Estimation of Births Averted Due To Use of Family Planning Methods in Major States of India

Abstract

This study attempts to estimate the births averted due to contraceptive use, with the latest available data for 20 Indian states. This study also aimed to estimate extra births that could have been avoided if assumed that the unmet need for contraception is fulfilled. Applying TFR method proposed by Liu and others (2008), a wide variation in births averted at the state level has been found. The estimation of births averted not only provides approximation of the number of births prevented by using contraception, it also show that the significant impact of contraceptive use on reducing fertility level. It can conclude that though sterilization is fully effective method and use of sterilization is more but it is not properly practiced then the effect of the method for birth aversion cannot be satisfied and thereby the target of reducing fertility level cannot achieve in the way it can be expected.

Estimation of births averted due to use of family planning methods in major states of India

1. Introduction

In recent years, socialization and westernisation vastly adopted by Indian women and it has a huge impact on their reproductive preferences. The demand for small family became more pronounced nowadays compared to the past. Majority of the couples now desire to have fewer children and to fulfil their desire they have the means to control their family size in the form of various methods of contraception. Therefore, within last few years the proportion of couples using contraceptives has increased steadily and the mix of methods is now dominated by modern methods that have become easily available compared to the before.

The major target of the population programmes and policies is to control the rapid growth of population in most of the populous or high fertility countries, including India. Promoting family planning methods, specially the modern contraceptive methods has been the priority of the population programmes or family planning programmes of those countries to achieve that target in a direct way. Government aims to make policies and campaign for promoting and distributing various modern contraceptive methods. Apart from government many organizations and NGOs are also working in this field for promoting the modern family planning methods especially in those areas where use of contraception is less and women are having a large family size.

Now the question arise that how much effective this contraceptive use is to control the population pressure. In this linkage, the main question of the evaluation of the effectiveness of the family planning programme is - how many births have been averted by the use of family planning? This study is an attempt to estimate the births averted due to use of family planning among Indian states.

2. Literature review

Literatures on estimation of births averted

With the steady increase in the use of contraception and implementing various family planning programmes specially in the high fertility countries many attempts has been taken in researches to estimate the births averted due to the use of contraception (Mauldin 1968; Potter 1979; United Nations 1982, 1985; Venkatacharya 1971, 1972; Bhattacharya *et al.* 1984, Liu *et al.* 2008) . For the evaluation of family planning programmes the estimation of births averted were mainly done by the

researchers and programme managers and it is also used for the cost effectiveness of family planning methods (Liu *et. al., 2008)*.

Among several methods which have been developed and applied for estimating the number of births averted by various researchers in the past, three standard approaches are: (1) selected rules of thumb (2) Potter's approach using couple-years of effective contraception and (3) various age-specific fertility rate approaches (Elena Prada-Salas 1975; Liu et al 2008). The rule of thumb is have been widely used and Kenney and other (1968) has estimated that each IUD insertion can prevent 0.64 births using data from Korea and Taiwan. The method used by Potter (1969) of couple years of effective contraception though can provide better estimation of births averted than the earlier method, but it requires extensive computation and many detail data which are not available always. Besides it can be used for the evaluation of family planning programme rather than the impact of use of contraceptive on birth rate or fertility (Potter 1979).

There are a number of variations on the age-specific fertility rate approach, but basically they all require calculating the age-specific fertility rates (ASFR) of women in the program at the beginning of contraception and at the end of the period in question. The change in ASFR is multiplied by the average continuation rate for the period. But the information before starting of the family planning are not usually available easily and it may not be reliable data. Kelly (1971) modified this approach slightly and created what is called the "parity approach". Elena Prada-Salas (1975) had tried to estimate the births averted using the same parity approach from primary follow up survey of a family planning clinic was performed in Cambodia in 1969.

In his paper Mauldin (1968) has suggested five major approaches to estimate the birth averted. Among those the main two approaches one was to see the difference in the expected number of births and actual number of births among the case group i.e., contraceptive users and control group of non-users of contraceptives with the same socio-economic characteristics as the case group. The other approach was to observe the difference in the expected number of births among contraceptors and calculated number based on the estimated couple years of effective contraception offered by the family planning programme. This study was based on the Taiwan data.

Venkatacharya (1971) used a model to estimate births averted in Indian situation due to IUCDs and Sterilizations. The methodology of deriving the matrix of annual probabilities of live births specific to age at adoption of a method and duration since adoption is obtained. One matrix is presented for adopters of IUCD, another for salpingectomy, and a third for vasectomy. These matrices are used to obtain estimates of births averted for India due to IUCDs and sterilizations performed during 1956-

69. The entire work is programmed on a high speed electronic computer. In further research Venkatacharya and Das (1972) has applied Simulation model to derive the age and duration of use of family planning method, specific birth rates depending upon initial susceptibility status. These rates are applied to women sterilized in India between 1956-67 and women inserted with IUCD during 1965-67.

