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MATERNAL CARE RECEPTIVITY - AN INNOVATIVE APPROACH FOR THE EVALUATION OF MCH SERVICES

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ABSTRACT

Despite rapid expansion in the maternal and child health and family planning services, there have been few attempts made to study the extent of utilisation of these services and their impact. The present study reports a simple method evolved in the quantification of utilisation of maternal care services (called maternal care receptivity -MCR), the relationship of factors such as age, parity, caste of the. women and the distance of the health centre on the MCR and the impact of MCR on perinatal and neonatal mortalities. An inverse relationship was observed between MCR and perinatal and neonatal mortality rates and the two rates were three times less among babies born to mothers with high MCR scores compared to those with poor MCR scores.

The World Health Organisation has recommended the integration of Maternal and Child Health and Family Planning (MCH/FP) services into a 'Health Care Package. The Government of India, in a similar measure, integrated MCH care with family welfare programme and these services are now provided as a part of the basic health service through the Primary Health Centres. With these new trends and approaches, there has been a rapid expansion and strengthening of the MCH/FW services In our country. The number of Primary Health Centres increased from 725 in 1955-56 to 5,400 in 1978 and the number of sub-centres rose from 2,175 to 38,610 during the same period Each of these facilities

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offers MCH/FW care. Although performance of these centres have been studied, the actual coverage of the target population group and their utilisation of these services need to be assessed 3-5.

The present study was therefore, undertaken with the following objectives:

1. to measure the extent of utilisation of maternal care services through a scoring system;

2. to study the influence of age, parity, socio- economic status and the distance from the health centre on the utilisation; and

3. to study the outcome of utilisation with perinatal and neonatal mortality as indicators.

Material and Methods

` The study was conducted at the Rural Health Centre, JIPMER, Pondicherry. This is one of the typical Primary Health Centres of the Union Territory of' Pondicherry, catering to a population of 13,626 (in 1977) residing in 12 villages1. The centre provides comprehensive family centred health service with a staff: population ratio of one doctor, one public health nurse and one auxiliary nurse midwife per 4,500 population. The system of maintenance of family folders and other MCH records and registration of vital events in this Rural Health Centre is similar to that reported by Gopalakrishnan and Datta^. The components of maternal care services provided by the Centre have already been described elsewhere?.

Study Group

There were 2,536 families (1977 enumeration) residing in the Health Centre area. The study was carried out in these families in which there were 1,955 married women in the age group of 15 to 44 years. All the pregnancies in them were registered, followed upto delivery and during the 42 days of

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* Each of the Primary Health Centres in the Union Territory of Pondicherry covers much less a population (12,000 to 15,000) unlike those in other parts of the country.

puerperium. Further, the babies born to them were kept under observation for a period of one year by periodic home visits. Of 447 women, whose pregnancies terminated between 1st January and 31st December, 1977, there were 24 abortions, 18 still births and 409 live births. All those who had still births and live births were included in the study. They numbered 423. 'However, the number of births was 427, as four women delivered twins.

Assessment and Scoring Procedure

The extent of utilisation of maternal care services was assessed taking into consideration the following factors: (1) time of commencement of antepartum care; (2) number of antenatal clinic visits; (3) tetanus toxoid immunization, and (4) place of and person attending delivery. Weighted scores were assigned to each of these factors. The details of the scoring system are given in appendix I. The scores for the four factors were added up to give the 'Maternal Care Receptivity' (MCR) score of each expectant mother. The maximum obtainable score was 11 and the minimum was zero. The MCR score Indicated the extent of utilisation of the services. The higher the score, the greater was the utilisation and, therefore, women, with high scores were considered more receptive to maternal care services. However, depending on the score obtained by each woman, her MCR was classified as high (11 to 8), Moderate (7 to 4) or poor (3 to 0).

The data was analysed to determine whether factors such as age, parity and caste of the mother and the distance of her village from the health centre exercised any influence on her utilisation of the maternal care services provided. The relation between the Maternal Care Receptivity and perinatal and neonatal mortality was also studied. For this purpose, the neonatal mortality rate has been computed as the number of deaths under 28 days of age per 1000 live births and the perinatal mortality rate as the number of still births and deaths under seven days of age per 1000 births.

Observations

Certain characteristics of the study group are shown in table 1. Ninety two per cent of them were illiterate and only 8 per cent had some schooling. Also 78 per cent of the women had a total family income of less than Rs.150 per" month. The distribution of the women according to their Maternal Care Receptivity scores are given in table 2.

TABLE 1

CHARACTERISTICS OF THE STUDY GROUP

(N=423)

CHARACTERISTIC	GROUP	PERCENTAGE
MATERNAL AGE	15-24	39
(IN YEARS)	25-34	51
	35 A ABOVE	10
PARITY	PRIMI	23
	2-4	52
	5 AND ABOVE	25
RELIGION AND	CASTE HINDU	72
CASTE	HARIJAN	27
	CHRISTIAN	1
VILLAGE OF	HEALTH CENTRE VILLAGE	9
RESIDENCE	SUB-CENTRE VILLAGE	17
	2 KM FROM HEALTH CENTRE	29
	2-4 KM FROM HEALTH CENTRE	30
	BEYOND 4 KM FROM HEALTH CENTRE	15

TABLE 2

DISTRIBUTION OF PREGNANT WOMEN ACCORDING TO MCR GRADING

MCR GRADING	NO. OF WOMEN	PERCENTAGE
POOR	40	9
MODERATE	222	53
HIGH	161	38
TOTAL	423	100

It can be observed from table 3 that 45 per cent women in the age group of 15 to 24 years had high receptivity as compared to 26 per cent of those aged 35 years and above and 64 per cent of the latter age group were moderately receptive whereas among the poorly receptive mothers, age did not seem to have much influence. Though, there was a negative correlation between age and MCR (r = - 0.11), it was not statistically significant. As regards parity, among the primipara, 49 per cent had high MCR and only 8 per cent had poor MCR. In others, the parity status did not seem to influence the receptivity.

A higher proportion of caste Hindu women (41%) had high MCR as compared to Harijans (30%) as shown in table 3. The proportion of Harijan women with poor MCR (14%) was nearly double that of caste Hindu (8%). Thus, the caste Hindus has utilised the services better than the Harijans.

TABLE 3
AGE, PARITY, CASTE AND RELIGION IN RELATION TO MCR

Factor	Group	No. of women	Maternal care receptivity grading		
			Poor*	Moderate*	High*
Maternal	**15-24**	**164**	**7**	**48**	**45**
age (in	**25-34**	**217**	**11**	**53**	**35**
years)	**35 and above**	**42**	**10**	**64**	**26**
Parity	**Primi**	**96**	**8**	**43**	**49**
	2-4	**221**	**10**	**57**	**34**
	5 and above	**106**	**10**	**53**	**37**
Caste and Religion	Caste Hindu	303	8	51	41
	Harijan	115	14	57	30
	Christian	5	20	40	40

* Figures indicate percentages rounded off to the nearest whole numbers.

Accessibility of the services to the pregnant women is considered to play a vital role in the utilisation of the services. Therefore, when the distance of the Health Centre from the villages of residence of the women and the MCR were compared as given in table 4, it was observed that 76 per cent of the women from the village where the Health Centre is located had high MCR scores as against only 9 per cent of women from villages beyond 4 km. from the health centre who were in the high MCR group. The difference was statistically significant (p ^.0.05). Similarly, the proportion of women with poor MCR scores increased with the increase in distance between their village and the Health Centre. The negative correlation between distance and MCR was statistically significant (r = - 0.308).

TABLE 4

DISTANCE FROM HEALTH CENTRE IN RELATION TO MCR

Distance from the Health Centre	No. of Women	Maternal care receptivity grading		
		Poor*	Moderate*	High*
Health Centre village	38	5	18	76
Sub- Centre village	72	1	56	43
Less than 2 km	124	6	53	41
2-4 km	126	15	50	35
Beyond 4 km	63	18	73	9

* Figures indicate percentage rounded off to the nearest whole number.

The overall perinatal and neonatal mortality rates as shown in table 5 were 66 and 32 respectively. When the influence of MCR on perinatal and neonatal mortalities was studied, it was found that the perinatal mortality rate was 146 among babies born to women with poor MCR scores, whereas, it was 56 *i.e.* three times less among babies born to mothers with high MCR also shown in table & Fig.1 Similarly, the neonatal mortality rate was 79 among babies born to mothers in the poor MCR group whereas it was only 26 among babies born to women in the high MCR group *i.e.* three times less than the poor MCR group. Even among the high risk group of pregnant women, the perinatal mortality rate in high MCR group was 71, four times less than that for those with poor MCR 286 as shown in table 5 and Fig. 2. Thus, there was an inverse relationship between utilisation of maternal care services and the perinatal and neonatal mortalities.

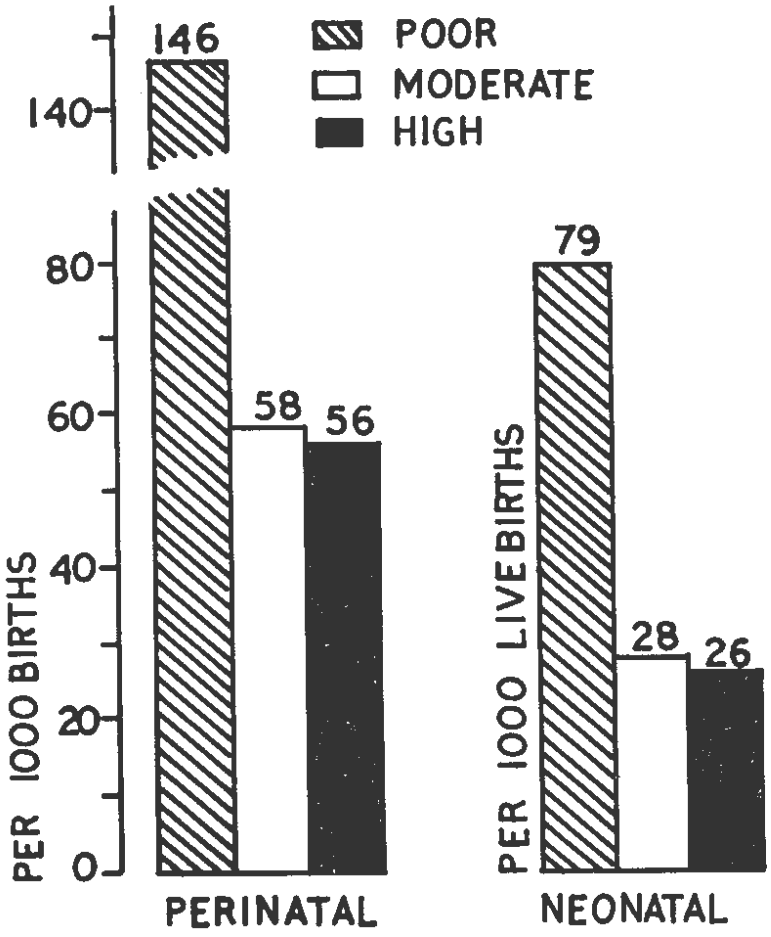
TABLE 5

MATERNAL CARE RECEPTIVITY AND PERINATAL AND NEONATAL MORTALITY RATES

MCR Grading	Number of women*	Outcome of pregnancy			Perinatal mortality rate**	Neonatal mortality rate***
		Live births	Still births	Total*		
a. Total group						
Poor	40*	38	3	41*	146	79
Modernate	222*	215	9	224*	58	28
High	161*	156	6	162*	56	26
Total	423*	409	18	427*	66	32
b. High Risk Pregnancies only						
Poor	6*	7	0	7*	286	286
Moderate	28*	27	3	30*	100	185
High	27*	26	2	28*	71	0
Total	61*	60	5	65*	108	117

*Rate calculated per 1000 births
**Rate calculated per 1000 live births
***The difference in figures in the two columns is due to twin deliveries.

