

COST ACCOUNTING IN HOSPITALS

Iftikhar Bukhari*

ABSTRACT

Cost accounting assists Health Administrators in controlling the costs and monitoring the progress of various services. Thereby it can lead to the rational allocation of scarce health resources. Various methods and techniques of cost accounting as applicable to health organizations have been discussed in this study.

All the countries of the world are committed to the goal of Health for All by the year 2000. The success of this aim much depends upon the effective utilization of all the necessary resources. In the context of total socio-economic development an all out effort should be made in health planning.

A primary health care approach in solving most of the present health problems in the developing countries depends upon self-reliance and effective utilization of resources. It is highly imperative to define the available resources, to understand how these would be utilized and to determine the savings, and consequently the benefits, which could be achieved by adopting alternative strategies.

In July 1979, the World Health Organization (South-East Asia Region) discussed the financing of health care delivery with the main objective of considering alternative ways in which costs of assuring health for all could be estimated and projected. They concluded that there was a lack of information in these countries on such aspects, and stressed the need for strengthening research capabilities in this area.

It is therefore, essential to consider financial planning as a part of the overall planning and managerial process, and also as an integral part of health systems research. Whilst considering how to link these two aspects, it is equally important to determine the estimates of expenditure on programmes, units, jobs or services.

Such analysis could be achieved by introducing a cost accounting system in health services. Costing is the principal means of measuring the relative efficiency of health service units, jobs and functions. Cost accounting can be defined "as a process of manipulating or rearranging the data or information in the existing accounts in order to obtain the cost of services rendered by an organization".

Cost accounts will not of themselves improve the efficiency, but we have to combine it with the management techniques in an organisation. Cost analysis provides us with a tool of measuring success in monetary terms, and thus helps to control and monitor the costs.

*Deputy Medical Superintendent, Shere-I-Kashmir Institute of Medical Sciences. Soura. Srinagar.

OBJECTIVES OF COST ACCOUNTING

The prime function of cost accounting is to provide an analysis and classification of expenditure which helps to ascertain the total cost of any particular unit of production/service, with a reasonable degree of accuracy and determines the make-up of the total cost into the components of which it is constituted. The system should consequently be able to differentiate the efficient activity from the inefficient and the profitable product from the unprofitable, and also relate such information to the individual department or respective budget holders directly responsible for them⁵. The main objectives of a costing system are to (i) control costs in an efficient manner and monitor them regularly; (ii) assess the efficiency of past efforts so as to plan in a rational way; (iii).forecast the future costs, determine budget and financial allocations; (iv) matching needs with costs, *e.g.* in staffing of different units like nursing, maintenance etc.; (v) create cost consciousness among different workers, which in turn can enable the management to economise; (vi) enable various charges to be fixed; (vii) determine cost benefit ratio; and (viii) bring changes in clinical practices by allowing clinicians to monitor efficiency of one form of clinical practice against another.

TYPES OF COST INVOLVED

In determining the cost of a product or a service, two types of expenditure are involved; these are direct costs and indirect costs.

Direct Costs: These are expenditures which can be identified as directly associated in running a particular service or on any particular unit of activity. Direct costs can usually be further sub-divided into three groups which are labour costs, material costs and direct expenses.

Indirect Cost: These are a kind of joint product expenses, *i.e.* which cannot readily be identified wholly as having been incurred on any one activity, *e.g.* expenses of administrative department, rent of buildings, depreciation costs, etc. These are also called overhead expenses, or overheads, and sometime as on cost.

METHODS OF COST ACCOUNTING

The following methods are employed:

Unit Costing: The purpose of this method is to find out the cost per unit of service or production.

Unit Cost - Total cost divided by number of units of production.

Job Costing: such type of costing is applied to all capital works and can be carried out for various maintenance works. It can also be employed for any one off activity such as a computer feasibility study in a hospital, cost of work study exercise or cost of a new experimental technique etc. It enables the cost of completing each job to be ascertained.

Job Cost - Total cost of all individual relevant items incurred in attaining a specific job.

Job costing provides a basis for comparison with outside tenders and it enables recharges to be made for services provided to outside bodies.

Process Costing- When a product passes through different processes before it can be utilized, the costs of each process are computed and added to give the total processing cost. Unit cost per process is equal to total cost of process, divided by units of production. Total processing cost for the unit of production is equal to unit costs of each separate process? In a hospital laundry different items of linen are subjected to a series of processes like sorting, washing, tumbling, drying, ironing etc. before being issued, Each process has a different cost and all articles may not be subjected to all the processes and may cost less to launder them. In the central sterile supply department of a hospital, a number of processes are involved before a sterile pack can be utilised, and may involve process costing technique for determining costs of sterilising stages and combine a unit costing method for computing, packaging and supplying.

Operating Costing- This method is used to determine the cost of providing a service rather than a product. Various costs are collated under different headings and expressed in terms of unit of service provided, For example, cost of transporting per kilometer The ambulance service and transport service for staff members of an organisation can employ this technique very easily.

Departmental Costing: This method is employed where it is desirable to know the cost of one department or all departments and their output. Total expenditure incurred is calculated and then by applying unit costing, process costing or any other relevant methods the unit cost of department is worked out.

Calculation: *Unit cost of departmental output is equal to total departmental expenditure divided by number of units of output.*

TECHNIQUES OF COSTING

There are five particularly important techniques which can be used with various costing methods like unit costing, process costing or other methods, these are.

Standard Costing: A standard cost is a predetermined figure of what the cost of a process, job unit or service should be during a particular period. This procedure .using data as basis for assisting the management in controlling the costs is called standard costing. It is based on: (a) A predetermined standard of performance i.e., setting standards for each unit of service or product (b) Determining actual costs incurred; (c) Comparing standard and actual costs; (d) An analysis to determine the variances; and (e) Taking appropriate action where necessary.

The overall information that forms, the basis of a standard costing system can

be best provided in association with a system of budgetary control. This should be integrated with accounting and reporting system of an organisation. Standard costing has the following advantages: (i) by calculating variances, 'management by exception' can be followed in an organisation; (ii) setting standards for various units/service, may involve determining the best methods, thereby leading to economy of operation; (iii) the standards can act as a measure of efficiency and targets for staff can be set, thereby stimulating cost consciousness; (iv) it is a valuable technique for policy formation, profit planning and pricing policies; and (v) the operation of 'cost centres' (location person or function in respect of which costs may be determined) assists in defining responsibilities.

Marginal Costing: Marginal cost is the variable cost of one unit of service or product and the technique which enables the management to determine the effect of changes in its value or type of output, (*e.g.*, on profits), by analyzing the information which lead to the increase or decrease. There are certain type of costs which tend to increase or decrease directly with the quantity of output, whilst other costs are constant in nature and do not vary in total with the output. These costs have been classified as variable costs and fixed costs. In addition, there are semi-variable costs. Fixed costs do not vary in amount with increase or decrease in output for a particular period of time *e.g.*, rents, buildings, furnishing and fixtures, depreciation of equipment and machinery. In the short-term they remain constant regardless of changes in the volume of work.

Variable costs are those which consist of supplies, raw materials and other direct product costs which usually vary in total, depending upon the volume of production or output.

Semi-variable (semi-fixed) costs are partly fixed and partly variable. For example, due to, the closure of a service or by extension/acquisition of new premises, the fixed costs become semi-fixed owing to the fact that unit levels of output have changed.

The cost of fixed and semi-fixed overhead will be reduced as the level of output increases. When the level of output decreases, the variable overheads can be reduced, but it is difficult to reduce the cost of semi-fixed overheads and impossible to achieve savings from fixed overheads.

The benefits of marginal costing are that it integrates with other aspects of accounting, *e.g.* unit costing, standard costing, and can also determine relationship between fixed and variable costs, and as such assists the management in its control function.

Uniform Costing: Methods of costing may vary between different organisations, it is, therefore, a common practice for the methods to be standardised so that information produced is comparable. A similar basis of cost analysis and cost presentation is adopted by different organisations, *e.g.*, different hospitals in a region or State. This practice is useful in the public sector, where cost comparisons can lead to higher efficiency. In the national health services (United Kingdom),

costing information provided to the Department of Health and Social Security is produced uniformly in order to enable comparisons to be made between hospitals, districts and regions.

Specialty Costing: The objective of speciality costing is to ascertain the expenditure incurred by each medical speciality in a hospital. It is calculated by (i) allocating direct expenditure to each speciality in accordance with the actual usage or on the basis of known activity multiplied by unit costs or in proportion to patient numbers; and (ii) the apportionment of indirect costs, either as a percentage of direct expenditure or in accordance with statistical evidence.

Information on speciality costs can arouse cost consciousness in the clinicians; encourage them for participating in financial management and development of clinical budgeting.

Patient Costing: This form of costing, which is widely used in the USA and in private hospitals, determines the total cost of treating each individual patient. Naturally, it will involve a lot of day-to-day paper work and time of medical and nursing staff in recording various elements from admission to discharge of a patient. It involves recording of all the medical treatments, every diagnostic procedure, therapeutic measures, nursing care activities, accommodation costs; diet, laundry and all other appropriate overhead expenses incurred on each patient.

Each of the possible units of service provided would have to be allotted a predetermined charge and collection of all the costs would provide patient costs.

Patient costing is useful in providing information like overall cost per patient case, differential costs of treating different age groups, cost of treatment by different alternative methods, but it has some problems. In developing, e.g., involvement of additional resources, mainly time of medical and nursing personnel and their reluctance in record keeping rather than devoting time for patient care.

ADVANTAGES AND LIMITATIONS OF COST ACCOUNTING

An efficient costing system can have the following advantages:

1. Identification of such activities which are costly, thus providing an opportunity to the management for considering the alternatives or modifications.
2. Determination of standards and allowing comparisons, which can thereby lead to economies.
3. Detailed investigations in costs in health can further lead to estimation of benefits derived from the resources spent.
4. Reduction in the cost of patient care without sacrificing the quality.
5. Can lead to the development of a comprehensive financial management plan of an organisation, covering financial planning, budgeting and resource allocation. The same is true for a district or a region or State.

Limitations of a costing system could be:

1. A costing system does not itself make an organisation more efficient, but provides information to the management to take decisions.
2. A costing system involves costs and as such the cost of starting and running a system may prove to be inadequate if it is not properly designed and can consequently delay actions.
3. The information supplied may refer to the costs incurred in the past *i.e.*, historical costs. Care should be used while planning as the future costs may not necessarily be the same as in the past.
4. The complexity of allocating some direct, or patient related costs to the individual medical specialities, *e.g.*, in speciality costing it is sometimes very difficult to allocate drug costs, or supportive service costs to different specialities.
5. The problem of case mix, because medical specialities are not homogenous and costs vary greatly between different patients, specific groups and specialities.
6. Incompletely recorded information has its own limitation. Medical and nursing staff may not be willing to keep records of each and every individual activity undertaken on a patient, if we are starting patient costing system.

CONCLUSION

Health authorities should have a firm commitment in developing and implementing a costing system in their institutions for the better management of their resources. A system of cost accounting should be considered as an investment, with the objective of giving a benefit in excess of the expenditure incurred upon it. The cost accounting and financial accounting should either be integrated into one system or so arranged that the results produced by them could be reconciled, thereby decreasing the possibility of errors. Accurate and regular information should be produced enabling the administrator to take prompt action.

Lkkjk'k

लागत व्यय लेखा प्रणाली से स्वास्थ्य प्रशासकों को विभिन्न सेवाओं को बेहतर बनाने के लिए लागत को नियंत्रित करने तथा प्रगति का प्रबोधन करने में सहायता मिलती है। इसके आधार पर अपर्याप्त स्वास्थ्य संसाधनों का यथोचित आवंटन किया जा सकता है। प्रस्तुत लेख में स्वास्थ्य संगठनों में लागू लागत-व्यय प्रणाली की विभिन्न पद्धतियों और तकनीकों पर विचार-विमर्श किया गया है।

REFERENCES

1. WORLD HEALTH ORGANIZATION (1984) Financial Planning for Health For All by the Year 2000. *SEARO Technical Publication No. 5*, WHO, Regional Office for South-East Asia, New Delhi.

2. RIGDEN, M.S. (1983) Health Services Finance and Accounting. London, William Heinmann Ltd.
3. BERMAN. H. JANET, WEEKS. E.L (1979) The Financial Management of Hospitals. USA, Health Administration Press.
4. THORNTON, NORMAN (1978) Management Accounting. London. William Heinmann Ltd.
5. NALGO CORRESPONDENCE INSTITUTE Lecture Notes on Costing. Mabelton Place, London.
6. PROWLE, MALCOLM (1987) Cost Information and Decision Making in the *NHS Journal of Management in Medicine*. 2. (1) p. 71 -79.
7. POLYTECHNIC OF SOUTH BANK Notes on Health Services Finance for Higher Diploma in Hospital and Health Services Administration, London.
8. FINK, F.S. (1984) Hospitals Looking to Standard Costing Systems. *Hospitals*, 58 (19) p. 88-89.
9. OWLER. L.W.J., BROWN, J.L (1974) Wheldon's Costing Simplified. London. Macdonald and Evans Limited.
10. MONTACUTE. C.A. (1962) Costing and Efficiency in Hospitals. Oxford University press.

**A STUDY OF BREAST FEEDING PRACTICES AND PROBLEMS RELATED
TO BREAST FEEDING IN RURAL WOMEN**

V.K. Gandotra*, N. Sethi and G. Rishma*****

ABSTRACT

A sample of 327 women who had delivered in the previous two years was taken for the study of their knowledge, attitude and practice of breast feeding. Information was also obtained about their lactational problems. Breast feeding had been almost invariably practised by women. Areas of concern were poor feeding practices.

Findings revealed that about one quarter of mothers had lactational problems but in majority of them, those were of not much consequence. Even for medical problems women relied upon home remedies and self-cure with predominantly favourable outcome.

The importance of breastfeeding for child nutrition has been emphasised by a number of researchers. Breast feeding is of special relevance to developing countries and lower socio-economic groups. Unfortunately, there has been a trend towards decline in breast feeding which if allowed to continue would result in further increase in morbidity and mortality among children. The detrimental effects of artificial feeding have now been well documented and on a global scale WHO and UNICEF have also made efforts to promote breast feeding and limit the use of proprietary preparations. In India, Ministry of Social Welfare has formulated Indian National Code for the protection and promotion of breast feeding.

Studies which have been conducted in India to ascertain the breast feeding practices have found that breast feeding is still widely practised in our country especially in the rural areas². Endeavour has to be made to keep up this practice and promote it further. A need has been felt to determine knowledge, beliefs and practices related to breast feeding and the problems faced by the mothers during lactation as these could have resulted in non-start or premature termination of breast feeding.

OBJECTIVES

The study was undertaken with the following objectives: (i) to study knowledge, attitude and practices related to breast feeding; and (ii) to study the medical problems which affect lactation.

*Associate Professor, Department of Community Medicine, Government Medical College, Jammu-180 001 (J&K).

**Coordinator, Project on Childhood Disability, Government Medical College, Jammu-180 001 (J&K).

***Social Worker, Government Medical College, Jammu-180 001 (J&K).

MATERIALS AND METHOD

The study was conducted as a part of community-based rehabilitation project for the disabled children. From a random sample of ten villages in Bishnah block in Jammu & Kashmir State, 327 women were selected to form the study sample. These women had delivered a child within last two years. Information was collected on a pretested proforma about demographic characteristics, lactation, knowledge, attitude and practice related to breast feeding, feeding of colostrum, supplementary nutrition, galactogogues and conditions which could have resulted in cessation/termination of breast feeding.

RESULTS

Demographic characteristics have been shown in Table 1. Majority of the women were between the age of 20-30 years. Literacy level was low as 64 per cent of women were illiterate or had not cleared primary level education. Over half of the families were either peasants or landless labourers. Next group was of service -government "or private employees. Majority of the families (61%) had income below Rs.500 per month.

TABLE 1
DEMOGRAPHIC CHARACTERISTICS

Age Distribution

Age	Number	Percentage
20-25	101	30
25-30	133	41
30-35	68	21
35+	25	8
	327	100

contd.

From pre-page

Education

Illiterate	117	35.7
Below primary	95	29.0
Primary	45	13.7
Middle	42	12.8
Matric and above	28	8.6
	327	99.8

Occupation of Husband

Farmer/Landless Labourer	170	52.0
Service {Government/Private)	135	41.2
Skilled Worker	11	3.4
Business	11	3.4
	327	100

Income Per Month

Rs. 100-500	200	61.2
Rs. 501 -750	30	9.2
Rs. 751-1000	90	27.6
Rs. 1000+	7	2.1
	327	100.1

Attitude towards breast feeding has been given in Table 2. Breast feeding was considered essential by 94.8 per cent of the interviewed women but only 64 per cent of the women thought it to be the best feed. Only 44 per cent of the women were in favour of giving colostrum to the child. Though 90 per cent of the women thought that breast feeding spoils the figure of the women even then they were breast feeding the child because of totally positive attitude towards breast feeding. When women were asked reasons for breast feeding the highest proportion (62%) contended that it is good for the child-mother relationship.

Knowledge about breast feeding has been described in Table 3. Mothers were tested in regard to their knowledge about breast feeding. It showed that only 38 per cent of the women considered colostrum to be nutritious whereas majority (55%) considered it to be harmful. Regarding the incidence of diarrhoea the knowledge was better as 53.2 per cent knew that there is less diarrhoea in breastfed children. Eighty per cent of the women knew that vegetarian mothers produce sufficient quantity of milk. Knowledge of women regarding supplementation of food was inadequate. Only one-third of women knew that breast milk alone is not sufficient for the child after six months of age though 75 per cent women were in favour of starting supplementation before six months. Half of the women did not know about the mode of introduction of supplementary feeding. Interestingly, 63 per cent of the women thought that if a lactating woman takes cold water the child will catch cold.

TABLE 2
RESPONDENTS ATTITUDE TOWARDS BREAST FEEDING

Statement	Response	
	Yes	No
Don't Know		
1. Breast feeding is essential for the child	310(94.8)	17(5.2)
-		
2. Whether colostrums should be given to the child	144(44.0)	164(50.1)
19(5.8)		
3. Breast feed is the best feed for the child	212(64.8)	115(35.2)
-		
4. Breast feeding spoils the figure of woman	295(90.2)	20(6.1)
12(3.6)		
5. Why breast feeding should be done mother-child	Nutritious	Money
Easy		
relationship	203(62.0)	81(24.8)
43(13.2)		

Respondents 327

Figures in Parentheses show percentages.

TABLE 3
RESPONDENTS' KNOWLEDGE OF WOMEN ABOUT BREAST FEEDING

Statement	Response		
	First day	Second day	Third day
1. Breast feeding should be started on first day/second day/third day	126(38.5)	107(32.7)	94(28.4)
2. Colostrum is Nutritious/Harmful/Average	Nutritious 124(37.9)	Harmful 181(55.3)	Average 22(6.7)
	Yes	No	Don't Know
3. Less chance of diarrhoea in breastfed child	174 (53.2)	84(25.7)	69(21.1)
4. Vegetarian mothers produce sufficient milk	264 (80.7)	17(5.2)	46(14.1)
	3 months	3-6 months	over 6 months
5. Breast milk is sufficient for the child upto 0-3/3-6/over 6 months	5(1.5)	106(32.4)	215(65.7)
6. Supplementary feeding to the breastfed to be started before 6 months/6-9 months/more than 9 months of age	237(72.7)	74(22.6)	16(4.9)
	Before Feeding	Between Breast Feeding	After Breast Feeding
7. Supplementary food to be given to the child before or between breast feeding/after	158(48.3)	169(51.7)	-
	Yes	No	Don't Know
8. Child will catch cold if mother takes cold water	206 (62.9)	71(21.7)	50(15.3)

Respondents 327

Figures in parentheses show percentages.