A model has been derived for estimating the number of births to a female during a time interval since marriage assuming the conception rate, incidence of foetal losses and chance of on-set of sterility following a child birth. This model can be widely used to study the impact of increased contraception or induced abortion and of induced sterility on fertility (Bhattacharya *et al*. 1984).

Recently Liu and others (2008) have suggested three simple methods of estimating the number of births averted that is attributable to the use of contraceptive. The first method is based on the observed relationship between the GFR and contraceptive prevalence rate (CPR) for women who are currently married or in a union. The second method is similar to the first but uses the observed relationship between TFR and CPR. The third method is based on the Bongaarts' proximate determinants model of fertility. They have estimated number of births that would have occurred in a recent year in the absence of contraception for 156 countries around the world.

Literature on unmet need for contraception and its effect on fertility

The purpose of using family planning method by women is to delay or avoid pregnancy. But sometimes though women want to use family planning method they are not using any method. According to John and Winfrey (2002), more than 100 million women in less developed countries, or about 17 percent of all married women, would prefer to avoid a pregnancy but are not using any form of family planning. Demographers and health specialists refer to these women as having an "unmet need" for family planning. Over the past few decades, increasing level of contraceptive use have reduced unmet need for family planning in most of the countries.

Unmet need for contraception can lead to unintended pregnancies, which pose risks for women, their families, and societies. In less developed countries, about one-fourth of pregnancies are unintended that is, either unwanted or mistimed (Carl and Britt 2002). According to the International Conference on Population and Development 1994 (ICPD 1994) -"Governmental goals for family planning should be defined in terms of unmet needs for information and services". In 1999, at the five-year review of the conference, governments set a new target of reducing unmet need by half by 2005 and entirely by 2015.

A significant number of women say that they do not want another child but are not using any method of contraception. This gap between women's preferences and actions inspired many governments to initiate or expand family planning programs in order to reduce unintended pregnancies and lower their countries' fertility rates (Casterline and Sinding 2000). From a demographic standpoint, reducing unmet need can lower fertility in countries struggling to cope with rapid population growth. Reducing unmet need is also important for helping couples in achieving their reproductive goals. Reducing unmet need and serving current users of contraceptives can help in reducing unintended pregnancies that lead to abortions and unwanted births - both of which are unacceptably high in many countries (Becker 1999). In general, the lower the unmet need for family planning services the higher is the effectiveness of the program. However, an effective program itself may further generate the demand for contraceptives.

3. Need for the study

Estimation of birth averted is the procedure to find out how much contraceptive methods need for how many birth averted and the effectiveness of contraceptive methods. These types of estimates were used primarily by researchers and by managers of family planning programmes to assess the effectiveness of various programmes to promote contraceptive methods. In India, the official family planning programme has started since 1952 and since then various techniques has been adopted to expand the use of contraception among the couples and as a result there has been a steady increase in the proportion of couples using family planning methods to control their family size. Though many researchers have been attempted to estimate the births averted due to use of family planning methods, those methods are not either giving results for the Indian states nor it is showing the overall impact of contraceptive use. Major focus was on the issue of estimation procedure and many of those studies focused only on specific method. From earlier researches it is established that the permanent modern methods like female sterilization, male sterilization and IUD which are extensively used in India are almost 100 percent effective method to prevent pregnancy. While other modern temporary methods like condom, pills etc. are not that much effective and it is also found that these are only fifty percent effective method to prevent pregnancy. This study, therefore, is a worth attempt to estimate the births averted by the use of contraception at present time and also by some specific permanent methods for Indian states, using an easy and standard procedure.

Maternal and infant deaths still continue to be high in most of the states of India. This will have direct bearing on women's overall fertility and health in general. It is widely recognized that family planning contributes to reducing maternal mortality by reducing the number of births and, thus, the

number of times a woman is exposed to the risk of mortality. Therefore, to evaluate the impact of use of family planning methods on maternal and infant mortality, the estimation of birth averted provides the basic information that how many women can be saved from experiencing such situation.

It has been found from many earlier studies that a significant proportion of women are having unintended or unwanted pregnancies/births and many of those unwanted pregnancies resulted in induced abortion. Induced abortion is not only an economic burden for the women or her family but also the health care system has to be properly equipped with the facilities for abortion. There is also evidence of practice of unsafe abortion, which sometimes becomes a health risk for the women also. Therefore, to know up to what extent these unwanted or unintended pregnancies can be avoid through the use of contraceptives, it becomes very important to estimate the births averted or pregnancies stopped by use of contraception.

Though there is increase in the use of contraception, still many couple do not use contraception in spite of the fact that they require to use contraception. To satisfy this unmet need of contraception is one of the policy targets of national population policy for population stabilization. If it is assumed that the unmet need for contraception can be fulfilled or in other words the total demand for family planning methods can be satisfied then, it will be interesting to know how many extra births could have been avoided in that situation.

