CHILD HEALTH IN INDIA :
AN INTER-STATE ANALYSIS OF CAUSALITY
BETWEEN PUBLIC EXPENDITURE AND HEALTH STATUS

DISSERTATION SUBMITTED TO THE JAWAHARLAL NEHRU UNIVERSITY IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF

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C E R T I F I C A T E

This is to certify that the dissertation entitled "CHILD HEALTH IN INDIA : AN INTER-STATE ANALYSIS OF CAUSALITY BETWEEN PUBLIC EXPENDITURE AND HEALTH STATUS", submitted by **Ms SREEJATA SENGUPTA** in partial fulfilment of the requriements for the award of the Degree of **Master of Philosophy (M.Phil)** of this University, is her own work carried out under my supervision and guidance.

It is also certified that this work has not been presented for the award of any other degree of this or other University and may be placed before the examiners for evaluation.

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I am solely responsible for any omission, error or shortcomings in my work.

(SREEJATA SENGUPTA)

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INTRODUCTION

"The nation's children are a supremely important asset ...... children programmes should find a prominent part in any national plan for the development of human resources, so that our children grow up to become robust citizens, physically fit, mentally alert and morally healthy...".

National Policy for Children, 1974

The health status of people is of crucial importance, not only for its own sake, but for the overall growth and development of the nation. A healthy population can contribute to economic growth in many ways - by improving productivity, allowing better utilization of resources, benefiting future generations through better education etc. (WDR, 1993). Health is an important component of human capital and spending on health is considered to be a productive investment.

It is in this context particularly, that health of children becomes important. Children constitute the future human resources of an economy and

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hence investing in them implies investing in the future of a country. It has been widely recognized that health has a positive impact on productivity. Since healthy children are more capable of learning and retaining what they learn, they can be expected to take better advantage of the available socio-economic opportunities in the future. In addition to improving their own productivity they can also help to improve return on other forms of investment (UNICEF, a, 1993).

In addition, improved health status of children can help to tackle the problem of rapid population growth, with which most developing countries today are faced. As was pointed out during the Earth Summit, 1992, "....... the efforts to reduce child illness and malnutrition ..... is crucial not only for it's own sake but also as a means to help slow population growth and make possible environmentally sustainable development in the 21st Century and beyond" (UNICEF, 1994). One often comes across the mis-conceived notion that if more children survived, population problems would get aggravated in the developing world. This however is unlikely to be the case. Rate of growth of population tends to have a strong negative correlation with the survival probability of children (UNICEF, a, 1993). If parents,

specially the poor ones, are more confident about the survival chances of their children, then family planning would be a more acceptable proposition to them. And since rapid population growth has been one of the most impeding factors in the development process, slowing it down would enable countries to take better advantage of the benefits of growth.

Just as children represent an invaluable resource capable of accelerating growth and development, they also constitute one of the most vulnerable groups in society, easily subject to constant exploitation, deprivation and discrimination. Since they are incapable of looking after their own needs, they are left at the mercy of several external factors, which often affect their survival chances. Hence specially designed programmes are required for them, which would ensure their survival, growth and development.

The realization that children are important from the point of view of both social and economic development, has in fact led to the formulation of policies and programmes specially meant for children. In India, the Constitution makes special provisions for the protection and welfare of children. Since maximum

number of deaths are concentrated in the 0-4 age group,
GOI,
(SRS, 1989) programmes specially in the area of health
care and nutrition, have been designed over the years
to take care of the health of these children.

The UNICEF advocated a package of programmes,
for the children, popularly known as the "GOBI" which
comprises four elements (Ramalingaswamy, 1986).

    a.   growth monitoring

    b.   oral rehydration

    c.   breast feeding

    d.   immunization

In India, the programmes initiated have mainly been in
line with the above package. In addition, several
nutritional programmes have also been initiated. The
important programmes currently being undertaken
include:

- UIP
- ORT   Part of Maternal and Child Health

- MDM
- SNP   Part of Nutrition Programmes
- ICDS

A detailed review of some of these programmes has been provided in Appendix 1.

Over the years, resources devoted to health and other related activities has increased, though their share in total Plan outlay has been maintained at about 5% (Mundle, 1991). From the policy point of view what is important is that since resources are scarce, they should be optimally allocated to achieve the maximum possible gains in improving child health and the health of the population at large. It has been suggested that to achieve the maximum possible gains, the magnitude of various health and other programmes should be assessed, their costs and benefits estimated and then the best alternative chosen (Mosley and Becker, 1985). However, in reality, to what extent these methods are adopted in choosing between alternative programmes remains to be seen.

Lately in India, the assumption that expenditures on health programmes would result in positive health has come under much criticism. This has been mainly due to the inability to achieve the goals set for improving child health status, inspite of the several child specific programmes in the area of health, nutrition and other related activities. For

example, regarding the Universal Immunization Programme (UIP) it has been argued that there is no epidemiological evidence to support the contention that the programme would make any dent on aggregate infant mortality (NIHFW, 1990). The programme is meant to prevent children from six major childhood diseases - measles, polio, pertussis, tuberculosis, diptheria and tetanus which are believed to cause only 10% of deaths below five years. 60-90% of childhood deaths are caused by diarrhoea and respiratory diseases which are not vaccine preventable. Hence it is felt that one needs to justify the resources devoted towards the programme.

Similarly, inspite of there being several Nutrition Intervention Programmes ever since the beginning of the Plan Periods, almost 63% of children in India were found to be suffering from severe and moderate form of malnutrition during the period 1980-92 (UNICEF, 1994). This again would lead one to question the efficiency of the programmes in achieving their goals. An indepth analysis of various other programmes would reveal that inspite of the efforts being made at improving child health status, children continue to suffer from high rates of morbidity and mortality.

Such experiences has led one to question the supposed link between expenditures on health and health status. The few studies that have tried to measure the impact of health spending on health have come up with varied results (Tulasidhar   ...j 1990; Jolly 1986). While some studies have found expenditure on health to have a positive effect on health status, others have found no significant relationship between the two.

The objective of the present study is to apply the statistical technique of GRANGER CAUSALITY to test for the possible existence of a causal link between public expenditure on health programmes, particularly aimed at improving child health, and the health status of children. Child health is affected by various factors, which may be grouped as socio-economic factors and medical and other intervention factors. Often it becomes difficult to demonstrate the causal link between health expenditure and health because of the socio-economic factors that are simultaneously operating and continuously changing (Berman, 1991).

In general, even if two variables are highly correlated, it does not necessarily mean that one causes the other, or that variations in one would lead to variations in the other. This is particularly true

for time - series data, where the possibility of finding a significant relationship between two variables over time is quite high, (since both may be driven by a time trend). Hence classical regression analysis would be inappropriate to examine causality between two variables.

Granger Causality Tests (Granger 1969), have been developed to particularly study the possibility of a causal link existing between variables. A variable X is said to cause Y relative to the universe set U, if predictions of Y_t based on U_s for all S<t are better than predictions of Y_t based on all components of U_s except for X_s for all s<t. Thus, if expenditure on a particular programme is found to have a causal effect on child health, then expenditure on that programme may be increased relative to other programmes.

In addition to Granger Causality, the study has also applied the technique of COINTEGRATION, which is a statistical concept developed to examine the existence of a long term equilibrium relationship between variables. In fact, over the years it was realized that the causality tests often led one to make incorrect conclusions, mainly because of certain assumptions that had to be satisfied to apply the

tests. For instance, Granger's Causality Tests can be applied to stationary series only; if a series is not stationary, it has to be transformed to stationarity before the tests can be applied. This transformation often leads to loss of information which may have been crucial in explaining the causal link. Hence one may reach wrong conclusions about causality between variables.

COINTEGRATION, however says nothing about causality. It only tests for the existence of a long term relationship between variables and assumes that if such a relationship exists, then there is a causal link between the variables. Hence in analysis of time series data, it has now become customary to first test two or more series for cointegration. If the series are found to be co-integrated, then the causality tests are undertaken to test for the direction of causality.[*] This is the approach that would be followed in this study also.

The Study has been divided into six main chapters.

.*(Kalirajan & Shaud, 1992).

In Chapter 1, some of the commonly used indicators of child health have been briefly discussed. In Chapter 2 the determinants of child health have been discussed. A distinction has been made between socio-economic determinants and medical and other interventions.

In Chapter 3, general trends in child health as reflected by child health indicators, have been examined, across time and across States in India.

In Chapter 4 a background to the statistical concepts of causality and cointegration has been given. It is hoped that this will allow a better understanding of the estimation procedures later.

In Chapter 5 an account is given of the data sources, estimation procedures, results and implications of the causality Tests.

Finally, in Chapter 6 an attempt has been made to construct a composite health status index for children. The MULTIPLE-INDICATOR-MULTIPLE-CAUSES model (MIMIC) has been used for the estimation which is based on aggregate state-level data.

Limitations of the Study

The tests of Causality and Cointegration are asymptotic tests based on large samples. Unfortunately, due to data limitations (discussed in Chapter 5) the study is limited to a fifteen year period. As a result, the chances of there being a small-sample bias is quite high. Also, due to data limitations again, information on expenditure on individual child health and other programmes could not be relied upon. Hence it was not possible to examine which of the programmes have had a positive impact on improving child health status and which haven't.

CHAPTER 1

INDICATORS OF CHILD HEALTH

In discussing the issues of child health, the foremost important question that is asked is how to measure child health. Health as such, is an unobservable variable. It cannot be directly measured but it gets reflected in certain indicators, which are assumed to measure the state of the health of children. Indicators may either be positive indicators or negative indicators of health. A positive indicator is one whose increase implies an improvement in the health status. For example, the nutritional status of a child is a positive indicator of his health. Similarly, a negative indicator is one whose increase implies a deterioration in the health status of the child. The most commonly used mortality indicators like Infant Mortality Rate (IMR), Neo-Natal Mortality Rate (NNMR), Post-Natal Mortality Rate (PNMR) and Under 5 Mortality Rate (U5MR), are negative indicators of child health.

In general, indicators of child health may be clubbed into two broad groups:

    i.   Pre-natal indicators

        - peri-natal mortality

        - still birth rate

        - births attended by trained persons

    ii. Post-natal indicators

        - IMR, NNM, PNM, U5MR;

        - percentage of low birthweight babies

        - cause specific child mortalities

        - percentage of children immunized

        - nutritional status of children etc.

Since information is not always available on a regular basis for most of the above mentioned indicators except the mortality indicators, for empirical purposes one finds IMR, NNMR, PNMR and U5MR to be used.

Infant Mortality Rate (IMR) in particular has been well recognized as a summary index for the quality of life and socio-economic development in an economy (Jain and Visaria, 1988). It is an indicator, not only of the state of health of infants in an economy, but an

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indicator of the quality of life of the people at large. IMR is defined as the number of infants dying below the age of one year per thousand live births in a given year. Most nations have adopted the goal of reducing their IMR to a certain level in their pursuit of achieving "Health for All by 2000 A.D." as per the Alma Ata Declaration of 1978.

IMR has been further divided into Neo-natal and Post-natal mortality rates. This distinction helps to clearly understand the factors that affect infant deaths during different periods within that one year. Neo-natal death is the number of deaths of infants under 28 days of age in a given year per thousand live births in that year. Post-natal death is the number of deaths occurring from the 29th day up to the completion of one year in a given year, per thousand live births. Since NNMR are affected more by endogenous factors and PNMR by external factors, different types of policies are required to tackle the two types of mortality.

Under Five Mortality Rate, U5MR which is another important summary measure of child health is the number of deaths of children occurring in the age group below five years per thousand live births in a given year. While U5MR is a measure of the state of

health of children in an economy, controlling U5MR is considered to be a foremost goal in any health programme (UNICEF 1993a).

Birthweight is another important indicator of child health which reflects a variety of factors relating not only to the child but also to the mother. Birthweight directly reflects many of the underlying factors like the health and nutritional status of the mother, pre-natal care received by her, environmental conditions, state of water supply and sanitation and the like. It specially tells a lot about the socio-economic status of the mother, which in turn reflects her living conditions, the education level, nutritional and health status etc. Effects of birth weight are more prominent in the neo-natal period. The probability of neo-natal deaths is 50% higher for low birth weight infants (Jurg Mahner,1977). A baby with a weight of less than 2500 gms is considered to be of low birth weight. If birth weight figures are available at a disaggregated level, then they can be useful indicators of the existing social inequality in the economy (Mahner Jurg, 1977). For example, low birth weight in some socio-economic groups would provide policy makers with the target groups where the problem needs to be tackled. Unfortunately in most countries,

detailed information on birth weight is not available on a regular basis and hence one has to rely on mortality indicators.

Nutritional status of children is another important indicator of child health status. To measure the nutritional status, anthropometric measures such as height-for-age, weight-for-age, mid-upper-arm-circumference (MUAC) etc., are used. All these indirectly reflect the state of health of children. Nutritional status is believed to be an important `cause' of health. The findings of a review of studies on the effect of nutritional status of children on the incidence of infection and on mortality rates (H O 1984) showed that nutritional status had an insignificant effect on reducing the incidence of infection though it did lead to substantial reductions in mortality rates. Again, consistent information on nutritional status is not available at an aggregate level. They are more commonly used in micro-level studies where researchers measure the nutritional status of a sample of children on whom the study is conducted. At the aggregate level, mortality indicators are the ones, which continue to be used as measures of child health.

However, mortality indicators, have been criticised on several grounds. Firstly it has been argued that these are mere quantity indicators, which say nothing about the large number of children who suffer from diseases which are not fatal. IMR and U5MR do not include these children, though they are not in a perfect state of health. Thus one fails to take into account loss of healthy life due to diseases that are not fatal. Further, an appropriate indicator of health should be one, which not only reflects the state of health but also gives an insight into how the health status can be improved by changing the "inputs" of health into positive health. In other words, an indicator should reveal what the marginal impact of different variables would be on the health status. Mortality indicators fail here since they do not provide the link between "inputs" and "output" of health.