Practices related to breast feeding has been shown in Table 4. Majority of the women (81 %) had been cleaning their breast at times, before feeding, mostly with water. The figure seems related to the manual work most of the women were performing. Seventy four point six per cent of the women were breast feeding the child while he was sick but only 29.3 per cent of, the women. nursed while they themselves were sick; 35 per cent did not feed their children while 35.5 per cent infrequently breastfed the child at that time. About two-thirds of mothers were providing breastfeed on demand. Thirty seven per cent of mothers replied that their children slept after taking feed while 47 per cent said that their children sometimes slept after the breastfeed. This probably reflects the effect of age of children, breast milk being sufficient for the younger children. Sixty three per cent of the women said that milk secretion can be increased by special diet/drugs whereas 57 per cent of the women had actually tried to increase milk secretion by these means. The various types of food supposed to increase milk secretion were milk, rice, rice-water, whey, food in more quantity than usual, curd, vegetables, fruits, etc.

TABLE 4
RESPONDENTS' PRACTICES RELATED TO BREAST FEEDING

Statement	Responses		
	Feeding Demand	Interval Less than 2 hrs.	Interval more than 2 hrs.
1. Frequency of feeding Demand/Interval less than 2 hrs./Interval more than 2 hrs.	218(66.6)	74(22.6)	35(10.7)
	Yes	No	Occasionally
2. Cleaning of breast Yes/No/Occasionally	265(81.0)	26(8.0)	36(11.0)
3. Baby normally sleeps after breast feeding	121(37.0)	156(47.7)	50(15.3)
4. Nursing regularly while child is sick	244 (74.4)	54 (16.5)	29 (8.8)
5. Nursing regularly while mother is sick	96(29.3)	116(35.5)	115(35.2)
6. Special diet etc. used for increasing milk secretion	188(57.5)	139(42.5)	

Respondents 327

Figures in parentheses indicate percentages.

Problems related to breast feeding have been depicted in Table 5. Seventy five per cent of women never had any problem while breastfeeding whereas 25 per cent reported some problem. Seven per cent of the mothers had complaints related to ejection/sucking difficulty at the start of breast feeding like discomfort or pain in breast which totally disappeared with home treatment or Just regular feeding and there was no residual lactational problem. About 5 per cent of mothers had problems related to difficulty in lactation when child started cutting teeth. This varied between discomfort and pain presumably due to child applying teeth at nipple or breast. Fortunately, none of these had stopped breast feeding.

Rest of the lactational problems deserve more attention as they require specific advice or medical treatment. In all 11 per cent of the lactating women had conditions like engorgement, a sore nipple, mastitis/abscess and less or no milk.

Regarding treatment taken by mothers interesting findings emerge. Only seven women (9%) had taken medical treatment. About 40 per cent had not taken any kind of treatment but sizeable proportion (27%) had just relied upon regular feeding.

TABLE 5
MAIN LACTATIONAL PROBLEMS REPORTED BY MOTHERS AND THEIR TREATMENT

Problem	No.	Percent- age ment	Home Treat- ment	Regular Feeding	Doctor	No Treat- ment	Other
1. Initial sucking Problem/ejection Difficulty	23	28.4	4	19			
2.Sore nipple	7	8.6	4		2(1)	1	
3. Engorgement	7	8.6	2	2	1	1	1
4. Mastitis/ Abscess	8	9.8	2		3	1	2(1)
5. Less milk	4	4.9				3(3)	1
6. No milk	3	3.7		1		1(1)	1(1)
7. Problem supplementation	5	6.1				5	
8. Problem	21	25.9				21	
9. Other	3	3.7	1		1	1	
	71	99.7	13	22	7(1)	34(4)	5(2)

Figure in parentheses depict number of mothers out of the group who had residual lactational problem

About 16 per cent had used home remedies like ghee, saline fomentations, etc. Only 9 per cent of the affected mothers did not show any recovery as far as their lactation was concerned.

DISCUSSION

The study shows that attitude towards breast feeding is pre-eminently favourable among rural women though four areas deserve attention. First, women tend to start breast feeding late. The results of the present study are comparable to the study conducted by Datta Banik in whose sample 34.1 per cent had started feeding on the first day. Second, the colostrum is thought to be harmful by the women, in general. Third, only 34 percent of the women thought that after six months of age breast milk alone is not sufficient for the child. Though majority of women felt that breast feeding spoils figure of a woman but they were found to be unmindful of this because of other overwhelming factors in favour of breastfeeding. It also needs explaining that it is the pregnancy itself and not the breast feeding that spoils the shape of female body and by frequent feeding from both the breasts and use of supportive clothing they should not become misshapen⁴. Scheduled feeding as found in this study is not desirable and mothers along with their children could be happier if they could be convinced that there is no need for scheduled feeding. Fourth, there appears to be a need for educating women to feed their children while they were sick. In the present study only 74.6 per cent women had done so.

The study also brings out information about problems faced by lactating women. One-fourth of the women had one problem or the other. These could have been benefitted by giving proper advice and support. It seems that health staff is not sufficiently trained to advise the mother regarding minor problems like initial discomfort while feeding or lactational problem while cutting teeth. Other conditions also require suitable guidance, support and simple drugs which the health staff should be able to provide. Only mastitis/abscess require substantial use of drugs in the form of antibiotics. For care of these, there should be a proper referral system.

CONCLUSION

The breast feeding has been found popular in rural women though their knowledge about breast feeding needs to be improved. The focus of attention should be starting of breast feeding within hours of child birth, feeding colostrum, starting supplementary feeding between 4-6 months of age and continuation of breast feeding of the child when sick.

The peripheral staff should be adequately trained to advise about lactational problems faced by the women. It should be possible to create general awareness among women regarding promotion and continuation of breast feeding so that they can help each other. Teaching aids - like slides etc. were available which need wider dissemination to peripheral workers.

Lkkjk'k

पिछले दो सालों में मां बनने वाली 327 महिलाओं के एक सैम्पल को स्तनपान कराने के बारे में उनके ज्ञान, अवधारणाओं तथा व्यवहार का अध्ययन करने के लिए चुना गया था। उनके शरीर में दुग्ध-निर्माण संबंधी समस्याओं के बारे में भी सूचना प्राप्त की गई थी। साधारणतः स्तनपान कराने की प्रक्रिया अधिकांश महिलाओं द्वारा अपनाई गई थी। निश्कृष्ट पोषण संबंधित पहलुओं से सरोकार रखा गया है।

निश्कर्षों से पता चलता है कि लगभग एक-चौथाई महिलाओं को उनके शरीर में दुग्ध-निर्माण संबंधी समस्याओं को कम झेलना पड़ा लेकिन उनमें से अधिकांश ने इनके परिणामों को भुगता है। महिलाओं द्वारा चिकित्सकीय समस्याओं तक के लिए घरेलू नुस्खों और अपने आप ठीक हो जाने पर भरोसा करने के प्रबल संतोषजनक परिणाम निकले हैं।

REFERENCES

1. WORLD HEALTH ORGANIZATION (1982) The. Prevalence and Duration of Breast Feeding. A Critical Review of Available Information. World Health Statistics Quarterly. 35 (2), p. 892-916.
2. NARAYAN, INDIRA (1987) Promotion of Breast Feeding: Random Reflections. Indian J. of Community Medicine. XII (3), p. 137-140.
3. BANIK DATTA, N.D. Breast Feeding and Weaning Practices of Indian Preschool Children, p. 109-116. *Ibid*.
4. HELSING, ELISABET & KING, F. SAVAGE (1982) Breast Feeding in Practice: A Manual for Health Workers. Oxford University Press, p. 12.
5. BHARGAV, INDIRA (1987) Breast Feeding. Indian J. of Community Medicine. XIX & XII (3), p. 106-108.

BIRTH WEIGHT DIFFERENTIALS BY DEMOGRAPHIC AND SOCIO-ECONOMIC FACTORS

H.V. Vivekananda Murthy*, J. Neela* and B.A. Ramalaxmi*

ABSTRACT

During the last three decades, there has been no appreciable decline in maternal and child health indices. The percentage of low birth weight reflects the socio-economic development of any region/country. Though the survival chances of LBW infants have increased over a period of time, due to improvement in perinatal medicine, the prevalence of LBW has remained constant. The birth weight differentials by demographic and socio-economic factors have been studied in this paper. The results of the study indicate that primi parous women had higher prevalence of LBW, female babies had prevalence of LBW than male babies.

During the last three decades, there has been no appreciable decline in maternal and child health indices like maternal mortality, proportion of low birth weight infants, perinatal or neonatal mortality commensurate with the expansion of health services. In the society, women and children form very important segments of population former because of their physiological necessity and later for growth and development. The proportion of low birth weight infants reflects the socio-economic development and health care services of any region or country. Although the chances of survival of LBW infants have increased over the period of time, due to improvement in perinatal medicine, the prevalence of LBW has remained constant¹. Therefore, a need was felt to identify women who were at risk of delivering LBW based on maternal risk factors as well as socio-economic factors:

With the objective of studying the birth weight differentials by demographic and socio-economic factors, the present study was undertaken.

DATA BASE

The study was carried out in the city of Hyderabad, Andhra Pradesh. Data was collected for one consecutive year for all women who have delivered singleton live born infants within 24 hours after the delivery. The total number of mothers covered for the study were-2,600.

PROFILE OF THE STUDY POPULATION

The profile of the study population is presented in Table 1. The average age of the mothers was 24.5 years and the mean parity was 2.5. The percentage of mothers with grand multi-para (5+) was 9.0. With respect to literacy 50 per cent of the mothers

*National Institute of Nutrition, Indian Council of Medical Research, Hyderabad-500 007.

TABLE 1
THE PROFILE OF THE STUDY POPULATION

1.	Mean age	24.5	
2.	Mean parity	2.5	per cent below parity 3= 279.3 per cent with parity 54=9.0
3.		Level of education of women	Level of education of husband
	Illiterate	49.6	30.1
	Literate	2.0	1.3
	Primary	10.8	9.4
	Secondary	10.8	9.3
	High School	16.6	23.0
	High school and above	8.7	25.0
	Do not know	1.3	1.9
4.	Percentage of working women	10.8	
	Percentage of housewives	83.7	
	Information not available	5.5	
5.	Percentage of households with total family income below Rs.300p.m.	62.2	
	Mean income of households per month	Rs.255	

were illiterate, while 23 per cent had below secondary level of education. Only 8.7 per cent of the mothers had high school and above level of education. About 11 per cent of mothers were gainfully employed, while the housewives constituted 83.7 per cent. About 62.2 per cent of mothers were from households earning below Rs.300 per month. The average Income of the households was Rs.255 per month. Thus the study population was from low socio-economic strata of the urban society.

DISTRIBUTION OF BIRTH WEIGHT

The systematic recording of birth weight had begun in Paris in 1802 and now birth weight is an essential piece of information which is part of the statutory notification of birth. In the present study, 2,600 women who delivered live born infants were used for the analysis. The mean birth weight of the infants in study population was 2,730 gms. The per cent of mothers delivering infants of very low birth weight ($\leq 2,000$ gms) was 9.1 and low birth weight (≤ 2500 gms) was 31. The birth weight distribution is essentially Gaussian. According to WHO, one in every 6 infants had birth weight $\leq 2,500$ gms in the world². The ratio in Asia was 1:2, while it was 1:17 in Europe and in the present study the ratio is around 1:3.

BIRTH WEIGHT DIFFERENTIALS BY DEMOGRAPHIC FACTORS

Maternal Age: The cumulative percentage distribution of birth weight by

maternal age is presented in Table 2. It was the teenage mothers (below 20 years) who had higher prevalence of LBW, which was 40.3 per cent. This prevalence decreased with increase in age upto 30-34 years and thereafter increased again. The infants born to teenage mothers had lower mean birth weight (2,614 gms) as compared to the mothers in the older age groups except 35+years. Similar observations were noticed by other workers. The U-shaped curve was typical for women over 30 years. The correlation between maternal age and proportion of LBW was -0.70. Improperly spaced pregnancies seem to be one of the reason for the occurrence of LBW infants. The age in general did not show deleterious effect on risk of delivering LBW infant.

Parity: The relationship between parity and birth weight has been well documented in the literature. The cumulative percentage distribution of birth weight by parity has been given in Table 3. The primis who had the highest prevalence of LBW constituted 42 per cent and the lowest mean birth weight was the lowest (2,600 gms). The prevalence of LBW decreased as parity increased. Lower birth weight at lower parities may partly be caused by shorter gestation, Primi parous women are especially susceptible to preterm delivery. The mean birth weight (2,709 gms) showed decline after para 5 and above. The correlation between parity and proportion of LBW was -0.74. However, in the literature divergent opinion exists between increasing and decreasing birth weight for various para ranging from fourth to ninth. The minimal values for LBW were found in parity 2-4. Thus, Primis and grand multi-parous women need more attention in the antenatal care.

Sex of the Infant: Several studies confirmed that the female babies have higher prevalence of LBW than male babies. The cumulative percentage distribution of birth weight by sex of the infant has been presented in Table 4. In this study, the female babies had 33.4 per cent of prevalence of LBW, while male babies had 29.5 per cent. The difference in per cent prevalence of LBW between male and female babies is highly significant ($P < 0.001$). The corresponding mean birth weights were 2,696 gms for female infants and 2,730 gms for male infants, respectively. Thus, prevalence of LBW varies by sex of the new born babies.

Inter-pregnancy Interval (IPI): The relationship between birth weight and IPI is U-shaped. The cumulative percentage distribution of birth weight by inter-pregnancy interval has been shown in Table 5. The prevalence of LBW was maximum 33.3 per cent when the IPI was below 18 months. The prevalence of LBW decreased as the IPI increased upto 18-29 and again increased when the IPI crossed 30 months. The prevalence of LBW was the lowest when the IPI was 18-29 months, in other words, the optimum interval for having next pregnancy is 19-29 months. The mean birth weight was 2,624 gms for IPI below 18 months and 2,790 gms for IPI 18-29 months. While reviewing various studies, it has been observed that when the interval between delivering is less than 12 months there is a sharp rise both in proportion of LBW infants and perinatal mortality. Further, it has been observed by another researcher that birth weight remained unaltered by variations in IPI from 12-48 months. The present study also revealed that the prevalence of LBW is maximum when the IPI was below 18 months. Hence, there should be more emphasis on spacing of births, particularly for women who have had IPI less than 18

TABLE 2
CUMULATIVE PERCENTAGE DISTRIBUTION OF BIRTH WEIGHT BY
MATERNAL AGE

Cumulative Birth Weight (in gms.)	MATERNAL AGE					Total
	120	20-24	25-29	30-34	35 +	
<2000	13.3	6.9	7.6	7.0	9.3	9.1
<2250	19.9	10.4	11.9	10.0	10.1	13.6
<2500	40.8	26.4	27.6	25.2	28.7	31.4
2500+	59.2	71.6	72.4	74.8	71.3	68.6
Total	100 (754)	100 (620)	100 (750)	100 (328)	100 (129)	100
Mean Birth Weight	2614	2751	2750	2770	2737	2712
Standard Deviation	529	438	450	435.	469	475

(Figures in parentheses indicate number of women in each category)

TABLE 3
CUMULATIVE PERCENTAGE DISTRIBUTION OF BIRTH
WEIGHT BY PARITY

Cumulative Birth Weight (in gms.)	PARITY				
	1	2	3	4	5 +
<2000	13.4	7.7	6.6	5.3	9.7
<2250	19.8	12.2	9.9	8.8	22.4
< 2500	42.3	38.6	25.4	24.0	27.5
2500 +	57.7	71.2	74.6	76.0	72.5
Total	100 (762)	100 (795)	100 (575)	100 (283)	100 (236)
Mean Birth Weight	2600	2742	2775	2794	2709
Standard Deviation	529	453	439	404	515

(Figures in parentheses Indicate number of women In each category)

TABLE 4
CUMULATIVE PERCENTAGE DISTRIBUTION OF BIRTH WEIGHT BY SEX OF INFANTS

Cumulative Birth Weight (in gms.)	SEX OF INFANTS	
	Male	Female
≤2000	8.4	9.7
≤2250	123	24.8
≤2500	294	33.4
2500 +	70.6	66.6
Total	100 (1350)	100 (1242)
Mean Birth Weight	2730	2696
Standard Deviation	463	465

(Figures in parentheses indicate number of women)

TABLE 5
CUMULATIVE PERCENTAGE DISTRIBUTION OF BIRTH WEIGHT BY INTER-PREGNANCY INTERVAL

Cumulative Birth Weight (in gms.)	INTER- PREGNANCY INTERVAL (months)					
	6-17	18-29	30-41	42-53	54-65	65
≤ 2000	10.6	5.6	6.6	6.9	7.1	13.8
≤ 2250	16.4	9.2	10.1	9.4	11.6	17.2
≤ 2500	33.3	24.3	25.0	27.0	33.9	39.1
2500 +	66.7	75.7	75.0	73.0	66.1	60.9
Total	100 (207)	100 (676)	100 (544)	100 (204)	100 (112)	100 (87)
Mean Birth Weight	2684	2790	2777	2764	2715	2626
Standard Deviation	500	410	429	433	449	534

(Figures in parentheses indicate number of women in each category)

months. However, severely malnourished mother would give birth to a LBW infant, whatever may be the IPI.

BIRTH WEIGHT BY SOCIO-ECONOMIC FACTORS

Maternal Education: The percentage distribution of birth weight by maternal education has been given in Table 6. It was also revealed that only the illiterate mothers who had the highest prevalence of LBW (36.5 per cent) and the mean*birth weight was 2,663 gms. The prevalence of LBW, decreased as the level of maternal education increased. The mean birth weight increased from 2,663 gms for illiterate mothers to 2,780 gms for mothers with high school and above level of education. One of the factors that affect maternal education is the age at marriage. Since, the study women come from a low socio-economic group, with 50 per cent of women being illiterate, their average age at marriage is quite low. The average age at marriage for females in Andhra Pradesh is 17.1 years according to Census of India, 1981¹⁰. The age distribution of married female population given by the census authorities would give the extent of women who are at risk of delivering LBW infants. The teenaged married women should be counseled to postpone their first pregnancy. There should be greater stress on education of women and in particular on reproductive health. It was observed from the relevant literature that attainment of atleast high school level of education was associated with improved outcome in terms of LBW rates. Thus, a positive association exists between maternal education and prevalence of LBW.

Paternal Education. The percentage cumulative distribution of birth weight by paternal education has been presented in Table 7. The percentage of prevalence of LBW was 38.4 for illiterates and mean birth weight was 2,638 gms. The prevalence gradually decreased as the level of education increased. The lowest incidence of LBW (21.9 per cent) was observed with high school and above level of paternal education and the mean birth weight was 2,818 gms. A cross comparison of parental education with LBW confirms greater effect of maternal education on prevalence of LBW than paternal education. Hence, more emphasis should be placed on female education to reduce the incidence of LBW.

Occupation of Women: The cumulative percentage distribution of birth weight by occupation of women has been shown in Table 8. Only 10 per cent of women are engaged in gainful occupation. The prevalence of LBW for working women was 35.6 per cent while for housewives it was 30.6 per cent ($P < 0.001$). The corresponding mean birth weights were 2,656 gms and 2,733 gms. The higher prevalence of LBW among working women may be due to excessive strain throughout pregnancy as most of them were servant maids.

Economic Status: The household income reflects the economic status of the respondent. The cumulative percentage distribution of birth weight by household income has been indicated in Table 9. The highest prevalence of LBW was observed in the low income group (below Rs.200 per month). As the income increased the proportion of LBW decreased. The correlation between income and proportion of LBW was -0.89 with the slope being -0.041 and intercept of 41.62.

