the rest of India. This pattern repeats itself for hospitalised care but much more strongly as Kerala seems to prefer private hospitals and that too for special services within it (NSS, 2016; NSS, 2020).

The increase in the number of private sector units is reflected in the utilisation pattern for reproductive health services. There is near universal institutional delivery in Kerala, with a reported 38.4 percent in the public sector and 61.4 percent in the private sector in 2015-16(International Institute for Population Sciences (IIPS) and ICF, 2018). The deliveries in public sector reduced to 34.1 percent in public sector and increased to 65.1 percent in 2019-20 period in Kerala (International Institute for Population Sciences (IIPS) and ICF, 2018). Private sector conducted more than twice the number of deliveries compared to the public sector between 2010-2017 in Kerala (Department of Economics and Statistics, 2019). This points to the fact that reproductive health care service delivery happens in a highly medicalised context in the state and many of these services, specifically reproductive health care is most often sought in the private sector rather than the public sector. This means that infertility treatment which is a specialised care is largely offered via private sector in Kerala. This will limit the affordability of infertility care for many couples in the State.

With the declining TFR and the shifting of age-specific fertility, there is an urgent need to shift our attention to other important sexual and reproductive matters like infertility, especially initiatives for prevention and treatment of infertility. The need for infertility services will be increasing in the future and absence of public sector interventions for the management of infertility will leave a large majority with limited or no access to care (Ramanathan &Thomas, 2021). In order to bring infertility into the policy agenda, there is a need to understand the nature and magnitude of the problem. For the State to intervene in provisioning of affordable care for infertility, there is need to demonstrate the demand for such services in the State. Also, it is important to understand how much of this demand is met by the supply side. Infertility is usually measured as the extent of childlessness among those who can no longer reproduce. This is because the status of those who have reached the end of their reproductive period cannot change and therefore the measure of infertility is robust. This might yield accurate measures of infertility, but from a public policy perspective it provides little guidance on how much of provisioning for external interference through medical means may be needed to address this reproductive health issue. This need is shaped by the existing technology, its affordability and the propensity to intervene in any population. Determining this is a public health goal, this analysis aims to do this using published data on age and fertility from the Census of India, 2011. It is also more robust, given the recent changes in marriage patterns. An actual cohort experience will be more meaningful in this context, but due to limitations an artificial cohort using census data-based measure from the children ever born data will yield more 'real' estimates of infertility. But a measure of infertility that is only cohort measure using the census data may not capture the changes with regard to the changes happening via medical interferences. Gauging the impact of shifting fertility regimes means that the estimate of infertility should capture the period effects as much as it should reflect cohort experiences.

Therefore, this study aims to estimate levels of infertility and analyse its age patterns for Kerala and its districts and to construct an index for infertility to compare the level of infertility that is bridged between the ages 30-34 and 45-49 years using the Census of India 2011 data. The ages 30 and above have been selected as they represent the potential ages when infertility care is likely to be sought by couples.

Materials and Methods

To estimate levels of infertility and examine the age patterns for Kerala and its districts, data on children ever born among ever married women (Fertility Table-F3) and births during the past one year among currently married women by birth order (Fertility Table-F9) from the Census of India, 2011 Fertility Series have been used (Census of India: F-Series: Fertility Tables 2011).

Measuring infertility

Measuring infertility is rendered difficult due to the fact that it can be caused by fertility impairments in either of the partners of a heterosexual relationship or could be a consequence even without such impairments. The dataset being used for this infertility estimation considers the outcome of such impairment either in the male or the female partner, measured using women's reports of their child bearing during their lifetime or during the past one year. Therefore, throughout the analysis, the expression 'infertility in ever married women' is not meant to reflect exclusive fertility impairment in ever married women alone, but the consequences of fertility impairments the couple experiences.

Infertility has been estimated using the formulation suggested by Pandey and Suchindran (1987) for estimation of reproductive events where infertility is described as a Poisson process for a given fertility schedule indicated by the TFR 'λ' and birth orders indicated by 'k'. This essentially gives the expected number of women with birth order '0' per 1000 women in a particular age group given the age schedule of fertility represented by the current TFR.