4. Objectives

The main objective of this study is to estimate the effect of contraceptive use in terms of births averted for the states of India.

Specific objective of this study are as follows

1) To estimate births averted due to use of contraception method (for any method and only modern methods) and percent increase in total births in absence of contraception.

2) To estimate the number of birth averted and percentage increase in births due to use of specific methods- female sterilization, male sterilization and IUD.

3) To estimate extra births that can be averted in absence of unmet need for contraception.

5. Data and methods

Secondary data has been used to fulfil the objectives of this study. Data required for the estimation are Crude Birth Rate (CBR), total population, Contraceptive prevalence rate (CPR) for currently married women 15-49 years and TFR. The whole analysis has been carried out for 20 states of India.

Except Delhi all other union territories and Uttaranchal along with all the North-eastern states are not considered for this study.

CBR has been taken from the recent available Bulletin of Sample Registration System (2011). Total population of the states has been taken from Report of The Technical Group On Population Projections 2006. Contraceptive prevalence rate (CPR) is the proportion of women of reproductive age who are using (or whose partner is using) a contraceptive method at a given point of time. In other words, the percentage of (married) women of reproductive age (15-49) who are currently using a contraceptive methods. CPR has been taken from the recent District Level Household Survey Report, 2010. For state level TFR, the data has been taken from recent SRS Statistical report, 2008.

The estimation procedure for births averted has been adopted from the methods suggested by Liu and others (2008). They have used a robust regression with a quadratic and linear term of TFR on CPR and the analysis they carried out was based on the data of 156 countries. To apply the similar technique on 20 Indian states, at first the simple OLS regression has been carried out to see the effect of CPR on TFR. But, to capture the scatters which are slightly deviate from the linear trend line, a quadratic term for CPR has been added. The R square value showed improvement after inclusion of the quadratic terms. Based on the regression coefficients, $\mathrm{TFR}_{\mathrm{potential}}$ for method i was obtained by

$$\mathrm{TFRpotential_i} = \mathrm{TFRactual_i} - \mathrm{b_1} * \mathrm{CPR_i} - \mathrm{b_2} * \mathrm{CPR_i}^2$$

Where, $\mathrm{TFR}_{\mathrm{potential_i}}$ is the TFR that currently married women of reproductive age would have experienced if they never used any family planning method; $\mathrm{TFR}_{\mathrm{actual_i}}$ is the actual TFR in presence of current level of CPR; $\mathbf{b_1}$ is the estimated coefficient for the linear term of CPR and $\mathbf{b_2}$ is the estimated coefficient for the quadratic term of CPR obtained from the regression.

For estimating births averted and percent increase in births in absence of contraception similar processes given by Liu and Others (2008) have been adopted. The number of births for each state was found by multiplying the total population with CBR for the same year.

$$\textbf{Birth avterted (BA)} = \left(\frac{\mathrm{TFR_{potential_i}}}{\mathrm{TFR_{actual_i}}} - 1\right) * \mathrm{Births}/1000$$

$$\textbf{Percent Increase(PI)} = \left(\frac{\mathrm{TFR_{potential_i}} - \mathrm{TFR_{actual_i}}}{\mathrm{TFR_{actual_i}}}\right) * 100$$

For estimating extra births averted if there is no unmet need for contraception, at first the curve fitting of CPR and birth averted have been performed. It will help us to found the beta coefficient with best fit model. It is found that though the 3rd and higher order polynomial shows improved R square value, but the beta coefficients were becoming negligible. So finally 2nd order polynomial fitting has been used, though the R square value is less (R^2 = 0.0278). The equation for estimating births averted is

$$y = 0.0004x^2 - 0.0283x + 14.141,$$

Where, y= natural log of births averted and x= CPR. Now, to find out the extra births averted due to no unmet need CPR has been replaced by the level of unmet need.

6. Results and discussion

Table 1 represents the inputs for applying the TFR method of estimating birth averted due to contraception. Over the years birth rate of India has steadily declined from almost around 50 to 21 in the last century, though the decline has been very slow (National Commission on Population). A huge disparity the level of birth rates can be observed of among Indian states. In all the EAG states like Uttar Pradesh, Bihar, Madhya Pradesh, Rajasthan, Chhattisgarh and Jharkhand the birth rate is more than 25, which is much higher than the national level of 21. While birth rate is below 18 in some states, such as, Kerala, Tamil Nadu, Maharashtra, West Bengal, Himachal Pradesh and Punjab. From Table 1, the highest CBR can be observed in UP (28.7) followed by Bihar (28.5). The lowest level of CBR is in demographically better performer state Kerala (14.7) followed by second lowest state Tamil Nadu (16.3) and third lowest Punjab (17). When it comes to the absolute number the total number of births will depend not only on the birth rate but also on the size of the population of that states. Highest number of births is found to be in highest population state UP (5762) and Bihar (2785) is in the second position, whereas the lowest number of births takes place in Himachal Pradesh (117) followed by Jammu and Kashmir (218).