TABLE 6
CUMULATIVE PERCENTAGE DISTRIBUTION OF BIRTH WEIGHT BY LEVEL OF MATERNAL EDUCATION

Cumulative Birth Weight (in gms.)	LEVEL OF MATERNAL EDUCATION					
	Illiterate	Literate	Primary	Secondary	High School	Above High School
<2000	11.3	11.8	6.9	7.5	5.3	4.0
<2250	16.4	17.7	12.1	9.6	10.9	7.1
<2500	36.5	33.3	33.4	24.6	25.5	17.7
2500 +	63.5	66.7	66.6	75.4	74.5	82.3
Total	100 (1295)	100 (57)	100 (282)	100 (380)	100 (432)	100 (227)
Mean Birth Weight	2663	2676	2708	2775	2780	2849
Standard Deviation	506	519	473	440	413	362

(Figures in parentheses indicate number of women in each category)

TABLE 7
CUMULATIVE PERCENTAGE DISTRIBUTION OF BIRTH WEIGHT BY LEVEL OF PATERNAL EDUCATION

Cumulative Birth Weight (in gms.)	LEVEL OF PATERNAL EDUCATION					
	Illiterate	Literate	Primary	Secondary	High School	Above High School
< 2000	12.4	10.4	10.6	10.3	8.4	4.3
<2250	17.5	16.7	16.7	16.9	12.1	7.2
<2500	36.4	33.3	35.5	34.3	28.9	21.9
2500+	61.6	66.7	64.5	65.7	71.1	78.1
Total	100 (783)	100 (48)	100 (245)	100 (242)	100 (597)	100 (652)
Mean Birth Weight	2636	2687	2670	2679	2739	2878
Standard Deviation	518.9	503	500	498	461	378

(Figures in parentheses indicate number of persons in each category)

TABLE 8
CUMULATIVE PERCENTAGE DISTRIBUTION OF BIRTH WEIGHT BY OCCUPATION OF MOTHERS

Cumulative Birth Weight (in gms.)	OCCUPATION OF MOTHERS	
	Working	Housewife
≤2000	12.8	8.5
≤2250	16.4	13.1
≤2500	35.6	30.6
2500 +	64.4	69.4
Total	100 (281)	100 (2319)
Mean Birth Weight	2656	2733
Standard Deviation	523	469

(Figures in parentheses indicate number of women)

TABLE 9
CUMULATIVE PERCENTAGE DISTRIBUTION OF BIRTH WEIGHT BY HOUSEHOLD INCOME

Cumulative Birth Weight (in gms.)	MONTHLY INCOME (in Rs.)			
	HOUSEHOLD			
	<100	101-200	201-300	301 +
≤ 2000	15.2	10.5	8.7	7.0
≤ 2250	19.8	16.4	12.9	10.2
≤ 2500	37.0	40.0	29.3	24.6
2500 +	63.0	60.0	70.7	75.4
Total	100 (151)	100 (734)	100 (743)	100 (824)
Mean Birth Weight	2621	2640	2730	2777
Standard Deviation	557	496	469	435

(Figures in parentheses indicate number of women in each category)

SUMMARY

(i) Maternal age did not seem to affect the birth weight. Primi parous women have had higher prevalence of LBW and lowest mean birth weight compared to women of para 2-4. (ii) Female infants had higher prevalence of LBW than male infants. (iii) Women who have had inter-pregnancy interval below 18 months had higher prevalence of LBW. The optimum IPI is between 18-29 months, (iv) Maternal education showed greater effect on prevalence of LBW than paternal education, (v) The working women had higher prevalence of LBW than housewives, (vi) The prevalence of LBW was the highest in low income group. The correlation coefficient between income and per cent of LBW was -0.89.

ACKNOWLEDGEMENT

The authors are thankful to Dr. Vinodini Reddy, Director, National Institute of Nutrition, for her constant encouragement throughout the preparation of the paper.

Lkkjk'k

गत तीन दशकों में मातृ एवं शिशु स्वास्थ्य सूचकांकों में कोई खास गिरावट नहीं आई है। निम्न जन्म-भार द्वारा किसी भी क्षेत्र / देश का सामाजिक-आर्थिक विकास प्रतिबिम्बित होता है। यद्यपि कुछ समय से निम्न जन्म-भार वाले शिशुओं के जीवित रहने की आशाएं बढ़ी हैं, किन्तु प्रसव-पूर्व दी जाने वाली चिकित्सा में सुधार के कारण निम्न जन्म भार की व्यापकता स्थिर रही है। प्रस्तुत लेख में जनांकिकीय एवं सामाजिक-आर्थिक कारकों के द्वारा जन्म-भार विभेदकों का अध्ययन किया गया है। अध्ययन के परिणामों से यह संकेत मिला है कि पहली बार मां बनने वाली महिलाओं में निम्न जन्म-भार वाले शिशुओं को जन्म देने के मामले अधिक पाए गए तथा लड़कों की अपेक्षा लड़कियां अधिक कमजोर पैदा हुईं।

REFERENCES

1. MURTHY, H.V.V. (1990) Relative Risk of Low Birth Weight in *Statistics in Health and Nutrition*. Proceedings of VIth Annual Convention on Medical Statistics (in press).
2. WHO (1984) *Weekly Epidemiological Record*, 59(27) p. 205-212.
3. BHARGAVA, S.K. *et al.* (1979) A Study on Low Birth Weight Infants in an Urban Community. *Health and Population, Perspectives & Issues*. 2: p. 54-65,
4. MURTHY, H.V.V. (1990) How to prevent LBW. *Health Action* (Special Issue) Mother and Child Care, p. 37-40.

5. PACHAURI ,S. *et al.* (1971) A Multi Factorial Approach to Study the Factors Influencing Birth Weight in the Urban Community in New Delhi. *Indian Journal of Medical Research*, 59: p. 1318-1339.
6. CHAKRABORTY, R. (1975) Proportion of Low Birth Weight Infants in an Indian Population and Its Relationship with Maternal Age and Parity. *Human Heridity*. 25(2): p.73-79.
7. WHO (1984) *Perinatal Mortality and Morbidity Including Low Birth Weight*. SEARO: Regional Health Paper No. 3.
8. DUNN, P.M. (1979) *Low Birth Weight Incidence, Aetiology and Prevention In Phlllpt (Ed.) Maternity Services In Developing World What Community Needs*. (London: Royal Colleges of Obstetricians and Gynaecologists.) p. 233-240.
9. PREM A, K. (1978) Pregnancy and Lactation, Some Nutritional Aspects. *Indian Journal of Medical Research*, 68 (Suppl.) p. 70-79.
10. CENSUS OF INDIA, 1981. SERIES - 2 (1985) Andhra Pradesh Office Registrar General of India.

QUALITY IN HEALTH SERVICES

A.K. Agarwal*

ABSTRACT

We have quantity of care to some extent but what quality is provided is the question being asked by the consumers. The paper presents an analysis of the performance of the existing health infrastructure both rural and urban and identifies the issues related to quality assurance in health services. A more comprehensive approach has been taken in dealing with these issues in the primary health care setting. The paper is based on the personal experiences and observations of the author in different regions of the country as well as discussions with the community health experts at those places.

India has a wide network of health care institutions spread along the length and breadth of the country. In terms of infrastructural facilities by the year 1991 there would be 23,000 PHCs, 1,30,000 sub-centres, and 2,500 community health centres in different regions of the country. In addition to this there exists over 9,000 hospitals and about 6,00,000 hospital beds. But a lot remains to be achieved on the quality front.

Adequate number of medical, nursing, para-medical and auxiliary personnel have also been recruited by the various governments and organisations to run these centres. The main objectives being: (i) to provide reasonable preventive; promotive, curative and rehabilitative health services to the people close to where they live and work; (ii) to improve the quality of life of people by involving them in the planning and organisation of health services and by imparting simple health skills to them; (iii) to mobilize local resources and community participation; and (iv) to seek inter-sectoral and intra-sectoral coordination.

Obviously, if these were to be achieved then there has to be a mass movement at the grassroot level by a committed force of health functionaries to translate the policies, decisions and objectives into action and results.

Further, the success of health and family welfare programmes in India depends on good teamwork among over 100 categories of health workers. The medical officer is the leader of this team. Today, all studies and findings suggest that this young medical graduate is not playing the leadership role, rather it is a most derogatory one. But the doctor also cannot be squarely blamed. The fault probably, lies with the system of medical education and lack of community orientation and participation.

*Associate Professor, Department of Medical Care and Hospital Administration, National Institute of Health and Family Welfare, New Mehrauli Road, Munirka, New Delhi-110 067.

WHAT CAN BE DONE?

The health policy makers, planners and administrators will have to address themselves to the following issues in order to improve the quality of health services:

Epidemiological Surveillance: Poor records, lack of a system of notifying notifiable diseases and poor case detection etc. were some of the important factors coming in the way of communicable diseases control. The epidemiological surveillance have to be strengthened so that the health workers would be able to detect cases of polio, tuberculosis, leprosy, malaria, cholera, typhoid and other important public health problems. It would not be out of place to mention the "example of Thailand. In a small country like Thailand, they know the number of fresh cases of polio occurring in the community every month. This very fact helped them not only in containing the disease but also for achieving the goal of eradicating polio by 1990 as well.

Monitoring and Supervision: A sound system of monitoring and supervision needs to be in-built in the system. It was most unfortunate that the district health officers and other supervisors were not seriously discharging their role. This resulted in perceptible slackness and lethargy among the PHC and sub-centre staff.

Professional Attitudes: The medical officers working at the PHCs particularly were biased heavily in favour of Western system of medicine. They were out to come to the cities at an earliest opportunity. Though they were physically present at the PHCs their heart and soul was elsewhere. A serious effort has to be made to bring in the attitudinal change in favour of rural bias.

Management Information System: For an accurate planning and implementation strategies a sound and accurate data is the most important prerequisite. Reliable and accurate data on different aspects of health and family welfare programmes has been lacking at present. Time has come for the introduction of the computer-based management information systems. Now that most of the district headquarters are connected through NIC-NET it would facilitate linking of the PHC level information to the national levels.

Involvement of Social Scientists In Primary Health Care: The experience for primary health care all over the world has shown that the social scientists play a very positive role in the successful delivery of primary health care and also in improving the quality of life of people. Our planners must take a tip from this and gainfully utilize the services of social scientists and other health workers².

Managerial Training to Health Professionals: Another important lapse in the health care delivery system has been to deploy the fresh medical graduates to the PHCs and CHCs without any induction training. Unless these doctors were exposed to a short managerial training it would not be possible to bring-in the right type of attitudinal changes and management skills in them.

Logistics Support: The various health and family welfare programmes cannot be sustained in the absence of a sound and functional logistics system. This would ensure regular supply of the medicines, vaccines and contraceptives to the field level institutions and the community.

Quality/Potency of Drugs and Vaccines: It is said that 20 per cent of the drugs which are being manufactured in our country have been found as substandard and spurious. Several studies have also shown that the vaccines in large number were found not as potent to prevent the diseases. This calls for increasing the number of drug and vaccine testing laboratories all over the country.

Referral Services Support: Referral services support exists only as a concept. Primary health care needs a good referral support from the secondary and tertiary hospitals. The district hospital in particular needs to be strengthened to provide this support.

This is to illustrate only a few which if taken care of the health care delivery system would be more vibrant in responding to the felt health needs of the people. This would in the long run assure quality health services to those living in peripheral and difficult areas of our country.

Further, the phase of expansion of health infrastructure has gone on for quite a long time, time is now ripe to work on its consolidation to get maximum out of it. Some, studies have been undertaken for this purpose where efforts have been made to understand functioning of medical and health services to maximise their output. The quality of medical and health services becomes basic in this pursuit. Therefore, it becomes essential to determine the irritants and strengthen the quality of the services. It would not be out of place to mention a few findings and observations of the ORG workshop on quality of health and family welfare services held at Baroda in 1987. The following were the important findings and their programme implications.

1. The utilisation of government health services is far below the desired level only 37 per cent people utilise government health facility whenever they need. It means that the government services have not yet come to the expectations of people.
2. In domiciliary visits, more contacts have been reported by male health workers than females. The low contacts by the female health workers have also reflected in low utilisation of MCH services which were female-oriented. Thus, a need has been felt to ensure that female health workers make visits more frequently. The better quality of her services would also be helpful in increasing contacts of people with female workers.
3. The reasons reported for non-utilisation of government services suggests need for more health education activities and better quality services. Availability of greater supply of medicine would help to build better rapport of the health workers.
4. Most of the users of health and family welfare services reported satisfaction with the services. But it was strange that the users did not become salesmen for the programme they did not recommend use of the government services to others.

This may suggest that the users were probably satisfied but they were not happy so as to be the spokesmen for the government services.

5. Almost three-fourths of the users of health and family welfare services had reported one or the other problems with the use of the programme services. The major problems were poor services, ineffective medicines and money which was being charged by the health staff for the services.
6. The quality of MCH services received were not good, some women have been getting ante-natal check up irregularly. Similarly, most of the women had one to two contacts with health workers during the total period of pregnancy. Need to improve the quality in the use of these services has been felt.
7. People have felt need for more visits of the health staff, more medicines and services for major illnesses.
8. The health education activities have not been very good - only 50 per cent respondents reported that somebody from the government health department had contacted them for educational purposes in the last one year. Similarly, most of the users of family planning methods were motivated by sources other than health department staff. This aspect of the programme needs strengthening. Overall, it seems that the programme services are being utilised and people do feel satisfied with them. But there is still need to increase its utilisation by improving its quality. Those who have used the services have not become salesmen of this programme, may be because of some reservation which needs to be attended to.

CONCLUSION

The supervisors must be trained to view their role as guides and educators and not inspectors or bosses. They must ensure that quality of health services delivered by the field staff was not sacrificed for merely achieving numerical targets. Supervisors must be vested with enough powers/authority to reward or take remedial action against ineffective, uncooperative workers. The health services require both a human approach and strong management which is sadly lacking at present.

Lkkjk'k

हमारे देश में स्वास्थ्य परिचर्या संबंधी सेवाओं की मात्रा तो बहुत अधिक है, किन्तु उपलब्ध कराई जाने वाली सेवाओं की गुणवत्ता के विषय में उपभोक्ताओं द्वारा प्रश्न किए जाते हैं। प्रस्तुत लेख में गांव तथा शहर दोनों में, स्वास्थ्य के संगठनात्मक ढांचे के निष्पादन का विश्लेषण करने के साथ-साथ स्वास्थ्य सेवाओं की गुणवत्ता की विश्वसनीयता संबंधी विषय पर भी प्रकाश डाला गया है। प्राथमिक स्वास्थ्य परिचर्या व्यवस्था संबंधी इन मुद्दों को हल करने के लिए एक व्यापक अभिगम अपनाया गया है। यह लेख, देश के विभिन्न क्षेत्रों में लेखक के व्यक्तिगत अनुभवों एवं

पर्यवेक्षकों पर आधारित होने के साथ-साथ उन स्थानों पर सामुदायिक स्वास्थ्य विशेषज्ञों के साथ किए गए विचार-विमर्श पर भी आधारित है।

REFERENCES

1. HEALTH INFORMATION INDIA (1988) CBHI, Directorate General of Health Services, Nirman Bhavan, New Delhi, D. 129.
2. INDIAN COUNCIL OF SOCIAL SCIENCES AND RESEARCH - Indian Council of Medical Research, "Health for All - An Alternate Strategy", Report of a Study (1981). Published by Indian Institute of Education.
3. NATIONAL INSTITUTE OF HEALTH AND FAMILY WELFARE (1986) "Report on Logistics and Supply Management System of Drugs in the Rural Areas of Madhya Pradesh".
4. OPERATIONS RESEARCH GROUP WORKSHOP ON QUALITY OF HEALTH AND FAMILY WELFARE SERVICES PROVIDED BY PHC/SUB-CENTRES IN RURAL INDIA (1987) Baroda. p. 14-16.

COVERAGE SURVEY OF ALLAHABAD CITY UNDER UNIVERSAL IMMUNIZATION PROGRAMME

PL Joshi*, M. Bhattacharya** and B. Raj***

ABSTRACT

The coverage survey carried out as a part of the evaluation of the Universal immunization Programme, recorded an overall coverage of 47 per cent infants with three doses of DPT, Polio and -one dose of BCG. When measles was also considered the figure dropped to 30 per cent: An average of 38 per cent dropout rate was observed for both DPT and Polio from the first to the third dose. The main causes for incomplete immunization in infants were -postponement to a later date in 28 per cent and unawareness of the need for vaccination in 14 percent. Ninety per cent of the parents were aware about Polio and Tetanus, being preventable by vaccination. Pregnant ladies had a coverage rate of 71 percent with two doses of tetanus toxoid. Radio/TV and hospital staff had been the major sources of information about the vaccines. Fifty per cent of the immunizations had been carried out at the hospitals followed by the outreach 33 per cent.

The Universal Immunization Programme was launched by the Government of India in November 1985 with the aim of providing 85 per cent coverage of infants against the six EPI diseases by the year 1990. Since then, coverage surveys have been carried out annually at all those places where the programme has been implemented. Vaccination coverage survey is an important managerial tool in assessing the progress of the programme and its achievements, determining reasons for immunization failure, and better understanding of the sources of immunization services. This paper presents the results of the vaccination coverage evaluation survey, carried out in Allahabad City in April 1988.

MATERIALS AND METHOD

The survey was carried out in the City of Allahabad and in its districts. It was one of the first 30 districts to be taken up under the UIP in 1985. Ever since the implementation of the programme, immunization services are delivered through outreach camps organised by medical college; immunization clinics at six hospitals, voluntary agencies and private practitioners. The vaccination coverage evaluation survey used the standard 30 cluster WHO methodology, adopted to suit programme needs in the country². The thirty clusters were randomly selected from the list of 241

*Reader, Department of Social and Preventive Medicine, M.L.N. Medical College, Allahabad.

**Reader, Department of Social and Preventive Medicine, M.L.N. Medical College, Allahabad.

***Professor & Head, Department of Social and Preventive Medicine. M.L.N. Medical College, Allahabad.

total urban units covering a population of 17,41,800. At each of the clusters at least seven children between 13-24 months of age and seven women with an infant were surveyed. The children and the mothers were selected by starting at a random point in the cluster area and going from one house to the next nearest house seeking children and mothers in the eligible age groups. The immunization status, source of immunization and reasons for failure to initiate or complete immunization were ascertained, from the guardian of each child. Besides, the coverage with two doses of tetanus toxoid, the women were questioned about the vaccines given to the children, the diseases prevented and the source of their information.

RESULTS

A total of 1,560 households were visited in the 30 clusters with an average of 52 households per cluster. A total of 244 children in the age group 13-24 months were recorded from the clusters. Immunization cards were available with only 97 (39.8%) of the surveyed children. Others were included after a definite history of immunization by the parents and on checking the BCG scar mark among the children. In case of any doubt the inference were regarded as negative. All children vaccinated with three doses of DPT and OPV and one dose of BCG were considered fully immunized.

Vaccination Coverage: A total of 190 children (77.80%) had been vaccinated with one or more doses of the scheduled vaccines. It may be noticed from Table 1 that 58 per. cent of the children received BCG, 49 per cent all the three doses of DPT and 47 per cent all the three doses of Polio. Only 30 per cent had received measles. Forty seven per cent (114), of the children were considered fully immunized. An average of 38 per cent drop put rate was observed for both DPT and Polio. The vaccination coverage with two doses of tetanus toxoid in pregnant women was

TABLE 1
VACCINATION COVERAGE IN CHILDREN COVERAGE (N = 244)

Vaccine	Number	Percentage	Dose	Dropout Rate	Number
				Percentage	
BCG	142	58.2	-	-	-
DPT 1st	190	77.9	III	39	20.5
DPT II nd	151	61.9	II-III	31	20.5
DPT III rd	120	49.2	I-III	70	36.8
OPV 1st	168	77.0	I-II	35	18.6
OPV II nd	153	62.7	II-III	39	25.5
OPV III rd	114	46.7	I-III	74	39.4
Measles		73	30.0		

observed to be in 71 per cent with a dropout rate of 11 per cent as has been given in Table 2.