Let X be the number of events in a given interval, and if 'λ' is the mean number of events per interval. Then the probability of observing k events in a given interval is given by;

$$\mathrm{P(X{=}k)} = \frac{e^{-\lambda} \cdot \lambda^k}{k!}$$

where k= 0,1,2,3, 4,… and λ=TFR,

In estimating the levels of infertility k=0, and therefore the probability of observing the events in a given interval is:

$$\mathrm{P(X{=}k)} = e^{-\lambda}, \qquad \text{------------------------------(1)}$$

Infertility estimation was done using three different measures for the 14 districts of Kerala. Estimate 1 is based on age specific fertility rate, estimate 2on age specific marital fertility rates and estimate 3, calculated using '0' parity women in the age group 45-49 years. Estimates 1 and 2 are indirect measures of infertility whereas estimate 3 is a direct measure of infertility.

Indirect estimate of infertility based on age specific fertility rates (ASFR) and modified age specific marital fertility rates (ASMFR): Estimate 1 uses the period based TFR measure for all women irrespective of their marital status. The total number of women and total number of births for last one year was used to compute the Age Specific Fertility Rates (ASFRs) and from this TFR was computed. This was then used to estimate the expected level of infertility using formula (1).

In estimate 2, for computation of expected levels of infertility, total ever married women and total births for past one year was used. Here we have taken ever married women and not currently married women to make it comparable with estimate three which has the same denominator. For this age specific (marital) fertility was computed and the levels of infertility were estimated using the formula (1).

Direct measure of infertility using '0'parity of women in the age group 45-49 years: The expected level of infertility was estimated by dividing the total number of women with '0' parity in the age group 45-49 years by total number of ever married women in the age group 45-49 years.

Examining age patterns of infertility

The age patterns of infertility were examined using the cohort-based measure of Children Ever Born (CEB) by age of ever married women and the period-based measure of Cumulative Fertility Rates (CFR) by age for ever married women. Here, ever married women was used as the denominator to compute the CFR based estimate and not currently married women. This was done so as to enable the comparison across CEB and CFR measures. The CFR measure which uses birth in the past one year based on currently married women gave very small estimates of expected levels of infertility and thus comparison was difficult.

CEB based estimate was used to describe the variations across the different age cohorts. The CEB measure would accommodate multiple regimes of fertility and mortality within itself. We have included mortality of children as a factor affecting CEB, on the assumption that sometimes CEB levels can exclude those children born but died subsequently and this then, affected the reported fertility of women. The total children ever born in an age group divide by total ever married women in that age group was computed to give the average children ever born for that age group and this was used to get the expected infertility estimate using the formula (1). This gave the age pattern of infertility using the cohort based CEB measure.

The CFR is a synthetic cohort constructed using births during the past one year. Therefore, it represents the period experience of fertility. The CFR based estimate helps to describe the current age pattern and the likely changes in it. Using the F-9 table of census 2011 on number of women and ever married women by present age, number of births last year by sex and birth order, CFR based estimate was computed.

The Age specific marital fertility rate (ASMFR) was computed by dividing total births for last one year by the total ever married women instead of currently married women as is the convention to render comparisons with the CEB based measure. From this, the cumulative martial fertility rate was computed and this was multiplied by five in age group to get the cumulative fertility rate.

$$\mathrm{CFR(x)}=\int_a^x m(a)da$$

where m(a) is the age specific fertility rate at age 'a'

The probability of not having birth before age x is given by $e^{-\int_a^x m(a)da}$.

Thus, the infertility level for each age group is given by the formula $e^{-\mathrm{CFR}}$.

Indexing infertility rates

By examining the ASFR, it was found that close to 90 percent (87%) of the TFR is achieved by 30-34 years. There is very limited scope for extension of TFR after this age. Therefore, this age group (30-34) was used to index the infertility levels. By indexing using the ASMFRs (2nd estimate), the potential for change in infertility status by age and age cohorts is explained. For the purposes of indexing the CFR based measure was preferred as it is a synthetic cohort depicting the cumulative fertility experience at the current point of time.

The index of infertility is given by the formula;

$$\text{Index} = \frac{[\text{Inf(30-34 years)-Inf(45-49years)}]}{\text{Inf(45-49 years)}}$$

where 'Inf' is the expected level of infertility for the age group within the parenthesis.

As we were looking for intervention aided reductions, if we assume that there is very limited scope for natural fertility-based extension after 34 years (and 90% of TFR is achieved by this age); one can assume that decrements in infertility are a consequence of interventions. As this is an attempt to capture the potential need for these interventions; this form of indexing (against infertility at or up to age 45-49 years) was preferred. What the index represents is the potential for reduction (or increase) in infertility below (or above) what is expected at age 45-49 years; that occurred between ages 35-49 years.