The next two columns of table 1 show contraceptive prevalence rate (CPR) for any method and for modern method. CPR for any method considered here is the percentage of currently married women aged 15-49 years who are currently using any contraceptive method. The modern methods such as Male sterilization, Female sterilization, IUD, Pill, and condom are generally considered as the modern contraceptive methods and use of modern contraceptive methods are more than the use of traditional methods such as Rhythm and Withdrawal method. CPR for any method considers both modern as well as traditional methods. The difference between these two methods shows that the

use of modern method is more prevalent compared to traditional methods in some states such as Andhra Pradesh, Karnataka and Maharashtra. On the other hand use of traditional method is more in West Bengal (18.6) followed by Assam (17.6). CPR any method is highest in West Bengal (72) than other states and it is lowest in Bihar (33), whereas, CPR for modern methods is highest in Himachal Pradesh (69.5) followed by Andhra Pradesh (66.7) and it is lowest in UP (27.2) followed by second lowest in Bihar (29.4).

(Table 1 is about here)

The Total Fertility Rate (TFR) is defined as the sum of the ASFRs over different ages 15-49. It is the most widely used measure of fertility by demographers and expressed as number per woman. It is most used standard definition of fertility measure which can be used for comparison purposes. It is also independent of age structure of fertility. S similar to the level of CPR, state level variation in the level of TFR can also be observed from Table 1. TFR is found to be highest in Bihar (3.9) then closely followed by second highest in UP (3.8) and it is lowest in demographically advanced states like Kerala (1.7) and Tamil Nadu (1.7).

The scatter diagram with the fit of quadratic regression results for TFR on CPR any method and CPR for modern method is presented in Figure 1 and 2.

(Figure 1 is about here)

In Figure 1, the quadratic regression result shows that the value of R square =0.656 which means that the variation in TFR due to only CPR for any method is 66 percent when there is no other variables which can have any effect on the TFR. In Figure 2, the fit of regression results with quadratic regression term for TFR on CPR modern method, shows the value of R square is 0.504 which means that only CPR for modern method can explains 50 percent variation in TFR not considering other predictors of TFR. In other words it can be said that CPR for any method can explain 66 percent variability of TFR whereas CPR for only modern methods can explain half of the variation in TFR, not controlling for other predictors of TFR.

(Figure 2 is about here)

(Table 2 is about here)

Table 2 represents the estimated births averted and percentage increase in births when there is no contraception using the earlier mentioned methodology. From first two columns it can be said that births averted due to use of any method of contraception or over all CPR is more compared to the births averted due to use of only modern methods of contraception in all the states. It is also visible that the major portion of total births averted due to use of only modern method is high and the traditional method has little effect on birth aversion. For West Bengal, the difference between total births averted due to CPR for any method and CPR for modern method shows that the high proportion of women who are using traditional method of contraception, they are using it more effective manner. These facts are more clear when the comparisons of percent increase in absence of contraception are compared. State level variation in number of births averted and percent increase due to contraception can be clearly visible from the Table 2.

Highest BA (in 1000) is found in Maharashtra both due to use of CPR for any method (3536) and CPR for modern method (3062) and it is found to be the lowest in Himachal Pradesh (238,199) by both methods. The second highest BA is in UP (3346) for CPR any method but the second highest BA is in AP (2729) for CPR of modern method. As the births averted is showing the absolute numbers, it is sometimes influenced by the population of that states, where as for comparison propose it is better to use the percent increase (PI). Columns three and four shows that Percentage increases high in Kerala (208) followed by second highest in WB (205), where as PI are low in Bihar and UP for both the methods. By CPR for modern method PI is found as higher level in the southern states Andhra Pradesh (176) and Tamil Nadu (173) because the use of permanent sterilization among modern methods is more in these states which is highly effective method.

These findings indicate that there is variation in the number of births averted due to contraception among Indian states. It is not simply due to variation in use of contraceptive methods or the size of population of the states. It may also vary because of the method mix or because of the variation in use of modern and effective contraceptive methods. In some states the only modern method used by the couples is female sterilization like Andhra Pradesh, Karnataka, Tamil Nadu, Maharashtra are more than fifty percent, while uses of other temporary modern method are less.

From the results of Table 2 the explanation for BA and PI for modern method, the effectiveness of modern permanent methods are impending repeatedly. Therefore to get further insight or evaluate the effectiveness or impact birth averted for these three effective methods were shown in Table 3.