In short, mortality indicators have been criticised because,

- they are believed to be merely quantity indicators which reflect nothing about the quality of life of children at large;

-       they do not take into account the various
        stages of "illness" in which a person may be;

-       they do not provide the link between "inputs"
        and "output" of health.

In other words, quantity indicators do not
provide any indication of the marginal impact of
various policies and programmes on health status. Also,
inter-state or inter-country comparison becomes
difficult on the basis of these. For example, if in the
same state or country, different indicators of health
move in different directions, then it becomes difficult
to draw conclusions about the state of health in that
state.

The first criticism that these indicators
merely measure the quantities of deaths occurring and
reflect nothing about the quality of life, is not
really acceptable. It is criticised that reducing the
number of deaths alone cannot be very fruitful unless
the quality of life, the living conditions etc., of the
surviving children can be improved. However, UNICEF and
other propagonists of the indicators have justified
their use on grounds that in addition to measuring the
quantity of deaths they also helps to identify

underlying factors that affect the quality of life (UNICEF, a, 1993).They are directly affected by factors such as the income of parents, their level of education, prevalence of malnutrition and disease, availability of clean water and sanitation etc. It is true that these quantity indicators do not give an insight into all the different dimensions of health, they definitely are the starting point for any analysis or evaluation of health conditions.

The second criticism about mortality indicators not giving any indication about the sufferings of an individual from diseases which are not fatal is true. Probably this is what prompted the World Bank to compute a health measure called the Disability Adjusted Life Years (DALYs) which would give an account of the loss of healthy life due to disease. DALYs is measured in the following manner. First, the number of years lost due to disease is calculated by subtracting the actual age at death from the expectation of life at that age in a low mortality population (World Bank, 1993). This gives the loss of life due to deaths. The impact of disabilities is then calculated by multiplying the expected duration of the disability with a "severity factor". Diseases are grouped into 6 classes of severity of disability. For

example, class 2, including most cases of leprosy and some inflammatory diseases is given a severity weight of 0.22; class 4 with some cases of dementia and blindness is given a severity factor of 0.6. The death and disability losses are then combined, the losses being adjusted by a weight and a discount rate so that life lost at different ages are given a different value and future years of healthy life are valued at progressively lower rates. The value of life lost at different ages is shown to rise steeply from zero at birth to a maximum at age 25, and then decline gradually with increasing age (WDR ., 1993).

What is obtained in this way by a combination of discounting and age weights gives what is called DALYs or disability adjusted life years. The total number of DALYs gives a rough measure of the global burden of disease. The global burden measures the present value of the future stream of disability-free life lost as a result of death, disease or injury during a given year. According to the Banks calculations about 1.36 billion DALYs were lost due to ill-health in the year 1990. And a quarter of this was accounted for by the major childhood diseases. Thus,

this kind of an indicator does have a wider scope than a mere quantity indicator since it takes into account life lost due to disease and disability also.

In order to take care of the third problem, construction of composite indices of health has been suggested. These allow an indepth study of the causes and consequences of health. They help one to evaluate the marginal impact of a health service or a health programme on the health of the people. Hence such indices would be particularly important as indicators when one is trying to analyse the efficiency of different health care programmes. Over the years, attempts have been made to construct such indices, both at micro and macro level, including indices particularly for children.

However what has been realized is that given the multidimensional aspects of health, it is not possible for a single indicator to reflect all dimensions of health. An indicator may be used for a variety of purposes and can reflect a variety of things.What is therefore required is a classification scheme for sorting indicators into a state of exhaustive and mutually exclusive categories (Chen and Bryant, 1975). The WHO suggested classifying indicators

according to their applicability to individuals
families and households, social groups, communities and
nation. That is, classifying indices in two groups -
micro and macro. But, such a classification is not
always logical since an individual level index may be
applicable to the community also.

Baumann (1961), suggested classifying
indicators into three groups:

1. those that reflect the general feeling of
    well-being into the "feeling state
    orientation" group

2. those that show the presence or absence of
    some symptom as "symptom oriented" and

3. those that reflect the activities of a
    healthy individual into "performance
    oriented" group.

The drawback here is that the most widely
used statistics, the mortality statistics do not enter
the classification scheme in any way, unless the
"performance orientation" group includes mortality as
the extreme state of functioning.

A much wider classification scheme was been provided by Chen and Bryant (1975) who considered three major dimensions of classification - a measurement dimension, an applicability dimension and an orientation dimension. It is an extension of the Baumann classification. The measurement dimension refers to the manner in which the data has been obtained, that is whether it is self-reported, observed or both. The applicability dimension refers to the type of data that is being considered, that is whether it applies to individuals, groups or to the population. The orientation dimension finally, refers to whether information is based on the feelings of the individual or population, or symptoms or performance.

Culyer, Lavers and Williams (1971) feel that there are three types of indicators that are required to fulfill three different functions. These are the

1.   State indicators

2.   Need indicators and

3.   Effectiveness indicators

Need indicators are required in order to set the priorities. Since all health related demands cannot be met simultaneously due to limited resources, it becomes essential to identify those needs which are more pressing than others. Effectiveness indicators provide the technical relationship between the inputs of health and the output (which may be measured in terms of the state indicator). They would basically show what the effect would be on health status of varying inputs or health services. State indicators reflect the state of health in the economy. They basically are the mortality and morbidity indicators that one uses as measures of child health.

State indicators may be considered as goals which an economy wishes to achieve, the Need and Effectiveness indicators being expressed as functions of this. In other words, given the goals, the need indicators and the effectiveness indicators would tell how to achieve these goals. Over the years several health status indices specially of the Effectiveness kind have been formulated (Wolfe and Gaag 1981; Van Vilet and Van Praag 1987; D.N. Rao and R.L. Bhat 1991). These indices help to understand the link between causes or inputs of health and indicators or outputs of health. But the commonly used indicators continue to be

the State indicators. This is probably so because it is much simpler to collect information on these indicators.

Also, inspite of the drawbacks of the mortality indicators, they are well justified for the purpose they serve. They give an idea of the goals that need to be achieved. In order to see how they are to be achieved, the help of other types of indicators may be taken.

Thus, it may be concluded that the most commonly used indicators of child health are the mortality indicators which have been suitably defined according to the period during which death occurs. Specially in macro level studies, these are the indicators that are more commonly used. In micro-level studies, which are mostly based on surveys of certain groups of population, since it is simpler to collect information on personal and individual characteristics, other indicators are also used. These include measuring height-for-age, weight-for-age, birth weight, MUAC etc. At macro-level, such informations are not yet being collected on a regular basis.

CHAPTER 2

DETERMINANTS OF CHILD HEALTH

There are a large number of factors that influence the health of the children. In this chapter we briefly discuss some of them. If child health is to be improved, it is essential to understand the factors that influence child health and the manner in which they do so. In general, a distinction is made between socio-economic determinants on one hand and the medical interventions on the other. It is the optimum interaction between favourable changes in socio-economic conditions and the right kind of medical interventions that can bring about the desired changes in the health status of children and people at large. Considerable research has been undertaken to understand the socio-economic determinants, though the same cannot be said for policy induced interventions.

The chapter has been divided into two sections. In **Section A** some socio-economic determinants of health have been mentioned while in **Section B** policy

interventions and the relationship between interventions and health as revealed by previous studies has been discussed.

SECTION A

Socio-Economic Determinants of Child Health

In this section, we concentrate on discussing the socio-economic and behavioural determinants of health. Factors influencing infant mortality have been broadly classified into two groups:

- endogenous factors
- exogenous factors.

Endogenous factors are those which are more biological in nature and dominate deaths in the neo-natal period, that is during the first month after birth. They include deaths due to congenital malformations, absence of proper pre-natal care, unsatisfactory birth process and the like (Jain and Visaria, 1988). Exogenous factors are the environmental factors that predominate deaths in the post neo-natal period (that is, after the first month of birth). These mainly include deaths due to

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infections, parasitic and respiratory diseases etc..
Since the exogenous factors are more external in
nature, they are easier to control through appropriate
policy options than endogenous factors.

An analytical framework for studying child
survival was provided by Mosley and Chen (1984) who
integrated both social and biological approaches to
child survival to identify the proximate determinants
of mortality and morbidity. They identified five groups
of proximate determinants of child survival:

1. Factors related to the mother (age, parity,
   birth interval).

2. Environmental contamination.

3. Nutritional deficiency.

4. Injury.

5. Personal illness control.

All these are believed to be influenced by
socio-economic determinants which include (1)
individual level variables (productivity, education,
occupation, etc.), (2) household level variables (e.g.,
income and wealth of the household) and (3) community
level variables (wealth system, environment, etc.).

In India several micro-level studies have been conducted to analyse the socio-economic determinants of child health. In a study on infant mortality in regional India, Beenstock and Sturdy (1990) using Factor Analysis have identified a set of socio-economic variables, which explain IMR across different states. The study is different from many previous studies because the authors have not used a Linear Regression Model. Since IMR is bounded between 1 and 1000, linear regressions are not very appropriate. A semilogistic model worked out to give the best fit. Twelve socio-economic variables including availability of medical facilities, medical attention at birth, nutrition, clean drinking water, poverty, literacy, vaccination and some others were condensed into four factors which were found to be statistically significant. The results of the study isolated vaccination, poverty, caste, use of medical facilities and adult female literacy as some of the important contributory factors in infant mortality. Adult female literacy in particular worked out to be a very significant factor.

Infact, in all works done on determinants of health, whether reflected by IMR or U5MR, factors related to the mother, stand out very specifically -

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her level of education, nutritional status, economic status and often her area of residence. Though there are various other factors external to the mother, like level of family income, environment, availability of medical facilities etc., that have an influence on child health, the willingness and the ability of the mother to adapt to changing conditions and do what is best for her child, exerts an influence which is quite independent of other factors (Basu,   1987). Maternal factors influence both neo-natal and post neo-natal mortality.

Neo-natal Mortality (NNMR) is strongly influenced by the age of the mother and parity. IMR is expected to show a V-shaped or a J-shaped relationship with age and parity (Jain and Visaria, 1988). In a study on effects of mothers education on death clustering and child mortality, Monica Dasgupta (1990) found that shorter live birth intervals resulted in a higher probability of death. There could be many reasons for this - inadequate time for the mother to recover from the previous birth, sibling competition for care etc. Shorter the interval, higher are the chances of the child failing to survive. She also found that there was a tendency of deaths to cluster within families. This clustering could be explained to a large

extent "....by the basic abilities and personality characteristics of the mother, independently of education, occupation, income and wealth".

Of all the maternal factors _education of the mother_ was found to be a highly significant factor in explaining both neo-natal and post neo-natal mortality (Pampel and Pillai, 1986). Higher education was found to improve prenatal care and encourage greater use of health care facilities. Education improves knowledge and skills of mothers specially regarding child care practices (Dasgupta, 1990); it also increases their autonomy and decision making powers within the household, which allows them to implement their child care decisions. Educated mothers are more aware of availability of modern medical care facilities need for immunization, handling diarrhioeal attacks, their personal hygiene and hygiene of their children, family planning services and the like. They find it far more easier to adapt to changes to meet the needs of their children.

Thomas, Strauss and Henriques (1991) have investigated three ways in which maternal education can affect child height (used as a proxy for child health): income augmenting effects, information processing

effects and interactive effects through community services. In their model, they express child health (child height) as a function of child characteristics (age and sex), household characteristics (parental education, income etc.) and community characteristics (prices of goods, community services etc.). Their results show that almost all of the impact of mothers education can be explained by indicators of her access to information such as reading papers, watching television and listening to the radio. Education operates by making a person a more efficient consumer of information.

Birth weight of the baby which is an indicator of health, is also another important determinant specially of NNMR. It often reflects the underlying socio-economic conditions under which the child is born, like the income level of the family nutritional status of the mother, gestation period, birth order etc. The norm for classifying low birth weight babies has been provided by WHO, according to which babies with less than 2500 grms. of weight are considered to be of low birth weight. However, in India, it has been argued by some pediatricians that normal birth weight is 2000 gms - 2500 gms, given the small structure of Indian women (Bhargava et.al. 1980).

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For infants with weight less than 2500 gms the chances of dying are extremely high. Birthweight again reflects the underlying characteristics of the mother. Unfortunately disaggregated data on birth weight are not easily available which inhibits indepth analysis of factors contributing to low birth weight.

Though a large number of studies have gone in to show the positive impact of maternal education on child health, the effect of mothers employment has not been extensively studied. In an attempt to study this effect, Basu and Basu (1991) found that among the poorer sections of society, the probability of a child dying are greater for a mother who is working. Though the advantages of female labour force participation have always been discussed, its negative impact on child welfare has somewhat been neglected.

Mothers employment can have two effects - a direct impact of her working and an indirect one of households increased income. In poor households then the direct effect of mothers employment on child health is usually adverse. Womens employment does bring in more income into the family and gives women a greater command over their resources which are more likely to be used for child welfare. Womens employment also

increases access to knowledge about better child
bearing and child rearing practices which also has a
positive effect on child health. But at the same time
the working mother loses out on _time_ that she could
devote to her child.

Basu and Basu (1991) conclude that a major
explanation for the higher child mortality experience
of poor working mothers is their physical inability to
look after their children themselves and to arrange for
adequate substitute childcare.

Thus of all the factors that affect child
health, characteristics related to the mother stand out
to be the most important ones; her level of education,
her autonomy in decision making, her employment status
etc., all have a significance on the health of the
children. Even in the presence of other conducive
socio-economic factors, the ultimate impact is that of
the mother in her ability to take advantage of these
opportunities.

As far as government interventions as
determinants of health are concerned, it is _assumed_
that they have a significant effect on child health.

But in reality it becomes difficult to establish the link at times. The following part discusses this problem as revealed by some studies.