Source of Immunization: Out of the total 190 children, nearly 50 per cent had been fully vaccinated at the hospital and 33 per cent at the outreach service centres. Private practitioners had immunized only 11 per cent of the children (Table 3). The dropout rates from first to third dose of DPT was less at the hospital 35 per cent as compared to 41 per cent at the outreach, but the trend reversed for Polio where the dropout rate was 38 per cent at the hospital compared to 34 per cent at the outreach. The drop out was high 50 per cent in case of private practitioners for Polio. Vaccination for measles was highest at the hospital 53 per cent. The difference in the dropout rates was statistically not significant ($P > .05$). The drop out for TT was only 11 per cent (Table 2).

Age at Vaccination: Almost all the children had received the third dose of DPT and Polio before the first birthday. Only 15 (12.5%) were inoculated after 12 months of age for DPT and 23 (20.2%) for third dose of oral polio vaccine. BCG was given to 51 per cent of the infants before the age of six months and measles to 80 per cent before the end of one year.

Causes for Immunization Failure: A total of 130 infants were incompletely immunized and their parents gave various reasons as the cause for it has been given in Table 4. Out of the three categories for non-immunization obstacles was the main reason put forward by 37 per cent of the parents and chief amongst these were mothers' illness 11 per cent and place of vaccination too far to go 9 per cent. Next to obstacles, was lack of motivation in 34 per cent of the families. Lack of information was the cause in 29 per cent of the cases. The single most reason for partial immunization was postponed till another time' observed in 28 per cent followed by unaware of the need in 14 per cent of the parents.

Community Awareness About Vaccine Preventable Diseases: Majority of the parents were aware about one or the other of these diseases. Ninety per cent of the parents knew about polio, and 87 per cent about tetanus, the two common serious illnesses. Diphtheria was known to only 53 per cent of the parents, however, 86 per cent knew about the need for three doses of DPT vaccination. The least knowledge was about measles present in 39 per cent of the parents as has been shown in Table 5.

DISCUSSION

Coverage surveys are essential for evaluating the performance of the on-going Universal Immunization Programme. In the present study the overall immunization coverage with three doses of DPT and OP V and a dose of BCG was found to be 46.7 per cent, slightly higher than that of our last survey (43%). Better coverage rates have been reported by various authors from other urban studies. Rates were also varying between 55.7 per cent to 83.4 per cent for different localities of Delhi. Other

TABLE 2
TETANUS TOXOID COVERAGE AND SOURCE OF IMMUNIZATION

Source	No. of Doses		Dropout Rate	
	1 st	II nd	Number	Percentage
Hospital	86 (51.2)	78 (52)	08	9.3
Private Practitioners	36 (21.4)	32 (21.3)	04	11.1
Outreach Activity	46 (27.4)	40 (26.7)	0.6	13.0
Total	168 (80.0)	150 (71.4)	18	10.7

TABLE 3
SOURCE OF VACCINATION OF INFANTS

Vaccine	Hospital	M. Centre	Source of Immunization Outreach	Private Practitioner	Total
DPT I	99 (52.1)	7 (3.6)	64 (33.7)	20 (10.5)	190 (77.9)
II	74 (49.0)	4 (2.6)	53(35.0)	20 (13.2)	151 (61.9)
III	64 (53.3)	4(3.3)	38(31.7)	14(11.7)	120(49.2)
Dropout rate Ist-III rd dose	35 (35.3)	3(42.9)	26 (40.6)	6 (30.0)	70 (49.2)
Polio I	97 (51.6)	7 (3.7)	64(34.0)	20(10.6)	188(77.0)
II	81(52.9)	4(2.6)	49(32.0)	19 (12.4)	153 (62.7)
III	58(50.9)	4(3.5)	42(36.8)	10(8.8)	114(46.7)
Dropout rate Ist-III rd	39 (38.1)	3(42.5)	22(34.4)	10(8.5)	114(46.7)
BCG	81 (57.0)	3(2.1)	46(32.4)	12 (8.4)	42(58.2)
Measles	39(53.4)	3 (4.1)	24 (32.9)	7 (9.6)	73 (30.0)

Note: Figures in parentheses represent percentage.

TABLE 4
CAUSES FOR IMMUNIZATION FAILURE

	Number	Percentage
A. Lack of Information		
- Unware of treed.	18	13.8
- Unaware of the llnd and llld doses	9	6.9
- Place or time of vaccination unknown	1	0.7
- Fear of side reactions	6	4.6
- Wrong ideas about contraindication	4	3.1
Total	38	29.2
B. Lack of Motivation		
- Postponed till another time	36	27.7
- No faith	7	5.4
- Rumours	1	0.7
Total	44	33.8
C. Obstacles		
- Place of immunization too far	11	8.5
- Time inconvenient	6	4.6
- Vaccinator absent	2	1.5
- Vaccine not available	6	4.6
- Mother too busy	1	0.7
- Child ill	6	4.6
- Family problems/illness of mother	14	10.7
- Child ill and brought but not vaccinated	2	1.5
Total	48	36.9

TABLE 5
COMMUNITY AWARENESS ABOUT VACCINE PREVENTABLE
DISEASES

Disease	Number	Percentage
Polio	225	922
Tetanus	211	865
Three doses of DPT	210	86.0
TB	163	660
Diphtheria	129	523
Pertussis	175	71.7
Measles	94	385

researchers gave the rate of 62.4 per cent for Shimla town and for Dehradun 57.8 per cent. Lower coverage rates have also been observed but mainly from those studies covering both the rural and urban areas. 35 per cent for a district in Andhra Pradesh and 36 per cent from a district in Himachal Pradesh. The main reason for the poor coverage rates may be attributed to high dropout rates between the first and third doses of DPT and OPV. As is obvious from the present study (Table 1). Though 77 per cent of the infants received the first dose of DPT and OPV only 50 per cent turned up for the third dose giving a dropout rate of about 37 percent. Majority of the authors from other urban studies have stated dropout rates varying between 9.6 to 12.4-per cent. It has been stated that a range of 13.2 to 35.7 per cent for different localities of Delhi. In other studies of Thane and Sirmaur districts a dropout rate of 9 per cent and 12.5 per cent has been reported respectively. The chief reason for the dropout rates irrespective of the fact whether high or low or whether they were urban or district studies, put forward by all the researchers was 'lack of information. Nearly 50 per cent of the drop outs were due to the ignorance on the part of the parents about the need for immunization and the schedule for. immunization. The next important cause 'Obstacles' was mainly in the form of vaccine or vaccinator not available mostly observed in the district coverage 7+ 8 reports and mother busy/ill or child ill, noted from most of the urban studies. Last, but not the least, was the 'lack of motivation" reflected by the fact that nearly 5-8 per cent of the vaccinations were postponed and eventually never completed, observed in both urban and district studies. The causes for incomplete immunization and drop outs are also influenced by the availability of the services. In majority of the urban studies with good coverage and lower dropout rates than the present study, health centres and private practitioners had played an important role in improving the coverage compared to ours. Though hospital was the main source of vaccination, 35 per cent of the immunizations had been carried out by private

practitioners in the studies reported from Delhi and Panaji observed by the authors of the present study and in the studies of other authors. Though outreach services, however, had been provided in the research studies but the coverage had been low in comparison to the urban studies. This discrepancy in the rates may be explained by the fact that all those parents in the urban areas who utilized the services of the hospitals, health centres and private practitioners were better motivated than the parents who came for immunization at the outreach centres. Thus, it is evident that more number of outlets in the form of health centres and involvement of private practitioners can improve the coverage in an area. Such measures will also eliminate partly the problems of 'lack of motivation' and the various 'obstacles' observed in this study and the other authors in their respective studies. Removal of the obstacles would also help to fill in the gap between knowledge and practice as substantiated by the data from this study and that of another study. Ninety per cent of the parents in our study were aware that poliomyelitis and tetanus were vaccine preventable diseases and 60-80 per cent knew about the BCG and the three doses of DPT but the coverage in our population was only 47 per cent where as in the study at Thane, awareness about the vaccine preventable diseases was present in 2/3rd of the respondents and 80 per cent knew about the three doses of DPT, observations were very similar to the results of the present study regarding knowledge, but the coverage was good (78%), just because of the presence of more immunization outlets in the form of private practitioners, and voluntary agencies⁹. Radio and Television were the most common communication channels for 41 per cent of the parents in this study, in contrast to the figure of 19 per cent reported by another researcher, where the health staff was the most effective source of information for 73 per cent of the parents⁹. The role of the health staff was noted 'lacking' in this study alongwith that of the voluntary workers both of which need to be augmented for creating awareness and eliminating lack of information amongst the public.

Better coverage rates were reported from centres where private practitioners were also involved besides the hospitals.

The coverage of pregnant women with two doses of tetanus toxoid had increased significantly to 71 per cent from the figure 35 per cent reported in the present study as per last survey. Other authors have reported values ranging between 68-79 per cent in a study of a district has reported a coverage figure of 51.7 per cent. Better coverage and less drop out ranging between 6-11 per cent was observed in all those studies including this study where private practitioners had played a role in immunizing women. Hence, mothers involvement of private practitioners besides the hospital and outreach services helped to improve the performance.

It may be pointed out that knowledge and awareness has been observed amongst the people but the practice is lacking. The situation would improve if more outlets were to be provided with the corporation of dispensaries, urban family planning centres, involvement of private practitioners and voluntary agencies. Cold chain facilities should also be provided at each of the centres. Such a network of

services would help to eliminate the 'Lack of Information' and 'Obstacles' encountered so far for reaching out in the target of 85 per cent coverage by the year 1990.

Lkkjk'k

सार्वजनिक प्रतिरक्षण कार्यक्रम के मूल्यांकन के एक भाग के रूप में किए गए कवरेज सर्वेक्षण द्वारा डी.टी.पी. और पोलियो की तीन-तीन डोज और बी.सी.जी. की एक डोज के साथ कुल मिलाकर 47 प्रतिशत शिशुओं का एक समग्र कवरेज रिकार्ड किया गया था। खसरे को भी इसमें शामिल किया गया तो इन आंकड़ों में 30 प्रतिशत की गिरावट आ गई थी। डी.टी.पी. और पोलियो दोनों को मिलाकर पहली से तीसरी डोज दिए जाने पर 384 प्रतिशत गिरावट पाई गई थी। लगभग 28 प्रतिशत मामलों में बाद में टीके लगाए जाने में टाल-मटोल तथा 14 प्रतिशत मामलों में प्रतिरक्षण की आवश्यकता के बारे में अनभिज्ञता शिशुओं के अधूरे प्रतिरक्षण का प्रमुख कारण थी। टीकों द्वारा पोलियो और टिटनेस जैसे रोगों की रोकथाम किए जाने के बारे में 90 प्रतिशत माता-पिता जागरूक थे। 71 प्रतिशत गर्भवती महिलाओं को टिटनेस टाक्साइड की दो डोज द्वारा कवर किया गया था। टीकों के बारे में रेडियो/टी.वी. और अस्पतालों के कर्मचारी सूचना के स्रोत थे। पचास प्रतिशत टीके अस्पतालों में लगाए गए थे जिसे से 30 प्रतिशत जनसंख्या प्रतिरक्षण सीमा से बाहर हो गई थी।

REFERENCES

1. SCHEME ON UNIVERSAL IMMUNIZATION IN SELECTED AREAS (1985) Directorate General of Health Services (EPI) Section. Ministry of Health and Family Welfare, New Delhi.
2. EVALUATE VACCINATION COVERAGE (1987) Module for Training under UIP, Ministry of Health and Family Welfare, Government of India, New Delhi.
3. JOSHI, P.L., BHATTACHARYA, M., DWIVEDI, S., RAJ. B., & VERMA, J. (1987) Immunization Coverage in the City of Allahabad. *Ind. Jour. Prev. Soc. Med.*, 18 (3).
4. SEHGAL, S., & CHAWLA, U. (1988) Vaccination Coverage Assessment in Union Territory of Delhi in 1987, *Communicable Diseases Bulletin, NICD*, 5(2).
5. AHLUWALIA, S.K., GUPTA, N.K., & VAIDYA, GUPTA, B.P. (1987) Vaccination Coverage Assessment in Shimla Town: *Communicable Diseases Bulletin, NICD*. 4.
6. SEHGAL, S. (1988) Vaccination Coverage Survey in Dehra Dun. *Communicable Diseases Bulletin, NICD*, 5 (2).
7. PRASAD, K.R. (1988) Vaccination Coverage Survey in Anantapur District (Andhra Pradesh). *Communicable Diseases Bulletin, NICD*, 5(2).

8. MOHIL, DP. (1987) Vaccination Coverage Assessment, Survey in Sirmaur District (Himachal Pradesh). *Communicable Diseases Bulletin, NICD*, 4(2), July, 1987.
9. SOKHEY, JOTNA, DEWAN, M.P. & PATHAK. P.R. (1987) Vaccination Coverage valuation Survey. Thane District, Maharashtra 1987, Ministry of Health and Family Welfare. New Delhi.
10. HELECAR. A. & SINGH, H. (1986) Vaccination Coverage Assessment. *Communicable Diseases Bulletin, NICD*, 3(1).

HEALTH CARE IN PAKISTAN: A DILEMMA OF POPULATION GROWTH

Syed Mubashir Ali*

ABSTRACT

Health development programmes are affected greatly by the rapid growth of an already oversized population. An attempt has been made thereto show that reduction in fertility could benefit the country by saving the resources otherwise Incurred on the health care requirement of a very large population.

But the fact remains that in Pakistan despite all efforts to lower fertility the increase in population is likely to continue unabated for many years to come. In such a situation, the adoption of Primary Health Care (PHC) programme, especially in the rural areas, where majority of the population is found will be a step in the right direction. The PHC programme will help reduce the sickness rate at the same time check the high cost of providing standard curative measures.

Managerial services for national health development need to be appraised of the various impediments that may restrict the progress of health development process in a country. Of several other important variants an important one is the population growth rate in the country undertaking such a programme. Since, health development programmes have been affected greatly by the rapid growth of an already oversized population, an attempt has been made to quantify the implications of high, medium and low rate of population growth on health system infrastructure *e.g.*, doctors, dentists, nurses, paramedical staff, hospitals, hospital beds and health centres, by the mid period 2013-2018. Further, in order to achieve health for all, a policy-oriented discussion has also been included.

The existing health facilities are projected on three assumed rates of population growth. These assumptions are formulated in view of the demographic changes in the past and the projected decline in fertility and mortality as envisaged in the development plan of Pakistan (Government of Pakistan, 1983).

Under the first assumption, there will be a gradual decline in Total Fertility Rate (TFR) from 5.9 in 1983 to 4.78 children per woman in the mid period 2013-2018. During the period mortality rates would show a steady decline and as a consequence the life expectancy would rise to 63 years from the present (1983) 55 years. It may be mentioned here that under the first assumption, the decline in fertility and mortality would largely be the effect of overall socio-economic development in the country. Additionally, a major breakthrough in the use of contraception is

*Research Demographer, Pakistan Institute of Development Economics, Islamabad.

unforeseen. However, a gradual increase in the age at marriage, as was observed by a number of studies in the recent past, may continue in the future and have some effect on lowering the fertility rate.

Under the second assumption, there would be a moderate decline in fertility and mortality over the projection period. The life expectancy at birth would show an increase of about 11 years. Besides developmental effects, particularly the spread of education and improvements in general health conditions, the increase in life expectancy would be accounted for by the control over infant and child mortality due to mass immunisation programme. A decline in fertility would largely be due to considerable increase in the use of contraception particularly among young couples who will practice contraception for the purpose of spacing between children. Concurrently, a decline in infant mortality and overall general development may lead couples to change their attitudes and adopt small family size norms. This change in fertility would account for a reduction of 2.2 births, per woman by the end of projection period.

The third projection is made on the assumption that the diffusion of contraceptive use would achieve universality in the country by the mid period 2013 to 2018. Rapid development in the health sector and efficient immunisation programme would also be operative. Moreover, an increased participation of females in the secondary and tertiary education will affect positively the age at marriage and, being about a change towards small family size norms. Under the presumed situation, the total fertility rate would show a reduction of about 3.1 children per woman and life expectancy at birth would be 71 years by mid-period 2013 to 2018. It is noteworthy that decline in TFR under this assumption corresponds closely to the government targets (Government of Pakistan, 1983). The population of 1983 has been projected upto 35 years into future. Each health facility is estimated by multiplying the ratio (health facility/population) in 1983 to the projected population upto 2018 under the three assumptions.

RESULTS

Table 1 shows that population would increase from 90.80 million in 1983 to 226.48 million in 2018 under first assumption. Whereas, under second and third assumptions, the population would grow of a relatively reduced pace and hence would reach 209.52 millions and 184.77 millions respectively by the year 2018. The availability of doctors in 1983 has been estimated at 20,000. In other words there is one doctor for 4540 persons. Assumable maintaining the same doctor/population ratio, the year 2003 will need an addition of 13,634 doctors and the year 2018 will need additionally 29,884 doctors under first assumption. However, under second assumption, 560 fewer doctors will be needed by the year 2018. The requirement of

1 The estimated population for 1983 has been taken from 6th Five year Development Plan of Pakistan, 1983-1988; Planning Commission, 1983.

2 The FIV FIV computer programme has been used. This computer package programme basically follow the approach of cohort component method. The method takes separate account of the effect of fertility, mortality and migration change on population size and structure.

doctors would be substantially lower under the third assumed rate of population growth as has been shown in Table 1.

The present (1983) ratio is estimated to be 82,547 persons per dentist in the country. In order to maintain the same dentist/population ratio an additional 750 and 1644 dentists will be needed in 2003 and 2018 respectively under the first assumption. The requirement of dentists will be relatively lesser under the second assumption. The subsequent requirement of dentist would be even lesser if the population grows according to the third assumed rate of growth.

At present the availability of nurses is estimated to be 5530 and 52,000 paramedics including community health workers and midwives. In order to obtain the same ratio in 2003 and 2018 as in 1983, an addition of 3770 nurses in 2003 and 8263 nurses in 2018 will be needed. The requirement of paramedics will be much higher that is, an additional staff of 35,448 in 2003 and 77,700 in 2018 under first assumption. Under the second assumption, 155 fewer nurses and 1456 fewer paramedics will be required in the year 2003 and 654 fewer nurses and 9911 fewer paramedis will be needed in 2018. In order to maintain the same nurses and paramedics ratio per person as in 1983, the requirement of such staff will fall further under third assumption of population growth.

The number of health establishments particularly, hospitals, hospital beds and health centres/dispensaries are also good indicators of the health status of a country's population. There are 626 hospitals and 51,400 hospital beds in the country in 1983. In order to maintain the current ratio of hospitals and hospital beds to population, these facilities have to be increased to 1053 and 86,439 respectively by the year 2003 and 1561 and 128,204 respectively by the year 2018 under first assumption. This shows that in 2018 the requirement of hospitals and hospital beds would be about two and a half times more than what we have to-date (1983). However, the need for these facilities would be less under second assumption and the requirement would be even lesser if the population grows according to third assumption.