In India female sterilization is the most practiced method among all the methods of family planning. The prevalence of female sterilization was much higher in southern states like Andhra Pradesh (61.6

percent), Karnataka (58.3 percent), Tamil Nadu (55.5 percent) and also one of the developed states Maharashtra (53.0 percent). Among all twenty states it was lowest in Assam (11.5 percent) and Uttar Pradesh (17.5 percent). Among modern spacing methods, use of IUD was relatively higher in Punjab (5.7 percent), Jammu and Kashmir and Delhi (4.6 percent). There is not much variation across the states in the Prevalence rate of male sterilization except Himachal Pradesh. Male sterilization is highest in Himachal Pradesh (7.8 percent) followed by Andhra Pradesh (4.1 percent), while it is practiced by less than or around one percent males in most of the states.

Results show that BA by Male sterilization is high in Andhra Pradesh (430) followed by Maharashtra (350) and it is the lowest in Assam (7) followed by Jharkhand (12). For female Sterilization, BA is high in Andhra Pradesh (1268) and Maharashtra (1256) is in the second position. By IUD method BA high in Gujarat (280) followed by UP (252) and it is found to be the lowest in Himachal Pradesh (13) followed by Chhattisgarh and Jharkhand (21).

(Table 3 is about here)

The prevalence of specific methods is reflected in the PI shown in Table 3. Percent increase by male sterilization high in Himachal Pradesh (50) followed by Andhra Pradesh (27.7) and the lowest increase in UP (0.6), followed by Bihar and Karnataka (1.2). For female Sterilization also percent increase is highest in Andhra Pradesh (81.8) followed by Tamil Nadu (78) and it is the lowest in Assam (10.6) and second lowest is UP (11). Percentage increase by IUD high in Punjab (49.9) then Delhi (38.3) and lowest in Bihar (1.7) followed by Madhya Pradesh (2.5). The above results again prove the fact that the sterilization is the most effective method and the birth averted or the decrease in the total births are more due to the use of sterilization. It also reflects the fact which can be found from earlier researches, that in most of the southern states and Maharashtra use of sterilization are practiced for controlling the births and it is practiced in timely manner, while in the northern states or EAG states, by the time couple use the sterilization they already have a large family or several children and that may be the reason why the estimates of BA and PI is not showing better impact in these states.

(Table 4 is about here)

Table 4 shows the state wise unmet need for contraception and estimated extra births to be averted if unmet need can be satisfied. Unmet need for family planning is lowest in Andhra Pradesh (8.1) followed by West Bengal (11.1). It is found to be highest in Bihar (35.9 percent) followed by Jharkhand (33.5 percent) and UP (32.6 percent). Using the fitted model the estimated births averted

if unmet need is satisfied has been calculated and presented in Table 4. Though the level of unmet need is lowest in Andhra Pradesh, but the extra births that can be averted if that unmet need is satisfied is the highest (1073) while in Bihar, Jharkhand and UP even if higher level of unmet need satisfied then the effect in terms of births averted are less. Total birth averted with a CPR level where unmet need is not present is highest in Maharashtra (3937) followed by Andhra Pradesh (3801) and West Bengal (3190).

For the states of Bihar, UP and Jharkhand even though the level of unmet need is higher but the births averted are found to be less. The reason may be the fact that in these states the nature of contraceptive use or the timing of use of contraception is different and most of the cases they demand for limiting methods i.e., sterilization. The time of use of sterilization is not properly practiced for limiting the family size in these states. It can also be said that though many studies shown that the age at marriage is low in these states, the women started bearing children early and they stop child bearing near about when they reach at age beyond 30 years by using sterilization and at that time they already had several children.

(Figure 3 is about here)

From the Figure 3, the state level variations in the births averted can be easily observed. There is not much fluctuations in the extra births averted when unmet need is not present. But huge fluctuations in the births averted when the CPR level is considered with the presence of unmet need for family planning and thereby in the total birth averted also when CPR considered with satisfied unmet need. Births averted due to CPR for modern method are more than the extra birth averted if unmet need satisfied for the states of Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu, UP and West Bengal. It is clearly visible from the above figure that the opposite situation is also occurring for the states of Delhi, Haryana, Himachal Pradesh and Jammu and Kashmir, where the extra births averted when there is no unmet need are more than the births averted.

7. Conclusion

This study is an attempt to estimate the births averted due to use of contraception using the latest available data for 20 Indian states. The estimation of births averted has been done by using TFR method applied by Liu and others (2008). It is a known fact from various survey reports and literatures that there exists state level variation in the use of contraception. Findings of this study also showing the variation in births averted at the state level. The estimate of births averted not only provides an approximation of the number of births that can occur if that had not been prevented by

using contraception, it also show that the use of contraception has significant impact on reducing the fertility level. It can also conclude from the findings that even if the sterilization is fully effective method and use of sterilization is more but still if this method is not properly practiced then the effect of the method for birth aversion cannot be satisfied and thereby the target of reducing fertility level cannot achieve in the way it can be expected.

However, this study is not free from drawbacks. Due to unavailability of recent population data, the estimated population for the states have been taken from the Technical Group of Population Projection report, 2006 published by Registrar General of India. For estimation of births averted other available methods can also be done and the consistency of the results can be compared and checked, so that a better method can be found, which was not attempted for this paper. However, further research based on the estimated value of births averted can be used for estimating the effect of family planning methods on maternal mortality and abortion.