SECTION B

Government Interventions as Determinants of Health

It has been long recognised that government interventions are necessary for improving the existing health status of people. But unlike socio-economic determinants, there has been relatively less research on understanding the mechanisms by which interventions affect health. In reality, both these factors operate simultaneously in determining health status.

Government incurs expenditure on various activities like health care, nutrition, water supply, sanitation etc., with the <u>belief</u> that these expenditures would help to better the existing health status of people. Often programmes are targetted at certain groups or regions whose health status the government wants to improve. But how the assumed causal link operates, whether at all any causal link exists or not, has not been much explored. There is growing recognition that government ·interventions· are not

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yielding the expected results. Programmes have not been well focused and there is inefficiency in their implementation.

In this section we review a few studies which have tried to measure the impact of health spending on health status. Often it becomes difficult to demonstrate the causal link because of the socio-economic factors that operate simultaneously and keep on changing all the time (Berman, 1991).

Findings of some studies show that there is a lack of correspondence between needs and resources, with the high mortality states incurring less health expenditure (Berman, 1991). Berman suggests that this is probably a consequence of health being a state subject. The poorer states have higher child mortality but are less able to devote resources to meet the health needs.

Views on whether health spending affects health are varied. A study on the impact of public spending on medical care on infant mortality (Tulasidhar, 1990) suggests that the ultimate impact of public spending on mortality rates depends not only on the effectiveness of providing medical care

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infrastructure, but also on the utilization rate of the infrastructure so created. The study expresses neo-natal mortality and post-natal mortality as functions of medical care at birth (reflecting quantity of medical care), per capita real curative expenditure, per capita expenditure on immunization and nutrition status as reflected by the level of poverty. The composite model has been estimated using two stage least squares (TSLS). The results show that medical attention at birth and level of public spending do have a significant inverse relationship with neo-natal mortality rate. Level of poverty and expenditure on preventive care were however found to be insignificant. Also expenditure on creating medical infrastructure did not necessarily imply greater utilization of these facilities. Utilization depended on the costs involved in availing these facilities.

Another study on the effect of Oral Rehydration Therapy (ORT) on reducing diarrhoeal mortality (Fauveau, Yunus, Islam 1992) however did not find any significant impact of ORT on mortality. The study was conducted in the Matlab Region of Bangladesh. Small amounts of oral rehydration solution used, early discontinuation of oral rehydration, delay in referring severely ill children were all responsible for the

apparent lack of effect of ORT. The authors suggest that intervention programmes aimed at selective diseases should be taken as a part of other curative and preventive expenditures also.

This point has been emphasized by Mosley and Becker (1985) also. According to them, most health intervention programmes are meant to tackle diseases in isolation. But diseases, particularly amongst children, do not occur in isolation but in combination with various other diseases. Hence the risks associated with other diseases considerably reduce the effectiveness of the disease specific technologies. This was the observation of Greenwood[*] also, who studied the patterns of mortality amongst immunized children in Gambia. He found that inspite of being immunized, the children continued to face a high probability of death. This was due to the influence of other non-immunizable diseases which simultaneously affected children.

The impact of immunization on child health has been questioned regarding the Universal Immunization Programme (UIP) also.[**] It has been argued that there is no epidemiological evidence that immunization for the six vaccine preventable diseases would make any dent on IMR. This thus contradicts the

[*] (Reference in Mosley & Becker, 1985)   38
[**] (NIHFW, 1990)

assumption on the basis of which government incurs expenditure on health and related activities; the assumption that expenditures are bound to yield results.

However, another study on estimating the effect of ORT, (Rashad, 1989), finds a significant causal link between ORT programme and child mortality. The study however suggests that the causal link is not a simple one. The potential of an ORT intervention is strongly linked to the type of treatment under ORT adopted which in turn influences the health status of children. Time series data on diarrhoea related mortality has been used. The series has been divided into two parts - pre-programme years and post-programme years. The trend in the series is examined as a function of time which is used as a proxy for other causal factors. Tests are performed to see whether the speed of decline in mortality in the post-programme period could be attributed to the ORT programme. The analysis revealed a substantial absolute decline in mortality, specially diarrhoea associated mortality in the post-programe years.

Bongaart's analysis (1987), on the impact of family planning on reducing IMR suggests that family planning adoption is unlikely to have a significant favourable effect on IMR. The study only considers the effect of family planning on IMR through changes in the family building patterns. Other indirect effects of family planning programme have not been considered.

However, a positive link between greater medical expenditure and improved health status was suggested by Wolfe (1986). The study differed from others in that it considered real and not nominal expenditure on health and took into account life style changes due to urbanization, increase in income etc. Life style changes can have a negative impact on reducing health status which in turn would lead to greater medical care utilization. Hence more medical care is required to counter the negative effect of life style changes. This in turn implies that greater medical care expenditure would result in positive health status. But as was pointed out by Tulasidhar, (1990) increased expenditure on medical care does not really mean increased utilization. Utilization would depend on the relative costs of availing the medical facilities.

An analysis of health care expenditure in India by Reddy and Selvaraju (1994) also found that all components of health expenditure did not really have a significant impact on health status (indicated in this case by life expectancy at birth). Running a simple regression, the study found only curative expenditure to have a significant impact on health status. Expenditure on other services such as nutrition, water supply and sanitation did not have any effect on health status.

Thus there appears to be varied opinions regarding the impact of health expenditure on health. While it is assumed that increased expenditure should improve health status, whether in reality such a link operates or not depends upon various other enabling factors.

CHAPTER 3

TRENDS IN CHILD HEALTH AND EXPENDITURE

In this chapter, an attempt has been made to examine the trends and patterns in infant and child health and in the expenditures on child health. It is hoped that such an analysis would help us to understand better the link between health status and expenditure to be examined later.

The chapter has been divided into three main sections. In Section 1, a comparative analysis is done between India and some other developing countries to see the progress made by India over the years to improve the health status of the children. In Section 2 an inter-state analysis has been attempted with the aim to highlight certain dimensions of the child health problem in India. In Section 3, expenditures on some child health and nutrition programmes have been examined, across states and over time. Given the complex structure of the health care financing system in India, and the unavailability of consistent data,

the analyses has been limited to a few programmes like the MCH, ICDS, etc. Health expenditure at the aggregate level has also been briefly discussed.

As has been discussed in Chapter 1, the most widely used indicators of child health status are the mortality indicators which include IMR, U5MR, NNMR and PNMR. In this chapter too these have been used as the major indicators of child health. However, wherever information was available, other indicators such as birthweight, level of malnutrition, level of immunization etc., have also been analyzed.

SECTION 1

Child Health in India Vis-A-Vis Other Countries

Inspite of having made considerable progress in improving the health status of children, India still lags behind some of the other developing countries. The Indian Constitution has always laid special emphasis on the welfare and development of children which has resulted in the initiation of various child health programmes over the years. But India continues to be classified in the group of countries with the highest U5MR (UNICEF, 1994). In 1992, India's rank according

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to the UNICEF classification was 42 out of 145 countries, while in 1981 it was 38 out of 129 countries. This has raised several questions regarding the adequacy and the efficiency in implementation of the child health programmes.

The slow progress stands out more prominently when India is compared to countries such as China and Sri Lanka. As far as economic development goes, these countries would also be classified amongst countries with the lowest per capita income. But, over the period 1960-1990, they have made significant progress in attaining their social welfare goals. As Table 1 shows, Sri Lanka managed to bring down her IMR by 83.3% and U5MR by 85.5% during the period 1960-90, while China brought down her IMR by 75% and U5MR by 79.4%. In contrast, India was able to reduce her IMR by 42.36% and U5MR by 47.45% only. Pakistan and Indonesia both of which have a per capita income higher than India, have however not done as well as China and Sri Lanka. Indonesia has done marginally better than India while Pakistan lags behind India.

A similar picture emerges from Table 2 which gives an account of the nutritional status of children.

Table 1

IMR and U5MR Across Countries

	IMR			U5MR		
	1960	1990	% decline	1960	1990	% decline
Pakistan	137	95	30.66	221	137	38.00
India	144	83	42.36	236	124	47.46
Indonesia	127	71	44.10	216	111	48.61
China	140	35	75.00	209	43	79.43
Sri Lanka	90	15	83.33	130	19	85.54

Source: UNICEF, 1993.

Table 2

Nutritional Status of Children

	% of infants with low birthweight		% of 0-4 years suffering from severe and moderate malnutrition (1980-92)	
	1985	1990	Moderate and severe	Severe
Bangladesh	31	50	66	27
Pakistan	25	25	40	14
India	30	33	63	27
Indonesia	14	14	40	-
China	6	9	21	3
Sri Lanka	28	25	29	2

Source: UNICEF 1994.

In India, during the period 1980-92 as high as 63% of 0-4 years suffered from severe and moderate type of malnutrition. This is inspite of the fact that supplementary nutrition programmes have been given priority ever since the beginning of the planning process. Also, as high as 27% suffer from severe malnutrition in India, the comparable figures for China and Sri Lanka being 3% and 2% respectively. It may be argued that rapid population growth has been a major factor responsible for slowing down the progress in improving childrens health, but growth of population has been an impeding factor in countries like China also. But China has succeeded in attaining a higher health status for its children. Even in Pakistan, where IMR and U5MR are higher than what they are in India, the surviving children seem to have a better nutritional status (Table 2). Also, in 1990 in India, as high as 33% of infants were born with low birth weight (i.e., less than 2500 gms.) while in China, Sri Lanka and Pakistan the comparable figures were 9%, 25% and 25% respectively.

Developing countries that have succeeded in improving the health status of their children are the ones who invested rigorously in health, nutrition and

education of their people (UNICEF 1994). For example, as early as in 1945, the Sri Lankan government had extended free medical care to almost every part of the country and introduced free education upto university level. During the fifties and the sixties several other programmes in the areas of health, education and nutrition were undertaken which were to yield positive results later on (UNICEF, 1993a). In India too, the concern for improving child health has been there but probably it has been inadequate and remained dormant for too long (NIPCCD, 1993). Percentage of government expenditure devoted to health in India is almost 3 times less than what it is in Sri Lanka. Pakistan spends marginally less than India even though its share of defense expenditure is much higher than that of India (TABLE 3)

As a percentage of GDP however, India is supposed to be spending more than many of the other developing countries (Berman, 1991). According to one estimate, India spent about 3.4-6.8% of its GNP on health in 1986-87. However, given the different methodologies that are adopted in estimating health expenditure, too much importance should not be given to these figures (Berman, 1991) (TABLE 4).

Table 3

Share of Health in Total Central
Government Expenditure

	Health		Education		Defense	
	1980	1991	1980	1991	1980	1991
India	1.6	1.6	1.9	2.5	19.8	17.0
Pakistan	1.5	1.0	2.7	1.6	30.6	27.9
Indonesia	2.5	2.4	8.3	9.1	13.5	8.2
Sri Lanka	4.9	4.8	6.7	8.3	1.7	9.4

Source: WDR 1993.

Table 4

	PC health expenditure as % of PCGNP	Government health expenditure as % of GDP
India (86-87)	3.4 to 6.8%	1.8%
Indonesia (85-86)	1.6%	0.6%
Pakistan (86-87)	2.8%	0.9%
Sri Lanka (82)	2.5%	1.4%

Source: Berman, 1991.

The above brief analysis of state of health of India's children in comparison to some other developing countries, would lead one to ask some important questions.

- inspite of the concern expressed for childrens health, why is it that children in India continue to face high rates of mortality and morbidity;

- given the seriousness of the problem, should more funds be devoted to the health sector;

- has there been an optimal allocation of funds within the health sector.

In the following section, further dimensions of child health in India have been discussed.

Child Health in India: An Inter-State Analysis

In India, the concern for improving child health is not merely a concern to reduce the <u>total number</u> of infant and child deaths. The National Health Policy (GOI, 1982) has set goals for the year 2000AD when IMR is to be reduced to below 60, U5MR to 10, and percentage of low birthweight babies to 10. However, if one looks more closely at the patterns of child health in India, it would be realized that one needs to go beyond the mere "numbers". There are three distinct features of childrens health in India.

1. the rural children suffer more than the urban children;

2. the female children are at a greater disadvantage than the male children; and

3. children in some states like U.P., Bihar, M.P. etc., are worse off than children in some other states like T.N., Kerala and Karnataka.

Hence merely reducing the total number of deaths through various programmes/policies would not improve the health status of children unless the above problems are taken care of.

Recognizing the fact that rural children suffer more than the urban children, the government has made serious efforts to improve the health infrastructure and provision of health care services in the rural areas. Primary Health Centres and sub-centres have been set up, which are the core institutions through which various maternal and child health services like immunization, ante-natal care, professional attendance at birth, ORT etc., are provided. The total number of Primary Health Centres operating in the country has gone up from 725 during the First Plan Period to about 7210 during the Sixth Plan Period (Gill, 1987). In 1991-92, there were 20719 PHC actually operating in the country. From the Fifth Plan onwards (1974-79), the rural health care delivery system was made a part of the Minimum Needs Programme in order to further strengthen the health care delivery and meet other basic needs of the people.

However, as Table 5 shows, infant and child mortality continues to be high in rural areas, specially when compared to the urban areas.

All the mortality indicators are almost 1.5 to 2 times higher in the rural areas than the urban areas. Though the difference has reduced between 1981 and 1988, rural mortality rates still continue to be quite high. Neo-natal mortality for example, in the rural areas was almost double (96%) that of urban areas but by 1988 this gap reduced by about 15%. In light of the Dais Training Programme, that was initiated in the rural areas to deal particularly with neo-natal mortality, one would have expected a more rapid improvement in neo-natal mortality reduction.