It is estimated that there are 6863 health units in the country in 1983. Which means there is one health units for 13230 persons. In order to maintain this ratio, an additional 4678 health units by year 2003 and 10255 health units by year 2018 would be required under first assumption. However, under the third assumption the requirement of health units would be 811 less by the year 2003 and 3153 less by the year 2018 when compared to the need of such facilities under first assumption.

If we presume that there is a strong relationship between mortality levels and the availability of the health facilities in a country, then the health facilities projected so far on the basis of constant ratio of number of persons per health facility infact imply that the present mortality levels would prevail throughout the projected period. But the fact is that our population projects are based on the assumptions that during the projection period mortality would decline and consequently, life expectancy at birth will rise gradually from about 55 years to 63 years under first assumption. Under second and third assumptions, a relatively fast decline in mortality is envisaged.

TABLE 1
DISTRIBUTION OF HEALTH FACILITIES UNDER THREE ASSUMPTIONS OF
POPULATION GROWTH FROM 1983 TO 2018

		1983			2003			2018		
Population and Health Facilities	Year	1st Assumption	2nd Assumption	3rd Assumption	1st Assumption	2nd Assumption	3rd Assumption	1st Assumption	2nd Assumption	3rd Assumption
Population in (000)		90802	90802	90802	152701	150158	141969	226482	209524	134769
Doctors		20000	20000	20000	33734	33074	31270	49884	46150	60697
Dentists		1100	1100	1100	1850	1819	1720	2744	2538	2238
Nurses		5530	5530	5530	9300	9145	8646	13793	12760	11253
Paramedics		52000	52000	52000	87448	85992	81302	129700	119989	105812
Hospitals		626	626	626	1053	1053	979	1561	1444	1274
Hospital Beds		51400	51400	51400	86439	85000	80364	128204	118605	104591
HealthCentres/Dispensaries		6863	6663	6863	11541	11349	10730	17118	15636	13965

Source- Data for health facilities were taken from the Sixth Five Year Plan 1983-88. Planning Commission. Islamabad. Pakistan, 1983.

Assumptions: 1st refer to high variant
2nd refer to medium variant
3rd refer to low variant

which in turn will improve the life expectancy upto about 66 years and 71 years respectively by the year 2018. That means to achieve these targets of life expectancy the country needs to develop the health facilities at a much faster pace than what is envisaged in Table 1.

Romania has a life expectancy of 71 years at birth, with a proportion of one doctor for 750 persons and one hospital bed for 300 persons (Government of Pakistan, 1984). Population projections under third assumption indicate that by the year 2018, Pakistan could also achieve life expectancy of 71 years. Assuming that there will be a 5 per cent growth in every health facility over every five successive years, there would be a ratio of 1739 persons per doctor and 1953 persons per hospital bed in the year 2018. In order to achieve the same standard as Romania *i.e.*, a life expectancy of 71 years, we would further need 140,133 doctors and 521,279 hospital beds by the year 2018.

In Pakistan where the increase in population, despite all government efforts to lower fertility, will continue for many years to come, to achieve the stipulated health infrastructure targets, is as described by Jones "it is a matter of running up the down escalator, where it is possible to reach the top, but the effort involved is much greater than it would be If the escalator were halted.

Another approach to provide the health care to masses, is through the Primary Health Care (PHC) programme. As Alma Ata Conference in 1978, the member countries endorsed the proposal of World Health Organisation (WHO) to achieve the objective of health for all by the year 2000 by adopting primary health care strategy. The PHC approach emphasises the need of active participation of community in dealing with the health and related problems. In China, the role of "bare-foot doctors" is also akin to PHC approach.

In Pakistan, where a majority (70 per cent) of the population lives in rural areas with meagre health facilities of the total *i.e.* there are only 23 per cent hospitals, 34 per cent mother and child health centres, 18 per cent hospital beds, 15 per cent doctors and 5 per cent nurses, the adoption of PHC strategy seems to be a step in the right direction⁷. Mozambique, Vietnam, Cuba and Nicaragua are a few among many countries where PHC has been practiced in a true sense and has shown encouraging results.

Sri Lanka has achieved life expectancy of 66 years at birth with a proportion of about 7,000 persons per doctor and 400 persons per hospital bed (Government of Pakistan, 1984). Population projections under second assumption indicate a life expectancy of 66 years at birth with a proportion of 1972 persons per doctor and 2214 persons per hospital bed by the year 2018. A comparison of Pakistan and Sri

3 In 1970's and early 80's most of the health facilities expanded rapidly. However, the pace of expansion of most of the health facilities in 6th Five Year plan is fixed at around 5 percent over and above the figures achieved during last five year plan *i.e.* between 1978 and 1983.

4 It is presumed that the availability of other health facilities in Romania would be roughly proportionate to the doctor/population and hospital bed/population ratio, hence other health facilities in Pakistan would have to be developed accordingly.

Lanka with respect to these facilities suggests that a moderate decline in mortality may be achieved without even improving reasonably the doctor/population ratio, but providing better hospital facilities. However, it is believed that a decline in mortality in Sri Lanka is largely achieved because of the spread of education among masses and also through the implementation of primary health care.

SUMMARY AND CONCLUSION

The above discussion highlights that a rapid reduction in fertility could benefit the country by saving the cost of additional requirements of health facilities. And the resources so released could be used for providing better health facilities, which in turn will improve the health status of the people. In a country like Romania, the increase in life expectancy at birth, besides other factors, seems to have been as a result of improved modern health facilities available to their population. On the other hand, the improvement in life expectancy of Sri Lankans seems to have been the result of an integrated approach where roughly an equal emphasis has been placed on the spread of modern health facilities and primary health care.

In Pakistan, majority (70 per cent) of the population lives in rural areas, without access to standard health amenities as available to urban population. Presently available curative medicare facilities are considered inadequate to combat enormous health hazards prevalent in the country. Pakistan in fact presents a mortality pattern typical of a country with high mortality rate, where children's diseases such as infective, parasitic and water borne infections are widespread. According to another study, elimination of these diseases could raise the average length of life by about 13 years². Thus, by adopting the PHC programme at the periphery (rural areas) the sickness rate as well as the cost incurred on providing standard curative interventions may decrease considerably.

ACKNOWLEDGEMENT

The author is grateful to Dr. A.S. Nasir, a retired WHO Advisor for his useful suggestions and comments on this paper.

Lkkjk'k

विशाल जनसंख्या में तीव्र गति से हो रही और वृद्धि के कारण स्वास्थ्य विकास के कार्यक्रम अत्यधिक प्रभावित होते हैं। इस लेख में यह स्पष्ट करने का प्रयास किया गया है कि देश की विशाल जनसंख्या की स्वास्थ्य परिचर्या संबंधी जरूरतों पर अथवा प्रयोग में लाए जाने वाले संसाधनों को प्रजनन दर में कमी करके बचाया जा सकता तथा इस प्रकार देश को लाभ पहुंचाया जा सकता है।

किन्तु सच्चाई यह है कि प्रजनन क्षमता में कमी लाने के सभी प्रयासों के बावजूद

⁵It is presumed that network of hospitals would be well spread in Sri Lanka.

भी पाकिस्तान में आने वाले अनेक वर्षों तक जनसंख्या वृद्धि की गति निरन्तर बने रहने की सम्भावना है। ऐसी परिस्थिति में प्राथमिक स्वास्थ्य परिचर्या कार्यक्रम को धारण किया जाना, विशेष रूप से उन ग्रामीणों क्षेत्रों में जहां अधिसंख्य जनसंख्या पाई जाती है, सही दिशा में एक कदम होगा। प्राथमिक स्वास्थ्य परिचर्या कार्यक्रम जहां एक और रूग्णता दर कम करने में हमारी सहायता करेगा वहीं दूसरी और मानक उपचारात्मक उपाय प्रदान करने की उच्च लागत को भी नियंत्रित करने में सहायक सिद्ध होगा।

REFERENCES

1. ALAM, IQBAL AND MEHTAB, S. KARIM (1986) Marriage Patterns, Marital Dissolution, and Remarriage. In Nasra M. Shah, ed., *Pakistani Women*. Pakistan Institute of Development Economics, Islamabad.
2. ALI. S. MUBASHIR AND NASIR, Z.M. (1989) Gains in Life Expectancy by Elimination of Specified Causes of Death in Pakistan. *Pakistan Development Review*, XXVII(4),
3. MAHMOOD, N. AND ALI SYED MUBASHIR n.d. *Nuptiality Patterns In Pakistan. Pakistan*. Pakistan Institute of Development Economics, PLM Report No. 2.
4. PAKISTAN, GOVERNMENT OF (1983) *The Sixth Five Year Plan 1983-88*. Planning Commission, Islamabad.
5. POPULATION COUNCIL (1972) *Population Chronicle*. No. 7. New York.
6. PAKISTAN, GOVERNMENT OF (1984) *Pakistan Basic Facts 1983-84*. Finance Division. Islamabad.
7. ZAIDI, S. AKBAR (1985) The Urban Bias in Health Facilities in Pakistan. *Social Science and Medicine*, 20(4).

TRENDS IN BIRTHWEIGHT IN KERALA A HOSPITAL-BASED STUDY

K. Vljay Kumar*, V. Raman Kutty**and C.R. Soman***

ABSTRACT

The birth weight trends in a major teaching hospital in Trivandrum, Kerala, India has been examined during the period 1955 to 1986 in this study. During this period, birth rate in Kerala fell from 37/1000 to 22/1000, and the Infant Mortality Rate (IMR) from 120/1000 to 27/1000. Further, an increase in the mean birth weight in the first two decades has also been found, followed by a decrease in the eighties. The proportion of low birth weight babies declined from 36 per cent in 1955-56 to 10.5 per cent in 1976, but tended to increase in the eighties. In 1956, 48 per cent of births were para 4 or above, but the proportion declined to 7 per cent in 1986. The mean age of mothers also showed a decline. The dramatic shift in the fertility behaviour of women in the State appears to have contributed to the trends observed.

Birth weight trends serve as important indicators of health status of a community. Birth weight is one of the aspects suggested by WHO as an index to monitor progress towards Health for All'. In developing countries, proportions of Low Birth weight Babies (those whose birth weight is below 2500 gms) usually exceed 10 per cent. A good proportion of them are babies below 2000 gms in weight. The risk of mortality in the first year of life, especially in the neonatal period, increases dramatically with the lowering of birth weight.

A number of studies on birth weights from developing countries focus on birth weights at a point of time. There are very few which have recorded birth weights over time. Lack of suitable data may be cited as a reason; however, it appears that important data sources such as obstetric records have not been exploited much in this respect. Even though hospital births form only a small percentage of total births in developing countries, the information from hospital records could still be valuable because (a) hospitals serve very much the same community over time; and (b) standardisation of methods leads to the reliable data.

Birth weights in the Sri A vittam Thirunal Hospital in Trivandrum, Kerala has been studied. This hospital was founded in the early fifties as a premier maternity hospital in the State and continues to be the leading teaching hospital in obstetrics and

*Assistant Surgeon, Department of Community Medicine, Medical College, Trivandrum-695 011.

**Research Scientist. Sri Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum-695 011.

***Professor, Department of Applied Nutrition. Medical College. Trivandrum-695 011.

paediatrics. It caters to a fairly representative cross section of the population from in and around Trivandrum.

Kerala has undergone a transformation during the recent decades. There has been a sharp fall in birth rate from 37 /1000 in 1956 to 22 /1000 in 1988. During this period the Infant Mortality Rate fell from 120/1000 to 27/1000. Over 90 percent of childbirths in Kerala at present take place in institutions.

Birth weight is recognized universally as an important determinant of infant mortality. In the context of a sharp fall in infant mortality experienced in Kerala in recent decades, it was expected that hospital birth weights would show a steady increase. The dramatic decline in birth rates lead us to expect significant declines in births of higher parity in the hospital, which in turn could also contribute to improved birth weights.

OBJECTIVES

The study was undertaken with the following two objectives: (1) to study the trends in birth weights of babies born in SAT Hospital in the period 1951 -1986; and (2) to examine the trends in parity of mothers for the same period.

METHODOLOGY

Birth weights were studied from the obstetrics records of the SAT Hospital. For the present work the selected time periods have been chosen¹1955-56 to represent 1951 - 60, 1962-66 to represent 1961 -70, 1972-76 to represent 1971 -80 and 1982-86 to represent 1981 -88. The fifties had to be represented by 1955 and 1956 only since the earliest records were for 1955. From each year a sample of about 10 per cent of birth related data was extracted using systematic sampling technique. Mean birth weights for each decade, has also been calculated i.e. 50's, 60's, 70's and 80's. The proportion of multiple births remained more or less unchanged during this period justifying its non-exclusion in the study. The SAT Hospital being a teaching institution, the weighing procedures and equipment used throughout have been standardised. In addition to the birth weight, data on age and parity of the mother were also extracted. For comparison the mean birth weight of each decade was standardised with respect to parity and maternal age, taking the sample of 70's as the standard.

OBSERVATIONS

The trends in birth weight, along with the proportions of low birth weight and very low birth weight babies have been shown in Table 1. The data averaged for the decades have also been given in Table 2. It is clear that the birth weights do not show a continuous increase over the years. The mean and median birth weights remain more or less unchanged between 1956 and 1966. In the early seventies, however, a sharp increase in birth weights has been observed, the mean weight increasing by over 200 gms while the median weight rose by 300 gms. Both the mean and median birth weights started to decline from 1983. The data also revealed that the proportion

TABLE 1
MEAN BIRTHWEIGHTS, 95 PER CENT CONFIDENCE INTERVALS, AND
PROPORTIONS OF LOW BIRTHWEIGHT AND VERY LOW BIRTHWEIGHT BABIES IN
SAT HOSPITAL, 1955-1986

Year	N	X (K. Gms.)	95% CI	LBW Percentage	VLBW Percentage
1955	1649	2.66	2.63-2.69	34.0	13.1
1956	755	2.73	2.69-2.77	38.8	13.8
1962	1000	2.73	2.69-2.77	32.9	11.7
1963	943	2.74	2.70-2.78	-	-
1964	1200	2.68	2.66-2.70	32.1	11.0
1965	1200	2.73	2.71 -2.75	31.0	9.5
1966	999	2.73	2.71-2.75	31.3	10.5
1972	915	2.53	2.91-2.95	11.0	2.5
1973	899	3.03	3.01-3.05	10.1	2.1
1974	898	2.99	2.97-3.01	13.5	1.5
1975	924	2.91	2.89-2.93	14.2	3.5
1976	902	2.98	2.96-3.00	10.5	2.8
1982	1000	2.95	2.93-2.97	11.8	2.8
1963	1000	2.96	2.94-2.98	12.8	4.2
1964	1200	2.88	2.87-2.89	22.2	3.7
1985	1035	2.81	2.80-282	18.2	3.7
1986	994	2.79	2.77-2.81	21.5	5.5

TABLE 2
WEIGHTED MEANS OF BIRTHWEIGHTS IN 1955-1956, 1962-1966, 1972-1976 AND 1982-1986

Period	N	Weighted (Kgs.)	Mean S.D.	P value
1955-56	2404	2.68	0.61	
1962-66	5342	2.72	0.57	.005'
1972-76	4538	2.97	0.51	<.001'
1982-86	5229	2.87	0.51	<.001'

1. Per comparison error" rate.

Largest adjusted P value per experiment error rate
(Bonferroni adjustment) - 0.015.

of babies in VLBW and LBW categories declined markedly during the period 1956 to 1976 only and it rose again during the eighties. The proportions of LBW babies which was 38.8 percent in 1956 fell to 10.5 per cent in 1976 but demonstrated an increase in the eighties, rather abruptly after 1983. The trend in the decline of proportions of very low birth weight babies is similar; However, when the data was analysed separately for the two categories, namely babies in the birth weight range 2000-2499 and less than 2000 gms., it emerges that a considerable proportion of the overall decline was contributed to by the latter category. But during the post-1983 increase in proportion of low birth weight babies, the contribution of the VLBW babies was only marginal.

The trends in mean maternal age and mean parity during the three decades have been given in Fig. 1. The downward shift in parity during the three decades demonstrates the rapid change in the fertility behaviour of the mothers, a feature well brought out by the cumulative frequency chart as has been shown in Fig. 2. Further, it emerges that the major shift in parity occurred between 1956-76 but the trend continues. While in 1956, 48 per cent of births were either fourth para or above, such births constituted only 35 per cent in 1966, 12.5 per cent in 1976 and 7 per cent in 1986. Looking at it differently, in 1956 only 22 per cent of children were first born, while the proportion rose to 48 per cent by 1986.

The decadal mean birth weights show more or less the same trends as has been shown in Table 2. There was an increase of mean birth weight of 2.68 kg. in 50's to 2.72 kgs. in 60's and 3.06 kgs. in 70's. But mean birth weight declined to 2.88 kgs. in the 80's. When considered with the standardised means, it was found that standardisation has not resulted in any considerable difference as has been shown in Table 3.

There has been a steady decline in the mean age of mothers from the fifties to the early eighties. The trend, however, was not found to have sustained in the eighties. The mean age differs by about three years between 1956 and 1986. The

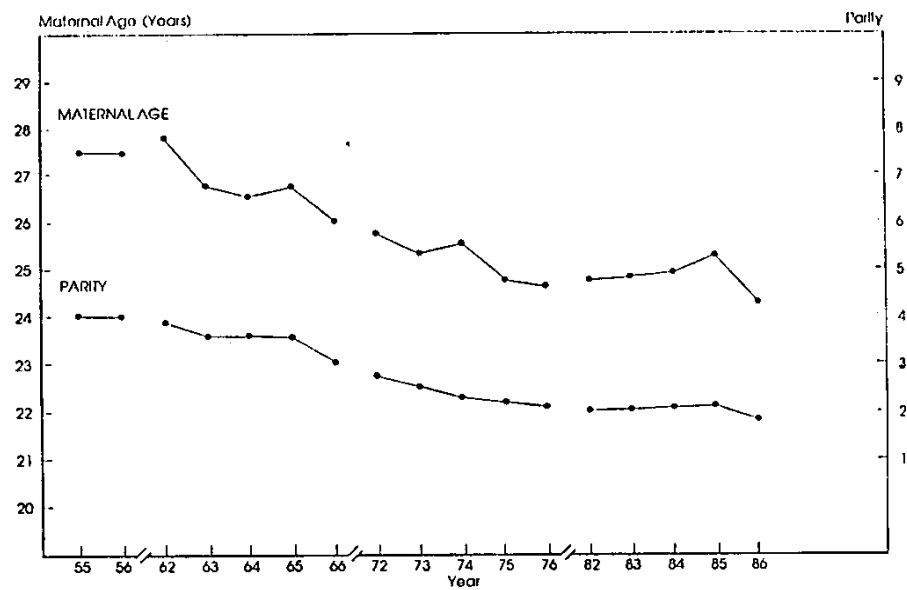


Fig. 1: Trends in mean maternal age and mean parity 1956-1986.