M.C.R., PERINATAL AND NEONATAL MORTALITY RATES - TOTAL GROUP

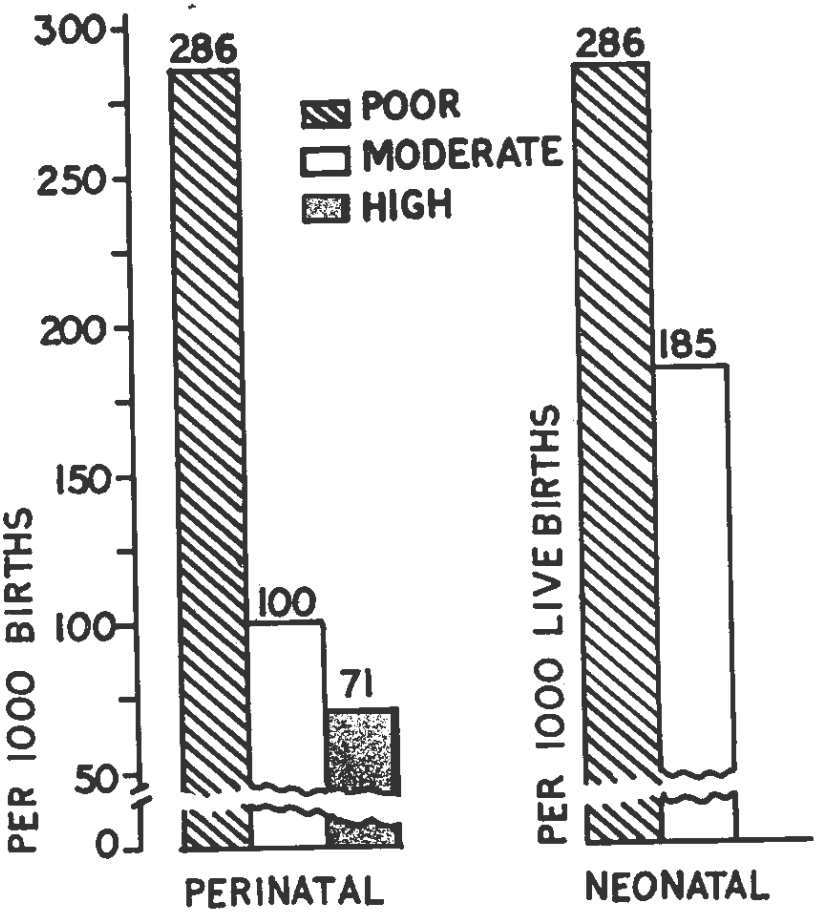


TOTAL GROUP

MATERNAL CARE RECEPTIVITY

FIG. 1

M.C.R., PERINATAL AND NEONATAL MORTALITY RATES - HIGH RISK GROUP



HIGH RISK GROUP

MATERNAL CARE RECEPTIVITY

FIG. 2

Discussion

Periodic assessment of the use of the services and facilities provided and of the characteristics of the population seeking them are necessary8. With this in view, a scoring procedure was evolved to assess the extent of utilisation of maternal care services by the expectant mothers. As already described, this procedure gave due weightage to the time of antepartum registration, number of clinic visits, tetanus toxoid immunisation, place of and attendance at delivery. This enabled us to quantify the utilisation of maternal care services and classify the expectant mothers into three categories *viz.* of high, moderate and poor receptivity (MCR). Only 9 per cent of the mothers were poorly receptive to the services provided.

The population covered by the Health Centre under study was much less than the population expected to be covered by a Primary Health Centre in the country (80,000 to 1,20,000). Therefore, it may be felt that the findings are only of local interest. But many studies have indicated that the effective zone of a PHC is only 5 to 8 kms. radius covering a population of about 10,000 to 13,000[9-11]. Thus, the population catered to by the PHC studied was not appreciably less than that effectively covered by larger PHCs. Further, the emphasis was on evolving a methodology with a scoring system by which utilisation of different components of maternal care services was quantified and expressed in a single figure, *i.e.* the Maternal Care Receptivity score.

Our hypothesis was- that a mother who was more receptive to maternal care would utilise the services better, and would register herself in the first trimester, visit the antenatal clinic periodically, receive tetanus toxoid immunisation and seek skilled attendance for delivery, than a mother who was not so receptive.

The purpose of the scoring system was to permit the classification of the mothers into different categories, those with low scores being at the greatest risk of the perinatal or neonatal mortality. Certain characteristics of mothers are known to be associated with poor outcomes of pregnancy^. i_n fact, in the present s tudy, an inverse relationship was observed between MCR and perinatal and neonatal mortality rates. The latter were three times higher

in babies' born to mothers with poor MCR as compared to those born to mothers with high MCR as is shown in Fig. 2. Among the high risk mothers, a four-fold difference was observed in the perinatal mortality rates between births of high and poor MCR groups of mothers are given in Fig. 2.

The scoring system adopted for MCR with perinatal and neonatal mortality rates as outcome indicators, therefore, seems to offer a method for assessment of utilisation of MCH services. In the procedure followed, weighted scores were allocated for each component of antenatal care, the weightage given being based on experience and according to the recommendations for optimum prenatal and natal care. A WHO task force on risk approach for improved maternal and child care has recommended development of such scoring systems by allocating *ad hoc* number of points for each characteristic based on experienced.

It may be argued that the weightages given to various factors (Appendix I) are on a numerical scale and are arbitrary and may not measure the exact risk of the outcome of pregnancy. However, the inverse relationship observed In this study and in similar studies using scoring procedures by Chase, Srinivasa *et at.* and Kessner *et at.* seems to validate the predictive value of the low scores!4-l6. Also, a WHO working group on the methodology of multi factor preventive trials on ischaemic heart disease used an *ad hoc* scoring method for defining high risk groups and found that the crude scores had much the same predictive value as more sophisticated approaches^?. More evidence may be necessary from such studies in the field of maternal and child health care.

Many factors, such as the socio-economic status and prior health status, influence the infant mortality. However, the observation that the mortality rates during perinatal and neonatal periods were lower among those babies born to mothers with high or moderate MCR than among the births of mothers with poor MCR suggests that infant mortality could be brought down by improving the utilisation of the existing services inspite of the poor socio-economic status prevailing.

Among the study group, literacy level and the economic status were very low. Several Indian studies and even some carried out in more developed countries have brought out the

fact that in areas where literacy status and general socioeconomic conditions are low, the influence of these factors on the acceptance of health services is low. Further, in a study in Urban Pondicherry, it was observed that education and income did not influence the MCR15. In the light of the above findings and as caste plays an important role on the knowledge, attitude and practices of the people relating to health, the influence of caste on MCR was studied in preference to literacy and income.

Some differences in the utilisation pattern between caste Hindus and Harijans were observed but these were not statistically significant. The most significant factor influencing the utilisation by the women appeared to be the distance of the Health Centre from their village. Only 9 per cent of women residing in villages beyond 4 kms. from the Health Centre had high MCR as compared to 76 per cent of those residing in the village where the Health Centre is situated (P^.0.05). As there were no intrinsic differences in the demographic and socio-economic status of the population in the villages where the Health Centre and sub-centre are located and in the other villages, utilisation, thus, closely correlated with convenience. In this context, the envisaged programme for Health for All by 2000 A.D. of providing one sub-centre for every 5000 population would be welcome and might improve the utilisation as only about 40-50 per cent of pregnant mothers are reported to be receiving antenatal care in the country at present.

In conclusion, it is seen that services provided by the staff and the physical facilities available in the Health Centre appear to have been utilised well, the benefit of utilisation being evident from the comparative reduction in the mortality rates among the births of mothers with better receptivity to maternal care. The scoring system adopted for maternal care receptivity with perinatal and neonatal mortality as outcome indicators seems to offer a simple method for assessment of utilisation of MCH services. All that it requires is some reorganisation and effort at maintenance of MCH records in the health centres. Similar studies aimed at establishing standard measures for assessment of utilisation of services would be valuable for evaluation.

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सारांश

यद्यपि मातृ–शिशु व स्वास्थ्य एवं परिवार कल्याण सेवाओं का प्रसार काफी तीव्र गति से हुआ है, किन्तु यह देखा गया है कि इन सेवाओं का उपयोग–स्तर तथा सेवाओं की प्रभावकारिता का आंकलन करने संबंधी बहुत ही कम प्रयास किये गये हैं। मातृ–स्वास्थ्य सेवाओं की उपयोगिता, जिन्हें मातृ–स्वास्थ्य सेवा सुग्राह्यता– एम. सी. आर. कहा जाता है, का मात्रात्मक आंकलन करने, विभिन्न पहलुओं के अन्तः संबंधों जैसे, आयु, समानता, महिला की जाति पेरीनेटल और मृत्यु दर पर एम.सी.आर. के प्रभाव आदि का आंकलन करने के लिए इस अध्ययन में एक सामान्य सी विधि प्रयोग की गई है। एम.सी.आर.तथा पेरीनेटल मृत्यु दरों में प्रतिलोमी सम्बन्ध बनाया गया तथा यह देखा गया कि कम मात्रा में एम.सी.आर. प्राप्त करने वाली महिलाओं से उत्पन्न होने वाले बच्चों में दोनों प्रकार के मृत्युदर तीन गुणा कम थे।

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APPENDIX I

SCORING PROCEDURE FOR ASSESSMENT OF EXTENT OF UTILISATION OF MATERNAL CARE SERVICES

FACTOR	SCORE
A. Time of commencement of antenatal care	
12 weeks	3
13-24 weeks	2
25-33 weeks	1
33 weeks	0
B. Frequency of antenatal clinic visits	
5 visits	3
3-4 visits	2
1-2 visits	1
Nil	0
C. No. of doses of tetanus toxoid immunisation received	
2 and more or 1 booster	2
1 only	1
Nil	0
D. Place of delivery	
a. For deliveries in hospital/health centre	
i. If the woman had three or more antenatal clinic visits	3
ii. if the woman had one/two antenatal clinic visits	2
iii. if the woman did not attend the antenatal clinic	1
b. For home deliveries	
i. if the woman had 3 or more antenatal clinic visits and the delivery was by trained traditional birth attendant (TBA) or midwife	3
ii. if the woman was in the high-risk group, had antenatal care and the delivery was by trained TBA or midwife	2

iii. If the woman had one/two antenatal clinic visits and the delivery was by trained TBA/mldwife	2
iv. if the woman did not attend the antenatal clinic and the delivery was by trained TBA/ midwife	1
v. if the- delivery was by an unskilled person	0

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EFFECTS OF MATERNAL AGE ON REPRODUCTIVE PERFORMANCE AND OPTIMAL CHILD BEARING AGE AMONG MUSLIM SHIA DAWOODI BOHRA MOTHERS OF UDAIPUR, RAJASTHAN

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ABSTRACT

Reproductive performance data on 212 randomly selected Muslim Shia Dawoodi Bohra mothers, who have completed their reproductive life cycle have been analysed to study, the effect of maternal age on reproductive wastage and neonatal mortality. Birth order effects have also been evaluated. The study reveals that occurrence of very low frequency of reproductive wastage and pre-reproductive mortality, the maternal age group 25-29 years seems to be the optimal child bearing age among the Dawoodi Bohra mothers.

The average reproductive life span of human female is accepted to be 15-44 years of age. It is an established fact that hormonal, physiological, morphological and histological changes in the reproductive and related organs with the advancing.age indicate the deterioration in the reproductive capacity with age. Studies on the western populations have brought forth data on the importance of maternal age in the causation of reproductive wastage *i.e.* abortion and still-births. Recent studies indicate that the maternal age plays an important role in perinatal mortality also. It has been suggested that the risk of mortality to the fetus for child is highest in young maternal ages followed by a

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comparatively risk free period and with the advancement of age again there is a spurt in the risk figures. A concurrent increase in the risk figures with birth order has also been seen.