Table 5

Mortality Indicators in Rural and Urban India

	1981		1988	
	Rural	Urban	Rural	Urban
Infant mortality rate	119.1	62.5	102.0	62.0
Neo-natal mortality rate	75.6	38.5	62.0	34.6
Post-natal mortality rate	43.5	24.0	40.1	27.5
Under 5 mortality rate	45.5	20.4	35.7	18.7

SOURCE : SRS , various issues

Table 5a (at the end of the chapter) gives a State-wise breakup in IMR by region of residence. It is surprising to note that even in a state like Kerala, where substantial improvement in child health has been otherwise made, rural IMR was much more higher than urban IMR in 1989. In Rajasthan, rural IMR is about 75% more than urban IMR.

Hence inspite of the apparent increase in (child) health expenditure, health of rural children continues to remain relatively poor.

Discrimination faced by the female child is another important feature of the child health problem in India. Any programme aimed at improving child health should also try to reduce the discrimination faced by the girl child. As Table 6 shows, even though female IMR has slightly improved over the years, in the 0-4 age group, girls continue to face a higher death rate.

It was only after 1981 that the male-female ratio of IMR, tilted slightly in favour of the females. In general, at birth, the sex-ratio is 105 males per 100 females. However since boys have a higher

probability of death specially during the neo-natal period, by the end of the first year the sex ratio is a little less than one (Bourne and Walker, 1991). In India, however the girl child faces a higher probability of death so that the male-female ratio is tilted in favour of the boys. Though at the all-India level, this has changed since the early eighties, in many of the States, female IMR continues to remain high (Table 6a, end of the chapter). States where sex discrimination is prominent include UP, Rajasthan, MP and Haryana. As far as U5MR is concerned, in all States except Karnataka, Kerala, Punjab and West Bengal, female death rates are higher than male.

Table 6

IMR and U5MR By Sex

	IMR		U5MR	
	Male	Female	Male	Female
1979	119	121	44	48
1981	110	111	39	43
1989	92	90	28	31

Source: SRS, various issues.

Studies on gender discrimination have concluded that discrimination is faced by girls mainly in terms of food intake and medical care received (Basu, 1989; Sen and Sengupta 1983, Bourne and Walker 1991; Dasgupta 1990). Since the government has made efforts and devoted resources for providing both medical facilities and supplementary nutrition to children, this should have had a positive effect on reducing gender discrimination.

In fact the study by Sen and Sengupta (1983), of the nutritional status of children in two villages of West Bengal suggests that the village with the direct nutritional intervention programmes had a lower level of female discrimination in terms of food intake. Since such a programme is external to the system its impact should be the same on both boys and girls. Another study on the effect of public health intervention programmes on sex differential on childhood mortality (Pebley and Amin, 1991) in the Ludhiana District of Punjab also shows that health interventions, specially those with a nutritional component in them, were successful in reducing excess female mortality.

Looking at the composition of deaths in the different age groups, one finds that the maximum number of deaths occur in the 0-4 age group. The very fact that deaths continue to be concentrated in the 0-4 age group, probably the most vulnerable age group, again raises question regarding the efficiency of the health care and nutrition programmes for children. In States like U.P., Rajasthan and M.P. almost 50% of the total deaths still occur in the 0-4 age group (Table 7a and 7b end of the chapter). Compared to 1982, there has been some improvement in the percentage of deaths in 0-4 age, but in the 0-1 age group, the improvement has been marginal, at the all-India level. Here too there are substantial inter-state variations with Kerala having only 7.2% of total deaths in 0-1 age group and 10.5% deaths in 0-4 age group in 1989 on one hand and UP having 34.6% of total deaths in 0-1 age group and 47.2% of total deaths in 0-4 age group, on the other.

Table 7

**Percentage of Infant and Child Deaths
to Total Deaths**

	IMR	U5MR
1982	29.78	43.3
1989	27.10	38.8

Source: SRS, various issues.

Infant mortality has been further divided into two parts - neo-natal mortality and post-natal mortality (NNMR and PNMR respectively). Since NNMR is influenced more by endogenous factors while PNMR by exogenous or environmental factors, the latter can be expected to be more responsive to health care intervention programmes. In India, NNMR accounts for a higher proportion of total infant deaths (Tables 8 and 8a).

Table 8 *

**Percentage of NNM and PNM to Total
Infant Mortality**

	NNM	PNM
1982	63.6	36.4
1989	62.00	38.0

SOURCE : SRS, 1982,1989

Since PNMR depends more on external factors, it is much easier to control. However, as Tables 8 and 8a show, there has in fact been an increase in percentage of PNMR at the all-India level over the period 1982 to 1989. This is so for many of the states

also. Since the immunization programmes, ORT etc., should have a greater impact on PNMR, again there is a question of their efficiency.

In addition to the mortality indicators, the nutritional status of the children is another important reflector of their state of health. The nutritional status of the child, directly affects the duration and severity of a disease and the ability of the child to recover from the same (Bourne and Walker 1991). Malnutrition has an adverse influence on morbidity, mortality and life expectancy. The four major nutritional problems faced by children in India are protein calorie malnutrition (PCM), iron deficiency anaemia, vitamin A deficiency and goitre. PCM is prevalent more in children below 5 years of age. Recognizing the problem of rampant malnutrition, the government has taken steps to handle all the 4 types of malnutrition, by introducing supplementary nutrition programmes, distribution of iron and vitamin A tablets (ICDS prog), the National Goitre Control Programme etc.

Unfortunately, data on trends in prevalence of malnutrition or trends in birthweight etc., are not available. However findings of the surveys of National Nutrition Monitoring Bureau show that in the few states

that have been considered, percentage of children falling in the category with severe and moderate malnutrition has declined but there has been an increase in the category of mild malnutrition (Table 9). Consequently, there hasn't been any significant increase in the percentage of children in the category with normal body weight. The NNMB follows the GOMEZ classification whereby bodyweight is expressed as a percentage of some given standard. Thus, though there has been a positive impact on the nutritional status of children with a decline in the percentage of children with severe malnutrition, yet more remains to be done.

Table 9

	No. of children		Normal		Mild		Moderate		Severe	
	1978	1982	1978	1982	1978	1982	1978	1982	1978	1982
KER	300	201	28	32	41	49	27	17	43	1
TN	531	598	15	16	45	44	35	35	46	5
KAR	748	449	10	14	44	43	39	37	7	6
AP	392	340	15	13	40	43	35	38	10	6
MAH	615	580	9	14	37	39	43	41	11	7
GUJ	627	171	10	12	37	29	43	44	9	15
MP	188	-	12		37	-	35	-	16	-
ORS	235	123	14	13	48	36	31	42	6	9
WB	518	61	11	21	40	56	36	23	13	0
UP	559	-	19		54	-	24	-	3	-
TOTAL	4713	2523	14	17	42	42	36	35	8	6

Source: NNMB, Various Issues.

SECTION 3

Expenditures on Child Health

Given the scarcity of resources in developing
countries, proper allocation of funds to the health
sector and within the health sector assumes great
importance. Over the last one decade, several studies
have attempted to estimate the volume of health
expenditure in India (Reddy and Selvaraju; (1994) Duggal 1986;
Gill, 1987; Rao et al 1987;   and Ravishankar, 1989).
However, given the different methodologies followed in
estimating health expenditure, the estimates are often
not comparable.

We will emphasize more on expenditures
related to child health in this section, specially on
MCH, ICDS and Nutrition. Major child health programmes
like UIP, ORT, MDM, SNP and ICDS are included under the
above three major heads. Unavailability of data on the
individual programmes has limited the analysis to data
at the aggregate level.

In a state controlled economy like India,
public expenditure gives a fair measure of the emphasis
laid on the basic needs of the people such as health,

housing and nutrition (Mundle, 1991). Hence we begin by looking at the pattern of investment on health and nutrition over the plan periods.

From the First Plan Period to the Seventh Plan Period, percentage of public expenditure devoted to health has declined from 3.3% to 1.9% while that of Family Welfare has increased from a marginal amount to about 1.38% (Table 10). Thus, even though in nominal terms there has been substantial increase in the expenditure on health, it's share in total plan outlay has steadily declined. Share of Family Welfare has increased while that of nutrition has followed no steady trend.

Share of health in the total outlay on health and family welfare alone (Table 11) declined from about 99% to about 55% while that of Family Welfare increased from a negligible amount to almost 45% during the same period of time. Thus there seems to have been an increase in the share of family welfare at the expense of health without there being any obvious impact on population growth control, which is a major item of expenditure under family welfare.

Table 10

Pattern of Investment on Health,
Family Welfare and Nutrition

	Total plan investment outlay	Health . (%)	Family welfare	Nutrition
I Plan	1960	65.2 (3.3)	0.1 (0.00)	-
II Plan	4672	140.8 (3.0)	5.0 (0.11)	-
III Plan	8576	225.9 (2.63)	24.9 (.29)	
IV Plan	15779	335.5 (2.13)	278 (1.76)	45.1 (.28)
V Plan	39426	760.8 (1.93)	491.8 (1.25)	405 (1.03)
VI Plan	109292	2025.2 (1.85)	1387.0 (1.27)	238.14 (.22)
VII Plan	220216	3694.1 (1.68)	2958.1 (1.34)	1229.61 (.56)

Source: Health Information India.

Table 11

Share of Health and FW in Total H&W Outlay

	Total outlay on health and FW	% of health	% of family welfare
I Plan	65.3	99%	0
VII Plan	6652.2	55%	44.5

Source: Health Information India.

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However, an important component of Family Welfare is the Maternal and Child Health Programme which encompasses some of the most important child health services such as immunization, prophylaxis against nutritional anaemia, oral rehydration therapy etc. Hence it would be fruitful to see how the share of MCH in family welfare has changed. As Table 12 shows, share of MCH increased from 23% during Sixth Plan to 27% during the Seventh Plan.

Table 12

Share of MCH in Family Welfare

	Total FW	MCH
VI Plan	1078.00	250.30 (23%)
VII Plan	3256.26	888.44 (27%)

This is more in the positive direction since MCH is one of the more important child health programmes. Trends in actual Central government expenditure on MCH over the years, and the share of MCH in family welfare reveals that (Table 13) share of MCH has increased over the period 1975-90, though it has

not been a steady upward trend. Share of ICDS (which includes, health, nutrition and education programmes for children) has also increased substantially over the years.

Table 13

Share of MCH and ICDS

				(Rs lakhs)
	FW	MCH	SS & W	ICDS
1975	7695	76.39 (.99)	1242	0 (0)
1980	13630	481.99 (3.5)	3036	39 (1.2)
1985	52563	1064.35 (2.02)	28579	448 (1.6)
1990	75596	3638.71 (4.8)	63636	3373 (5.3)

Source: Reddy and Selvaraju, 1994.

Looking at the expenditures on MCH, Nutrition and ICDS across States, one finds considerable fluctuations across states and over time. In order to be able to relate mortality to expenditure levels, the analysis of the expenditures has been carried out in the following manner (expenditures computed from State Budget Documents).

Given that the services provided under MCH like UIP, ante-natal & post natal care, ORT etc., are likely to have a greater impact on IMR, per capita MCH expenditures of States have been arranged on the basis of the States IMR in ascending order. IMR for the year 1989-90 has been considered while per capita MCH expenditure for the years 1988-89 and 1989-90 have been reported. This would at a broad level allow us to see whether expenditure of the previous year has any relationship with this years IMR (Table 14).

Table 14

Per Capita Expenditure on MCH

States	IMR 1989	PC Expd. MCH 1988-89	PC Expd. MCH 1989-90
Kerala	22	.25	1.21
Maharashtra	59	.36	1.31
Punjab	67	.00	0.06
Tamil Nadu	68	.62	0.44
West Bengal	77	.17	0.11
Karnataka	80	.50	0.41
Andhra Pradesh	81	.23	0.84
Haryana	82	.23	0.78
Gujarat	86	.21	0.46
Assam	91	1.28	0.62
Bihar	91	.12	0.07
Rajasthan	96	.76	0.97
Uttar Pradesh	118	.62	0.15
Orissa	122	0.05	0.08

Sources: 1. SRS, 1989; 2. State Budget Documents.

AT the extreme ends, the two states with the lowest IMR (Kerala and Maharashtra) have the highest per capita expenditure on MCH while Orissa with the highest IMR has the lowest expenditure on MCH (except Punjab). But otherwise there does not appear to be any association between per capita expenditure on MCH and IMR. Rajasthan for example, which has the third highest IMR has a per capita MCH expenditure which is higher than Punjab, Tamil Nadu, West Bengal, Karnataka and Andhra Pradesh, which are the states with relatively lower IMR (the per capita expenditure figures may be slightly underestimated since total population has been used to compute the per capita figures while the programme is aimed at children and mothers alone). However, what is important is to see whether variations in expenditure over time has had an impact on IMR intead of just a point of time association.

Looking at the per capita MCH expenditure trends over time, one again finds that there is no discernible trend in many of the States, though the move in general has been upwards (Table 15).

Turning to expenditures on nutrition, since the nutrition intervention programmes are aimed mainly at children in the age group 0-14 years, the states

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have been arranged in ascending order of their U5MR
(Table 16). However as the tables (15 and 16) show,
there is not much change in the ranking whether states
are arranged on the basis of their IMR or U5MR.

Table 15

Per Capita MCH Expenditure

	1975	1980	1985	1989
Kerala	0.01	0.01	0.23	1.21
Maharashtra	0.02	0.06	0.20	1.31
Punjab	0.01	0.00	0.00	0.06
Tamil Nadu	0.02	0.06	0.01	0.44
West Bengal	0.01	0.02	0.02	0.11
Karnataka	0.03	0.08	0.26	0.41
Andhra Pradesh	0.05	0.05	0.41	0.84
Haryana	0.00	0.07	0.28	0.78
Gujarat	0.03	0.08	0.02	0.46
Assam	0.09	0.17	0.26	0.62
Bihar	0.02	0.03	0.04	0.07
Rajasthan	0.09	0.22	0.42	0.97
Uttar Pradesh	0.07	0.02	0.16	C.15
Orissa	0.00	0.00	0.01	0.08

Source: Computed from State Budget Documents.