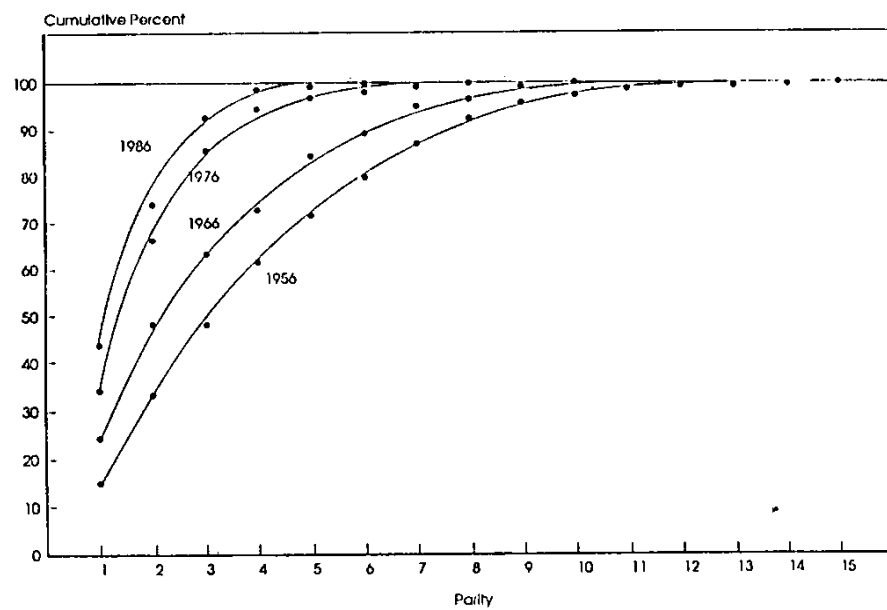


Fig. 2: Cumulative frequency of parity 1956-1986.

TABLE 3

DECADAL MEAN BIRTHWEIGHTS (KGS.): CRUDE AND STANDARDISED FOR PARITY AND MATERNAL AGE

Year	Mean BWT (Crude)	Mean BWT (Standardised)
1955-56	2.66	2.68
1962-66	2.72	2.73
1972-76	3.06	3.06
1982-86	2.88	2.83

shift in the maternal age was well brought out in Fig. 3. In 1956, about 30 per cent of the mothers were found to be above the age of 30 years while the share of such mothers fell to a mere 8 per cent in 1986.

DISCUSSION

There were two components related to the trend of birth weights over time: (a) an increase from the fifties to the seventies; and (b) a decrease in birth weight in the eighties.

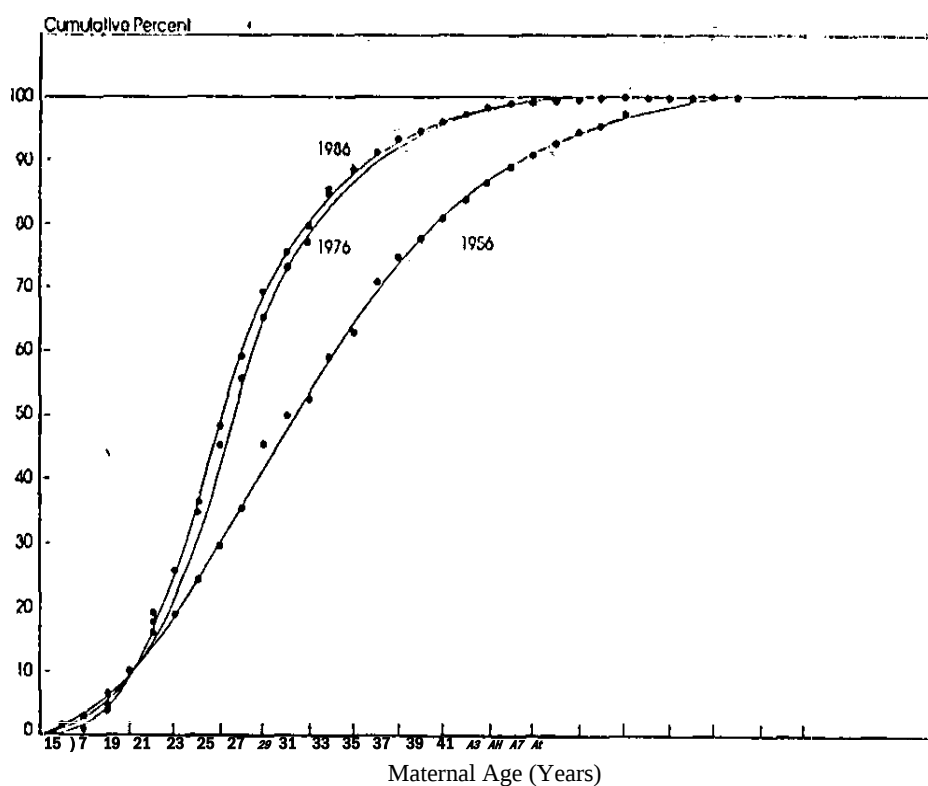


Fig. 3- Cumulative frequency of maternal age 1956-1986.

The increase in mean birth weight from the sixties to the seventies is associated with a decrease in births of higher parity suggesting a contributory role. However, when birth weights were studied with respect to parity, birth weight was found not lower at higher parity levels at any of the time periods. So elimination of higher parity births fails to explain the observed improvement in the birth weight. These have been reflected in the standardised mean birth weight also.

Adolescent pregnancies are known to have resulted in low birth weight babies. According to the findings of the study, the proportion of primiparas below 20 years have declined sharply from the fifties to the seventies (from 36.3% in 1956 to 20.8% in 1976) and having declined further only to 19.2 per cent in 1986. This may partially explain the improvement in mean birth weight observed during the period. But even after standardising for parity and maternal age the improvement in mean birth weight from 50's to the 70's remains more less the same.

Another important factor which has to be considered as an explanation for the improvement in birth weight in SATH. An increase in the use of antenatal facilities in Kerala has been noticed during the examination period. Majority of births in SATH are now booked: the mothers being regularly followed up in antenatal clinics. Antenatal checkup tends to detect and correct such complications as anaemia, eclampsia, etc. which generally results in low birth weight babies. Thus, it can be said that this important behavioural change has contributed to the improvement of birth weight in SATH.

Despite the sharp drop in proportion of primiparas below 20 years, the mean age of mothers of para 1 have registered only an increase of 0.56 years in the study period. This was because there were more elderly primies in the earlier year (13.7% in 1956 vs. 4.2% in 1986).

The more disturbing trend was the fall off in improvement of birth weight in the eighties. Even though births of parity were greater than three still continue to decline, birth weights show a tendency to fall. This may partly be explained by the increase in proportion of births of parity one (as discussed above). Firstborn babies are well known to be at risk for low birth weight. The proportion of very low birth weight babies increased only from 4.2 per cent in 1983 to 5.5 per cent in 1986, whereas the proportion of low birth weight babies rose from 12.8 per cent to 21.5 per cent. Since VLBW babies are at much greater risk of mortality when compared to LBW babies, the fall in mean birth weight may not have had a significant impact on the infant mortality.

From the standardised mean birth weights, it has been observed that the decline in 80s cannot explain the changes in parity and maternal age. One plausible explanation was given that there has been a growth of private hospitals catering to the upper socio-economic stratum of society in recent years" in and around Trivandrum City. So the clientele of SAT Hospital has become representative of the poorer strata of society.

Fifty two point five per cent of mothers in 1956 were of parity status three or less. This increased to 65.8 per cent in 1966, 86.9 per cent in 1976, and 93.6 per cent in

1986. This reflects the tendency towards acceptance of the small family norm. The increasing levels of literacy, especially of females, the sharp fall in I MR during the period 1951 to 1967 (from 120/1000 live births to 57/1000 live births), increasing coverage of maternal and child health services, and outreach of the national family planning programme could all have contributed to this change in fertility behaviour.

CONCLUSIONS

Even though the present study has concentrated on birth records from one major hospital in Kerala, it has been felt that the implications go beyond the hospital. The period which have been studied has witnessed a remarkable fall in birth rates and IMR in Kerala. Simultaneously, there has also been an increase in the use of hospital facilities. These trends were also reflected in the SATH data. These could be attributed to the conscious response by an increasingly literate female population. The secular trends in birth weights were also sequel to these factors.

Lkkjk'k

इस अध्ययन में भारत के केरल राज्य के त्रिवेन्द्रम जिले में स्थित एक बड़े अस्पताल में 1955–86 की अवधि से संबंधित जन्म भार प्रवृत्ति रिकार्डों की जांच की गई है। रिकार्डों की जांच करने पर यह पाया गया कि इस अवधि के दौरान केरल राज्य में जन्म दर 37 प्रति हजार से 22 प्रति हजार और शिशु मृत्यु दर 120 प्रति हजार से 27 प्रति हजार तक गिर गई। इसके अतिरिक्त पहले दो दशकों में औसत जन्म भार में वृद्धि भी पाई गई है तथा उसके बाद अस्सी के दशक में इस जन्म भार में गिरावट देखी गई। निम्न जन्म भार शिशुओं का अनुपात 1955–56 में 36 प्रतिशत से गिर कर 1976 में 10.5 प्रतिशत हो गया। किन्तु अस्सी के दशक में इसमें फिर वृद्धि की प्रवृत्ति देखी गई। 1956 से जन्मे 48 प्रतिशत की गिरावट आई। महिलाओं की औसत आयु में भी गिरावट देखी गई। इस अध्ययन से ऐसा प्रतीत होता है कि राज्य में महिलाओं के प्रजनन-व्यवहार में हुए नाटकीय परिवर्तन का योगदान इन प्रवृत्तियों से हुआ है।

REFERENCES

1. WORLD HEALTH ORGANISATION (1981) *Development of Indicators for Monitoring Progress Towards Health for All by the Year 2000*. Geneva (Health for All Series, No. 4).
2. GHOSH, SHANTI (1976) *Feeding and Care of Infants and Young Children*. New Delhi UNICEF, p. 70.

3. CARMELA GREEN-ABATE (1986) *Changes in Birth weight Distribution from 1973 to 1982 in Addis Ababa. Bulletin of the World Health Organisation*, 64 (5), p. 711 -714.
4. VAN ROOSMALEN, J. (1988) *Birth weights in Two Rural Hospitals in the United Republic of Tanzania. Bulletin of the World Health Organisation*, 66 (5), p.653-658.
5. GOVERNMENT OF KERALA (1980) *A Handbook on Health and Family Welfare Statistics*, Trivandrum, p. 5.
6. REGISTRAR GENERAL OF INDIA *Sample Registration Bulletin*, various issues.
7. AVROY, A. FANAROFF & RICHARD. J. MARTIN (1987) *Neonatal and Perinatal Medicine*: Toronto, C.V. Mosby Co.

A COMPARATIVE STUDY OF CERTAIN SOCIAL CORRELATES AND CHILD SURVIVAL AMONGST FAMILIES OF ARMED FORCES PERSONNEL AND CIVILIANS IN A CANTONMENT

J. Mukhopadhyas* and D.P. Achar**

ABSTRACT

The influence of certain social correlates as the per capita income, maternal education and parity status on the child birth/child loss among two groups of population i.e., the military community and the civilians in Pune Cantonment has been studied. Despite living in the same social environment and availing comparable health care facilities, the service community had not only a distinctly significant lower rates of child loss but also a remarkably significant smaller family size as compared to the civilian group- The need, Inter-alia, for an effective bio-medical and social science research in the area of social paediatrics has also been highlighted.

Child survival or loss is both an important index of prevailing social conditions as well as a determinant of the fertility of a population. It is nearly a decade since the Overseas Development Council formulated a composite index known as PQLI (Physical Quality of Life Index) which consolidates three indicators - infant mortality, life expectancy at age one and literacy status so as to monitor and evaluate the progress in economic growth and social justice achieved by any country in meeting the basic human needs¹. The study of child loss and child survival has thus gained considerable public health, social and demographic significance. In India, child mortality has always been high (40 per cent of total deaths) as compared to mortality among other age groups and despite great bio-medical advances, high child mortality in India continues to hinder the acceptance of a small family norm.

Demographic studies have reported that woman's experience of child mortality has considerable influence on her completed family, size. High child mortality is a major psychological, social, economical and cultural barrier to fertility control. The effect might be involuntary as a biological phenomenon or a response to loss that is replacement motivation or a fear of child loss by insurance motivation⁴. Therefore, child mortality is a complicated intervening variable between fertility and family planning which cannot be explained on the basis of a single factor in isolation from its inter-relationship with other socio-economic factors. In the present study, three important proximate determinants namely, per capita income, maternal education and parity status have been studied to identify the effect of child mortality on family size amongst two groups of population, namely armed forces personnel and their civilian counterparts in different military, units in Pune Cantonment.

*Officer Incharge. SHO AF Station, Tambaram. Madras-46.

**Commandant. AFMSD. Bombay-400 1 01.

MATERIALS AND METHOD

The study was conducted in four major units, namely, Armed Forces Medical College, Military Intelligence School, Command Hospital and Artificial Limb Centre, Pune. Besides geographical contiguity, the units chosen were large and static and had a comparable number of civilians as well as military personnel posted in various ranks and holding different appointments. The period of study extended from April, 1987 to November, 1987. There were 636 families staying in this locality out of which 602 (94.65 per cent) were covered. 340 military families were studied as against 262 civilian families. The two groups were not only comparable in their demographic and socio-economic status, but also lived in similar environment and availed comparable health services. They were matched according to their socioeconomic and educational status to study and compare the effect of child mortality on the family size amongst the two groups. All the households were visited personally by the investigator and assistance of the senior member of the community was taken whenever required.

RESULTS

Total population studied in the locality was 2539. Children in the age group of 0-14 years comprised 37.1 per cent. Women in the child-bearing age (15-44 years) constituted 23.7 per cent. Majority of the households belonged to the Hindu religion. Virtually all families were nuclear in nature. The average number of children per woman was 1.9 and 2.63 in the service and civilian groups respectively. Over 50 per cent of the service personnel wives were educated upto secondary level as compared to only 14 per cent of their civilian counterparts. Majority of the families in both the groups had a per capita monthly income in the range of Rs.100-200.

The data in Table 1 shows that the highest average live births of 2.5 and child loss of 0.32 per family was seen in the service families with a per capita income of Rs.100-200 per month. Overall live birth and child loss per family among the service couples were 2.15 and 0.25 respectively.

The highest live births of 5.28 and child loss of 0.9 per family was seen in the civilian families with a per capita income of Rs.100 or below per month. Overall live birth and child loss per family among the civilian couples were 3.10 and 0.47. The differences observed in these parameters among the two groups were statistically significant.

Table 2 shows that the rate of live births per woman was maximum among the illiterate women (3.14 in the service and 3.57 in the civilians) whereas it was minimum among the graduate women (1.47 in the service and 1.43 in the civilian group). It is also noteworthy that child loss per woman was very high among the uneducated group as compared to the educated group in the communities.

It may be seen from Table 3 that women with higher (3+) parity order experienced higher percentage of child loss as compared to low parity women in both groups.

TABLE 1

DISTRIBUTION	OF LIVE	BIRTHS	AND	CHILD	LOSS	ACCORDING	TO PER	
Per Capita Income	Number of Families	Total Live Births	Live Birth Per Family	Total Alive Per	Living Children Family	Total Child Loss	Percent-age of Child Loss	Child Loss Per Family
Service Group								
Upto 100	-	-	-	-	-	-	-	-
100-200	210 (61.77)	529	2.50	462	2.20	67	12.67	0.32
200-300	85 (25.00)	143	1.68	126	1.51	15	10.49	0.18
300-400	37 (10.88)	56	1.51	52	1.41	4	7.14	0.11
400 +	8 (2.35)	4	0.50	4	0.50	-	-	-
Total	340 (100.00)	732	2.15*	640	1.90	86	11.75	0.25
Civilian Group								
Upto 100	32 (12.21)	169	5.28	140	4.38	29	17.15	0.91
100-200	145 (55.34)	465	3.21	386	2.66	79	16.99	0.55
200-300	65 (24.81)	152	2.34	138	2.13	14	9.21	0.22
300-400	14 (5.34)	18	1.29	17	1.21	1	5.55	0.07
400 +	6 (2.29)	8	1.33	8	1.33	-	-	-
Total	262	812	3.10*	689	2.63	123	15.15	0.47**

*p 0.01; **p 0.05. Figures in parentheses indicate percentages.

TABLE 2
DISTRIBUTION OF LIVE BIRTHS AND CHILD LOSS ACCORDING TO PER
CAPITA INCOME

Educational Status Wives	Number of Families	Total Live Births	Live Birth Per Family	Total Alive	Living Childre n Per Family	Total Child Loss	Percent age Child Loss	Child of Loss Per Family
Service Group								
Illiterate	44 (12.94)	138	3.14	113	2.57	25	18.12	0.57
Primary	52. (15.29J	125	2.40	109	2.10	16	12.80	0.31
Secondary	174 (51.18)	366	2.10	330	1.90	36	9.84	0.21
Graduate	70 (20.59)*	103	1.47	94	1.34	9	8.74	0.13
Total	340	732	2.15	646	1.90	86	11.75	0.25
Civilian Group								
Illiterate	92 (35.12)	326	3.57	272	2.96	56	17.07	0.61
Primary	115 (43.89)	376	3.27	322	2.80	54	14.36	0.47
Secondary	37 (14.12)	82	2.22	70	1.90	12	14.63	0.32
Graduate	14 (5.34)	20	1.43	19	1.36	1	5.00	0.07
Post-Graduate	4 (1.53)	6	1.50	6	1.50	0	0.00	0.00
Total	262	812	3.10	689	2.63	123	15.15	0.47

Figures in parentheses Indicate percentages.

TABLE 3
DISTRIBUTION OF LIVE BIRTHS AND CHILD LOSS ACCORDING TO
PARITY STATUS

	Parity Status of Wives	Number of Families	Total Live Births	Live Birth Per Family	Total Alive	Living Children Per Family	Total Child Loss	Percent- age of Child Loss	Child Loss Per Family
Service Group									
0		21 (6.18)	-	-	-	-	-	-	-
1		71 (20.88)	75	1.06	71	1	4	5.33	0.06
2		182 (53.53)	410	2.25	364	2	46	11.22	0.25
3		53 (15.69)	185	3.49	159	3	26	14.05	0.49
4 +		13 (3.82)	62	4.77	52	4	10	16.13	0.76
Total		340	732	2.15	646	1.9	86	11.75	0.25
Civilian Group									
0		10 (3.82)	-	-	-	-	-	-	-
1		41 (15.65)	44	1.07	41	1	3	6.82	0.07
2		68 (25.95)	152	2.24	136	2	16	10.53	0.24
3		84 (32.07)	285	3.39	252	3	33	11.58	0.39
4+		59 (22.51)	331	5.61	260	4 +	71	21.45	1.20
Total		262	812	3.10	689	2.63	123	15.15	0.47

Figures in parentheses indicate percentages.

DISCUSSION

It is for the first time that the association between the social correlates and child loss/survival among two distinct groups of population *i.e.*, the military, and the civilian community has been studied. Despite staying in the same social environment and availing comparable health care facilities, the service community had not only a distinctly significant lower rates of live birth and child loss but also a remarkably significant smaller family size than the civilian community.

It is also interesting to note that in each sub-cohort of various income groups, the live births and child loss were distinctly lower in the service group than in the civilians. As may be noted from Table 1, with a rise in per capita income, the couples experienced lesser number of live births and child loss in both the groups. This findings is consistent with the observation made by other researchers who revealed an inverse relationship between socio-economic status of the couples and the number of live births and child loss experienced by them. The inverse relationship between maternal education and child mortality (Table 2) as observed in the present study, has also been reported by other studies carried out in India in various settings. The average live births and child loss observed by the authors in the present study have been lower than the observations made in other studies in India⁸. This may be due to the fact that the communities studied in the present paper were more urban-based with a better socio-economic background and better organised facilities for maternal, child health care and family planning services. These facilities might have resulted in an overall favourable effect on family formation among both the groups.

The differences observed have been because of the fact that the armed forces community had undergone considerable social reformation and evolution to accept the new ideas and concepts according to the national need and interest. On the other hand among the civilians the age old concepts regarding family formation was found to be still persisting. The technical advances in medical science (immunisation, MCH) could in some measures, circumvent social constraints but lasting health improvement precisely require families to be aware of modern and scientific concept of disease causation and prevention.