References

B. N. Bhattacharya, K. K. Singh, A. D. Taskar, O. P. Srivastava. (1984). Births Averted under Family Planning Programme: A Mathematical Approach. *Sankhyā:The Indian Journal of Statistics, Series B , 46* (3), 320-330.

Herstad, Carl Haub and Britt. (2002). *Family Planning Worldwide,2002 Data Sheet.* Washington, DC: Population Reference Bureau.

International Institute for Population Sciences (IIPS), 2010. District Level Household and Facility Survey (DLHS-3), 2007-08: India. Mumbai: IIPS.

John A. Ross and William L. Winfrey. (2002). Unmet Need for Contraception in the Developing World and the Former Soviet Union: An Updated Estimate. *International Family Planning Perspectives , 28* (3), 138-143.

John B. Casterline and Steven W. Sinding: 2000.Unmet Need for Family Planning in Developing Countries and Implications for Population Policy, Population and Development Review 26 (4), 691-723

Keeny, S. M. (1968). Korea and Taiwan: The record for 1967 1, No. 29 (April): 1-9. *Studies in Family Planning , 1* (29), 1-9

Kelly, W. J. (1971). Estimation of births averted by family planning programs: the parity approach. *Studies in Family Planning , 2* (9), 197-201.

Kelly, W. J. (1971). Estimation of births averted by family planning programs: the parity approach. *Studies in Family Planning* . 2 (9), 197-201.

Liu, Li , Becker, Stan , Tsui, Amy and Ahmed, Saifuddin. (2008). 'Three methods of estimating births averted nationally by contraception',, 62: 2,. *Population Studies , 62* (2), 191 — 210.

Mauldin, W. P. (1968) Births Averted by Family Planning Programs. *Studies in Family Planning ,* 1 (33), pp. 1-7.

Potter, Robert G. (1979) Analysis of reproductive process. In *Manual IX the Methodology of Measuring the Impact of Family Planning Programmes on Fertility*. New York: United Nations, pp. 76-96.

Potter, Robert. (1969). "Estimating births averted in a family planning program" In Fertility and Family Planning: A World View. Edited by S. J. Behrman et al. Ann Arbor : University of Michigan Press, pp. 413-434

Prada-Salas Elena. (1975). Estimate of Births Averted in the Profamilia Program. *Studies in Family Planning , 6* (5), 121-125

Report of the Technical Group on Population Projections constituted by the National Commission on Population, *Population Projections for India and States 2001-2026*, May 2006, Registrar General of India, New Delhi.

Sample Registration System Bulletin, Volume 45 No.1, January 2011, Sample Registration System, Registrar General of India, New Delhi.

Sample Registration System Statistical Report 2008, Report No 1 of 2009, Registrar General of India, New Delhi.

Stan Becker. (1999). Measuring Unmet Need: Wives, Husbands or Couples?, *International Family Planning Perspectives,* 25 (4), 172-180

UN General Assembly, "Key Actions for the Further Implementation of the Programme of Action of the International Conference on Population and Development," accessed online at www.unfpa.org/icpd/reports&doc/215a1e.pdf, on Dec. 9, 200

United Nations (UN), "Programme of Action of the International Conference on Population and Development, "accessed online at www.unfpa.org/icpd/reports&doc/ icpdpoae.html, on Dec. 9, 2002.

Venkatacharya K. and Das N. P. An Application of a Monte Carlo Model to Estimate Births Averted Due to Various FamilyPlanning Methods. *Sankhyā: The Indian Journal of Statistics, Series B*, 34(3), pp. 297-310.

Venkatacharya, K. (1971). A Model to Estimate Births Averted Due to IDs and Sterilizations. *Demography , 8* (4), 491-505.

Table 1: Input data for estimation of birth averted and percentage increase in absence of contraceptive use

States	CBR	Births (in 1000)	CPR any	CPR modern	TFR
Andhra Pradesh	18.3	1551	66.7	66.7	1.8
Assam	23.6	721	48.6	31.0	2.6
Bihar	28.5	2785	33.3	29.4	3.9
Chhattisgarh	25.7	623	51.3	48.7	3.0
Delhi	18.1	334	65.4	55.2	2.0
Gujarat	22.3	1316	63.3	56.4	2.5
Haryana	22.7	577	62.9	55.7	2.5
Himachal Pradesh	17.2	117	71.4	69.5	1.9
Jammu & Kashmir	18.6	218	54.7	42.7	2.2
Jharkhand	25.6	806	35.7	31.8	3.2
Karnataka	19.5	1159	63.2	62.3	2.0
Kerala	14.7	508	64.4	55.9	1.7
Madhya Pradesh	27.7	2000	57.8	54.8	3.3
Maharashtra	17.6	1983	65.1	63.9	2.0
Orissa	21.0	856	48.2	39.6	2.4
Punjab	17.0	471	69.3	63.2	1.9
Rajasthan	27.2	1845	58.1	55.3	3.3
Tamil Nadu	16.3	1099	61.1	59.2	1.7
Uttar Pradesh	28.7	5762	38.4	27.2	3.8
West Bengal	17.2	1539	72.0	53.4	1.9