With nutrition also, the link between per child expenditure and U5MR does not become very obvious though most of the States with higher U5MR have relatively lower expenditures on nutrition. But unlike expenditure on MCH, there has been an increase in per child expenditure on nutrition over the years (per child expenditure on nutrition has been computed using child population in the age group 0-14 years). In Bihar, U.P. and M.P. with high IMR and U5MR, the per child expenditure on nutrition is low and has increased marginally over the years. Here again it becomes important to see how variations in expenditure on nutrition have caused changes in mortality rates.

Prior to 1981, expenditure on ICDS was a very small amount in most of the States. It was only after 1981 that ICDS expenditure started expanding. Since ICDS includes services meant for both infants and children it should have an impact on both IMR and U5MR.

Arranging states in order of their U5MR (as in Table 16) and analysing per capita expenditure on ICDS reveals that (Table 17) in most of the states there has been an increase in per capita expenditure on ICDS but again it is difficult to say whether states with a higher expenditure have a lower mortality rate.

Table 16

Per Child Nutrition Expenditure

	U5MR	Per Child Expn on Nutrition(87-88)	1984-86
Kerala	6.1	54.7	23.2
Maharashtra	18.0	19.0	8.8
Tamil Nadu	20.6	95.6	81.0
A.P.	21.8	19.9	10.9
WB	21.9	20.9	12.2
Punjab	21.9	6.0	2.4
Haryana	24.1	25.1	9.2
Karnataka	25.7	39.6	24.9
Gujarat	29.2	52.1	21.4
Assam	29.6	14.7	10.0
Bihar	32.8	6.0	5.2
Rajasthan	35.6	13.1	6.2
Orissa	39.7	21.4	8.2
UP	41.3	5.7	3.6
MP	43.0	8.2	2.0

Source: For (2) & (3) Radhakrishnana & Narayana, 1993.

Table 17

ICDS Expenditure

	U5MR 1989	Per capita expenditure on ICDS (1987-88)	1984-86
Kerla	6.1	1.22	0.17
Maharashtra	18.0	2.25	3.16
Tamil Nadu	20.6	0.85	1.02
A.P.	21.8	1.81	1.92
WB	21.9	-	-
Punjab	21.9	-	-
Haryana	24.1	4.28	4.84
Karnataka	25.7	0.15	0.21
Gujarat	29.2	3.83	5.55
Assam	29.6	1.76	2.86
Bihar	32.8	1.7	1.32
Rajasthan	35.6	1.63	1.82
Orissa	39.7	1.69	2.21
UP	41.3	1.32	0.20
MP	43.0	1.71	2.05

Source: Computed.

Conclusions

The findings of the preceding analysis may be summarized as follows:

1. Inspite of having made significant progress in improving child health, India continues to lag behind many of the developing countries like China and Sri Lanka.

2. Though there has been concern for investing in health, share of public expenditure devoted to health is lower in India compared to even Pakistan.

3. Within India, the problem of dealing with child health goes far beyond mere `numbers', since all children are not faced with the same kind of discrimination and deprivation. Particularly the poor health of rural children compared to urban children and that of female children compared to male children becomes very apparent.

4. Though over the years, children's health as reflected by IMR and U5MR has improved over time and expenditure on child health and aggregate health has increased, it is difficult to establish a causal link between the two.

With this background we move onto the tests of causality and co-integration. In the following chapter the theoretical concepts of causality and cointegration have been briefly discussed.

Table 5a

IMR in Rural and Urban Areas in the Major States

	1982			1989		
	R	U	T	R	U	T
INDIA	114	65	105	98	58	91
AP	86	50	79	55	53	81
ASM	103	72	102	93	63	91
BIH	116	60	112	93	63	91
GUJ	120	89	111	92	70	86
HAR	10	62	93	88	58	82
KAR	71	47	65	89	53	80
KER	32	24	30	23	15	21
MP	145	79	134	125	78	117
MAH	77	55	70	66	44	56
ORS	139	64	132	125	78	121
PNJ	82	53	75	71	44	64
RAJ	105	60	97	103	58	96
TN	97	51	83	80	43	68
UP	156	99	147	126	75	118
WBL	93	52	86	83	53	77

Source: SRS, various issues.

Table 6a

IMR & U5MR By Sex

	IMR				U5MR			
	1982		1989		1982		1989	
	M	F	M	F	M	F	M	F
INDIA	106	104	92	90	37.9	40.5	28.5	31.4
AP	84	75	89	73	26.6	26.8	21.7	22.0
ASM	106	96	97	85	39.7	40.0	29.6	29.5
BIH	107	118	94	88	46.8	45.4	29.6	36.8
GUJ	113	110	85	88	40.1	40.6	25.9	33.6
HAR	92	95	75	90	27.6	33.5	21.4	27.2
KAR	73	56	86	74	25.9	23.0	25.8	25.6
KER	32	28	23	20	12.1	9.5	7.0	5.9
MP	142	126	115	120	53.8	54.4	40.7	45.6
MAH	71	69	64	53	23.0	24.7	18.5	17.5
ORS	140	124	123	119	41.8	41.2	38.9	40.5
PNJ	78	3	72	56	21.9	25.3	22.5	21.2
RAJ	96	98	95	99	38.3	45.3	33.6	37.9
TN	82	83	67	69	30.4	32.9	19.7	21.5
UP	142	152	114	123	50.3	62.2	37.2	45.9
WBL	90	81	83	71	33.5	33.0	22.5	21.3

Source: SRS, various issues.

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Table 7a

% OF 0-4 Deaths to Total Deaths

	1982	1989
INDIA	4.30	38.8
AP	30.8	29.1
ASM	41.5	38.8
BIH	45.7	42.1
GUJ	44.9	34.9
HAR	46.5	42.4
KAR	32.5	35.6
KER	17.9	10.5
MP	51.6	48.2
MAH	33.3	30.3
ORS	42.9	40.5
PNJ	33.3	30.9
RAJ	47.3	46.8
TN	32.3	25.0
UP	53.7	47.2
WBL	40.6	32.7

Source: SRS, various issues.

Table 7B

Percentage of Infant Deaths to Total Deaths

	1975	1982	1989
INDIA	30.0	29.7	27.1
AP	28.6	23.2	22.1
ASM	25.0	28.0	25.7
BIH	-	29.7	26.0
GUJ	37.0	32.7	25.6
HAR	35.2	37.1	34.0
KAR	20.0	19.7	25.6
KER	18.0	11.9	7.2
MP	32.9	34.6	32.2
MAH	24.1	23.5	21.1
ORS	28.3	34.0	29.1
PNJ	28.8	27.1	22.2
RAJ	36.0	30.4	30.7
TN	23.0	20.3	18.0
UP	37.8	20.6	34.6
WBL	26.5	23.9	-

Source: SRS, various issues.

Table 8a

Percentage of Neo-Natal and Post-Neo-Natal
Mortality to Total Mortality

	1982		1989	
	NNM	PNM	NNM	PNM
INDIA	63.6	36.4	62.0	38.0
AP	71.2	28.8	37.7	32.3
ASM	63.5	36.5	38.7	31.3
BIH	63.4	36.6	62.2	37.8
GUJ	64.2	35.8	65.5	34.5
HAR	62.1	37.9	60.5	39.5
KAR	70.2	29.8	72.2	32.7
KER	71.6	28.4	66.7	33.3
MP	55.6	44.4	57.1	42.9
MAH	70.0	30.3	67.7	32.3
ORS	54.7	42.8	62.4	37.6
PNJ	60.2	39.8	61.5	38.5
RAJ	59.4	40.6	62.9	37.1
TN	66.5	33.5	73.9	26.1
UP	64.1	35.9	58.0	42.0
WBL	68.9	31.1	59.2	40.8

Source: SRS, various issues.

CHAPTER 4

CONCEPT OF CAUSALITY AND COINTEGRATION

In this chapter, the theoretical concepts of causality and cointegration have been discussed. Over time, values of many variables are observed with great regularity. Classical regressions of such time series variables is likely to give a high R^2, apparently implying a strong correlation between the variables. However, it would be misleading to rely much on such high R^2 values since such correlations, at least partly, are likely to be spurious, since both the variables exhibit consistent trend, either upwards or downwards (Thomas, 1993). Also, a high R^2 by itself does not mean that one of the variables causes the other or that variations in one would lead to variations in the other. This is partly because correlations between variables are likely to be symmetric in nature. That is, the extent to which Y can be explained by X is exactly the same as the extent to which X can be explained by Y (PALGRAVE). And causality as such is believed to be a non-symmetric relationship. Hence, classical regression cannot be

used to examine causal relationships in time series data between dependent and explanatory variables. Hence different techniques have been developed to examine long term relationships between time series variables. Causality and co-integration are two such techniques. The chapter has been divided into 2 sections. In Section 1 the concept of Granger Causality has been discussed. In Section 2, cointegration and tests for cointegration have been explained.

<u>SECTION 1</u>

A. Concept of Granger Causality

If value of certain variables are occurring with regularity over time there is likely to be some underlying mechanism that is causing the variables to occur. This is where the concept of causation arises from. The idea of causality was originally formulated by C.W.J Granger and hence the tests have came to be known as <u>Granger Causality Tests</u>. In his seminal article Granger (1969) discussed the concept of causality which is based on two main <u>axioms</u>:

1.   the cause occurs before the effect - that is, the present and the past can cause the future but the future cannot cause the past;

2. the cause contains some unique information about the effect.

The basic model of Granger may be explained as follows. <u>A variable X, is said to cause Y, if Y is better predicted by using the entire relevant information, including the past values of X, than by using the entire relevant information, except the past values of X.</u>

In other words, time series X is said to cause Y relative to the universe U (where U is a vector time series including X and Y as components) if predictions of Y_t based on U_s, where s<t, are better than predictions of Y_t based on all components of U_s except X_s for all s<t (Singh and Sahni, 1984). Granger used the <u>Minimum Predictive Error Variance</u> as the criterion for comparing the two models. He defines predictive error variance as follows (Granger, 1969).

If P_t (Y/X) is the optimum predictor of Y using past values of X, then the predictive error series would be defined as ϵ_t (Y/X) = $Y_t - P_t$ (Y_t/X_t). Then σ^2 (Y_t/X_t) would be the predictive error variance of ϵ_t (Y_t/X_t).

In a bivariate case, Granger causality model is defined as follows:

$$Y_t = b_o + a_o X_t + \sum_{j=1}^{m} a_j X_{t-j} + \sum_{i=1}^{n} b_t Y_{t-i} + U_t \qquad (1)$$

$$X_t = c_o + d_o Y_t + \sum_{i=1}^{n} c_i X_{t-i} + \sum_{j=1}^{m} d_j Y_{t-j} + V_t \qquad (2)$$

where U_t and V_t are mutually uncorrelated while noise processes such that $E(U_t U_t') = E(V_t V_t') = 0$ for all t.

The test for causality involves regressing Y and X on all the relevant variables including the past and present values of X and Y and then testing the appropriate hypothesis (Ashan, Kwan and Sahni, 1989). For e.g., in the above model the null hypothesis $a_j=d_j=0$ may be tested against the alternative hypothesis $a_j\neq0$ and $d_j\neq0$. Acceptance of the null hypothesis would imply that X does not cause Y and Y does not cause X.

Causality is considered not between any randomly chosen variables, but only those for which there is some a priori belief that causation in some

sense is likely. In other words, if there is some "degree of belief" about the causal relationship that exists between two variables, then the objective of the causality analysis is to influence this "degree of belief", one way or the other (Granger 1988).

There has been some criticism regarding this point. Zellner (1984) for example argues that Grangers definition "is a special form of predictability and it does not mention of economic laws. So it is devoid of any subject matter consideration". He says that the "degree of belief" that Granger talks about must be based on some generally acceptable theory but Granger seems to deal with no such theory or law.

Granger has defined four types of causality (Granger, 1969):

a. *Simple Causality*: If σ^2 (Y/U) < σ^2 (Y/U-X) then X is said to cause Y. That is, X is said to cause Y if one is able to predict Y_t better using all information than if information on X_t is not used.

b. *Instantaneous Causality*: If σ^2 (Y/U, X) <
    (Y/U) then there is instantaneous causality
    from X_t to Y_t. This means that current value
    of Y, Y_t is better predicated if current
    value of X, i.e., X_t, is included than if it
    is not.

c. *Causality Lag*: If X_t causes Y_t, then
    causality lag m is defined to be the last
    significant value, K, such that σ^2 (Y/U-X_K) <
    σ^2 (Y/U-X_{K-1}). Thus if lag m is significant,
    then knowing the values of X_{t-j},
    j=0,1....,m-1, will be of no help in
    improving the prediction of Y_t.

d. *Feedback Causality*: If σ^2 (Y/U)<σ^2 (Y/U-X)
    and σ^2 (X/U) < σ^2 (X/U-Y), then feedback
    causality is said to be occurring with Y
    causing X and X causing Y.

Models a-c are unidirectional causality
models while model d is a bi-directional model. The
unindirectional models, in general, help to discern the
exogeneity of one or more of the variables, while the
bi-directional model helps to understand the joint
dependence between variables (Singh and Sahni, 1984).

Often it is difficult to have all the possible information on the universal set U. Hence for operational purposes, what Granger considers is the set of all relevant information available. This information set may be assumed to contain information on X&Y alone.