It is within the framework of the family that the modern health systems interact with traditional social systems. It is only at this stage that most health interventions succeed or fail. Therefore, biomedical and social scientists must work together ardently to define, and solve the problems of social paediatrics, an arena where expeditious research has been found most wanted.

Lkkjk'k

पूना छावनी में रहने वाली जनसंख्या के दो वर्गों अर्थात् सैनिक और असैनिक समुदायों में शिशु जन्म/शिशु मृत्यु दर, प्रति व्यक्ति आय, स्त्री-शिक्षा और समानता स्तर के रूप में पड़ने वाले कुछ सामाजिक सहसंबंधों का अध्ययन किया गया है। एक जैसे

सामाजिक वातावरण में रहते हुए और समान रूप से स्वास्थ्य परिचर्या सुविधा प्राप्त करने के बावजूद भी असैनिक वर्ग की अपेक्षा सैनिक समुदाय में न केवल निम्न शिशु मृत्यु दर विशिष्ट रूप से महत्वपूर्ण थी बल्कि छोटे आकार के परिवार की दृष्टि से भी उल्लेखनीय थी। इसके साथ-साथ प्रस्तुत लेख में समाज शिशु रोग विज्ञान के क्षेत्र में एक प्रभावकारी जैव-चिकित्सा तथा समाज-विज्ञान अनुसंधान की आवश्यकता पर भी विशेष प्रकाश डाला गया है।

REFERENCES

1. GRANT, J.P. (1981) *World Health Forum*, 2(3): p.373-384.
2. ARORA, Y.L. (1980) Infant Mortality and Family Planning. *Journal of Family Welfare*, XXVI(4). p. 73-78.
3. SINHA, P. (1976) *Demography India*, 2: p. 457.
4. OMRAN, A.B. (1981) Further Studies on Family Formation Patterns and Health Education: Geneva, *WHO Publication*.
5. CHHABRA, S, JAJOO, U.N., WAGH, R.N. (1985) Child Loss and Fertility in Rural Eastern Maharashtra. *Indian Journal of Public Health*, XXIX(1): p. 55-58.
6. RAMNATH, T. (1980) The Influence of Maternal Education on Live Birth, Child Mortality and Their Inter-Relationship. *Journal of Family Welfare*, XXVII(1). p. 26-34.

FERTILITY ANALYSIS BY LINEAR REGRESSION MODEL

Girish Singh*, S.D. Bhardwaj* and A.S. Singh**

ABSTRACT

Fertility is affected by a number of socio-demographic and biological factors. In this paper an attempt has been made by fitting a stochastic linear regression model, to analyse the socio-demographic factors influencing fertility such as infant mortality rate, couple protection rate, female literacy, female age at marriage and females employment based on SRS data of 15 States of India.

Fertility behaviour is bounded by the prevailing social and economic conditions as well as cultural and religious traditions.

Prior to 1960 fertility in India was relatively high and remained virtually constant. The crude birth rate (CBR) seems to have declined from 43.4 in 1961 to 40.1 in 1971 and further to 34.9 in 1981, an 8 per cent decline in the birth rate between 1961 to 1971 and a 13 per cent decline between 1971 to 1981. The couple protection rate (CPR) has recorded a significant increase from 10.4 per cent in 1970-71 to 37.5 per cent in 1986-87. But this quantum of increase in CPR has not produced a matching decline in the CBR. This paper investigates the important socio-demographic factors such as females mean age at marriage, females literacy, females employment and infant mortality rate in addition to couple protection rate, influencing crude birth rate.

In view of this a stochastic linear regression model has been applied to the data of Sample Registration System (Registrar General of India, 1986) and family planning service statistics provided by the Department of Family Welfare programme of the Government of India:

REVIEW OF LITERATURE

It has been argued that social, economic and cultural conditions, termed indirect variables, affect fertility exclusively through direct determinants.

Since, fertility is affected by a number of socio-cultural and biological factors, therefore, an increase in contraceptives prevalence need not necessarily be associated with a decline in fertility. A number of social factors as female literacy, female's mean age at marriage, females employment, infant mortality etc. directly affect fertility.

Ever since the Davis-Blake analytical framework (1956) and the Davis (1963)

*Ph.D. Scholar, Department of Statistics, Banaras Hindu University, Varanasi, India.

**Ph.D. Scholar, Department of Preventive and Social Medicine, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India.

theory of change and response, attempts at declining the important variables affecting fertility have been made by various research workers.

Regression analysis is indispensable as a data analysis technique in many disciplines. In recent years, new techniques for regression analysis have been developed and are being increasingly used in areas of demography like fertility, mortality, migration, nuptiality, family planning, population projection and demographic models.

Regression methodology has been extensively used in demographic research by scholars in various areas. Researchers in 1975, 1977 and 1978 have contributed some excellent studies on fertility change in developing countries by using multiple regression models on macro-level data.

In a study of Indian family planning programme evaluation, author has taken acceptors of IUD or sterilization per thousand total population as the response variable and the measure of programme input and the socio-economic characteristics of the population such as literacy, urbanization, income per capita etc. as the predictor variables⁶. The analysis was carried out with district level data.

In another micro-level study, multiple regression analysis has been used by taking as many as 65 predictor variables for finding out fertility distributions and their relationships in India. Data have been taken from the Census of India 1961 at the district level.

MODEL

In this linear regression model, Crude Birth Rate (Y) is assumed to be functionally related with Infant Mortality Rate (X_1), Couple Protection Rate (X_2), Females Literacy (X_3), Females Mean Age at Marriage (X_4) and Females Employed in organised sector (X_5).

Thus, there are five explanatory variables X_1 , X_2 , X_3 , X_4 and X_5 and one dependent variable Y.

We consider the following regression model

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + u_i$$

Where $i = 1, 2, \dots, 15$ (data on the 15 States of India were considered for the present study)

β_0 , β_1 , β_2 , β_3 , β_4 and β_5 are the parameters - to be estimated and U_i is the stochastic disturbance term assumed to be normally distributed with mean zero and variance σ^2 .

By the method of least squares the best linear unbiased estimates of regression parameters have been obtained.

TABLE 1

	Estimates of β_s	Std. Error	Value of t	Partial r
X1	$\beta_1 = 0.0682$	0.0394	1.728	0.2492
X2	$\beta_2 = 0.0309$	0.0640	0.482	0.0251
X3	$\beta_3 = 0.1154$	0.1745	0.661	0.0463
X4	$\beta_4 = 1.8404$	0.7937	-2.319	0.3740
X5	$\beta_5 = 0.2183$	0.2006	-1.088	0.1163
Const.	$\beta_0 = 58.0081$			

Coefficient of Determinations? - 03675

Multiple Correlation Coefficient R= 0.9314

(The correlation matrix is shown in the Appendix 2)

The tabulated value of t at 5 per cent level of significance with nine degree of freedom =1.63

TABLE 2
ANALYSIS OF VARIANCE

Source	S.S.	D.F.	Mean square	F-Ratio	Prob.
Regression	259.6776	5	51.9355	11.76	9.791E-04
Residual	39.6798	9	4.4089		
Total	299.3573	14			

0.05 (5,9) = 3.48

Specifically, the estimated relationship of the given model is as follows:

$$\hat{Y}_i = 58.0081 + 0.0682X_1 + 0.0309X_2 + 0.1154X_3 - 1.8404X_4 - 0.2183X_5$$

S.E. (β_5):	(0.394)	(.0640)	(.1745)	(.7937)	(.2006)
t*:	(1.728)	(.4820)	(.6610)	(-2.3190)	(-1.088)

On substituting the observed values of X_1, X_2, X_3, X_4 and X_5 for all $i = 1, 2, \dots, 15$, the estimated crude birth rate ($\hat{Y}_i$) has been obtained. Once $\hat{Y}_i$ are known the residuals e_i are obtained using

$$e_i = Y_i - \hat{Y}_i$$

The values of observed (Y_i) and estimated ($\hat{Y}_i$) crude birth rate and residuals e_i have been shown in Appendix-3.

RESULTS AND DISCUSSION

Premodern fertility in India have been assessed to be only moderately high and fluctuating with a narrow spectrum. The fertility levels were kept well below the biological maximum possible for human beings and even substantially lower than the levels observed in many developing societies in the world. This was achieved through a number of cultural and institutional checks on fertility, operating within and outside marriage.

It has been observed that inspite of significant increase in CPR, females education, females employment, and females mean age at marriage the fertility has not been declined significantly. Apart from the biological factors there are many socio-demographic factors responsible for slowing down the decline in fertility in recent years.

The present study reveals that the crude birth rate is correlated (0.8053) with infant mortality rate. It is obvious that with the death of infants the desire for next conception increases which results in the increase of fertility rates. Further, it has been found that crude birth rate is negatively correlated with couple protection rate (-0.5098), females literacy (-0.8753), females mean age at marriage (-0.8565) and females employment (-0.8072).

The multiple correlation coefficient (joint effect of above five factors on crude birth rate) is obtained as 0.9314. The value of coefficient of determination R^2 is 0.8675 which shows that the given five explanatory variables accounted for 87 per cent of the variations in crude birth rate. The t-ratio for each regression coefficient has been calculated and it is found that except β_4 all the coefficients are not significant and hence the regressors do not appear to contribute to the explanation of the variations in CBR. However, β_4 is statistically significant.

It has been also observed that the CPR is positively correlated with females literacy (0.5726) and females mean age at marriage (0.6598).

The IMR. is found to be negatively correlated with females literacy (0.8329) and females employment (-0.7695).

The Appendix I exhibits the relevant data collected from 15 States of India used for analysis in the present study. It may be, mentioned that the data on crude birth rate, infant mortality rate and couple protection rate belong to the year 1986 SRS (RGI) while the data on female literacy and female mean age at marriage belong to the year 1981 census. The data on percentage of female employed in an organised sector refers to June 1984. It could have been ideal to use the data under different heads concerning to the same respective years. The authors opted to use the data pattern as shown in Appendix I. Such a decision was taken considering the fact that the difference of respective data over the difference of five years is negligible from the point of view of the present study.

SUMMARY

Analysis of fertility by stochastic linear regression model and its association with socio-demographic variables have been studied. We have considered-the crude birth rate as dependent variable and five socio-demographic factors such as infant mortality rate, couple protection rate, females literacy, females mean age at marriage and females employed in organised sectors as independent variables, and have fitted a linear stochastic regression model to the data of 15 States of India. The joint effect alongwith separate effects of the five independent factors on fertility has been studied. If more number of socio-demographic variables related to fertility are taken into account using valid statistical analysis a more significant regression line could found out.

ACKNOWLEDGEMENT

I express my sincere gratitude to Prof. R.C. Yadav, Head, Department of Statistics and Dr. R.N. Mishra. Department of Preventive and Social Medicine, IMS, Banaras Hindu University, Varanasi for their valuable guidance and suggestions from time to time.

Lkkjk'k

सामाजिक-जनांकिकी एवं जैविक जैसे असंख्य घटकों से प्रजनन क्षमता प्रभावित होती है। प्रस्तुत लेख में भारत के 15 राज्यों से सैम्पल रजिस्ट्रेशन सर्वे द्वारा उपलब्ध आंकड़ों के आधार पर एक उपयुक्त यादृच्छिक रैखिक समाश्रयण निदर्श शिशु मृत्युदर, दम्पति संरक्षण दर, महिला साक्षरता, विवाह के समय महिला की आयु तथा महिला रोजगार जैसे प्रजनन क्षमता को प्रभावित करने वाले सामाजिक-जनांकिकी कारकों को विश्लेषित करने का प्रयास किया गया है।

REFERENCES

1. DAVIS. K. & BLAKE. J. (1956) "Social Structure and Fertility, An Analytic Framework", *Economic Development and Cultural Change*, 4 (4).
2. DAVIS, K. (1963) "The Theory of Change and Response in Modern Demographic History", *Population Index* 29, No. 4.
3. HERMALIN. A.I. (1975) "Regression Analysis of Areal Data", in C. Chandrasekhran and A.J. Hermalin (eds.), *Measuring the Effect of Family Planning Programmes on Fertility*, Belgium: Ordina Editions, p. 245-299.
4. SRIKANTAN, K.S. (1977) *The Family Planning Programme in Socio-Economic Context*, The Population Council, New York.
5. MAULDIN, W.P. & BERELSON. B. (1978) "Conditions of Fertility Decline in Developing Countries, 1965-75", *Studies in Family Planning*, 9. p. 89-147.
6. SIMONS, G.B. (1971) *The Indian Investment in Family Planning*. The Population Council, New York.
7. CHAKRABORTI. B. (1982a) *Fertility Distribution in India and their Relationships*, Indian Statistical Institute, Calcutta (Mimeographed).

APPENDIX 1

States	CBR	IMR	CPR	Female Literacy	Female Mean Age at of Female Marriage	Percentage of Female Employed in Organised Sector
Bihar	36.00	99.00	20.60	13.62	16.53	7.40
Uttar Pradesh	37.50	132.00	25.00	14.04	17.77	7.10
Madhya Pradesh	37.10	117.00	36.10	15.53	16.52	8.90
Kerala	22.40	27.00	44.60	65.73	21.85	35.10
Punjab	28.60	67.00	62.40	33.69	21.04	13.10
West Bengal	29.50	71.00	29.50	30.25	19.26	9.20
Orissa	32.10	123.0	36.40	21.12	19.04	7.30
Haryana	34.90	65.00	53.20	22.27	17.87	9.40
Rajasthan	36.40	104.00	26.00	11.42	16.09	10.50
Andhra Pradesh	31.40	82.00	35.80	20.39	17.25	12.40
Karnataka	28.80	74.00	39.70	27.71	19.20	13.30
Maharashtra	30.00	63.00	54.90	34.79	18.76	11.30
Gujarat	32.20	107.00	51.00	32.30	19.51	11.10
Tamil Nadu	23.70	80.00	46.30	34.79	20.22	19.60
Assam	34.70	109.00	26.00	12.58	15.91	7.10

APPENDIX 2

CORRELATION MATRIX						
	Y	X₁	X₂	X₃	X₄	X₅
Y	1.0000					
X ₁	0.60532	1.0000				
X ₂	-0.50981	-0.49783	1.0000			
X ₃	-0.87525	-0.83287	0.57259	1.0000		
X ₄	-0.85652	-0.65668	0.65975	0.88134	1.0000	
X ₅	-0.80715	-0.76954	0.34474	0.88857	0.68994	1.0000

N =15

APPENDIX 3

NO.	Observed (Y_i)	Expected (Y_i)	Residual (e_i)
1	36.00	34.928	1.0717
2	37.50	35.146	2.3542
3	37.10	36.545	0.5548
4	22.40	20.935	1.4646
5	26.60	26.608	1.7921
6	29.50	29.796	-0.2956
7	32.10	33.320	-1.2200
8	34.90	33.075	1.8248
9	36.40	35.315	1.0850
10	31.40	32.603	-1.2029
11	26.60	29.237	-0.4373
12	30.00	31.020	-1.0197
13	32.20	32.275	-0.0753
14	23.70	27.415	-3.7146
15	34.70	36.882	-2.1817

FINANCIAL ANALYSIS OF UNIVERSAL IMMUNISATION PROGRAMME

M. Kataria* and K.L Gaba**

ABSTRACT

The analysis reported here is based on the study conducted in the two districts in which UIP was implemented in 1985, namely Nanded in Maharashtra and West Nimar in Madhya Pradesh. The paper presents the estimates of total cost of the programme, cost composition, unit cost and the cost of sustaining the programme for future years. The average cost per dose of immunisation to a child or a pregnant woman was estimated to be Rs.10 to 11 in West Nimar and about Rs.26 in Nanded during 1988-89. The cost per fully immunised child for six EPI diseases was estimated to be Rs.96.97 in West Nimar and Rs.270.25 in Nanded. The average incremental cost per fully immunised child was Rs.18.78 and Rs.25.66 in two districts - indicating lesser variation in the incremental cost compared to total cost of the programme. The yearly incremental cost for sustaining the programme would be Rs.12.69 lakhs and Rs.13.77 lakhs for the district West Nimar and Nanded respectively which is likely to increase every year with the inflation rate.

In India, lot of emphasis is being laid on the provision of a package of MCH services in which immunisation services is an important component. This is mainly to reduce maternal, infant and child mortality due to six communicable diseases -diphtheria, pertussis, tetanus, poliomyelitis, tuberculosis and measles. As a first step towards this, the Expanded Programme on Immunisation was started in the country in 1978 to provide vaccination to all eligible children and pregnant women by 1990. The Universal Immunisation Programme was launched on 19th November, 1985 as a living memorial to the memory of our Late Prime Minister Smt. Indira Gandhi to achieve 100 per cent coverage of pregnant women with Tetanus Toxoid and 85 per cent of infants with DPT, Polio, BCG, Measles by 1990. As a starting point to improve the coverage, number of inputs were provided by the Central Government and International Organisation at various levels of health organisations in terms of capital equipments, health education and training material vaccines and training of personnel.

The Government of India had allocated Rs.240 crores to the immunization programme over the five year period 1985-89. This had enabled formation of long-term plans for the programme and made it operationally feasible to attain high level

*Assistant Professor, Department of Statistics and Demography, National Institute of Health and Family Welfare, New Mehrauli Road, New Delhi-110 067,

**Research Officer, Department of Statistics and Demography, National Institute of Health and Family Welfare, New Mehrauli Road, New Delhi-110 067.

of coverage and quality of services to some extent. If this programme is to continue in future years after the initial support of Central Government and international agencies, the State Governments have to incur the expenditure required to sustain the programme. This necessitates information about the cost of running the programme at operational level, namely district, and the annual cost of sustaining the programme to the local and State Government. This will permit realistic estimation of the full resource requirements and for budgeting purposes. In the vast country spread over 33 million square kilometres, to achieve annual universal coverage of approximately 22 million infants and pregnant women to be immunized will require progressively reaching out to the more remote and difficult areas in the country.

OBJECTIVES

A financial analysis of the programme at district level was undertaken to help the planners, donors and administrators of the programme to do strategic planning incorporating all opportunities for cost attainment. The present paper provides: (i) estimate of total cost of the programme and the cost composition; (ii) estimate of unit cost of services provided under UIP; and (iii) estimate of annual cost of sustaining the programme for future years.

These cost estimates are based on the cost borne by local, State, Central Government and international agencies for the immunisation services provided by government health institutions. They exclude the costs incurred by private organisations providing immunisation services in rural and urban areas.

MATERIALS AND METHOD

The paper presents the information about the cost of the programme for two districts in which the UIP was implemented during 1985-86, namely Nanded in Maharashtra and West Nimar in Madhya Pradesh. Firstly, the data about various type of inputs available and utilized for IUD was collected from stock registers and other records, and interviewing the staff at State, district and institutional level. Secondly, quantum of programme output in terms of volume of services provided was collected from monthly reports submitted by district to State Health Directorate. Thirdly, data in regard to staff time allocation to the activities related to immunisation programme was collected by using delphi technique and interviews with the functionaries at various levels. To facilitate the data collection and its analysis, formats for data collection and framework of methodology and methods of estimation of the cost of the programme was developed in advance after thorough review of literature and discussions with experts from WHO and UNICEF.

FINDINGS AND CONCLUSIONS

The cost of the programme has been defined in this-paper as the monetary value of all resources utilized for the provision of immunisation services and related activities. Hence, the data collected about various inputs was grouped into two major components namely: (i) capital/non-recurring costs; and (ii) recurring costs.

Capital costs were of resources requiring payment at yearly or longer intervals while recurring costs included those resources which had to be paid for more frequently.

The capital cost was estimated by annualizing the value of the capital input utilizing: (i) the annualized factor determined using straight line depreciation for expected useful life of the equipment; (ii) general interest rate likely to have been received for the amount invested in capital items (10% per annum); and (iii) the purchase price of the capital items provided by the Government of India or UNICEF. The recurring cost of the programme was estimated by adding up the value of all inputs consumed for the provision of services and undertaking other activities related to UIP.