A few hospital based studies have been carried out to study the effect of maternal age on the pregnancy wastage and postnatal mortality^»7-9$_b$

This study attempts to evaluate the effect of maternal age on reproductive performance and optimal child bearing age among the Shi a Muslim Dawoodi Bohra mothers.

Methods and Materials

Data on the reproductive performance of 212 Dawoodi Bohra mothers,- non-consanguineously mated, with completed reproductive life cycles have Been analysed for the present study. Mothers who resorted to use . contraceptive devices, or practices like induced abortion were excluded. Data on the age at marriage, age at commencement of cohabitation, age at each pregnancy, outcome of each pregnancy, neonatal and infant deaths etc. were collected. Accidental deaths were ignored. Occurrence of abortions, still-births, neonatal deaths and infant deaths have been cross-checked from the hospital records, local *Safi Dispensary* and local dais etc. The data have been analysed and indices for the abortion, still-birth, and post-natal mortality have been calculated against the frequency of live births. Viability loss Index indicates the total reproductive wastage (abortion + still-births) and neonatal deaths (deaths within one week after birth).

Results

The average age at marriage among Dawoodi Bohra males and females was found to be 23.60 and 18.77 years respectively. The average age at commencement of cohabitation was 25.33 years for males and 20.49 years for females.

Only 6.218 per cent pregnancies were conceived in the young maternal age group (below 20 years). The highest number of pregnancies were noted in the maternal age group of 25-29 years and 11.631 per cent pregnancies were conceived in the older age group between 35-40 years as shown in table 1.

TABLE 1

DISTRIBUTION OF PREGNANCIES WITH RESPECT TO MATERNAL AGE AND BIRTH ORDER AMONG DAWOODI BOHRAS OF UDAIPUR, RAJASTHAN

Maternal age group	All birth orders	Ist birth order	2nd birth order	3rd birth order	4th birth order	5th birth order
Under 20 yrs.	85 *(6.218)	54 (23.684)	18 (7.817)	6 (2.817)	1 (0.479)	-
20-24 yrs.	346 (25.311)	131 (57.456)	121 (53.304)	56 (26.291)	31 (14.831)	8 (4.494)
25-29yrs.	438 (32.041)	39 (17.100)	75 (33.040)	110 (51.643)	105 (50.239)	66 (37.079)
30-34 yrs.	339 (24.799)	4 (1.754)	12 (5.286)	41 (19.249)	53 (25.359)	77 (43.258)
35-40 yrs.	159 (11.631)	-	1 (0.441)	-	19 (9.091)	27 (15.169)
Total	1367	228	227	213	209	178

Analysis of the data on the outcome of pregnancy with respect to maternal age have been presented in table 2. A very high viability loss index (54.929) have been observed among the mothers below 20 years followed by a sharp decline to 20.588 in the next maternal age group of 20-24 years. Viability loss index was found to be lowest (19.289) in the maternal age group of 25-29 years and thereafter again an increasing trend in the viability loss index was observed as given in table 2.

Regarding the components of viability loss index, the abortion index did not show appreciable differences in the first three maternal age groups i.e.upto age of 29 years. Thereafter an increasing trend in the abortion index vas noted with the advancement of maternal age. Still-birth index was found to be highest (12.676) in the young maternal age groups (below 20 years) followed by a gradual decline to lowest (4.822) in the maternal age group 25-29 years. Thereafter again an Increasing trend in the still-birth index was noticed in the higher maternal age group as shown in table 2.

TABLE 2

MATERNAL AGE AND REPRODUCTIVE PERFORMANCE

Maternal age group	Total No. of pregnan-cies	Total Live birth	Abortion index	Still birth index	Neonatal death index	Viability loss index	Infant death index
Under 20 yrs.	85	71	7.042	12.676	35.211	54.929	14.085
20-24 yrs.	346	306	7.516	5.555	7.517	20.588	10.457
25-29 yrs.	438	394	6.345	4.822	8.122	19.289	7.868
30-34 yrs.	339	274	13.868	9.854	7.664	31.387	6.205
35-40 yrs. and above	159	125	16.800	10.400	10.400	42.400	8.000
All age groups	1367	1170	9.572	7.265	10.256	27.094	9.547

$$\text{Abortion index} = \frac{\text{No. of abortion} \times 100}{\text{Live births}} \quad \text{and so on}$$

$$\text{Viability loss index} = \frac{\text{No. of abortions + No. of Still birth + Neonatal deaths} \times 100}{\text{No. of live births}}$$

The major component of the very high viability loss index in the younger maternal age groups (below 20 years), were neonatal deaths (35.211). Following a sharp decline in the neonatal death Index in the maternal age group 20-24 years (7.51) there was no marked Increase in the neonatal death index till the maternal age or 34 years.

No significant trend in infant mortality was seen with respect to maternal age although In the younger maternal age group a high frequency of Infant deaths (14.085) were seen.

Birth Order

1st Birth Order: Young primigravida mothers (below 20 years) showed very high viability loss index (67.442). Primigravidas in the maternal age group 20-24 years showed the least risk of fetal loss or neonatal mortality. Interestingly, no marked difference in the abortion index was seen for primigravidas till maternal age of 29 years as shown in table 3. Still-births also were most frequent in the young maternal age group (below 20 years) followed by a sharp decline (4.348) in the maternal age group (20-24 years) and again showed an increasing trend with Increasing maternal age for primigravidas. Similar trend was observed for neonatal mortality among primigravida mothers. With respect to infant deaths, higher infant mortality was observed for younger maternal ages.

Ilnd Birth Order: At the 2nd birth order also the mothers in the age group 20-24 years showed the lowest viability loss index (20.952). Abortion and still-birth indices were lowest in the maternal age group 25-29 years. While the neonatal death index was lowest in the maternal group 20-24 years at 2nd birth order as given in table 3.

lllrd Birth Orden At 3rd birth order also the viability loss index showed lowest values in the maternal age group 25-29 years, although there were negligible difference in the total VLI between maternal age group 20-24 years and 25-29 years at 3rd birth order. Abortion index did not show any appreciable differences till the age of 29 years thereafter sharp increase in the abortion index In the next maternal age group was observed as shown in table 3.

TABLE 3

BIRTH ORDER AND REPRODUCTIVE PERFORMANCE

Maternal age group	Total No. of pregnancies	Total live birth	Abortion index	Still birth index	Neonatal death index	Viability loss index	Infant death index
1st Birth Order							
Under 20 yrs.	54	43	9.302	16.279	41.861	67.442	13.953
20-24 years	131	115	9.565	4.348	12.174	26.087	13.913
25-29 years	39	33	8.091	9.091	21.212	39.394	12.121
30-34 years	4	3	33.333	-	33.333	66.667	33.333
35-40 years	-	-	-	-	-	-	-
All age groups	228	194	9.794	7.732	20.618	38.144	13.918
2nd Birth Order							
Under 20 yrs.	18	15	6.666	13.333	33.333	53.333	26.667
20-24 years	121	105	7.619	5.619	5.714	20.952	10.476
25-29 years	75	68	2.941	7.353	13.235	23.529	14.706
30-34 years	1	1	-	-	-	-	-
All age groups	227	197	6.091	9.137	10.152	25.381	13.198
3rd Birth Order							
Under 20 yrs.	6	6	-	-	33.333	33.333	16.667
20-24 years	56	51	3.922	5.882	1.961	11.765	3.921
25-29 years	110	103	3.883	2.913	4.854	11.650	5.825
30-34 years	41	35	11.428	5.714	11.428	28.571	2.858
35-40 years	-	-	-	-	-	-	-
All age groups	213	195	5.128	4.102	6.154	15.385	5.128
4th Birth Order							
Under 20 years	1	1	-	-	-	-	-
20-24 years	31	23	8.6985	8.695	8.695	26.087	8.695
25-29 years	105	93	6.452	6.452	11.828	24.732	5.376
30-34 years	53	42	16.667	9.524	9.524	35.714	7.143
35-40 years	19	17	11.765	-	23.529	35.294	5.883
All age groups	209	176	-	-	-	-	-
5th Birth Order							
Under 20 years	-	-	-	-	-	-	-
20-24 years	8	7	14.286	-	-	14.286	28.571
25-29 years	66	59	10.169	1.695	1.695	13.559	1.695
30-34 years	77	62	14.516	9.677	8.064	32.258	4.839
35-40 years and above	27	19	26.316	15.789	10.526	52.632	10.526
All age groups	178	197	14.286	6.803	5.442	26.531	5.442

IVth Birth Order: At 4th birth order the lowest viability loss index was observed in the maternal age group 25-29 years. With increase or decrease in the maternal age, a corresponding increase trend in the VLI alpngwith its components was noticed.

Vth Birth Order: At 5th birth order also the Dawoodi Bohra mothers in the maternal age 25-29 years showed the lowest values of viability of loss index.

Discussion

From the analysis of the data it is clear that the active reproductive life span of the Dawoodi Bohra mothers is between 20-34 years. A very small percentage of pregnancies are conceived after or before that.

A very high viability loss index in the younger maternal age group below 20 years mainly constituted by neonatal mortality points out to the complex inter-actions involved between the Biological, physiological and hormonal factors in pregnancy outcome and child welfare. This is further supported by a sharp decline in the neonatal mortality in the next maternal age group (20-24 years) when the women are mature physiologically and biologically. High frequency of still-births in the younger maternal group also points out the role played by the maternal age in the pregnancy outcome. The results are in agreement with the studies reported on the Western and European populations.

It is evident from the data that the viability loss" index shows a gradual decline to lowest in the 25-29 years maternal age group. Similar findings have been reported on the European and Western Population groups^-** and also among the Jat mothers of Najafgarh area, Delhi9. Evaluation of the data with respect to birth orders it was noticed that primi-gravida Dawoodi Bohra mothers were at the lowest risk in the maternal age group 20-24 years. With the increase in birth order, however, no marked increase in the risk figures for the reproductive wastage (abortions + still-births) and neonatal mortality were seen till the maternal age of 29 years. As shown by the reproductive performance nearly 60 per cent of the pregnancies were conceived in this maternal age group (20-29 years) as shown in table 1.

It is evident from the data on prenatal and post-natal mortality that the maternal age 25-29 years is the optimal child bearing age among the Shia Muslim Dawoodi Bohras. However, keeping in view the ethnic origin, social customs, preferential marital alliances etc. which are invariably peculiar to the individual population groups the findings may be applied to other group with caution.

सारांश

गर्भक्षय तथा नवजात मर्त्यता के प्रभावों का पता लगाने के लिए इस अध्ययन के अर्न्तगत यादृच्छिक आधार पर चुनी गई मुस्लिम शिया दाऊदी बोहरा समुदाय की 212 ऐसी माताओं की प्रजनन क्षमता संबंधी आंकड़ों का विश्लेषण किया गया, जिन्होंने अपना प्रजनन–आयु क्रम के प्रभावों का मूल्यांकन किया गया। इस अध्ययन से ज्ञात होता है कि प्रजनन–क्षय तथा पूर्व–प्रजनन मृत्यु की बारंबारता की सबसे कम घटनाओं के आधार पर 25–29 वर्ष का आयु वर्ग दाऊदी बोहरा महिलाओं के लिए गर्भधारण आयु का सबसे उचित वर्ग है।

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PEOPLE'S PERCEPTION OF A FAMILY WELFARE FIELD WORKER: FINDINGS FROM A SAMPLE SURVEY IN KARNATAKA

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ABSTRACT

The most widespread and important manifestation of the change of emphasis in family planning programme is the increased use of trained field workers to call on families at their homes and provide doth education and services related to family planning. With regard to a variation in the field workers' performance, many studies in the past educed the impact of certain socio-demographic characteristics. The present endeavour, therefore, sought to circumspect whether people had any preferences for workers with homophilous characteristics such as age, sex, with/without children, religion and caste etc.