Sources: CBR has been taken from SRS Bulletin 2008, TFR has been taken from SRS Report 2008 and CPR has been taken from DLHS- 3 (2007-08) Report

Table 2: Estimated number of births averted and percent increase in births in absence of CPR for any method and modern method

States	Birth averted by methods (in 1000)		Percent increase (PI)	
	CPR any	CPR modern	CPR any	CPR modern
Andhra Pradesh	3139	2729	202	176
Assam	761	501	105	69
Bihar	1379	1232	49	44
Chhattisgarh	599	535	96	86
Delhi	598	470	179	141
Gujarat	1832	1502	139	114
Haryana	799	653	138	113
Himachal Pradesh	238	199	204	171
Jammu & Kashmir	303	231	139	106
Jharkhand	519	464	64	58
Karnataka	2013	1762	174	152
Kerala	1056	848	208	167
Madhya Pradesh	1945	1696	97	85
Maharashtra	3536	3062	178	154
Orissa	971	785	113	92
Punjab	933	760	198	161
Rajasthan	1802	1574	98	85
Tamil Nadu	2181	1904	198	173
Uttar Pradesh	3346	2447	58	42
West Bengal	3156	2227	205	145

Table 3: Contraceptive prevalence, birth averted and percent increase in absence of some specific methods of contraception

States	CPR			Birth averted by methods (in 1000)			Percent increase (PI)		
	Male sterilization	Female sterilization	IUD	Male sterilization	Female sterilization	IUD	Male sterilization	Female sterilization	IUD
Andhra Pradesh	4.1	61.6	0.3	430	1268	43	27.7	81.8	2.8
Assam	0.2	11.5	1.4	7	76	65	0.9	10.6	9.0
Bihar	0.4	26.1	0.4	35	445	48	1.2	16.0	1.7
Chhattisgarh	2.3	42.8	0.6	58	213	21	9.3	34.1	3.3
Delhi	0.8	24.5	4.6	16	98	128	4.9	29.3	38.3
Gujarat	1.9	44.3	3.2	122	557	280	9.2	42.4	21.3
Haryana	1.2	38.5	3.5	34	213	135	5.8	36.8	23.3
Himachal Pradesh	7.8	47.2	1.3	58	69	13	50.0	59.4	11.4
Jammu & Kashmir	1.5	26.5	4.6	18	63	76	8.3	28.8	34.8
Jharkhand	0.4	25.7	0.5	12	155	21	1.5	19.2	2.6
Karnataka	0.2	58.3	1.7	14	807	164	1.2	69.7	14.1
Kerala	0.8	49.1	1.8	29	351	90	5.7	69.0	17.6
Madhya Pradesh	1.0	47.1	0.5	74	682	50	3.7	34.1	2.5
Maharashtra	2.9	53.0	1.5	350	1256	247	17.6	63.3	12.5
Orissa	1.2	28.0	0.4	52	239	24	6.1	27.9	2.8
Punjab	0.7	35.3	5.7	21	209	235	4.5	44.4	49.9
Rajasthan	0.6	42.6	1.3	41	569	121	2.2	30.9	6.6
Tamil Nadu	0.3	55.5	1.8	24	858	194	2.1	78.0	17.6
Uttar Pradesh	0.2	17.5	1.0	37	634	252	0.6	11.0	4.4
West Bengal	0.5	35.0	0.7	49	678	94	3.2	44.0	6.1

Source: Level of male sterilization, female sterilization and IUD has been taken from DLHS- 3 (2007-08) Report

Table 4: Level of Unmet Need and estimated birth averted in absence of unmet need

States	Unmet Need (UN)	BA with UN	Extra BA if UN satisfied	Total BA in absence of UN
Andhra Pradesh	8.1	2729	1073	3801
Assam	23.6	501	568	1069
Bihar	35.9	1232	299	1531
Chhattisgarh	19.9	535	673	1208
Delhi	13.9	470	865	1334
Gujarat	15.6	1502	808	2310
Haryana	15.4	653	815	1468
Himachal Pradesh	14.0	199	862	1061
Jammu & Kashmir	20.6	231	652	884
Jharkhand	33.5	464	343	807
Karnataka	14.9	1762	831	2593
Kerala	15.8	848	801	1649
Madhya Pradesh	18.2	1696	725	2420
Maharashtra	13.6	3062	875	3937
Orissa	23.1	785	582	1367
Punjab	11.4	760	952	1712
Rajasthan	16.9	1574	766	2340
Tamil Nadu	18.1	1904	728	2632
Uttar Pradesh	32.6	2447	360	2807
West Bengal	11.1	2227	963	3190