Results

The results of the analysis is presented here. Firstly, the findings of the direct and indirect estimates of infertility is given which is followed by the age patterns of the infertility. Lastly, the index of infertility based on Cumulative Fertility Rate (CFR) is presented.

Indirect estimate of infertility based on Age Specific Fertility Rates (ASFR) and modified Age Specific Marital Fertility Rates (ASMFR)

The expected level of infertility for Kerala per 1000 women in the reproductive ages was 168 for the period 2010-11 (as this computation used the Census of India 2011 data). The expected level of infertility ranged from a high of 228 per 1000 women in Pathanamthitta district to a low of 112 per 1000 women in Malappuram. Districts like Kasaragod, Kannur, Wayanad, Kozhikode, and Malappuram have expected levels of infertility less than the overall expected level for Kerala of 168 per 1000 women. Followed by Pathanamthitta, the ASFR based infertility levels was highest in Thiruvananthapuram district with expected level of 214 per 1000 women. This estimate uses all women in the reproductive ages, and therefore does not reflect the actual expected levels since these women have the potential of becoming pregnant only if they enter the marital union and child bearing outside of marriage is not the norm. Therefore, using the ASFR to estimate infertility yields over-estimates of the levels of infertility. This is a limitation of such an estimate. Table1 has all three estimates of infertility by district.

The alternative estimate used the age specific marital fertility rate, as it permits separating the effect of overall fertility changes in nuptiality (age at marriage, propensity to marry and the marriage stability) from that of changes in the level of fertility within marriage. Age specific rates may be converted to approximate rates based on marital status by restricting the base population to currently married or ever married because of the norm regarding births within marriage that operates across the state. Here this measure used ever married women and hence is an approximate measure of expected infertility levels. Its limitation is that the period of exposure to fertility though relevant is not considered for those women who might not have been married for the complete duration of the past one year which is the reference period for the births.

The ASMFR based estimate of expected level of infertility for the state of Kerala was 61 per 1000 ever married women in the reproductive ages. Across districts, this ranged from a low of 45 per 1000 in Kasaragod to a high of 93 per 1000 in Pathanamthitta. The next highest to Pathanamthitta is Alappuzha with an expected level of infertility at 88 per 1000 ever married women.

Direct measure of infertility using women with '0'parity at ages 45-49 years

The expected level of infertility using the proportion of those with '0' parity among women aged 45-49 in Kerala was estimated to be 58 per 1000 ever married women. This estimate was highest in Malappuram with 67 per 1000 ever married women in the age group 45-49 years indicating that 67 out of every 1000 ever married women will remain childless at the end of their reproductive span. It was followed by Kasaragod which had an expected level of infertility of 64 per 1000 ever married women and Thiruvananthapuram with an expected level of 62 per 1000 ever married women. This estimate was the lowest in Wayanad district with an expected level of 44 per 1000, followed by Idukki with 47 per 1000 and Kollam with 49 per 1000 ever married women. Table 1 gives the three estimates for all the districts. The districts like Kasaragod, Malappuram, Palakkad and Thrissur had expected infertility levels above the state's expected level of infertility while Kannur, and Kozhikode had the same levels as expected for the state of Kerala.

Table 1: Estimates of expected level of infertility for Kerala state and its districts, Census 2011

Districts	**Expected level of Infertility (per 1000)**		
	Based on ASFR	**Based on ASMFR***	**Based on '0' parity at 45-49 years**
Kerala	167.73	61.48	57.92
Kasaragod	131.35	44.97	63.80
Kannur	138.26	52.13	58.01
Wayanad	154.13	53.94	43.51
Kozhikode	158.05	65.91	58.42
Malappuram	111.97	47.36	67.48
Palakkad	171.91	64.69	63.64
Thrissur	184.14	67.14	59.56
Ernakulam	190.31	68.22	58.94
Idukki	175.24	55.78	47.09
Kottayam	191.42	64.75	50.77
Alappuzha	202.85	88.40	57.76
Pathanamthitta	228.09	93.48	49.99
Kollam	199.44	80.57	48.95
Thiruvananthapuram	214.22	83.98	61.54

**we have taken ever married women and not currently married women to make it comparable with estimate three which has the same denominator*

Age patterns of infertility

The age pattern of infertility was estimated using the cohort based CEB and period-based CFR measure. These measures will provide an understanding of the fertility regime for the state since the direct and indirect estimates showed varying levels of infertility. If the fertility regime has been a constant then the CEB and CFR based measure of infertility will be more or less equal.