The study reveals that people, by and large, were not found to be having specific preferences regarding the so do-demographic characteristics of a field worker except for the sex preference among females. However, it was found that a field worker who is aged above thirty, married and having children would be more acceptable to the community.

Throughout the developing countries, family planning programines are designed or modified to give much mo re emphasis to motivational and informational outreach activities. Perhaps the most widespread and important manifestation of the change of emphasis in family planning programme is the increased use of trained field-workers to contact families at their homes and to extend to them an increasing range of services, from programme information, advice on maternal and child welfare, contraceptive supplies and

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referral to clinics. Of late, the range of responsibilities assigned to field worker is widening and consequently the determinants of their success or failure in these activities are becoming a subject of interest to researchers and administrators.

Many studies in the past have shown that there is considerable variation in the performance of field workers within the family planning programme. The said studies have ascribed certain socio-demographic characteristics of the field workers to their respective performances. For instance, a study by John Ross and others has revealed that age and marital status of the field worker correlated with his/her performance^. Another study revealed that Auxiliary Nurse-cum-Midwives aged over 30 years, married, having more than four living children with the youngest living child aged above two years were found better in their job performances compared to their counterparts^.

Despite the various attributions made in the preceding paragraphs for the variation in the field worker's performance, there may be variations on account of the differences in the receptivity of family planning by different communities in which the field worker operates. Everett Rogers has emphasised that successful communication depends on both the conveyor of information and those of the receiver. The relevant questions at this juncture are: who could be a successful conveyor of information? How does the receiver want him? What should be his/her socio-demographic characteristics? Parker Mauldin also holds an identical view. He stresses that research is needed in studying the extent to which family planning programmes have provided information, supplies and services that are needed by the population. This paper was an attempt to study the people's perception of how a field worker should be? As the field worker is expected to become a part of the community, it is imperative that he/she should be acceptable to them. Since his/her role is also of educating the people, proper communication links are essential. It is assumed that field workers with homophilous characteristics are more communicative and people will be suggestible to them. His/her operational efficacy depends largely on how he/she interacts with the clientele and how are his/her service and advice taken?

Objective

The objective of this paper . was to explore whether people have preferences for field workers with homophilous characteristics. Characteristics such as age, sex, with or without children, religion, and caste of the field worker as preferred by the people are considered for this study.

Study Setting and Sampling Design

The data used in this paper were collected in the first round of a Longitudinal Sample Survey (LSS) conducted during May-December 1975, by the Population Centre, Bangalore. The Bangalore Revenue Division in Karnataka formed the study setting. The Division consists of five districts, namely, Bangalore including Bangalore City, Chitradurga, Kolar, Shimoga and Tumkur.

The LSS adopted a Multistage - stratified - systematic sample design. The sample Included 5,200 households, out of which 3,200 were from rural and 2,000 from urban areas. The rural sample was composed of the households selected from sample villages of four Primary Health Centres each in all the five districts listed above. Bangalore City and the District Headquarters constituted the urban sample. The details of sampling design and sample size have been published in an earlier article by P.H. Reddy.

A question namely "who do you think is the best person to provide family planning services to you at home? With age, sex, marital status, whether with/without children, religion, caste and place of origin as variables, was asked In Section III of the survey schedule, which dealt with the perception, demand and practice of family planning. This was administered to both currently married women who were in the reproductive age group of 15-45 and husbands of currently married women alternatively".

Discussion

The data on the preferred age of the field worker by the age of respondent is shown in table 1. Data reveals that males and females in villages and towns do not have preference about the age of the field worker. However, it can be observed that in villages males and females in all the

TABLE 1

PREFERRED AGE OF THE FIELD WORKER BY AGE OF RESPONDENT (in percentage)

Age of Respondent	Sex	Number of Respondent	No pre-ference	Villages Preferred Age 15-29	30-39	40+	No Res-ponse	Number of Respondent	No pre-ference	Towns Preferred Age 15-29	30-39	40+	No Res-ponse
15-29	Male	263	55.1	4.2	10.6	11.0	19.0	126	53.2	7.9	18.2	11.9	8.7
	Female	712	62.1	6.2	4.8	9.7	17.2	426	44.1	14.6	19.5	12.4	9.4
30-39	Male	434	60.4	5.8	11.7	8.5	13.6	248	63.7	5.6	15.7	10.2	4.8
	Female	430	59.3	5.8	7.4	11.6	15.8	262	48.9	3.4	20.6	13.7	13.4
40+	Male	613	57.3	5.9	8.8	12.3	15.7	357	54.6	3.6	13.8	16.5	11.5
	Female	196	61.7	3.6	6.6	10.7	17.3	120	40.0	5.8	17.5	20.8	15.9
Total	Male	1310	57.9	5.5	10.2	10.8	15.6	732	57.4	5.1	15.2	13.5	8.8
	Female	1338	61.1	5.7	5.9	10.5	16.8	808	45.0	9.7	19.6	14.1	11.6

age groups (except males in the age group 30-39 where they prefer their age group worker) prefer more than others a field worker aged either 40 or above. In towns, it can be seen that relatively higher proportion of males and females prefer a field worker in the age group 30-39. It is also evident from table 1 that male and female respondents in the age group 40+ have preferred their age group person to render family planning services.

It is interesting to find that in villages while 58.4 per cent males have no preference to the sex of the field worker, 65 per cent of females prefer females only as family planning worker as shown in table 2. Towns also present a similar picture. While males prefer both sexes, females are found preferring someone from their own sex. This could be perhaps due to the feeling of more security of a female in the company of another female. By virtue of a male's more interaction in the society he has probably overcome the orthodox convictions.

TABLE 2

PREFERRED SEX OF THE FAMILY PLANNING WORKER BY SEX OF RESPONDENT (in percentage)

Sex of the Respondent	No. preference	Preferred		No. Response
		Male	Female	
		Villages		
Male	58.4	12.4	14.7	14.5
Female	19.2	0.5	65.1	15.2
		Towns		
Male	52.0	24.7	15.3	7.9
Female	30.8	1.5	56.8	10.9

Data relevant to the preferred marital status of family planning field worker is given in table 3. Males and females in general do not seem to have any preference regarding the marital status of the field worker in the villages and towns. Nevertheless, amongst those who have preference quite a sizeable proportion of both males and females in villages as well as towns prefer a married person. Thirty four per cent of males in villages as against 41.6 per cent in towns; 23.7 per cent of females in villages as against 40.7 per cent in towns prefer a married person to be a family planning field worker. Table 3 also shows that high proportion of males and females in towns prefer a married person than their village counterparts.

The data on the respondent's preference of a family planning field worker either with or without children or the

TABLE 3

PREFERRED MARITAL STATUS OF FAMILY PLANNING WORKER BY SEX OF RESPONDENT (in percentage)

Sex of the Respondent	No Preference	Preferred		No Response
		Married	Unmarried	
	Villages			
Male	49.8	34.0	1.5	14.7
Female	58.9	23.7	0.8	16.5
	Towns			
Male	50.1	41.6	0.3	8.0
Female	46.9	40.7	0.4	11.9

number of children the respondent himself are shown in table 4. A similar trend was also found in the preceding table. Fifty per cent or more of both males and females in both villages and towns are not found to have any preference regarding the field worker either having or not having children. Yet more than 25 per cent of males in both villages and towns and females only in towns are seen preferring a field worker having children. It is amazing that only 11.3 per cent of females in villages have preferred a field worker having children. The proportion of males and females preferring a field worker having children are more in towns than villages. Also in both villages and towns the proportion of respondents desiring a field worker with children is more with the respondents having two living children.

There is hardly any preference for religion of a family planning field worker. Three-fourths of both males and females in both the study units are found to be not having any preference about the religion of the field worker as shown in table 5. It is also evident from the table that 16.2 per cent among Muslims, females in towns prefer a Muslim as field worker.

Summary and Conclusion

The study conducted on a sample of 5,200 households has revealed that there is sex preference among females. Females prefer a female field worker as compared to a male field worker, although sex, age, mari tal s tatus, with/without children, religion, caste and place of origin have not elicited any preference.

However, when the preferred age of the field worker and the age of the respondent was compared to find out if there was a preference for-ones[1] own age group, by and large, such a preference was not found. , Yet, it was found that a majority in villages (except males who were in the age group 30-39) preferred a field worker aged above 40 years. In towns, the preference was toward 30-39 age group. This implies that some have preference for a middle aged field worker who they believe would also be responsible. The exemplification is that not many have desired a person in the age group 15-19 years.

TABLE 4

RESPONDENT'S PREFERENCE OF FAMILY PLANNING WORKER KITH/WITHOUT CHILDPEN BY NUMBER OF CHILDREN OF 'R' (IN PERCENTAGE)

No. of Children	Sex	Villages					Towns				
		Number of 'R'	No preference	Preferred		No response	Number of 'R'	No preference	Preferred		No response
				With Children	Without Children				With Children	Without Children	
0	M	180	50.0	20.0	2.2	27.8	93	58.1	35.5	0.0	6.4
	F	159	62.9	9.4	0.6	27.0	99	52.5	30.3	0.0	17.2
1	M	205	56.1	25.8	2.0	16.1	113	57.5	34.5	0.0	8.0
	F	216	72.2	10.6	0.5	16.7	111	55.9	38.7	0.0	5.4
2+	M	908	58.7	27.0	2.1	12.2	519	56.1	34.3	0.6	9.0
	F	961	72.3	11.8	0.4	15.5	598	55.9	30.9	0.2	13.0
Total	M		57.1	25.8	2.2	15.0	725	56.6	34.5	0.4	8.5
	F		71.2	11.3	0.4	17.1	808	55.4	31.9	Neg.	12.5

Note:- Neg. = Negligible, R = Respondent, M = Male, F = Female

TABLE 5

PREFERRED RELIGION OF THE FAMILY PLANNING WORKER (in percentage)

Religion of Respondent	Sex	Villages							Towns						
		No.of 'R'	No preference	Preferred Religion				No response	No.of 'R'	No preference	Preferred Religion				No response
				Hindu	Muslim	Christian	Other religions				Hindu	Muslim	Christian	Other religions	
Hindus	M	1253	78.8	5.8	0.2	Neg.	Neg.	15.0	556	86.5	5.0	0.2	0.0	0.7	8.1
	F	1269	73.3	10.3	Neg.	0.0	Neg.	16.2	612	82.8	4.9	0.0	0.0	0.3	11.9
Muslims	M	51	88.2	0.0	5.9	0.0	0.0	5.9	128	83.6	3.9	3.9	0.0	0.0	8.6
	F	62	83.9	0.0	1.6	0.0	0.0	14.5	154	66.9	1.3	16.2	0.0	0.0	15.6
Christians	M	6	*	*	*	*	*	*	36	72.2	5.6	0.0	13.9	0.0	8.3
	F	6	*	*	*	*	*	*	32	87.5	0.0	0.0	0.0	0.0	9.4
Other Religions	M	-	-	-	-	-	-	-	12	66.7	8.3	0.0	0.0	0.0	25.0
	F	1	*	*	*	*	*	*	10	90.0	0.0	0.0	0.0	0.0	10.0
Total	M		79.3	5.5	0.4	Neg.	0.0	14.7	732	85.0	4.9	0.8	0.7	0.0	8.5
	F		73.8	9.7	Neg.	0.0	0.0	16.3	808	80.1	4.0	3.1	0.0	0.0	12.5

Note:- Neg. = Negligible, R = Respondent, M = Male, F = Female
* = Percentages are not calculated as total frequencies are less than ten.