Thus, given the causality equations (1) and (2), the hypothesis that need to be tested for the existence of the above mentioned different types of causality, may be summarised as follows:

Simple : $a_o = d_j = o$ but $a_j \neq O ==> X$ causes Y

$d_o = a_j = o$ but $d_j \neq O ==> Y$ causes X

Instantaneous : $d_j = o$ but $a_o \neq$, $a_j \neq o ==> X$ causes Y

$d_j = a_j = o$ but $a_o \neq o ==> X$ causes Y

$a_j = o$ but $d_o \neq o$ and $d_j \neq o ==> Y$ causes X

$a_j = d_j = o$ but $d_o \neq o ==> Y$ causes X

Lag : $a_o = d_j = a_s = o$ but $a_{s+1} \neq o ==> X$ causes Y

$d_o = a_j = d_s = o$ but $d_{s+1} \neq o ==> Y$ causes X

Granger Causality test however cannot be applied to just any time series data. It is based on a stochastic notion and hence <u>it applies to only stationary time series</u>. Hence, before undertaking the causality tests, it is important to see that the series satisfies the property of stationarity.

B.   Stationarity

In any time-series data, the direction of the flow of time becomes an important feature. Stationarity requires that a time series be in a particular state of statistical equilibrium (Box and Jenkins, 1976). Grangers tests in fact assume that the series in question are stationary. Non-stationarity implies the existence of some sort of trend - stochastic or deterministic - in the series. In this case the moments of the distribution are likely change over time, and hence the existence of causality could also alter over time (Granger, 1969).

A stochastic process is said to be stationary if

1. $EY_t = \mu$ = constant for all t

2. Var $Y_t = \sigma^2$ = constant for all t = $E[(Y_t-\mu)]$

3. Cor (Y_t, Y_{t+s}) = constant for all t = s

Conditions (1) and (2) imply that the series has a constant mean and variance and condition (3) implies that the correlation between any two values of Y taken from different time periods depend only on the difference apart in time and are independent of time itself. (Thomas, 1993). Thus Cor (Y_{10}, Y_{12}) would be different from Cor (Y_{10}, Y_{15}) but would be the same as Cor (Y_{11}, Y_{13}), Cor (Y_{12}, Y_{14}) etc.

Since Grangers tests are applicable only to stationary series, a time-series must first be tested to see if it is stationary or not. And if it is not, then suitable transformation or filtering should be done to transform it to stationarity. The properties of stationarity mentioned above would be satisfied only if the error term in the equation is a WN (white noise) or serially uncorrelated process.

Testing for Stationarity

(a) ACF and PACF

An informal way of testing for stationarity is to visually inspect the plot of the sample autocorrelation function (SACF) and sample partial autocorrelation function (PACF) of a time series. Autocorrelations, expressed as a function of time difference or the lag, are referred to as the autocorrelation function (ACF) or the correlogram (Mills, 1990).

If, for example, we consider a series Y_t, $t=1 \ldots \ldots k$, then,

Mean $E(Y_1) = E(Y_2) = \ldots \ldots \ldots = (Y_t) = \mu$

Variance $V(Y_1) = V(Y_2) = \ldots \ldots = VV(Y_t) = \sigma^2$

auto covariances $cor(Y_t, Y_t - k) = E[(Y_t - \mu)(Y_{t-k} - \mu)] = \tau_k$

auto correlations $\dfrac{\tau k}{\tau_o} = \dfrac{Cor(Y_t, Y_{t-k})}{[V(Y_t) \cdot V(Y_{t-k})]^{1/2}} = P_k$

then P_k as a function of k (time difference), gives the ACF. The ACF plays an important role in modelling the dependencies among observations since it characterizes the stationary stochastic process that underlies the evolution of Y_t (Mills, 1990). It indicates, by measuring the extent to which one value of the process is correlated with previous values, the length and strength of the "Memory" of the process. For uncorrelated observations, P_k = o for all k=o.

Since the quantities mentioned above are population measures which are basically unknown, for operational purposes it is customary to obtain their sample counterparts. The sample statistics are consistent estimates of the population mean, variance, covariance and autocorrelation. Standardizing the sample autocovariance by dividing it by sample variance gives the SACF.

In general, if a series is non-stationary, then it would exhibit a distinct trend and its ACF (or SACF) would not die down quickly (Mills, 1990). If however the series is stationary, it would exhibit a rapidly dying down ACF or correlogram over time. The drawback of a visual inspection of the ACF to test for stationarity is that there is no yardstick to measure

whether the ACF is rapidly dying down or not. Hence it may often lead one to make false interpretations regarding the stationarity of the series. Consequently more formal tests of stationarity have been devised, which would be shortly discussed.

The ACF and the PACF may also be used to examine whether a series follows an Auto Regressive (AR) process or a Moving Average (MA) one. For this, the ACF and the PACF are examined together. The PACF, takes into account the correlation that variables from two different periods may have, with other intervening lags. Two variables may be correlated because both of them are correlated with some third variable. PACF measures the additional correlation between Y_t and Y_{t-k} after adjustments have been made for the intervening lags, e.g., $x_{t-1}, \ldots \ldots x_{t-k+1}$.

In an AR(p) process, (Mills, 1990)

i.   the ACF is infinite in extent and is a combination of dampened exponentials and damped sine waves and

ii. the PACF becomes zero or very small for lags larger than P.

In an MA(q) process,

i.   the ACF cuts off after lag q and

ii.   the PACF is infinite in extent.

For an ARMA process, both the ACF and the PACF will be infinite in extent and tail off as k increases. Then for k>q-p, the ACF is determined from the AR part of the model and for k>p-q, the PACF is determined from the MA part of the model.

(b)   Unit Root Test

In practice more formal tests are adopted in testing for stationarity than depending upon the visual inspection of ACF and PACF. One such important test of stationarity is the UNITROOT test where the roots of the lag equation are tested to see whether they lie within the unit toot. If they do then the series is non-stationarity. Consider a first-order AR process, which may be written as,

$$Y_t = \phi \, Y_{t-1} + \epsilon_t \quad , \ t=1,2\ldots\ldots \tag{3}$$

where θ is a real number and ϵ_t is a sequence of zero mean independent normal random variables with variance equal to σ^2. Using the lag notation this may be written as,

$$(1-\phi L)Y_t = \epsilon_t \tag{4}$$

where $LY_t = Y_{t-1}$

Considering $(1-\phi L) = 0$, it may be shown that the AR process given by equation (3) is stationary if, the root of $[1-\phi L=0]$ is greater than unity in absolute value. The root is given by $L=1/\phi$. For L to be greater than 1, ϕ must be less than 1 or greater than -1. Hence equation (3) would be stationary if $-1< \phi < 1$.

In an AR process of higher order, <u>all</u> the roots of the lag operator equation must be greater than unity in absolute value.

For example, using the lag operator notation, a pth order autoregressive process may be written as,

$$(1-\phi_1 L - \phi_2 L^2 - \phi_3 L^3 \dots \phi_p L^{t-p}) Y_t = \epsilon_t \tag{5}$$

Considering the following,

$$(1-\phi_1 L - \phi_2 L^2 - \phi_3 L^3 \ldots. \phi_p L^{t-p}) = 0, \tag{6}$$

it may be said that the associated AR process would be stationary iff <u>all</u> the roots of equation (6) are greater than unity in absolute value. Even if one root lies between 1 and -1 or is equal to 1 or -1, the process will be non-stationary.

In practice, since it is unlikely that in an economic time series ϕ would be negative, for stationarity ϕ should lie between 0 and 1, i.e., $0<\phi<1$. ϕ may be estimated by applying OLS to equation (3), However if $\phi=1$, so that the process is non-stationary, then the OLS estimator of ϕ can be shown to be biased downwards (Thomas 1993) and hence one may wrongly conclude that the process is stationary when it is not. Therefore the usual t test for the null hypothesis $\phi=1$ is not reliable in this case.

To take care of this problem, Dickey and Fuller reformulated the unit root test, which has come to be known as the Dickey-Fuller Test (DF) (Thomas, 1993). To begin with, the AR process, equation (3), may be rewritten as

$$Y_t - Y_{t-1} = \phi\, Y_{t-1} - Y_{t-1} + \epsilon_t \qquad (3a)$$

Then,

$$dY_t = (\phi-1)Y_{t-1} + \epsilon_t \qquad (7)$$

$$dY_t = \phi^* \, Y_{t-1} + \epsilon_t \qquad (8)$$

where $\phi^*=\phi-1$. Hence testing $\phi=1$ against $\phi<1$ is the same as testing $\phi^*=0$ against $\phi^*<0$. If $\phi^*=0$, it implies that the series is non-stationary. Hence to test for unit root, OLS may be applied to equation (8) to obtain the optimum estimator of ϕ^*, and then to use the critical values of the DF t statistic (τ) [instead of the usual t test] to test for its significance.

When the DF test is extended to the pth order AR process (the general case) it is called the Augmented DF Test.

In practice, often the data is not well approximated by a first-order AR process. To take care of this, equation (8) may be reparameterised as follows:

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$$dY_t = \phi^* Y_{t-1} + \phi_1^* d Y_{t-1} + \phi_2^* d Y_{t-2} + \ldots\ldots$$

$$+ \phi^*_{p-1} d Y_{t-p+1} + \epsilon_t \tag{9}$$

where

$$\phi^* = \phi_1 + \phi_2 + \phi_3 \ldots\ldots + \phi_{p-1}$$

and all the ϕ_j's are functions of the original ϕ_s.

If $\phi^* = 0$ in equation (9) then it is an equation in first differences.

In order to see what order of AR process best fits the given time series, the ADF test is conducted as follows (Thomas, 1993). Equation (9) is estimated adding as many terms of differenced variables as are necessary to achieve residuals that are non-autocorrelated. The LM test may be used to test for serial correlation. The final estimated version of equation (9) is called the Augmented-Dickey-Fuller Regression. This equation may then be used to test for stationarity. The null hypothesis to be tested is,

$$H_O \quad : \quad \phi^* \quad = 0 \text{ against}$$

$$H_n \quad : \quad \phi^* \quad < 0$$

If H_O is rejected then the series is stationary.

Thus, the steps involved in carrying out the augmented ADF test for Unit Root may be _summarized_ as follows.

The ADF regression equation may be written as:

$$dY_t = C_1 + C_2 T + \phi^* Y_{t-1} + \sum_{i=1}^{n} \beta_i \, dY_{t-1} + \epsilon_t \qquad (10)$$

where a constant and a trend term have been included. With the above regression equation we proceed as follows:

Step 1: first test equation (10) for the absence of serial correlation, since augmented DF test is applicable only to equations with white-noise residuals. The terms in first difference lagged dependent variables are included to take care of serial correlation. As many of these terms should be included as are necessary to achieve WN residuals. The _LM test_ may be conducted to test for serial correlation.

Step 2: after WN residuals have been obtained, equation (10) is tested for unit root using the DF test. $\phi* = 0$ is tested against $\phi* < 0$. The t statistic of $\phi*$ is termed $\mathcal{T}_t$ in DF (1979). The critical values are given in Fuller (1976).. If calculated ϕ_T is greater than the critical value (which is negative because it is a one tailed test), the null hypothesis of non-stationarity cann... be rejected. In other words, so long as the tabulated value is less negative than the table value, the series is accepted as non-stationary.

Once the series is accepted as non-stationary, before undertaking the causality tests it must be transformed to a stationary series. There are 2 ways of transforming a non-stationary series to stationarity.

1. Detrending or removing the deterministic linear trend by prior regression on a time trend.

2. Differencing the series to attain stationarity.

It Y_t is expressed as a function of time, called the trend, and a zero mean error stationary process as follows

$$Y_t = \alpha + \beta_t + U_t \qquad .$$

then the model is called a Trend Stationary Process (TSP). Transformation to stationarity here is done by regressing Y_t on time (Mills, 1990). TSP models are generally used when it is believed that the movements in the given time series are transitory in nature, driven by `shocks' and that they would eventually revert back to their natural rate (Krishnan, Sen and Majumdar, 1990). Thus Y_t is subject to a <u>deterministic</u> trend, t, which can be removed by regressing Y_t on t.

In the second case, if the model is generated by, say, $Y_t - Y_{t-1} = \beta + e_t$

$$dY_t = \beta + e_t$$

where e_t is a stationary process with mean zero and variance σ_e^2, then the model is called a Difference Stationary Process (DSP). Here stationarity is obtained by successive differencing of the series. Y_t here is subject to a stochastic trend. The logic behind

DSP is that a time series may be subject to both secular as well as cyclical components and hence such movements should be regarded as belonging to an integrated process. And in order to take care of both types of fluctuations, successive differencing should be done and not detrending.

For an informal way of testing whether a series is trend-stationary or difference stationary, the ACF for each series in both level and first difference may be calculated (Afextiou,1984). If the ACFs for levels are large and fall slowly, while for the difference they are found to be significant and positive, then the series may be taken to belong to the DSP class.

At a more formal level, the DF Unit Root Test may be applied. To test whether the equation is trend stationary or difference stationary, the ADF equation as given by equation (10) may be used. In fact, simply finding equation (10) to have unit root ⸱ ⸱⸱ ⸱⸱⸱. is not sufficient for the series to be accepted as first-difference stationary. For it to be first-difference stationary, the coefficient of time, C_2, must be zero. If coefficient of time is significantly different from zero, then the series is

trend stationary since it is dependent on time. And if C_2 is not significantly different from zero then it may be taken to be first-difference stationary.

Thus testing a series for TSP or DSP involves testing $\emptyset* = 0$ and $C_2 = 0$ simultaneously in equation (10). The critical values for this test is given by the Φ_3 statistic in Table VI, DF*(1981). If calculated Φ_3 is less than the critical Φ^*_3, then the null hypothesis is accepted. The null hypothesis is that the series is first difference stationary.

Since Granger Causality test is applicable to stationary series alone, if a series is found to be, say first difference stationary, then it is first converted to a stationary series through first differencing and then Granger causality applied to it. Over the years, it was realized that this process often led one to make incorrect conclusions about the existence of causality. <u>This is because, differencing leads to some loss of information which may have been important in explaining causality</u>. Hence one may reject the hypothesis of causality when it should actually be accepted.

* Dickey. Fuller (1981).

One way of taking care of this problem is to
test the series for co-integration. In the following
section the statistical concept of co-integration has
been discussed.