The total children ever born in the last year to ever married women in specific age groups provides estimates of CEB by age. The age pattern of infertility was estimated using CFR, to describe the current age pattern and the likely changes in it. The CFR by age, should the fertility regime be a constant, match the CEB at that age. We used the levels of CEB and CFR across age groups to calculate the expected infertility level in each age group using the Poisson process. This gave an estimate of the expected levels of infertility for different age groups across the districts of Kerala. The variation in the pattern across age groups provides a reflection of the change in the age patterns of infertility.

Table 2 shows the cohort and period measure of expected levels of infertility. The expected levels of infertility declined as the age increased. This is as expected owing to fact of marriage and subsequent childbearing. The findings facilitated an examination of the differences between CEB and CFR for districts and the changes in infertility levels across age groups within a district using both the cohort and period measures. The difference between the CEB based measure and the CFR based measure indicate the potential improvement in fertility over time, which gives rise to lower levels of infertility using the CFR as opposed to the CEB. The measure of infertility using the CEB is indicative of fertility levels in an earlier regime as opposed to the current one. The potential levels of infertility in the recent fertility regimes have reduced when compared to those that prevailed earlier, as indicated by the gap between the CEB measure and the CFR measure with the difference always favouring the cohort based CEB. Both measures of the expected infertility levels converge rapidly up to age 30-34 years. The age pattern in this convergence is demonstrated using figure1 which provides a graphical representation of the CEB and CFR based expected infertility levels for Kerala State in the census year 2011.There is an exception to this pattern however in Malappuram district where at ages 40-44 and 45-49, the CFR based measure was higher than the CEB based measure. Clearly, Malappuram has higher levels of infertility in the current period as indicated by the CFR based measure and also the ASMFR based measure.

The expected levels of infertility in table 2, indicate that up to age 30-34 years, the decline in levels of infertility was sharp. This is indicative of the natural decline owing to the fact that these are the prime reproductive ages for women. But as we move from 30-34 to higher age groups, the decline in the expected levels of infertility slowed down. As the women move from age 30-34 to 35-39, the highest decline was seen in Kottayam and Pathanamthitta.

Table 2: Age pattern of expected levels of infertility for Kerala state and its districts, Census 2011

Districts	CEB/ CFR	Expected level of infertility						
		15-19	20-24	25-29	30-34	35-39	40-44	45-49
Kerala	CEB	710	441	242	152	126	114	100
	CFR	555	222	109	78	70	67	61
Kasaragod	CEB	710	442	218	123	88	70	57
	CFR	556	211	96	63	53	50	45
Kannur	CEB	716	467	255	154	121	103	83
	CFR	582	235	113	76	64	58	52
Wayanad	CEB	698	394	196	120	101	94	79
	CFR	526	196	94	69	63	59	54
Kozhikode	CEB	707	431	225	139	117	104	89
	CFR	565	237	122	89	80	75	66
Malappuram	CEB	688	374	165	89	64	51	40
	CFR	483	195	97	67	58	54	47
Palakkad	CEB	674	384	205	135	113	101	81
	CFR	505	198	106	81	75	71	65
Thrissur	CEB	743	475	254	165	144	133	118
	CFR	592	223	108	79	72	70	67
Ernakulam	CEB	755	514	307	191	161	150	136
	CFR	674	258	117	81	73	71	68
Idukki	CEB	728	449	257	158	128	117	104
	CFR	622	226	99	68	61	59	56
Kottayam	CEB	779	532	323	189	148	135	127
	CFR	740	306	129	80	70	67	65
Alappuzha	CEB	777	527	314	200	167	151	136
	CFR	730	312	151	108	97	94	88
Pathanamthitta	CEB	793	545	334	205	166	151	138
	CFR	757	333	159	112	101	98	93
Kollam	CEB	730	474	272	182	158	146	130
	CFR	616	247	127	97	90	86	81
Thiruvananthapuram	CEB	725	477	278	185	159	145	131
	CFR	599	252	134	103	96	91	84