As mentioned already in the preceding paragraph, sex preference among females was observed in both villages and towns. A female, as mentioned already feels more secure to talk to a woman than to a man. A females[1] exposure to the outer world is limited as compared to that of a male's. Further, the feminine problems could well be understood and appreciated by a female rather than a male. In addition, certain of feminine problems, a female feels shy to part with a male. This probably could have led to sex preference among females.

In general, there was no preference for a married person as a field worker. However, more than one-fourth of the respondents In villages and nearly 40 per cent and more in towns prefer a married person. Such a preference might be due to the respondent's feeling that a married person can Understand the familial and sexual problems better than an unmarried person and also due to the trust they have in a married person. Besides, the inhibitions in freely conversing the problems might also be less when the listener is also married.

Field worker either having children or not having children are equally preferred by the respondents in both villages and towns. However, it was found that more than one-fourth preferred a person having children. Such a phenomenon might be due to the concern at the child*s health. People's belief could be that one with children can provide better child care. He/she might provide the parental touch in whatever services he/she provides. Urban people especially are concerned at the quality of service. Therefore, their specifications are always more and well calculated.

Co-existence in the society seems to have overcome the prejudice for religion. People in both villages and towns have decreed preference for a field worker of their religion. Similarly, caste of a field worker is not cared much. What Is conspicuous from this is, people are not worried about the religion or caste of a person but are worried about the type of services one provides. A field worker should be a responsible person capable of understanding the human as well as health problems of the community and honest enough to provide the healing touch. Once this is ensured preference for horaophilous characteristics does not arise.

In conclusion, it can be said that people by and large, were not found to have preference regarding the socio-demographic characteristics except for the sex preference among females. However, the study has obviated that one who is aged above 30, married and having children could be more acceptable to the community.

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सारांश

परिवार नियोजन कार्यक्रम के स्वरूप में परिवर्तन करने का सबस व्यापक एवं महत्वपूर्ण उद्वेश्य प्रशिक्षित क्षेत्र–कार्यकर्ताओं की सेवाओं के अधिकाधिक प्रयोग द्वारा लोगों के घरों में जाकर उन्हें परिवार नियोजन संबंधी सेवायें प्रदान करने के साथ–साथ उन्हें इस बारे में शिक्षित करना है। क्षेत्र कार्यकताओं की सेवानिष्पादन संबंधो असमानताओं के बारे में अतीत में किये गये अनेक अध्ययनों से पता चलता है कि कुछ सामाजिक–जनांकिकीय प्रभाव और भी अधिक महत्वपूर्ण हो गये है। इसलिए वर्तमान प्रयास का उद्वेश्य यह जानकारी प्राप्त करना था कि क्या लोग कार्यकर्ताओं की समलैंगिक विशेषताओं जैसे उनकी आयु, लिंग बाल बच्चेदार होने बच्चों से रहित होने, धर्म तथा जाति आदि को महत्व देते है।

इस अध्ययन से पता चलता है कि सामान्यतः लोग क्षेत्र–कार्यकर्ताओं की सामाजिक–जनांकिकीय विशेषताओं को कोई विशेष महत्व नहीं देते, किन्तु केवल महिलाओं मे प्रायः समलिंगी से अधिक आयु के विवाहित तथा बाल बच्चेदार क्षेत्र–कार्यकर्ता को समुदाय द्वारा सामान्यतः अधिक महत्व दिया जाता है।

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CORRELATES OF HUSBAND-WIFE ATTITUDES TOWARDS -FAMILY PLANNING IN RURAL GHANA (WEST AFRICA)

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ABSTRACT

The attitudes of rural Ghanaian husbands and wives towards family planning have been analysed. The analysis is based on the data obtained from the Danfa Comprehensive Rural Health and Family Planning Project. Multivariate statistical techniques have been used to find out the net effect of each of the'' independent variables of attitudes towards family planning. The results of the analysis reveal that our prediction of family planning approval is slightly better for the husbands than the wives, 14 per cent as against 10 per cent. Further, Knowledge of methods of contraception is found to have a highly significant positive relationship with the approval of family planning both by the husbands and wives. The net effect of number of children desired and number of previous marriages has been found to be statistically significant on the husband's approval but not on the wife's, while religion appears to be significantly related with wife's approval though not with the husband's.

Notwithstanding the fact that KAF (Knowledge, Attitudes and Practice) studies are of recent origin and there is generally lack of historical data having bearing directly on family planning practices, it is generally accepted that practice of contraception was the principal intermediate variable which brought about -a change from high to low fertility in the late nineteenth and early twentieth century (United Nations, 1973: 185). But whatever the role of contraception in the past might be, in the developing countries of today where the population pressures are very

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high, and the value of other factors inhibiting fertility is decreasing, contraception seems to have acquired a greater importance in influencing the outcome of fertility behaviour. Most developing countries now have either official family planning programme or voluntary programmes having official patronage. To aid in the effective organisation and functioning of these programmes, numerous KAF surveys have been conducted in many countries during the recent past^. The data on attitudes in KAF studies have generally found a widespread use among the population planners and administrators for studying, predicting and moulding the fertility behaviour on the assumption that attitudes are the determinants of human behaviour and that persons having favourable attitudes towards family planning are more likely to use birth control methods than those having unfavourable attitudes. The ultimate goal of all population programmes is to affect people's practices but since favourable attitude is considered a necessary step towards the achievement of that goal, these programmes attempt to change the negative attitudes towards family planning.

So far as attitudes of the African people towards family planning are concerned, the results of different studies vary widely. On the one extreme are the findings from the National Family Planning/KAP (1968-69) survey of Ghana which indicate that family limitation in that country is generally frowned upon in as much as 71 per cent of the rural women and 50 per cent of their urban counterparts disapproved the Idea of family limitation^, On the other hand Kenyans have been found to have most favourable attitudes towards family planning. In a survey carried out in Nairobi, about 66 per cent of the men and 90 per cent of the women thought that family planning was good^. This, however, seems to be too high a response for a developing nation. The results of other African studies are more close to Ghana than Kenya. In a Moroccan survey 43 per cent of the urban women with less than four children and 50 per cent with more than four children approved of family planning. But in the rural areas the level of approval was 31 per cent both for those having less than and more than four children4. The results from Ethopian study showed that about 55 per cent of the respondents had favourable attitude towards family planning. On the basis of a study carried out in rural Eastern Nigeria, Ukaegbu, it has been reported

that a little less than two-fifths of the women respondents expressed a favourable attitude towards family planning. These women also stated that their husbands also held similar views about family planning.

The nature of attitudinal differentials has also been reported in some studies. Those living in rural areas have been reported to be less favourable to family planning as compared with urban counterparts. The level of education of the respondents has also been found to be directly related with their approval of family planning. While no age differentials were found in the Moroccan study, the younger respondents in the Ghana survey were reported to have more favourable attitudes towards family planning than those in the older age groups. Again the religious differentials were looked into in the Ethopian study and Muslims were found to have the most negative attitude towards family planning[5]. Some Ghanaian studies also tried to find out the relationship between knowledge and approval of family planning and found that approval was significantly related with knowledge in as much as more knowledgeable approved more than less knowledgeable.

As mentioned above, one of the basic pre-requisites of any fertility control programme is to bring about a change in people's attitudes towards family planning. To affect this behavioural change, it is essential to gain knowledge of the factors which determine these attitudes. Once these factors are known, the programmes could be directed to influence one or more of these factors. However, inspite of a large number of studies in this area, our knowledge about these factors in developing countries in general, and African societies in particular thus far remain limited or at best fragmentary. Many of these factors are inter-related and there are not many multivariate studies to isolate the effect of one from the other. Furthermore,,in many African societies pattern of male dominance prevails and the wives are reluctant to use contraception without the concurrence of their husbands. In such a situation, the attitudes of wives alone would not be taken as true predictor of their contraceptive behaviour. It would, therefore, be appropriate to analyse data for both husbands and wives. Such studies are, however, rarely found in demographic literature.

Objectives, Sources of Data and Methodology

The main objective of this paper was to examine the attitudes towards family planning of a sample of husbands and wives in rural Ghana and to analyse the salient determinants of these attitudes. The analysis is based on interviews with 778 husbands and 857 wives. The survey was carried out by the comprehensive rural health and family planning project, Ghana (West Africa) with which the author was associated for about five years. This was a demonstration, teaching and research project developed and implemented jointly by the university of Ghana, medical school and school of public health, university of California, Los Angeles.

In order to ascertain the attitudes of respondents towards family planning, the following question was posed to both husbands and wives included in the sample "many people do something to postpone pregnancy so that they can have just the numher of children they want and can have them when they want them. How do yon feel about this? Would you say that you approve, disapprove or feel uncertain about this?" identical questions were asked of husbands and wives and every effort was made to see that they were interviewed individually but by the same interviewer. Interviews o f both husband and wife were conducted same day without much time lag so that they would hot have time or opportunity to discuss the interview with each other prior to their completion. The relationship of expressed attitudes with various independent variables has been analysed. The independent variables selected are: age, age at first marriage, education, religion, ethnicity, lineality, (patrilineal *vs* matrilineal), type of marriage (monogamous *vs* polygamous), type of conjugal relation (customary *v8* mutual consent or friendship), type of family (nuclear *vs* extended), number of previous marriages, number of children desired and knowledge of methods of contraception. One way analysis of variance was done to find out the level of significance of relationship between the dependent and each of the independent variables. Since there was likely to be interrelationship between the various independent .variables, the next step was to use multivariate statistical techniques to examine the net effect of any single independent variable on the attitudes towards family planning.

The main statistical techniques used are one way analysis of variance and multiple classification analysis (MCA). Since many of our independent variables are nominal, the technique of analysis was most appropriate for analysing the relationship between our dependent variable and independent variables in MCA. It is an extension of 'dummy[1] variable multiple regression analysis where the explanatory variables may represent membership in classes rather than numerical values. MCA obtains for each sub-class of independent variable a coefficient indicating its influence on the dependent variable after the effects of other variables have been taken into account. This technique is particularly useful for independent variables which are unordered (religion, ethnicity, family type etc.). MCH routinely computes a multiple R as well as Beta coefficients which are analogous to partial B coefficients in ordinary multiple regression with numerical values.

Results and Discussion

The attitudes towards family planning by husbands and wives are shown in table 1, which indicates that approximately two-thirds (66.4%) of the husbands and seven-tenth (70.0%) of the wives approve the concept of family planning and the proportion of those who feel uncertain about It is very small. Although the difference between husband's and wife's approval appears to be meagre, it is nevertheless statistically significant ($t = 1.74$; $P = 0.05$).

TABLE 1

APPROVAL OF FAMILY PLANNING BY RURAL GHANAINAL HUSBANDS AND WIVES

	Husbands		Wives	
	Number	Per cent	Number	Per cent
Approve	514	66.4	600	70.0
Disapprove	232	30.0	226	26.4
Uncertain	28	3.6	31	3.6
Total	774	100	857	100

An attempt was also made to analyse the effect of various socio-cultural and demographic factors on the approval of family planning by the husbands and wives. The statistical techniques used for this purpose, as mentioned above, are one way analysis of variance and analysis of covariance. In both these types of analysis which have been done separately for husbands and wives, a dichotomous criterian variable - approval or disapproval of family planning has been created by excluding all those cases in which response is uncertain.

The results of both our bivariate and multivariate analysis are shown in tables 2 and 3. In our one way analysis of variance, significant predictors of approval of family planning by the husbands are: age, education, number of previous marriages, number of children desired and knowledge of methods of contraception (F" 2.79, p - 0.016; F = 3.42, p - 0.017; F - 4.89, p - 0.008; F - 7.49, p 0.000; and F= 15.72, p = 0.000 respectively). However, in the analysis of covariance when the effect of other variables is controlled, age and education drops out while the net effect of other three variables, *i.e.* number of previous marriages, number of children desired, and knowledge of methods of contraception remains statistically significant (F - 5.92, p - 0.015; F - 5.67, p - 0.018; and F - 54.65, p - 0.000 respectively). So far as direction of these relationships is concerned, number of previous marriages and number of children desired have a negative effect on the approval of family planning, while there is a positive relationship between our dependent variable and knowledge of contraceptive methods. Furthermore, all these independent variables are able to explain 14 per cent ($R^2 = 0.140$) of the total variation in the approval of family planning by the husbands.