Source: Unmet need has been taken from DLHS- 3 (2007-08) Report

Figure 1: Fit of quadratic regression results for TFR on CPR for any method for 20 states of India

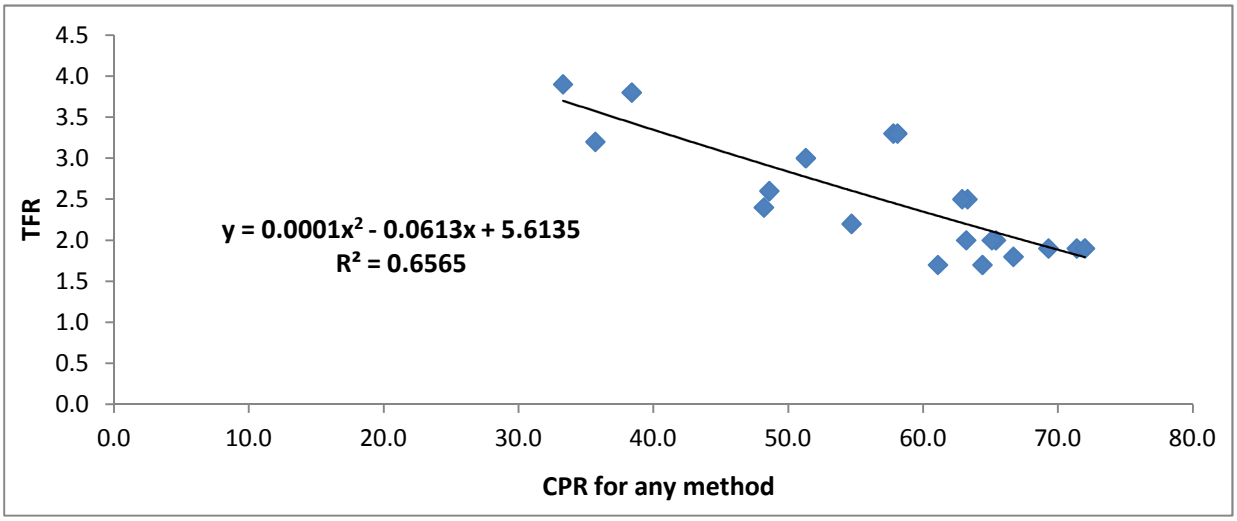

Figure 2: Fit of quadratic regression results for TFR on CPR for modern method for 20 states of India

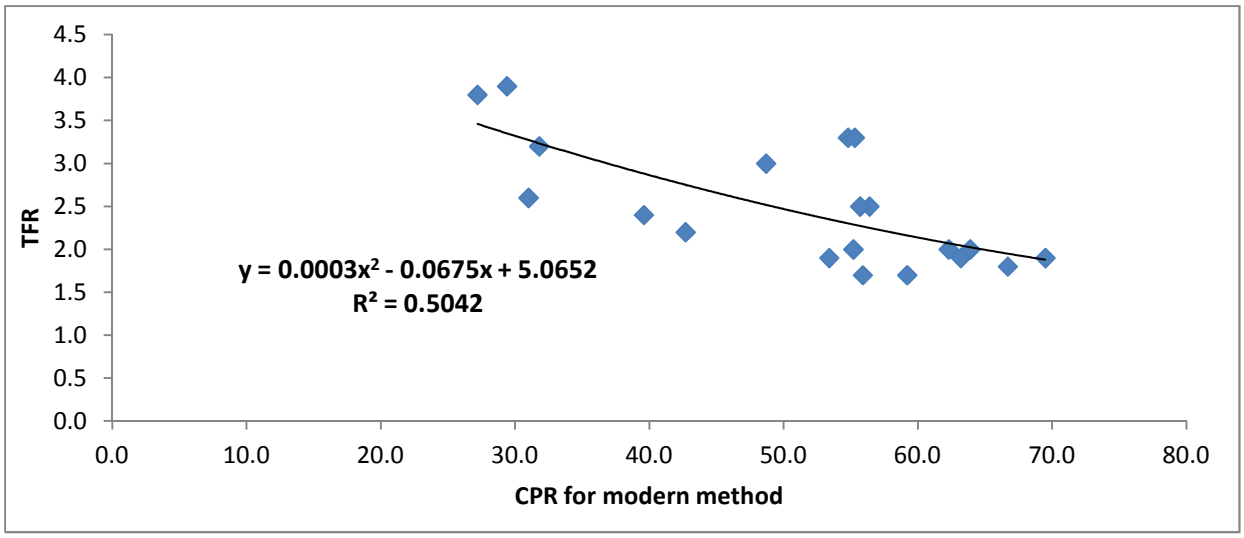

Figure 3: State wise variation in birth averted and expected birth averted in absence of unmet met need for contraception