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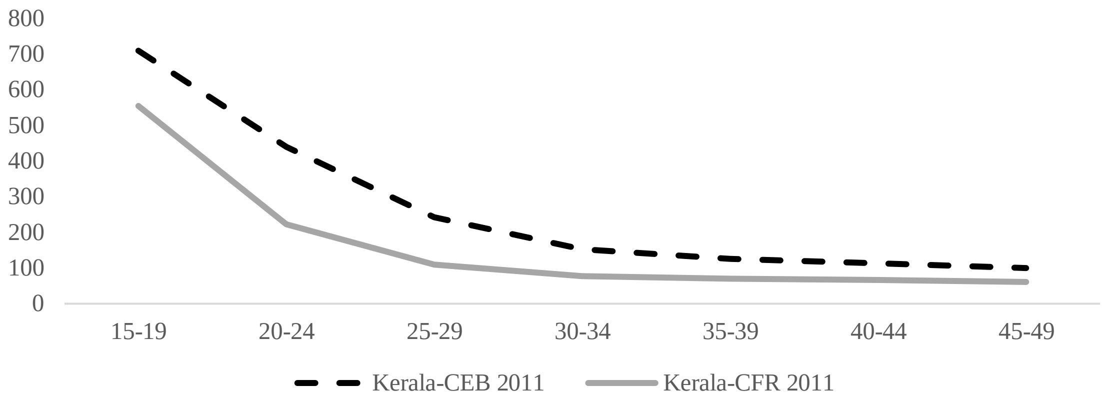
Figure 1: Age pattern of expected levels of infertility using CEB and CFR measures for Kerala state, 2011



Index of infertility

The index of infertility was computed to compare the level of infertility that is bridged between the ages 30-34 and 45-49 (Table 3). Higher values of the index indicated that there was a possibility of interventions that may be happening at ages 35 and beyond.

The indexed value ranged between a high of 0.45 in Kannur to a low of 0.18 in Thrissur. This represents the extent to which the infertility levels may potentially be bridged between ages 35-49. About 40-45 percent of it may be bridged in Kannur, Kasaragod and Malappuram. Alternatively, in the southern districts of Ernakulam Idukki, Kottayam, Alappuzha, Pathanamthitta, Kollam and Thiruvananthapuram it ranged between 0.19-0.24. It means, in these districts, a very limited proportion of the infertility gets bridged in the ages 35 and above.

Table 3: Index of infertility using CFR based expected level of infertility for Kerala state and its districts, Census 2011

Districts	**Age group**				**CFR based Indexed value**
	30-34	**35-39**	**40-44**	**45-49**	
Kerala	77.99	69.93	66.50	61.48	0.27
Kasaragod	63.10	53.46	49.70	44.97	0.40
Kannur	75.52	64.24	58.28	52.13	0.45
Wayanad	68.96	62.52	59.06	53.94	0.28
Kozhikode	88.93	80.02	74.78	65.91	0.35
Malappuram	66.80	58.05	53.75	47.36	0.41
Palakkad	81.31	74.72	71.05	64.69	0.26
Thrissur	79.05	72.24	70.17	67.14	0.18
Ernakulam	81.11	72.93	70.97	68.22	0.19
Idukki	68.00	61.35	59.15	55.78	0.22
Kottayam	80.42	69.79	67.48	64.75	0.24
Alappuzha	107.91	97.41	93.85	88.40	0.22
Pathanamthitta	111.78	100.92	97.94	93.48	0.20
Kollam	96.90	89.79	86.46	80.57	0.20
Thiruvananthapuram	103.30	95.64	91.06	83.98	0.23

Discussion

Based on the Census 2011 data, we found that the expected level of infertility for Kerala was approximately 6.1 percent among ever married women (estimate II), while the expected level of infertility among women in the age group 45-49 is 5.8 percent, which is a more direct measure of the infertility. The infertility estimates for India according to the Census of India 1981 was around 4-6 percent (as cited in Jejeebhoy,1998).

The TFR and TMFR based estimate showed a higher expected level for the southern districts of Kerala compared to the northern districts (except Kozhikode for TMFR based estimate). Since the infertility estimate uses the existing period estimate of fertility, those regions with relatively higher age at marriage and lower fertility seem to have higher expected levels of infertility. Also, the infertility estimate is a function of both the number of fertility events per ever married woman (quantum) and the age at childbearing (tempo of fertility). Across districts of Kerala, these two are not the same, with the districts in the north part of Kerala having higher number of fertility events per woman and on an average at earlier ages when compared to women in the southern districts.