As regards wives, in our bivariate analysis education, religion, type of marriage and knowledge of contraceptive methods are found to be significantly related with approval of family planning (F - 3.66, p - 0.012; F - 3.90, p - 0.009, t = 2.09, p - 0.019; and F - 15.88, p - 0.000 respectively). The results of our multivariate analysis, however, reveal that only the net effect of religion and knowledge of contraception methods is significant (F = 5.617, p = 0.000; F = 28.74, p = 0.000 respectively). Thus, in our multivariate analysis education and type of marriage as predictors of family planning approval are reduced to a level of statis-

TABLE 2

APPROVAL OF FAMILY PLANNING BY RURAL GHANAIAN HUSBANDS AND WIVES BY SELECTED CHARACTERISTICS

Selected predictors	Husbands				Wives			
	Number of Cases	Proportion Approving FP	Standard Deviation	Standard error	Number of cases	Proportion Approving FP	Standard Deviation	Standard error
Age								
Less than 19	-	-	-	-	31	0.87	0.34	0.06
20-24	29	0.76	0.43	0.08	140	0.79	0.41	0.03
25-29	83	0.82	0.39	0.04	205	0.73	0.45	0.03
30-34	130	0.68	0.47	0.04	184	0.69	0.46	0.03
35-39	136	0.73	0.45	0.03	137	0.68	0.47	0.04
40-44	142	0.60	0.49	0.04	123	0.72	0.45	0.04
45+	219	0.66	0.46	0.03	-	-	-	-
Age at First Marriage (Husbands)								
Below 20	44	0.70	0.46	0.06				
20-24	284	0.72	0.45	0.02				
25-29	267	0.67	0.47	0.02				
30-34	95	0.67	0.47	0.04				
35+	34	0.62	0.49	0.08				
Age at First Marriage (Wives)								
Below 16					82	0.77	0.42	0.04
16-19					445	0.75	0.43	0.02
20-24					235	0.69	0.47	0.03
25+					23	0.70	0.47	0.09
Education								
None	443	0.67	0.47	0.02	655	0.71	0.45	0.01
Primary	113	0.60	0.49	0.04	93	0.72	0.45	0.04
Middle	155	0.76	0.43	0.03	63	0.87	0.34	0.04
Higher	30	0.80	0.41	0.07	8	1.00	1.00	0.35
Religion								
Protestant	259	0.73	0.45	0.02	283	0.79	0.41	0.02
Catholic	40	0.70	0.46	0.07	29	0.62	0.49	0.09
Muslim	63	0.57	0.50	0.06	51	0.63	0.49	0.06
Traditional	376	0.68	0.47	0.02	455	0.70	0.46	0.02
Tribe								
Ga	244	0.67	0.47	0.03	241	0.75	0.44	0.02
Ewe	188	0.67	0.47	0.03	203	0.67	0.47	0.03
Akan	135	0.72	0.45	0.03	162	0.78	0.42	0.03
Others	168	0.68	0.47	0.03	173	0.71	0.46	0.03

(Table 2 contd.)

Lineality								
Patrilineal	432	0.67	0.47	0.02	444	0.71	0.45	0.02
Hatrilineal	310	0.70	0.46	0.02	376	0.74	0.44	0.02
Type of Marriaqes								
Monogamous	557	0.69	0.46	0.01	566	0.75	0.43	0.01
Polygamous	165	0.65	0.48	0.03	254	0.68	0.47	0.02
Type of Conjuga								
Relations								
Cuatomery	680	0.68	0.47	0.01	720	0.72	0.45	0.01
Mutual consent	49	0.71	0.46	0.06	81	0.74	0.44	0.04
Type of Family								
Nuclear	429	0.70	0.46	0.02	459	0.72	0.45	0.02
Extended	313	0.66	0.47	0.02	361	0.73	0.44	0.02
No. of Previous								
Marriages								
None	404	0.70	0.46	0.02	566	0.73	0.44	0.01
1	211	0.72	0.45	0.03	204	0.75	0.44	0.03
2 or more	127	0.57	0.50	0.04	50	0.60	0.49	0.06
No. of Children								
Desired								
0-3	26	0.81	0.40	0.07	56	0.73	0.45	0.06
4-5	84	0.82	0.38	0.04	208	0.75	0.43	0.02
6-7	126	0.79	0.41	0.03	222	0.77	0.42	0.02
8+	348	0.62	0.48	0.02	203	0.68	0.47	0.03
Family Planning								
Knowledge Score								
0-2	59	0.41	0.50	0.06	90	0.44	0.50	0.05
3-5	159	0.55	0.49	0.03	238	0.67	0.47	0.03
6-8	285	0.71	0.46	0.02	301	0.78	0.41	0.02
9-11	169	0.77	0.42	0.03	136	0.82	0.39	0.03
12-18	70	0.91	0.28	0.03	55	0.91	0.29	0.03
No. of Children								
Dead								
0	-	-	-	-	435	0.73	0.45	0.02
1	-	-	-	-	216	0.70	0.46	0.03
2	-	-	-	-	99	0.77	0.42	0.04
3	-	-	-	-	42	0.74	0.45	0.07
4+	-	-	-	-	26	0.75	0.44	0.08

* The score was derived by giving appropriate scores for methods of family planning mentioned spontaneously and on prob.

tical non-significance. Regarding effect of religion which persists even when other intervening variables are controlled, the Catholic wives who are closely followed By Muslims have the lowest rate of approval, while the proportion of wives approving family planning is highest among the Protestants. Those having faith in traditional religion have the level of approval which is lower than the Protestants and higher than the Catholics and Muslims. So far as the direction of relationship of our second variable (whose net effect on the approval of family planning by the wife came to be highly significant) is concerned, we observe a neat consistency in the positive relationship between family planning approval and extent of knowledge of various methods of contraception. In the case of wives the MCA gave a total R2 value of 0.10 indicating that all the independent variables are able to explain 10 per cent of the total variation in the approval of family planning by the wives.

TABLE 3

SUMMARY OF RELATIONSHIP BETWEEN DEPENDENT VARIABLE Y (ATTITUDE TOWARDS FAMILY PLANNING) AND INDEPENDENTVARIABLES x_I TO X_n

Independent variables X_i	Significance of relationship*			
	Husbands		Wives	
	Bivariate** analysis	Multi-*** variate analysis	Bivariate** analysis	Multi-*** variate analysis
1. Age	S	NS	NS	NS
2. Age at first marriage	NS	NS	NS	NS
3. Education	S	NS	S	NS
4. Religion	NS	NS	S	S
5. Ethnicity	NS	NS	NS	NS
6. Lineality	NS	NS	NS	NS
7. Type of marriage	NS	NS	S	NS
8. Type of conjugal relation	NS	NS	NS	NS
9. Type of family	NS	NS	NS	NS
10. No. of previous marriages	S	S	NS	NS
11. No. of children desired	S	S	NS	NS
12. Family Planning Knowledge Score	S	S	S	S
13. No. of children dead	-		NS	NS
	-			

*Level of significance .05 **$Y = a + b_1 x_1$

***$Y = a + b_1 x_1 + \ldots\ldots\ldots + b_n x_n$

S - Significant, NS - Not significant

For wives, the effect of infant and child deaths on the family planning attitudes has also been examined but no statistically significant relationship is observed between these two variables.

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सारांश

घाना के ग्रामीण क्षेत्रों के परिवारों के पतियों और पत्नियों की परिवार नियोजन संबंधी अवधारणाओं का विश्लेषण किया गया है। यह विश्लेषण 'डेनफा व्यापक ग्रामीण स्वास्थ्य एवं परिवार नियोजन प्रयोजना' से प्राप्त आंकड़ों पर आधारित है। परिवार नियोजन संबंधी उनकी अवधारणाओं के प्रत्येक स्वतन्त्र घटक पर पड़ने वाले सम्यक प्रभाव का पता लगाने के लिए ' बहुचर सांख्यिकी तकनीक (मल्टीवैरिएट स्टेटिस्टीकल टेक्नीक) का प्रयोग किया गया है। इस विश्लेषण के परिणामों से पता चलता है कि परिवार नियोजन –स्वीकार्यता संबंधी हमारा पूर्वकथन पत्नियों की अपेक्षा पतियों के बारे में कुछ अधिक सही था, 10 प्रतिशत की बजाय 14 प्रतिशत। इसके अलावा गर्भनिरोधक विधियों संबंधी उनके ज्ञान में तथा परिवार नियोजन स्वीकार्यता संबंधी उनकी अर्थात पति तथा पत्नी दोनों वर्गों की अवधारणाओं में बहुत गहन सकारात्मक सम्बन्ध देखा गया। सांख्यिकी–दृष्टिकोंण से यह तथ्य बहुत महत्वपूर्ण पाये गये हैं कि वहां बच्चों की वांछित संख्या तथा पूर्व– विवाहों की संख्या पति की स्वीकृति के अनुसार प्रभावित होती है, जबकि धर्म संबंधी मान्यताओं में पति की अपेक्षा पत्नी की स्वीकृति होना अधिक महत्वपूर्ण पाया गया है।

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A CONCEPTION DEPENDENT MODEL FOR NUMBER OF BIRTHS AND ITS APPLICATION

S.N. Singh* and V.K. Singh**

ABSTRACT

The paper deals with the derivation of a probability model for number of births to a female during a specified period of time since her marriage assuming fecundability and sterility to vary from conception to conception. A procedure of finding the estimates of some of the parameters has been given. The use of the suggested model in the evaluation of family planning programme is also illustrated.

The most important aspect of any study of couple reproduction is the estimation of feaundability which is considered as one of the parameters of fertility. Since fecundability cannot be measured directly, it is estimated with the "help of certain statistics which are based on observed data. It seems reasonable to base the estimates on the number of births to a couple during a given time period. If, however, data on the number of conceptions are available, it may also be used for estimation purpose.

Singh and Singh proposed a probability model for describing the distribution of number of conceptions to a female during a given interval of length T since her marriage assuming fecundability and sterility to vary from conception to conception.

Although both the types of probability models for describing either the variation in the number of births or in the number of conceptions have their utility in the appraisal of observed data and provide means for estimating some of the

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biological determinants of reproduction, relatively much attention has been paid to the former, because it is easier to get reliable information on number of births.

The reason stated above, the present paper is devoted to the derivation of a probability model for number of births to a female during the interval (0,T) from her marriage under the assumptions given by Singh and Singh[1]. Since, a significant proportion of conceptions results in pregnancy wastages, the model incorporates such type of pregnancies. A simplified version of the suggested model has been used for applying to an observed data. Further, the use of the model for the evaluation of certain family planning schemes has also been illustrated.

Model

Let X(t) ↘ 0 < t < T denotes the number of complete con--ceptions (that is, live births) to a female during the time interval (0,T) . The probability model for X(T) is derived under the assumptions similar to those of Singh and Singh which, are reproduced beldwl.

1. The female has led a married life throughout the observational period.

2. The probability that a conception results in a live birth is 0 so that (1 - 9) is the probability that the conception is incomplete (that is, foetal wastage).

3. The probability that the first conception, occurs during the time interval (t, T + ΔT) is mo ΔT + 0 (ΔT), M_O > 0, t > 0, where 0(Δ t) is the probability of more than one conception during the short interval at the constant MQ is known as conception rate for first conception following marriage

4. After a complete conception, there, is no chance of any additional conception for a constant time h_2 whereas if the conception is incomplete, there is no possibility of another conception for a constant time h_1. h_1 (i = 1,2) are known as 'rest period' associated with respective conceptions (h_1 < h_2). It is clear that rest period is a sum of gestation period and period of post-partum amenorrhoea.