Co-integration

Co-integration basically tests for the
existence of an equilibrium relationship between two
variables. Suppose an equilibrium relationship is
believed to exist between two variables X and Y given
by

$$Y_t = b X_t \qquad (11)$$

If at each point of time, the variables follow an
equilibrium path, then,

$$Y_t - b X_t = 0 \qquad (12)$$

However, in reality it is unlikely that the two series
would follow an equilibrium path at every point of
time. If the series is out of equilibrium then equation
(12) may be written as

$$Y_t - b X_t = \epsilon_t \qquad (13)$$

where ϵ_t is defined to be the "equilibrium error". As observed by Engle and Granger (1987) if an equilibrium relationship exists between Y_t and X_t, then the disturbance error ϵ_t should tend to fluctuate around its mean value, or show some systematic tendency to become smaller over time. This implies that the variables would not drift too apart from one another in the long run. Such an equilibrium behaviour between two series over time is defined as <u>cointegration</u> (Thomas 1993).

If two series are co-integrated, then they will be generated by an "error-correction" model taking the form

$$dx_t = r_1 \, \epsilon_{t-1} + \text{lagged } dx_t, \, dy_t + u_{1t} \qquad (14)$$

and $\quad dx_t = r_2 \, \epsilon_{t-1} + \text{lagged } dx_t, \, dy_t, \, u_{2t} \qquad (15)$

Equations (14) and (15) imply that the amount and the direction of change in x_t and y_t, take into account the size of the previous equilibrium error. Either dx_t or dy_t or both must be <u>caused</u> by ϵ_{t-1} which itself is a function of x_{t-1} and y_{t-1}. Thus, for a

series to have an attainable long run equilibrium, there must be some causation between them (Granger 1988).

In Grangers test of causality on a first-differenced series, the error correction term, ϵ_t, would not have been incorporated into the model. And since $\lambda \epsilon_t$ also includes some information about the relationship between x_t and y_t, excluding it would mean loss of some information.

Hence, before conducting the causality tests, it may be fruitful to test the series for co-integration. If two series are found to be co-integrated, it may be assumed that some type of causation exists between them. The causality test may then be conducted to test for the extent and direction of causality.

Tests for Cointegration

For two series to be co-integrated, they must be integrated of the same order. A series is said to be <u>integrated of order d</u>, denoted by I(d), if it has to be differenced d times to attain stationarity. And two series are said to be <u>cointegrated</u> of order d,b,

denoted by CI(d,b) if they are both integrated of order d, and there exists some linear combination of them, that is integrated of order b, b<d.

Thus if two series are integrated of order one, i.e, I(1) {that is they are non-stationary and attain stationarity on first differencing} but there exists some combination of the two which is integrated of order zero, I(o) {that is it is stationary} then the two series are said to be co-integrated.

The ADF test for unit root may be used to test for I(1). If both series are I(1) the test for co-integration may be conducted in the following manner,

The hypothesised equilibrium relationship of the following form is first estimated by OLS

$$y_t = c_1 + c_2 T + \alpha_1 x_t \qquad (16)$$

This is known as the <u>co-integrating regression</u>. The residuals from the above equation are retained such that

$$e_t = y_t - c_1 - c_2 - \alpha_1 x_t \qquad (17)$$

The residuals may be now used to test the null hypothesis that $\rho=1$ in

$$e_t = \rho\, e_{t-1} + u_t \qquad\qquad (18)$$

The null hypothesis of $\rho=1$ implies the series are <u>not</u> cointegrated. Hence for the series to be co-integrated, $\rho<1$, that is the alternative hypothesis should be accepted.

In practice the Augmented DF test is used to test for co-integration. The test for cointegration is basically a test for stationarity applied to the residuals retained from the cointegrating regression. Here too the number of lagged differenced terms included would depend upon obtaining WN residuals. The equation to be estimated is of the following form:

$$de_t = \Theta^*\, l_{t-1} + \sum_{i=1}^{n} \Theta^*_i\, dl_{t-i} + v_i \qquad\qquad (19)$$

Here, the null hypothesis of non-co-integration implies testing for $\theta* = 0$ as against $\theta* < 0$. If the t statistic on $\theta*$ is $< \theta*$ critical, then the null hypothesis of non-cointegration is accepted.

Given this background, we now more onto the estimation of our model in the next chapter, where statewise analysis is done of the causality between public expenditure and child health.

CHAPTER 5

ESTIMATION, RESULTS AND IMPLICATIONS
OF THE CAUSALITY MODEL

The present chapter deals mainly with the estimation procedure and the results. The chapter has been divided into two sections. In <u>Section A</u>, data sources and methodology adopted in estimating expenditures has been discussed. Data for a limited time period has been used to carry out the tests, this being a major limitation of the study. An attempt has been made to explain the reasons for not being able to use a longer time series. In <u>Section B</u> the estimation procedure, results and their implications have been discussed.

SECTION A

Data Sources and Methodology

In this section, an effort has been made to define the data that has been used and explain the sources and the methods of its collection. The section

has been divided into four parts. In the Part 1 the major sources of data have been mentioned. In Part 2, an explanation is provided regarding the selection of the time period and the regions of study. In Part 3, the expenditure data used have been defined and the method of their estimation explained. In India, no unique definition of health expenditure exists as a result of which different studies have adopted different methodologies to estimate aggregate health expenditure. In order to avoid the problem of aggregation, data on individual expenditure items have been used.

1.   Sources of Data

The entire study is based on secondary sources of data, published mainly by government and other official agencies. Even though data was collected from authoritative sources, minor adjustments had to be made for some of the variables or regions in order to maintain consistency across states and across variables.

There are two types of information that have been used in the tests for cointegration and causality. One relates to the mortality indicators for infants and

children and the other to the expenditures on health
and other related items. The data on the demographic
variables such as infant mortality, neo-natal
mortality, post-neo-natal mortality and under five
mortality, were collected from the various volumes of
the Sample Registration System. The data on the
expenditures on health and other related items were
collected from the budget volumes (Detailed Demand for
Grants) of the Central and the State governments.

2ð. Period of Study

As has been mentioned in the introduction, a
major limitation of the present study is that the
sample period considered is much too small for carrying
out the tests of co-integration and causality. However
due to certain problems in the basic structure of the
data it was not possible to increase the sample period.

The data on health expenditure has been
collected from 1974-75 budget year onwards. Prior to
this year, a different accounting structure was being
followed. Since April 1st, 1974-75 (CAG, 1974) the
method of classifying government transactions on a
function-cum-programme basis was adopted. This made the
budgetary allocation in the two periods incomparable.

A further change in the classification of government transactions was made in 1987, when the account heads were revised following the introduction of yet another new accounting system (CAG, 1987). The aim was to bring about a better and closer coordination between plan schemes and account heads of government. Some of the minor heads were elevated to the level of major heads and some of the major heads to the level of sub-sectors. However since the basic principles and the structure of the accounting system did not change much and also because our data pertains only till the year 1989, this change in classification did not much affect our data base.

In addition to changes in the accounting system, names of many ministries and their jurisdiction of financing has also changed several times over the years, mainly because of political decisions. This made the task of furnishing a common format for data collection (so as to maintain comparability across states and across time) very cumbersome. To overcome this problem, the latest accounting structure and classification of expenditures has been adopted (mainly in line with the study by Reddy and Selvaraju, NIPFP, 1994) and the earlier years have been adjusted to the

maximum extent possible. However, given the time
constraint, it was just not possible to do so for years
prior to 1974.

2b. The Sample States

The study has been limited to fifteen major
states of India. These include - Andhra Pradesh, Assam,
Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya
Pradesh, Maharahstra, Orissa, Punjab, Rajasthan, Tamil
Nadu, Uttar Pradesh and West Bengal.

The main reason for using only fifteen states
is that consistent and continuous data is not available
for many of the other states, both for mortality and
expenditure items. Even for important states like Bihar
and West Bengal, data on mortality figures are
available from early eighties only. As a result, the
cointegration and causality tests could not be
conducted for West Bengal and Bihar separately, though
they have been included in the tests conducted at the
all-India level. The problem of considering only 15
major states is that when the co-integration and
causality test is done at the all-India level, while
the all-India IMR and U5MR has been considered, for the
expenditure figures, the sum of the 15 major states and

central government expenditure were considered. This does not really give the true picture of all-India expenditure on health and other related items. However, a simple examination of the data (NIPFP, 1994) shows that the 15 major states account for more than 80%, at times more that 90% of total all India expenditure. Hence it was assumed that expenditures of the 15 major states plus central government expenditure together would provide a representative picture of the all-India expenditure level. Limited period of time did not allow us to obtain data for all the States and union territories to arrive at the true all-India expenditure figures.

3.. Specification of Health Expenditure

Since there is no standard definition of health expenditure, it becomes essential in any study dealing with health expenditure to specify exactly how health expenditure has been defined and used. Ideally health expenditure in its comprehensive sense should include expenditure on all services - promotive, preventive and curative - that have an influence in improving the health status (Gill, 1987). According to

Berman (1988) "...all the activities with a primary and significant purpose being health improvement, should be included while others must be judged on their merit".

Different studies have followed different methodologies in estimating health expenditure. In this study, aggregate expenditure on health has not been considered, in order to avoid any confusion regarding what constitutes health.

Central government and State government expenditures have been considered for the following heads.

1. Medical and Public Health - MPH

2. Family Welfare - FW

3. Nutrition - NUT

4. Social Security for Child and Handicapped Welfare. - ICDS

Medical and Public Health (MPH) includes expenditure on various public health and sanitation services which are expected to have a positive impact on child health, by improving the environment in which

they live, and providing them with various medical services. Hence it was included as a variable expected to "cause" child health.

Expenditure on Family Welfare (FW) was included since family welfare comprises various programmes specially meant for mothers and children. One of the important child health programmes, the MCH, is included under FW. Expenditure on MCH has been considered separately as a cause variable.

Ever since the beginning of the Plan Period, providing supplementary nutrition to children has been recognized as an important means of improving their health status. Accordingly nutrition expenditure was included as a potential cause variable.

Expenditure on Nutrition is basically incurred by two Ministries - Ministry of Agriculture (Department of Rural Development)* However, certain nutrition programmes are undertaken by the Ministry of Social Welfare also. These include Balwadi Nutrition Programme, ICDS, Supplementary Nutrition Programme etc. Hence to arrive at the aggregate Nutrition expenditure incurred by the Central government these nutrition

* and Ministry of Food & Civil Supplies,

programmes expenditure were added to the expenditure on nutrition by Ministry of Agriculture and Ministry of Food and Civil Supplies.

Gross expenditures for Medical and Public Health, Family Welfare and Nutrition were considered where gross expenditure includes expenditure on both revenue and capital accounts. Expenditure on Medical Public Health is incurred by Ministry of Health and Family Welfare and several other ministries. However due to time constraint , expenditure of other ministries could not be included.

For the State governments, nutrition expenditure is accounted for mainly by the nutrition intervention programmes. Hence State nutrition expenditure gives a good approximation of the expenditure on nutrition intervention programmes. Gross expenditure on Medical and Public Health and Family Welfare were also considered.

In order to arrive at the all-India expenditure figure, Central government and State government expenditures for the relevant heads have been added. To arrive at the per capita expenditure figures, total expenditures were divided by the

population figures. It may be argued that for MCH and ICDS at least, instead of using total population, child population alone should have been used. However in order to maintain consistency across all items of expenditure total population figures were used.

Per capita expenditure in current prices has been converted to expenditure at constant prices by deflating each expenditure by suitable deflators. For medical and public health, the GDP deflator has been used; for family welfare and MCH the consumer price index of urban non-manual workers was used. For Nutrition, wholesale price index of food articles has been used while for ICDS, wholesale price index of drugs and medicines has been used (following Reddy and Selvaraju, 1994 study).

Considering the fact that the aim of the present study was to establish an equilibrium relationship between child health expenditure and child health status, it would have been more appropriate to use expenditures on the various child health schemes alone instead of the broad categories of expenditure that have been used. However considerable problems are faced in the compilation of these data; only two child specific programmes - MCH and ICDS could be considered.

As far as expenditure on specific nutrition schemes for children are concerned, like the Mid-day Meal programmes (MDM), Supplementary Nutrition Programme (SNP) and Applied Nutrition Programme, even though they are available, they are limited to certain states and certain years only. Hence an aggregate of all these under the broad head of Nutrition has been considered. Expenditures on health related programmes such as Universal Immunization Programme (UIP) and Oral Rehydration Therapy (ORT) are not readily available. Their expenditures are included under the broad head of Maternal and Child Health (MCH). Expenditure on MCH is available and it has been considered in the study. Also information on ICDS is available separately in the budget documents and this too has been considered. However state expenditures on ICDS also includes expenditure on the services for children in need of care and protection (SCNCP).

SECTION B
Estimation Procedure

To recapitulate, the entire estimation procedure involves three main steps:

1. The ADF unit root test for stationarity
2. Test for cointegration
3. Test for causality.

1. ADF unit root test

The unit root test for stationarity has been conducted for each of the following series - IMR, U5MR, MPH, FW, MCH, NUT and ICDS. The equation estimated is of the following form:

$$dLY = C_1 + C_2T + \theta* LY (-1) + \theta_1{}^* d\ LX\ (-1)$$
$$+ \theta_2* dLX (-2) + \ldots\ldots \epsilon_t \qquad (1)$$

where Y refers to each of the above mentioned variables. First the Lagrange Multiplier (LM) test was conducted to test for the absence of serial correlation in residuals. Those many lagged differences terms were included as required to obtain WN residuals. Once the exact form of equation was determined, the following two tests were conducted.

Test 1 : Null: H_O : $\theta* = 0$

H_A : $\theta* < 0$

Acceptance of the Null hypothesis implies that the series is non-stationary.