Using the direct estimate of infertility (which is based on the cohort estimate), one notices that the northern districts have relatively higher rates of ever married women who remain childless at the end of the reproductive period than the southern districts. The northern district like Malappuram (6.8%), Kasaragod (6.4%) and Palakkad (6.4%) have a higher expected level of infertility in these age groups which means that a higher proportion of women in these districts were childless as they complete their reproductive ages. Given that these districts do not have relatively higher levels of age at marriage wherein postponement of child bearing could result in childlessness, it is possible that the male out migration from these districts resulted in these relatively higher proportions of women remaining childless. But this is speculative and a more careful evaluation may provide the actual reasons. This could be reflective that either the intervention for infertility is not happening or the couples with infertility have conditions which are not treatable by the interventions. Owing to the cultural and religious propensity of the district of Malappuram it is possible that certain interventions are not sought by the couples for their conditions. Alternatively, interventions may be happening at younger ages which may mimic the natural child bearing propensity. From the southern region, Thiruvananthapuram (6.2%) and Thrissur (6.0%) also have higher expected levels of infertility compared to other districts in this region, and this may be indicative of later age at marriage in these districts.

The age pattern of infertility for Kerala and its districts using both the CEB and the CFR indicates a rapid decline in expected levels of infertility across ages up to 30-34 years and then we see a gradual reduction in the rate of decline. Decline after the age 35-39 years are marginal on the basis of the CFR based infertility measure. The CEB based levels of expected infertility converge less rapidly across the districts after age 30-34 years. This is also true for the CFR based measure, but after 30-34 years, the convergence for this measure almost flattens. Such flattening of the curve is indicative of the slower declines in infertility levels after age 35. It implies that any subsequent reduction in infertility was difficult to attain in that period (as CFR is a period based measure).

The exception to this pattern was noticed in Malappuram district. The CFR based measure indicates that there is a relatively higher proportion of childless women in the age group 45-49 years in the current period. It is possible that older women who did not have the option of intervention driven reduction in infertility levels remain childless in Malappuram whereas younger women have the benefit of intervention-based reduction in infertility levels at younger ages. The CEB and CFR based measures showed the highest decline in Kottayam and Pathanamthitta from age 30-34 to 35-39 years. This indicates that either there is late marriage happening in these districts or the decline in levels of infertility is indicative of intervention aided decline after 34 years of age.

The potential reduction of the infertility through medical intervention is given by the index of infertility. For Kerala, only 30 percent reduction has happened from what was expected, which means that the intervention aided decline is not adequate in the state. The index values are relatively higher in the northern districts of Kasaragod (0.40), Kannur (0.45), Kozhikode (0.35) and Malappuram (0.41). This indicates that there is reason to believe that some of the reduction in infertility that is happening beyond ages 34 in these districts could be due to medical interventions. The reduction is not substantial and manages merely a maximum of 40 percent reduction in infertility after age 34 when one examines it against what it is at 45-49 years. This also throws light on the fact that in the northern district intervention is being postponed to a later age. It is still a better reduction when compared to the potential for reduction in the southern districts where the index value ranges between 0.20 to 0.24. Conversely, it could also indicate that in southern districts intervention aided pregnancy is happening before 34 years. Those who entered into marital union at later ages and having difficulty getting pregnant are pursuing such intervention in these districts.

Examining the index of infertility in tandem with the extent of fertility achieved by ages 30-34 and 35-39; we find that 91 percent of the TFR was achieved by 30-34 years and 95 percent by 35-39 years in Kerala. This means the bridging of infertility in this period could have also been achieved by the smaller numbers of first time mothers who may have a delay in entry into marriage for various reasons. This does not foreclose the possibility that intervention aided bridging of infertility happens before age 35 in Kerala. This could very well be a characteristic of the southern districts where the bridging of the index of infertility ranged between 0.20 to 0.24.

Conclusions

The findings of this analysis have implications for care-seeking for infertility in the State. These evidences collectively indicate that there is a potential demand for services to reduce infertility levels across the state. This demand is being possibly partly addressed, though at relatively higher ages in the northern districts through medical interventions but is less likely to be addressed in the southern districts or possibly identified and addressed at younger ages. In the district of Malappuram, there is a higher burden of infertility and this is not being treated via medical interventions. It could also mean that there are not enough facilities that could offer affordable infertility related services or there is postponement of treatment by the couples.

The right to family is a basic right of everyone and hence there should be more public provisioning for infertility care. This care should be provided at local levels, with comprehensive referral care at least at district levels given the requirements of economies of scale for such provisioning. This can cater to the needs of many couples who cannot afford treatment at the private centres, which may result in premature cessation or postponement of treatment.

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