5. Given X(t) = i, i - 1,2,..., the conditional probability of a conception during the time interval (t, t+ Δ t) is $m_i \Delta t + 0(\Delta t)$ if the ith conception occur prior to t-h_1, t > ih_1, or t-h_2, [illegible], according as the ith conception is incomplete or complete .

6. The probability that a female is primarily sterile or chooses to be so during the period (O,T) is (i-a_o) so that ao is the probability that she is fecund at the time of marriage. Further, let (1-a_i) be the probability that she becomes sterile or chooses to be so using hundred per cent effectiveness family planning method following the termination of the ith pregnancy.

7. Although the waiting time for a conception may be affected by the waiting time of the previous conception, we assume, for simplicity, that all the waiting times are mutually independent.

Under the assumption 4, it is clear that the maximum number of complete conceptions to a female during the time interval (O,T) cannot be more than n, where n = $[T/h_2]$ if $[T/h_2] = T/h_2$, otherwise it is equal to $[T/h_2] + 1$; $[T/h_2]$ stands for the greatest integer not exceeding T/h_2.

The probability distribution of X(T), under the given assumptions, is

$$P[X(T)=0] = 1 - \sum_{j=0}^{k_o} a_o a_i \ldots a_j \, \theta(i-\theta)^j \sum_{s=0}^{j} \frac{m_o m_1 \ldots m_{s-1} m_{s+1} \ldots m_j}{(m_o - m_s)\ (m_1 - m_s) \ldots}$$

$$\frac{\left\{1 - e^{-m_s(T-jh_1)}\right\}}{(m_{s-1} - m_s)\ (m_{s+1} - m_s) \ldots (m_j - m_s)} \qquad (1)$$

$$P[X(T)=r] = \left[\sum_{j=0}^{k_r - 1} a_o a_1 \ldots a_{j+r-1} \binom{r+j-1}{j} \theta^r (1-\theta)^j \right.$$

$$\sum_{s=0}^{j+r-1} \frac{m_0 m_1 \ldots m_{s-1} m_{s+1} \ldots m_{j+r-1} \left\{1-e^{-m_s(t-jh_1-\overline{r-i}\ h_2)}\right\}}{(m_0-m_s)(m_1-m_s)\ldots(m_{s-1}-m_s)(m_{s+1}-m_s)\ldots(m_{j+r-1}-m_s)} \Bigg]$$

$$\left[\sum_{j=0}^{k_r} a_0 a_1 \ldots a_{j+r} \binom{r+j}{j} \theta^{r+i}(1-\theta)^j \sum_{s=0}^{j+r} \frac{m_0 m_1 \ldots m_{s-1} m_{s+i} \ldots}{(m_0-m_s)\ (m_i-m_s)\ldots}\right.$$

$$\left. \frac{m_{j+r}\left\{1-e^{-m_s(T-jh_1-rh_2)}\right\}}{(m_{s-1}-m_s)(m_{s+1}-m_s)\ldots(m_{j+r}-m_s)}\right], \quad r=1,2,\ldots,n-i \qquad (2)$$

$$P\left[X(T) = n\right] = 1 - P\left[X(T) \leq n-i\right] \qquad (3)$$

where $k_r = \left[\frac{T-rh_2}{h_1}\right]$.

Proof: Let the successive conceptions occur at times T_0, $T_0 + T_1$, $T_0+T_1+T_2,\ldots$, since marriage, that is, T_0 be the time for first conception and T_i $(i > 0)$ the time between i^{th} and $(i+1)^{th}$ conceptions. Under the assumptions 1,2,3,4,5 and 7, it can easily be seen that T_0 follows an exponential distribution with probability density function (p.d.f.)

$$f(t) = m_0\, e^{-m_0 t}, \quad t > 0, \quad m_0 > 0 \qquad (4)$$

and T_i $(i > 0)$ follows displaced exponential distributions with p.d.f.

$$f(t) = m_i\, e^{-m_i(t-h_1)}, \quad t > h_1, \quad m_i > 0 \qquad (5)$$

if the i^{th} conception is incomplete, and

$$f(t) = m_i\, e^{-m_i(t-h_2)}, \quad t > h_2, \quad m_i > 0 \qquad (6)$$

if the i^{th} conception is complete.

We will first derive the distribution function $H_{r+j+1}(t/j)$ of Z_{r+j+1}, the waiting time for the $(r+1)^{th}$ complete conception assuming that there are j incomplete conceptions preceding the $(r+1)^{th}$ complete conception. Here

$$Z_{r+j+1} = \sum_{i=0}^{j+r} T_i \tag{7}$$

Since T_i's are independent random variables (see assumption 7), the distribution function of the random variable $T_0+T_1+\ldots T_{j+r}$ given that there are j incomplete conceptions prior to $(r+1)^{th}$ complete conception is

$$P\left[T_0+T_1+\ldots T_{j+r} \leq t\right] = F_0(t) * F_1(t)^{j*} * F_2(t)^{r*} \tag{8}$$

where $F_0(t)$, $F_1(t)$ and $F_2(t)$ are the distribution functions corresponding to density functions given by (4), (5) and (6). The symbol * used in the above expression stands for the operation of convolution and n* denotes the n-fold convolution of a function.

It is easy to see that

$$P\left[Z_{r+j+1} \leq t\right] = \sum_{s=0}^{j+r} \frac{\prod_{\substack{i=0 \\ i\neq s}}^{j+r} m_i}{\prod_{\substack{i=0 \\ i\neq s}}^{j+r} (m_i - m_s)} \left\{1 - e^{-m_s(t-jh_1-rh_2)}\right\}, \quad t > jh_1+rh_2$$

$$= 0, \text{ otherwise} \tag{9}$$

if all m_i's are distinct.

Since $a_0a_1\ldots a_{j+r}$ is the probability that the female will not acquire sterility upto the occurrence of the $(j+r)^{th}$ conception, the conditional probability that the female experiences at least (j+r+1) conceptions during the time interval (0,T), out of which j conceptions are incomplete is

$$H_{r+j+1}(t/j) = a_o a_1 .. a_{j+r} \sum_{s=0}^{j+r} \frac{\prod_{\substack{i=0 \\ i\neq s}}^{j+r} m_i}{\prod_{\substack{i=0 \\ i\neq s}}^{j+r} (m_i - m_s)} \left\{ 1 - e^{-m_s(t-jh_1-rh_2)} \right\} \qquad t > jh_1+rh_2 \qquad (10)$$

which is the distribution of Z_{r+j+1}

Finally, since the probability that there are j incomplete conceptions prior to $(r+1)^{th}$ complete conception is given by negative binomial distribution with probability function

$$P_j = P\left[J=j\right] = \binom{r+j}{j} (1-\theta)^j \theta^{r+1}, \quad 0 < \theta < 1; \; j = 0,1,2,.. \qquad (11)$$

the unconditional probability that the female will have at least (r+1) complete conceptions during the time interval (0,T) is

$$H_{r+1}(T) = \sum_{j=0}^{k_r} a_o a_1 .. a_{j+r} \binom{r+j}{j} (1-\theta)^j \theta^{r+1} \sum_{s=0}^{r+j} \frac{\prod_{\substack{i=0 \\ i\neq s}}^{j+r} m_i}{\prod_{\substack{i=0 \\ j\neq s}}^{j+r} (m_i - m_s)}$$

$$\left\{ 1 - e^{-m_s(T-jh_1-rh_2)} \right\}, \text{ for } T > jh_1+rh_2$$

$$= 0, \text{ otherwise} \qquad (12)$$

where

$$k_r = \left[\frac{T-rh_2}{h_1} \right]$$

Under the assumptions stated, the probability distribution of X(T) is given by

$$P\left[X(T) = r\right] = H_r(T) - H_{r+1}(T), \quad r=0, 1, 2, \ldots, n-1, \tag{13}$$

$$P\left[X(T) = n\right] = H_n(T) \tag{14}$$

with $H_0(T) = 1$.

Hence the expressions (1), (2) and (3) follow.

A Simplified Model

The expression for $H_{r+1}(T)$ above is obtained when all m_i's are distinct. However, such a general model is hardly applicable to observed data. In order to have a simplified version of such complex model, generally, on the basis of empirical investigations some of the parameters are assumed to be equal to others. Thus, keeping in view the nature of the data to which the model has been applied later on, a particular case of the suggested model is presented below:

Let us assume that, (i) m_o is different from other m_i's and $m_i = m$ for $i = 1,2,\ldots$, (ii) $a_i = 1$ for $i = 1,2,\ldots$ and (iii) h_2 takes two values h_2' and h_2'' with probabilities π and $(1-\pi)$ respectively.

Under the assumptions (i) and (ii), the distribution function of X(T) reduces to the following

$$H^*_{r+1}(T) = a_o \sum_{j=0}^{k_r} \binom{r+j}{j} (1-\theta)^j \theta^{r+1} \left[1-\left(\frac{m}{m-m_o}\right)^{j+r} e^{-m_o(t-jh_1-rh_2)}\right.$$

$$+e^{-m(t-jh_1-rh_2)} \sum_{s=0}^{j+r-1} \left(\frac{m_o}{m-m_o}\right)\left(\frac{m}{m-m_o}\right)^s$$

$$\left.\sum_{u=0}^{j+r-1-s} \frac{\left\{m(t-jh_1-rh_2)\right\}^u}{u!}\right], \quad t > jh_1+rh_2. \tag{15}$$

further, udner the assumption (iii), the extended expression for the distribution function of x(t) is given by

$$H^{**}_{r+1}(T) = \pi H^{*}_{r+1}(T/h_2=h_2') + (1-\pi) H^{*}_{r+1}(T/h_2=h_2''), \qquad (16)$$

so that the probability distribution of X(T) becomes

$$P\left[X(T) = r\right] = H^{**}_{r}(T) - H^{**}_{r+1}(T), \quad r = 0,1,2,\ldots,n-1 \qquad (17)$$

$$P\left[X(T) = n\right] = H^{**}_{n}(T). \qquad (18)$$

The derivation for $H^{*}_{r+1}(T)$ is given in the appendix.

Application and Results

due to flexibility of the probability expressions the model can be applied to data relating to variety of situations by taking appropriate relationship of fecundability with conception.

For illustration, the model has been applied to an observed data taken from varanasi survey 1969-70. A survey was conducted by demographic research centre, banaras hindu university, varanasi. The details of which are given in singh et al.

An observed distribution of number of births in first 8 years of married life to females with effective marriage duration (emd) 8-13 years is shown in table 1. For the data of varanasi survey, the analysis of births invervals similar to sheps has revealed that the first birth interval is relatively longer than other birth intervals and that first few birth intervals except the first are'approximately equal3 the reasons for longer duration of first birth interval are disucssed in singh *ET AL,4* further, the use of contraception and incidence of secondary sterility prior to age 30 of the female are almost negligible. Also, singh and bhaduri reported that for the surveyed population the distribution of post-partum amenorrhoea associated with a birth is bimodalj the two peaks occur at 2-3 months and 12-13 months respec-tivelys. Thus, in accordance with the above findings, we have used the simplified model given by (17) and (18), for illustration.

The model involves eight parameters; h1, h2', h2'', π, 0, a_o, m and m_o. With an observed distribution, it is not possible to estimate all of the parameters. It is, therefore, common practice to assume some of the parameters which are more or less constant during a small interval of time and estimate others with the help of observed data. We assume here the values of h1, h2', h2'', π, 0.