The capital and recurring costs were further sub-divided into two heads -obligatory costs and incremental costs. The obligatory costs were the costs incurred by the State/district for providing immunisation services and conducting related activities alongwith other health and family welfare activities without any additional input. So these costs included costs for utilising institutional facilities, staff, training and IEC equipment, transport, etc. at various levels provided for primary health care services and utilized for immunisation activities as well. These costs are also known as indirect costs as these are utilized for more than one function. The incremental costs were the costs of all resources directly indentifiable with the functions or activities related to UIP and separate budget provision made for them by the Central Government or resources provided by international agencies. Thus, it included costs on cold chain equipments, immunisation equipments and supplies, vaccines, transportation of vaccines to various points, etc. These costs were the direct or incremental costs of the programme.

A. Total Costs and its Distribution: The total cost of operating UIP in two districts, namely, Nanded and West Nimar estimated by adding up the total of all current expenditure and prorated proportion of past expenditure for UIP paid for in local or foreign currency or donated by any agency was observed to be Rs.126.74 lakhs and Rs.54.38 lakhs respectively (Table 1). The total cost of operating UIP was more than double in Nanded compared to West Nimar. This was due to earlier implementation of UIP in Nanded, more number of health infrastructure facilities, availability of large number of health functionaries in the district for providing immunisation services and implementation of Fourth Pay Commission recommendations in the State of Maharashtra prior to 1988.

Another dimension to this high cost of the programme was due to high percentage utilization of resources of common use in most of the health institutions resulting in the increase of obligatory cost of the programme which was 90.8 per cent for district Nanded and 81.8 per cent for district West Nimar. The remaining 9.2 per cent (Rs.11.6 lakhs) and 18.2 per cent (Rs.9.9 lakhs) was the incremental cost which accounted for direct expenditure incurred for immunisation activities in the two districts respectively as has been shown in Table 1.

In order to identify the areas of cost containment a detailed analysis of contribution of various elements in each of the cost component - direct and indirect

TABLE 1
TOTAL COST (IN RUPEES) OF UIP AT DISTRICT LEVEL BY TYPE OF
EXPENDITURE IN Nanded DISTRICT (MAHARASHTRA) AND WEST
NIMAR DISTRICT (MADHYA PRADESH) 1988-89

Type of Expenditure	Obligatory/ Indirect Cost	Nanded Incremental / Direct Cost	Total Cost	Obligatory/ Indirect Cost	West Nimar Incremental/ Direct Cost	Total Cost
1. Capital	2,07,525 (1.8)	1,65,848 (14.3)	3,73,373 (2.9)	62,337 (1.4)	86,016 (8.7)	1,48,353 (2.7)
2. Recurring	113,06,168 (98.2)	9,94,528 (85.7)	123,00,69 6 (97.1)	43,86,048 (98.6)	9,03,847 (91.3)	52,39,895 (97.3)
3. Total	115,13,693 (90.8)	11,60,326 (92)	126,74,06 9 (100.0)	44,48,385 (81.8)	989,863 (18.2)	54,38,248 (100.0)

Note: 1 Figures In parentheses indicate percentages.

2. Columnwise percentages are based on the total obligatory cost, incremental cost and total cost of UIP in each district and amounts to 100.

3. The percentages in row 3 are based on the total cost of programme in each district.

Cost was conducted and has been depicted in Table 2. The analysis of indirect cost component showed that salary of staff accounted for nearly 97 and 98 per cent of total indirect cost in Nanded and West Nimar. The remaining 3 and 2 per cent of total indirect cost was incurred on vehicles, their running and maintenance costs in those districts respectively.

In regard to direct cost, 8.7 per cent of the total direct cost was incurred on capital items in West Nimar and 14.3 per cent in Nanded. This was because of larger number of ILR's and other cold chain equipments as well as vehicles at district headquarter, Nanded. Among the direct recurring cost, the major expenditure was on vaccines and immunisation supplies that accounted for 74.8 per cent in West Nimar and 53.5 per cent in Nanded. The salary expenditure as percentage of total cost was only 5.9 per cent and 17.0 per cent in West Nimar and Nanded district respectively. The lower expenditure in West Nimar was due to unfilled vaccines of staff sanctioned under UIP at district headquarter and non-implementation of Fourth Pay Commission recommendations. The expenditure on other items like maintenance and repair of vehicles, POL. material for IEC and other contingencies was found to vary from 3 to 5 per cent in West Nimar and 0.5 to 8 per cent in Nanded.

B. Unit Costs: In order to examine variations in cost effectiveness of UIP in two districts the unit cost of services were estimated by dividing the total cost by the number of immunisations for the year 1988-89. It was assumed that the quantum of resources of various kinds utilised were equal for all immunisations with different

TABLE 2
TOTAL COST (IN RUPEES) OF UIP AT DISTRICT LEVEL AND ITS
COMPOSITION IN NANDED DISTRICT (MAHARASHTRA) AND WEST NIMAR
DISTRICT (MADHYA PRADESH) 1988-89

Item of Expenditure		West Nimar Incremental/ Direct Cost	Total Cost	Obligatory Indirect Cost	Nanded Incremental/ Direct Cost	Total Cost
1. Capital Cost						
Cold chain equipment		53.921 (5.5)	53,921 (1.01)	36,740* (0.3)	102.020 (88)	1,38,760 (1.1)
Imm. equipment		5,385 (05)	5,385 (0.1)	-	13,268 (1.1)	13,268 (0.1)
IEC equipment	6,726 (0.2)	-	6,726 (0.1)	4,415 (0.0)	-	4,415 (0.0)
Transport	55,611 (1.2)	26.710 (2.7)	82.321 (15)	1,66.370 (1.5)	50.560 (4.4)	2,16.930 (1.7)
1. Recurring Cost						
Salaries/ Manpower	43,35,088 (97.9)	58.489 (5.9)	44,13,577 (815)	1,11,70,348 (97.0)	136.774 (17.0)	1,13,67,122 (89.7)
Vaccines	-	5,47.813 (55.3)	5,47,813 (10.1)	-	5,04.273 (43.4)	5,04,273 (4.0)
Imm. supplies		1,92.696 (19.5)	1,92,696 (35)	-	1,17,333 (10.1)	1,17,333 (0.9)
3. Maintenance/Repair						
Vehicle		-	-	17,445 (0.2)	5,600 (0.5)	23,045 (0.2)
Equipments		-	-	-	-	-
POL	30.960 (0.7)	28.917 (2.9)	59.877 (1.1)	118.345 (10)	38,000 (3.3)	156,345 (1.2)
Material for IEC		43.932 (4.5)	43,932 (03)	-	36.548 (31)	36,548 (0.3)
Other Contingencies		32.000 (3.2)	32,000 (06)	-	96.000 (8.3)	96,000 (0.3)
Total	44.48385 (100.0)	9.89,863 (100.0)	54,38,248 (100.0)	115.13,693 (1000)	11,60,376 (100.0)	126,74,069 (100.0)

Note: Figures in parentheses Indicate percentages.

*Relates to refrigerators and stabilisers available in the institutions prior to the implementation of UIP and was for multipurpose use.

antigens and thus number of immunisations were aggregated for all antigens for expectant mothers and children. The results have been shown in Table 3.

The average total cost per dose of immunisation to a child and to a pregnant woman was 10 to 11 rupees (US \$ 0.7 to 0.8) in West Nimar and about 26 rupees (US \$ 1.8) in Nanded. This cost included the obligatory cost expended by the State and district organisations for immunisation services. The incremental cost of inputs utilised exclusively for immunisation activities was Rs.2.15 (US \$ 0.15) in West Nimar and Rs.2.52 (US \$ 0.2) in Nanded. It can be noticed from the Table 2 that the average incremental cost per dose of immunisation for children was higher than the average incremental cost per dose of TT for pregnant women. This was due to the fact that only single antigen administered to pregnant women and wastage rate for TT vaccine was less as compared to other antigens.

The cost per fully immunised child for six EPI diseases was estimated by using the denominator of number of fully immunised children. As per the WHO norm. 90 per cent of children immunised for measles were considered as fully immunised and average cost per fully immunised child was estimated to be Rs.96.97 (US \$ 6.6) in West Nimar and Rs.270.25 (US \$ 18.4) in Nanded. The average incremental cost per fully immunised child was Rs.18.78 (US \$ 1.3) and Rs.25.66 (US \$ 1.7) in two districts which indicates lesser variation in the incremental cost compared to total cost.

In contrast, it has been stated that the costs of fully immunised infants with BCG and two doses of DPT in Indonesia, Philippines and Thailand as \$ 2.86, \$ 4.97 and \$ 10.73 respectively'. Other researchers have also estimated the national cost per immunisation dose in Malawi, Switzerland and Gambia as US \$ 0.99, US \$ 2.58 and US \$ 1.09. Similarly, for the three delivery strategies of childhood communicable diseases (CCD) project in the Congo in 1985, the cost per immunisation for fixed centres in Brazzaville was estimated to be US \$ 1.42 for six month period January-

TABLE 3
UNIT COST OF WEST MINAR DISTRICT. MADHYA PRADESH AND NANDED DISTRICT.MAHARASHTRA - 1988-89

Indicator	West Nimar		Nanded	
	Total Cost (Rs.)	Incremental Cost (Rs.)	Total Cost (Rs.)	Incremental Cost (Rs.)
1. Average cost of one immunisation to a child	11.12 (\$0.8)	2.15 (\$0.15)	26.52 (\$1.8)	2.52 (\$0.2)
2. Average cost of one TT immunisation to a pregnant woman	10.14 (\$0.7)	1.23 (\$0.1)	25.94 (\$1.8)	1.96 (\$0.1)
3. Average cost per fully immunized child	96.97 (\$6.6)	18.78 (\$1.3)	270.25 (\$18.4)	25.66 (\$1.7)

June, 1985; for Grandes Endemies, cost per immunisation for fixed centres at operational headquarters was US \$ 1.06 for the five month period January-May, 1985; and for CARE Congo, cost per immunisation was US \$ 0.78 for the overall immunisation programme for the six month period January-June, 1985. In 1986-87 it has reported that unit cost of immunisation varying from US \$ 0.28 to US \$ 0.54 in different provinces in Indonesia. Similarly, in another study of Indonesia about the effectiveness of TT immunisation, the average cost of providing two TT injections to a pregnant woman varied from US \$ 0.57 to US \$ 2.40.

These estimates are comparable to only certain extent with the estimates provided for the two districts under study because of differences in the accessibility of immunisation centres, time periods, population and its rural/urban distribution in these countries and delivery strategies utilized by them.

C. Cost of Sustaining the Programme: The continuation of the immunisation programme is the responsibility of the Government of India after initial support from UNICEF and WHO. Therefore, to determine the financial commitment in future years after its initial implementation is important for the allocation of resources. This section estimates the incremental cost for sustaining the programme at district level with the proposed norms of the Government of India for input facilities, services and activities at various levels within the districts.

Utilizing these norms and assuming that the pattern of utilization of the resources and birth rates remain the same for future years as was observed during 1988-89 (36 in West Nimar and 30.7 in Nanded per thousand population), the yearly incremental cost for sustaining the programme was estimated to be Rs.12,68,600 for West Nimar and Rs.13,76,700 for Nanded. The higher cost in the latter district was due to more health facilities with cold chain equipments. While estimating the cost, fixed amount sanctioned to district by the Government of India specifically for UIP was assumed to have been fully utilized for the programme, *e.g.*, contingency money of Rs.2,000 per PHC per year or POL of Rs.9,500 per year per diesel vehicle provided under the programme; etc.

The cost composition of incremental cost showed that vaccines and immunisation supplies were the most important inputs needed to sustain the programme and these accounted for 57 per cent and 43 per cent of total incremental cost in two districts. This major component cost was estimated on the basis of quantum of vaccine of different antigens required to immunise expected number of infants and pregnant women in a year and allowance for wastage for each antigen was given as per WHO norm. The salary component accounted for only about 17 per cent in both the districts. Other recurring expenditure related to the delivery of services accounted for 8 to 13 per cent of incremental cost. For developmental activities, the cost incurred was only 2.2 per cent of total incremental cost in both the districts.

To estimate the cost of sustaining the programme per unit of immunisation services, total incremental cost was divided by the expected quantum of service output in a year which was determined by using birth rate, infant mortality rate and

number of doses for a particular antigen. The estimates were presented in Table 4.

For district in West Nimar in Madhya Pradesh, the incremental cost per dose of immunisation per child that Government has to incur will be Rs.2.48 whereas it will be Rs.3.24 for district Nanded in Maharashtra. This cost of immunisation is nearly 61 per cent more when compared to pregnant women in district West Nimar and 40 per cent more in district Nanded. The incremental cost per fully immunized child be about Rs.22 and Rs.29 in two districts respectively.

With these estimates, the present incremental cost is expected to increase 28.2 per cent in West Nimar and Rs.18.6 per cent in Nanded during the year 1989-90. This indicates that there is a need to provide additional inputs if these districts are to sustain the programme and achieve the objectives of 85 per cent immunisation coverage for infants and 100 per cent coverage for pregnant women.

The cost of sustaining the programme for future years beyond 1990 will depend on trends in birth rate, infant mortality rate, inflation rate in the country and foreign currency fluctuations. The trend analysis of birth rate for the two States did not show

TABLE 4
TOTAL INCREMENTAL COST AND UNIT COST OF IMMUNIZATION
SERVICES FOR SUSTAINING UIP FOR ONE YEAR IN WEST NIMAR AND
NANDED DISTRICTS (1989-90)

	District	
	West Nimar	Nanded
1.Total incremental cost	12,68,594	13,76,703
2.Output		
BCG	53,040	43,132
DPT	1,59,120	1,29,396
OPV	1,59,120	1,29,396
Measles	47,736	38,819
TT for pregnant women	1,40,400	1,11,526
3.Unit cost (in Rs.)		Unit cost (in Rs.)
Per dose per child	2.48	3.24
Per dose per pregnant woman	1.54	2.32
Per fully immunized child	22.05	28.81

Note: Output has been determined using formula

1. No. of doses of the antigen per child x [Total population x BR x (1-1mr)]
2. No. of doses of TT per pregnant woman x (Total population x BR)

steady decrease over the years but fluctuating at the current level (28.9 in Maharashtra and 36.4 in Madhya Pradesh)" whereas IMR has declined to the level of 66 in Maharashtra and 120 in Madhya Pradesh (1987). This is expected to increase number of infants for immunisation services. Thus, future cost increases due to increase in number of infants, inflation rates and foreign currency fluctuations will also have to be taken into account while allocating the budget to the districts.

In the present situation of scarce resources the means of cost containment in the programme by reducing wastage, underutilization and misuse of resources and at the same time increasing the output of services without sacrificing the quality is of importance. This will improve the overall efficiency and effectiveness of the programme.

While estimating the cost of the programme number of limitations were experienced and certain assumptions had to be made and on occasions certain elements of costs contributing to the overhead cost for operating the programme and non-programme specific capital and recurring costs have been excluded. Secondly, the details about qualitative aspects including potency of vaccines used due to time constraints. To that effect the estimates are underestimates but degree of underestimation is not expected to be large. In order to have better utilization of resources and effective means of cost containment, the districts should combine routine work with occasional mass campaign of immunisation. Lastly, at district level the desirable management should include performance and equity review and the projection of future requirements and appraisal of their sustainability.

***SRS estimates for the year 1987.**

Lkkjk'k

प्रस्तुत विश्लेषित महाराष्ट्र राज्य के नान्देड़ तथा मध्य प्रदेश राज्य के पश्चिम निमाड़ नामक दो जिलों में किए गए अध्ययन के आधार पर है, जिनमें वर्ष 1985 के दौरान व्यापक प्रतिरक्षण कार्यक्रम क्रियान्वित किया गया था, इस लेख में कार्यक्रम को लागत का आकलन, लागत प्रस्तुत की गई है। वर्ष 1988-89 के दौरान एक शिशु अथवा एक गर्भवती महिला की दी गई इम्यूनाइजेशन की प्रति खुराक की औसत लागत पश्चिमी निमाड़ में ₹0 10/- से 11/- तथा नान्देड़ में लगभग ₹0 26/- आंकी गई थी। विस्तारित प्रतिरक्षण कार्यक्रम के अन्तर्गत छः जानलेवा बीमारियों से पूरी तरह प्रतिरक्षित करने के लिए प्रति शिशु पर लगाए गए सभी टीकों की लागत पश्चिमी निमाड़ में ₹0 96.97 तथा नान्देड़ में ₹0 270.25 आंकी गई थी। कार्यक्रम की कुल लागत की तुलना में वृद्धिशील लागत में मामूली सी विविधा दिखाते हुए दोनों जिलों में जानलेवा बीमारियों से पूरी तरह प्रतिरक्षित करने के लिए प्रति शिशु पर लगाए गए टीकों की

औसतन वृद्धिशील लागत दर रू0 18.78 तथा 25.66 थी। पश्चिमी निमाड़ और नान्देड़ जिलों में कार्यक्रम को सुदृढ़ करने के लिए वार्षिक वृद्धिशील लागत क्रमशः रू0 12.69 लाख तथा रू0 13.77 लाख होगी, जो सम्भवतः स्फीति दर के साथ-साथ प्रतिवर्ष बढ़ती जाएगी।

REFERENCES

1. CREESE. A.L. SRIYABBAYA, N. CASABAL. G. & WISESO.G. (1982) Cost-effectiveness Appraisal of Immunisation Programme. *BULLETIN OF THE WORLD HEALTH ORGANISATION*, 60, NO, (4), p. 621-632.
2. ROBERTSON. R.L (1985) Cost of the Combatting Childhood Communicable Diseases(CCCD) PROJECT IN MALAWI. 1984-85. Chevy. Chase: University Research Corporation.
3. ROBERTSON, R.L. & QUALLS, N.L. (1985) Cost of Combatting Childhood, Communicable Diseases (CCCD) Project in Swaziland, 1984-85. Chevy Chase: University Research Corporation.
4. ROBERTSON, R.L. DAVIS, J.H. & JOBE. K. (1984) Service Volume and Other Factors Affecting of the Costs of Immunisations in the Gambia. *BULL. WHO*, 62, p. 729-736.
5. QUALLS. N.L. (1985) CCCD Cost Study Report: People's Republic .of the Congo. Final draft with Addendum, Chapel Hill; University of North Carolina School of Public Health.
6. BERMAN, PETER (1987) Indonesia Rural Health Services Cost Study, Johns Hopkins University. School of Public Health (Mimeographed).
7. BERMAN, PETER & QUINLEY, JOHN (1987) A Cost-effectiveness Comparison of Tetanus Immunisation Programme in Aceh, Johns Hopkins University (Mimeographed).
8. QUALLS, N.L. & ROBERTSON, R.L (1989) Potential Uses of Cost Analysis on Child, Survival Programmes: Evidence from Africa, Health Policy and Planning - *A JOURNAL ON HEALTH IN DEVELOPMENT*,4(1), p. 50-61.
9. NATIONAL INSTITUTE OF HEALTH AND FAMILY WELFARE (1990) Cost Analysis of Universal Immunisation Programme, New Delhi (Mimeographed).
10. WORLD HEALTH ORGANIZATION (Geneva) EPI Cost Analysis in Thailand and Indonesia.
11. GREECE, A. & PHILLIPS, M. (1988) Cost Analysis of Primary Health Care, Management Information System and Micro Computers on Health Care.
12. GREECE. A. & BATTERSBY. A. (1984) The Cost of Cold Chaih Equipment. *WORLD Health Forum*, 5 (2).