The estimates of A_O, M_O and m are obtained using the method given in Singh and Singh. An approximate expression for the mean of the distribution similar to (3.2.4) of Singh and Singh is given by:

$$\bar{x} \simeq a_o o \left[\pi \left\{ 1 + \frac{mT'}{1+m\bar{h}_1\left(1-\frac{\bar{h}_1}{2T'}\right)} \right\} + (1-\pi)\left\{ 1 + \frac{mT''}{1+m\bar{h}_2\left(1-\frac{\bar{h}_2}{2T''}\right)} \right\} \right] \qquad (19)$$

where $\bar{h}_1 = (1-\theta)h_1 + \theta h_2'$; $\bar{h}_2 = (1-\theta)h_1 + \theta\left[\pi h_2' + (1-\pi)h_2''\right]$,

$$T' = T - \frac{1}{m_o} - \bar{h}_1 \; ; \; T'' = T - \frac{1}{m_o} - \bar{h}_2 \; .$$

TABLE 1

DISTRIBUTION OF OBSERVED AND EXPECTED NUMBER OF BIRTHS FOR WOMEN IN 8 YEARS FROM MARRIAGE

Number of births	Observed number of women	Expected Number of women
1	2	3
0	52	52.0
1	101	98.7
2	173	179.2
3	153	156.3
4	57	52.6
5	19	17.2
6	1	
Total	556	556.0

χ^2 = 1.16, (degrees of freedom = 2)

In the present case, T = 8 years. We assume h_1 = 0.50 years, h_2'= 1.00 year, H2" = 1-75 years, Π V = 0.40 and φ = 0.90. The justification of these values are given in Singh and BhaduriS. The estimates of ao, HQ and m are obtained as

$$\hat{a}_o = 0.9673, \quad \hat{m}_o = 0.37, \quad \hat{m} = 0.61.$$

Once the estimates are obtained, the expected frequencies are calculated easily. The expected frequencies are presented in column 3 of table 1. For applying a X_2 test, the last two cells are grouped. The insignificant value of X_2 at 5 per cent level of significance indicates that the proposed distribution is a reasonable approximation.

Use of the Model for the Evaluation of Family Planning Pvogramne

With the realisation of the impact of increasing" population on every aspect of social and economic life of a nation, consideration of controlling fertility has become an important aspect of population policy of most of the developing countries. The fertility models are helpful to planners in making decisions by taking greater account of the probable consequences of alternative policy choices over the long term.

The present model can be used to measure the changes in fertility to a group of women during a given period of time since marriage using birth control methods of varying effectiveness and/or sterilisation techniques. Singh *et at.* have suggested some hypothetical schemes for birth control^. However, they have not considered the effect of induced abortion on fertility reduction.

Apart from sterilisation and highly effective contraceptives, it has been advocated by several demographers that induced abortion is and continues to be one of the most widely employed methods of fertility control among non-con tracepting as well as contracepting populations8,9_t Therefore, keeping in view induced abortion as one of the methods of birth control, a study of reduction in births has been done, in this section. Following Singh and Singh, we have considered here only three schemes, namely,

Scheme 1: No contraception, no sterilisation, *i.e.* $a_1 = 1$, $m_i = m_o$ for $i = 0,1,2,...$

Scheme 2: 25 per cent couples from among the remaining fecund couples becoming sterile (or using 100 per cent effective contraceptive) at each conception following the third conception and onwards, *i.e.* $a_o = a_1 = a_2 = 1$, $a_i = 0.75$, $i = 3,4,5,....$ and $m_i = m_o$, $i = 0,1,2,...$

Scheme 3: All the couples using contraceptive of 60 per cent effectiveness after third conception, *i.e.* $a_i = 1$, $i = 0,1,2...$ $m_o = m_1 = m_2$ and $m_i = 0.4\ m_o$, $i = 3,4,5,...$

Here, we have taken T = 20 years, $m_o = 0.50$, $h_i = 0.5$ years, $h_2 = 1.50$ years.

The probabilities for different order of births in first 20 years of marriage subjected to different abortion rates under the above schemes are given in tables 2, 3 and 4.

TABLE 2

THE PROBABILITIES OF EXACTLY x BIRTHS IN A PERIOD OF 20 YEARS SUBJECT TO DIFFERENT ABORTION RATES UNDER SCHEME 1

Number of births	Probabilities under the abortion rates (in per cent)				
	00.00	10.00	20.00	40.00	50.00
0	0.000045	0.000157	0.000507	0.004399	0.012000
1	0.000940	0.002593	0.006637	0.035149	0.072651
2	0.008298	0.018281	0.037175	0.120310	0.188609
3	0.040839	0.071932	0.116390	0.230726	0.274620
4	0.122870	0.173356	0.223564	0.272264	0.246352
5	0.233412	0.264421	0.272368	0.204523	0.140905
6	0.279632	0.255130	0.210474	0.097905	0.051462
7	0.205371	0.151506	0.100455	0.029122	0.011710
8	0.087231	0.052309	0.028007	0.005101	0.001574
9	0.019395	0.009521	0.004141	0.000501+	0.000117+
10 and over	0.001967	0.000794	0.000282	-	-
Mean births	5.81	5.37	4.92	3.92	3.37
Percentage reduction in births	-	7.6	15.3	32.5	42.0

\+ 9 or more births

TABLE 3

THE PROBABILITIES OF EXACTLY x BIRTHS IN A PERIOD OF 20 YEARS SUBJECT TO DIFFERENT ABORTION RATES UNDER SCHEME 2

Number of births	Probabilities under the abortion rate (in per cent)				
	00.00	10.00	20.00	40.00	50.00
0	0.000045	0.000420	0.002767	0.025125	0.054762
1	0.000940	0.009783	0.034553	0.132163	0.202784
2	0.008298	0.084606	0.154652	0.267838	0.301237
3	0.278308	0.286947	0.292086	0.275034	0.243041
4	0.247216	0.245753	0.234486	0.175071	0.129534
5	0.214769	0.193197	0.162468	0.086687	0.051612
6	0.151083	0.117251	0.083612	0.030199	0.014205
7	0.073570	0.048219	0.028692	0.006867	0.002535
8	0.021968	0.012085	0.005975	0.001016*	0.000290*
9	0.003539	0.001636	0.000709**	-	-
10 and over	0.000264	0.000103	-	-	-
Mean births	4.55	4.14	3.73	2.86	2.42
Percentage reduction in births	-	9.0	18.0	37.1	46.8

*8 or more births ** 9 or more births

TABLE 4

THE PROBABILITIES OF EXACTLY x BIRTHS IN A PERIOD OF 20 YEARS SUBJECT TO DIFFERENT ABORTION RATES UNDER SCHEME 3

Number of births	Probabilities under the abortion rate (in per cent)				
	00.00	10.00	20.00	40.00	50.00
0	0.000045	0.000270	0.001605	0.017089	0.040974
1	0.000940	0.006296	0.023235	0.109060	0.182832
2	0.008298	0.057169	0.120966	0.263608	0.316414
3	0.183156	0.236412	0.292916	0.318391	0.279881
4	0.341669	0.390744	0.340474	0.207236	0.137128
5	0.291191	0.207961	0.175357	0.070053	0.039466
6	0.129221	0.083927	0.043474	0.014156	0.002988
7	0.040150	0.016132	0.001152	0.000407*	0.000317*
8	0.004679	0.000984	0.000821**	-	-
9 and over	0.000651	0.000105	-	-	-
Mean births	4.48	4.06	3.66	2.86	2.42
Percentage reduction in births	-	9.4	18.3	36.2	46.0

*7 or more births **8 or more births

These tables further reveal that a nominal reduction (about 9% under scheme 1 and about 10% under schemes 2 and 3) will be achieved if the present abortion rate of about 10 per cent is doubled. The reduction is about 37 per cent under scheme 1 and about 41 per cent under schemes 2 and 3 even if half of the conceptions are converted into abortions.

A comparison of the schemes under same abortion rates are shown in table 5. The figures show that while for a given rate of abortion, substantial reduction occurs following schemes 2 or 3 as compared to scheme 1, induced abortion seems to be inefficient when used alone as a method of birth control. It is equally efficient when coupled with either sterilisation or contraception.

TABLE 5

PERCENTAGE REDUCTION IN BIRTHS UNDER SCHEMES 2 AND 3 AS COMPARED WITH SCHEME 1

Scheme	Abortion rate (in per cent)				
	00.00	10.00	20.00	40.00	50.00
Scheme 2	21.6 9	22.90	24.19	27.04	28.19
Scheme 3	22.89	24.39	25.61	27.04	28.19

सारांश

इस लेख में एक महिला के विवाह के पश्चात महिला द्वारा गर्भधारण क्षमता ग्रहण कर लेने, तथा प्रत्येक बार गर्भधारण करने की एक अवधि से दूसरी गर्भाधारण अवधि के बीच अप्रजननशीलता के लक्षण विकसित होने से गर्भक्षय होने सहित, अवधि विशेश में महिला द्वारा जन्मित बच्चों की संख्या का पता लगाने के लिए प्राथमिकता प्रतिदर्श (प्रोबेबिलिटी माडल) विकसित करने का प्रयास किया गया है। कुछ प्राचलों (पैरामीटरस) का अनुमान लगाने के लिए इसमें प्रक्रिया विधि का उल्लेख किया गया है। परिवार नियोजन कार्यक्रम के मूल्यांकन के लिए इस लेख में प्रस्तावित माडल के प्रयोग संबंधी दृश्टांत भी दिया गया है।

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Let $\phi_{r+1}(s)$ be the Laplace transform corresponding to the distribution function $H_{r+1}(T)$ given by (12). Then

$$\phi_{r+1}(s) = \int_0^\infty e^{-st}\, dH_{r+1}(t) \tag{A.1}$$

From (12) it is easy to see that

$$\frac{d}{dt} H_{r+1}(t) = \sum_{j=0}^{k_r} a_o a_1 \ldots a_{j+r} \binom{r+j}{j} (1-\theta)^j \theta^{r+1}$$

$$\sum_{k=0}^{j+r} \frac{\prod_{i=0}^{j+r} m_i}{\prod_{\substack{i=0 \\ i\neq k}}^{j+r} (m_i - m_k)} e^{-m_k(t-jh_1-rh_2)},$$

$$t > jh_1 + rh_2 \,. \tag{A.2}$$

Therefore

$$\phi_{r+1}(s) = \sum_{j=0}^{\infty} a_o a_1 \ldots a_{j+r} \binom{r+j}{j} (1-\theta)^j \theta^{r+1} e^{-s(rh_2+jh_1)}$$

$$\prod_{k=0}^{j+r} \left\{ \frac{m_k}{m_k + s} \right\} \tag{A.3}$$

Now if $m_i = m$ for $i = 1,2,\ldots(m_o \neq m)$ and $a_i = 1$ for $i = 1,2.$

the expression (A.3) reduces to

$$\phi_{r+1}(s) = a_o \sum_{j=0}^{\infty} \binom{r+j}{j} (1-\theta)^j \theta^{r+1} e^{-s(rh_2+jh_1)}$$

$$\left\{\frac{m_o}{m_o + s}\right\} \left\{\frac{m}{m + s}\right\}^{j+r} \qquad \text{(A.4)}$$

If $H^*_{r+1}(t)$ be the inverse of (A.4) then

$$H^*_{r+1}(t) = a_o \sum_{j=0}^{k_r} \binom{r+1}{j} (1-\theta)^j \theta^{r+1} \left[1-\left(\frac{m}{m-m_o}\right)^{j+} e^{-m_o(t-jh_1-rh_2)}\right.$$

$$+e^{-m(t-jh_1-rh_2)} \sum_{s=0}^{r+j-1} \left(\frac{m_o}{m - m_o}\right)\left(\frac{m}{m - m_o}\right)^s$$

$$\left.\sum_{u=0}^{r+j-i-s} \frac{\{m(t-jh_1-rh_2)\}^u}{u!}\right] , \; t > jh_1 + rh_2 . \qquad \text{(A.5)}$$