Statistic:The test statistic given by Dickey-Fuller (1979) is $\mathcal{T}_\tau$, which is given by 't' ratio on $\theta*$.

<u>Distribution</u>: The critical values for the test are given in Fuller (1976). If the estimated value of the statistic (absolute value) is greater than the critical value, then the null hypothesis of non-stationarity is rejected in favour of stationarity . And if it is less than the critical value, then the series is accepted as non-stationary.

Acceptance of non-stationarity does not however imply that the series is I(1) or difference stationary. It could also be trend stationary, in which case differencing would not be the appropriate way of attaining stationarity. For trend-stationary process, the test for cointegration is also not applicable. Hence to see whether a series is TSP or DSP, the following test is conducted.

Test 2

$$\text{Null} ==> H_0 : C_2 = \theta^* = 0,$$

which implies that the series is truly I(1) and there is no deterministic trend in it.

<u>Statistic</u>: Φ_3, which is given by the F-statistic of the restricted model.

<u>Distribution</u>: Critical values for this test are given in DF(1981). The F-statistic from the restricted model is compared with the critical value of Φ_3. If the tabulated Φ_3 (i.e., the F value) is less than the critical Φ_3, then the null hypothesis is accepted.

As the results of the test will show, in all cases, a non-statinoary series was also found to be difference stationary.

2. Test for Cointegration

If from the above tests it is found that the dependent variable series (that is, IMR, U5MR) and the independent variable series (MPH, FW, MCH, NUT, ICDS) are I(1), then the above are tested for cointegration. If for e.g., IMR, MCH and NUT are found to be I(1), then first IMR and MCH are tested for cointegration and then IMR and NUT. The test is carried out in the following manner.

First, the hypothesized equilibrium relationship between IMR and MCH is estimated by OLS. The regression equation is of the following form

$$LIMR = C + \beta \, LMCH + \epsilon_1 \quad . \tag{2}$$

It is called the cointegration regression equation or the static regression equation. The residuals from this are retained such that,

$$\hat{e}_t = LIMR - \hat{C} - \hat{\beta} \, LMCH \tag{3}$$

Now the ADF unit root test for stationarity is conducted on the residuals, which basically is the test for co-integration. The test equation thus becomes,

$$de_t = \Phi^* \, e_{t-1} + \sum_{i=1}^{p} \Phi_i^* \, e_{t-1} + U_i \tag{4}$$

and the null hypothesis $\Phi^* = 0$ is tested against $\Phi^* < 0$.

For co-integration of two series (IMR and MCH in this case), the null hypothesis of non-stationarity should be rejected. If the residuals are stationary, it

would imply that there is some linear combination of IMR and MCH which is stationary. This in turn would imply that IMR and MCH are cointegrated.

Statistic: The test statistic for co-integration is given in Engle and Yoo (1987). If the tabulated DF statistic is greater than the critical value, then the null hypothesis of non-cointegration is rejected.

3. Test for Causality

If two series are found to be co-integrated, it implies that there is a long term equilibrium relationship between the two. The existence of a causal relationship is then very likely. Cointegration tests however reveal nothing about the direction of the causal effect. The Granger test of causality is conducted to test for the null hypothesis which is as follows:

Null: IMR is not caused by MCH

MCH is not caused by IMR.

The F statistic given by the test is used to ascertain the direction of causation. The computer package TSP 7 has been used to carry out the above mentioned tests.

Results and Implications

The results of the Cointegration and Causality tests have been tabulated separately for each of the states and for the all-India level, and presented at the end of this chapter. For each state, Table A gives the results of the unit root test, Table B the cointegration test and Table C the causality test. In Table A, Υ gives the Dickey-Fuller t-statistic for the unit root test, Φ_3 gives the F value of the joint test $C_2 = \Phi* = 0$. The last row gives the number of lagged differenced terms included to obtain WN residuals. Table B gives the finding of the cointegration test which is conducted for those variables which are found to be non-stationary. Table C gives the direction of causality for the cointegrated series.

At the all-India level (Table 5.1A) all but MPH were found to be I(1) at 5% level of significance. The Φ_3 statistic confirms that all the series are of

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the DSP type. The test for cointegration, which has been conducted with lags 1, 2 and 3 (the test statistic has been reported only for those lags which give WN residuals) show that of all the variables only IMR and NUT are co-integrated at 5% level of significance and U5MR and NUT are cointegrated at 10% level of significance. For all the other I(1) variables the tabulated value is less than the critical value, thus making one accept the null of non-cointegration. Given that IMR and U5MR appear to have a long run relationship with nutrition, the test for causality is conducted to ascertain the direction of causality. The causality test has been carried out with 1 and 2 lags. Given the nature of the problem, it is unlikely that expenditures would have an impact on mortality with more than two lags.

The results of the causality test for the all-India level show that causation runs from IMR and U5MR to nutrition expenditure and not the vice-versa. This implies that in setting its expenditure, the government is guided by the present level of infant and child mortality prevailing in the country. In other words, this means that "needs" do have an influence on the level of expenditure but the expenditures, in turn,

have not had an impact on mortality.   However, a two-way causation is found between IMR and NUT when two lags are considered.

Similarly, the results may be analyzed for each of the given states. A summary of the results of each of the states is presented in the following Table A.

As the summary TABLE shows, except for Kerala, Punjab, Orissa and Uttar Pradesh, in all other states some causal relationship was found to exist between at least one of the expenditure heads and child mortality. In case of Kerala, the I(1) series were not found to be co-integrated, though the Granger Causality Test between the two I(0) series, i.e.,U5MR and MCH showed that causality ran from USMR to MCH. In Assam, Gujarat, Karnataka and Rajasthan, expenditure on nutrition, i.e., NUT, appears to have a causal effect on mortality, either infant or child or both.   NUT was found to be causally linked to IMR and U5MR at the all-India level also. In all the states where IMR/U5MR were found to be correlated with ICDS, [Gujarat, M.P ; and also Haryana and Maharahstra where a direct causality test was done since IMR and U5MR were I(O)] the

Table A

Summary Results of Cointegration and Causality Tests

		Variables cointegrated	Direction of causality
1.	A.P.	IMR & FW; U5MR & FW	IMR to FW; U5MR to FW
2.	Assam	IMR & NUT	NUT TO IMR
3.	Gujarat	IMR & NUT; IMR & ICDS	NUT TO IMR; IMR TO ICDS
*4.	Haryana	--	MPH TO IMR; IMR TO ICDS; MPH TO U5MR;U5MR TO ICDS
5.	Karnataka	U5MR AND NUT	NUT TO U5MR
6.	Kerala	---	U5MR TO MCH
7.	M.P.	IMR & ICDS	IMR TO ICDS
*8.	Maharashtra	-	MCH TO IMR; IMR TO ICDS U5MR TO MCH; MCH TO U5MR U5MR TO ICDS
9.	Orissa	NONE	
10.	Punjab	NONE	
11.	Rajasthan	IMR & NUT; U5MR & MCH; U5MR & NUT; U5MR&ICDS	NUT TO IMR; MCH TO U5MR NUT TO U5MR; U5MR TO ICDS
12.	Tamil Nadu	--	U5MR TO MCH
13.	Uttar Pradesh	NONE	
14.	India	IMR & NUT; U5MR & NUT	IMR TO NUT; NUT TO IMR U5MR TO NUT

Note: * : In Haryana and Maharashtra, direct Granger Causality
Tests have been done since IMR & U5MR were found to
be I(0) series.

direction of causality was found to run from IMR/U5MR to ICDS. This reiterates the belief that the state of child health has influenced the allocation of resources across states. However, the absence of a two-way causality means that even though the expenditures were incurred with the view to improve child health, they have not had the desired effect. A two-way causality was found to exist between IMR and NUT at the all-India level and between and U5MR and MCH in Maharashtra. Nutrition expenditures appear to have the most consistent causal relationship with mortality compared to all other expenditure items. MPH appears to have influenced IMR and U5MR in Haryana alone.

At this point, it may be fruitful to note that though results reported here relate to expenditure at constant prices, the tests were conducted with expenditure in current prices also (results not reported). With current expenditure, more variables were found to be cointegrated (IMR/U5MR were specially found to be cointegrated with MPH and FW, in many of the states) thus implying that in nominal terms, government expenditure may have an equilibrium relationship with the level of infant and child mortality, but once prices are taken into account this relationship breaks.

A separate causality test could not be conducted for Bihar and West Bengal, two of the major states, due to unavailability of mortality data for the earlier years. However, they have been included in the all-India test for causality.

The major findings of the cointegration and causality tests may be summarized as follows:

1. At the all-India level, a causal link was found to exist only between expenditure on nutrition (NUT) and IMR & U5MR, with the direction of causality running from IMR to NUT and U5MR to NUT. In case of IMR and NUT however, a bidirectional causality was found to exist when two lags were considered.

2. Of the 13 states considered, in Kerala, Punjab, Orissa and U.P., a causal relationship could not be established between any of the expenditure heads and the indicators of child health. In Kerala, however, for the two I(0) series U5MR and MCH, a significant causal relationship was found to exist between the two, with the direction of causality from U5MR to MCH.

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3. In Haryana, M.P., Gujarat, Maharashtra and
    Rajasthan, IMR/U5MR were found to "cause"
    ICDS, but a reverse causal effect could not
    be established.

4. As in Kerala, in Tamil Nadu and Maharashtra,
    U5MR was found to "cause" MCH, but again a
    reverse causal relationship could not be
    found.

5. In Rajasthan, which is one of the worse-off
    states in terms of peoples health status, NUT
    and MCH both were found to have a causal
    effect on IMR while U5MR was found to affect
    NUT and MCH. This is surprising since
    Rajasthan has been amongst the worse-off
    states comparable to U.P., Orissa and M.P.
    However over the period it managed to reduce
    its IMR and U5MR to levels below those in
    U.P., Orissa etc. This probably is the impact
    of the causal effect of expenditure on the
    health status of children.

In interpreting the results, it must however be remembered that the tests of cointegration and causality are asymptotic tests. Our sample size being small, the results may therefore be biased to some extent. However, the tests provide a more sophisticated way of analyzing causality between public expenditure and health status, than provided by classical regression methods which do not really test for causality in the Granger sense but for correlation between expenditure and health.

As has been mentioned time and again, expenditures on child health programmes are incurred because they are expected to improve the health status of children. If in practice they had a positive impact, the tests conducted in the previous section would have shown the existence of causality, probably a bidirectional causality between expenditures on child health and the health status of children. However, the fact that causality could be found to exist only in some of the states and in some of the variables, shows that expenditures on health have not always been successful in improving the health status of children. The probable reasons for this could be that either expenditures are not adequate, given the seriousness of the problem or that they are not optimally allocated.

This requires further investigation which is beyond the scope of this study. The fact that expenditure on nutrition has had a causal impact on child health in many of the states, brings out the benefits of the direct nutrition intervention programmes. However the finding that at the all-India level, IMR and U5MR have "caused" nutrition expenditure and not the other way around implies that though the Government in allocating resources to nutrition has kept in view the state of health of children, at the all-India level, nutrition expenditure has not affected child health. This is true for the causal link between IMR/U5MR and ICDS also where IMR and U5MR have been found to have a causal effect on ICDS but not vice versa.

This suggests that whether a particular programme has a causal impact on child health or not depends on state specific factors. This has important policy implications. Just because a programme is expected to have a positive impact on child health and is found to have a positive impact in one or two states it cannot be universally applied across all states and regions. While in some states it may have a positive impact, in others it may not. What is important is to investigate why the programmes do not show the expected results across all states.

There could be various reasons as to why a causal link could not always be established between expenditure and health. Some of the reasons may be listed as follows.

- inefficiency in the provision of child health services

- an imbalance in the composition of expenditure by economic categories

- non consideration of private health expenditure

- personal factors affecting the utilization of health care services by parents for their children.

1. Inefficiency in the Provision of Child Health Services

It is now well known that due to inefficiency in the provision of health services, the benefits of the health programmes often do not reach the people they are intended for. Public health services for children for example are provided mainly through the

Primary Health Centres, the Community Health Centres, Sub-centres and District Hospitals. Though their numbers have been increasing over the years, they are often found to be below the desired level (Berman, 1991). Also, even if a PHC or a CHC is established in an area, it does not mean that the health personnel would be available, who are finally responsible for providing the services. It has been found that a considerable number of health personnel positions remain vacant, specially at the level of medical officers and health assistants, which further hampers the provision of health services (Berman, 1991). Some studies have also found that often the PHCs, CHCs, etc., are not suitably equipped to provide adequate accommodation or security, specially to their female workers. As a result, the female workers are not physically present even though their positions are filled and budgeted (NIPCCD, 1988, Berman 1991). Further, since the success of the programmes depends upon community participation, it was always recognized that workers at the grass-root level should be recruited and trained from the community they are expected to serve. However, in practice, workers are not always recruited from the community and village but from other regions. In such situations, in the absence of adequate facilities, the female workers take up

residence in other villages and occasionally come down to the assigned centre to carry out their duties. These are the community based workers like the Anganwadis, the auxiliary nurse-midwives (ANM), multipurpose health workers etc., who are directly involved in reaching the health care services to the community people. Hence, often there is no regular health monitoring of people who do not go to the institutions to avail of the health facilities. Thus inspite of the expenditures being incurred, services do not reach the children they are intended for.

2. Composition of Aggregate Expenditure

Instead of looking at the aggregate expenditure, it becomes very important to examine the various components of expenditure, distinguishing particularly between salary, wages and administrative expenditure on one hand and other expenditures on the other. For the study of this, it was not possible to collect detailed expenditure data by economic categories but review of some other studies brings out the fact that wages and salaries account for a substantial amount of total expenditure (Reddy and Selvaraju, 1994 in Berman, 1991) (Table B).

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Table B

Share of Expenditure by Economic Categories

Year	Salary	Office expenses	Machinery & equip.	Others	Total
1974-75	39.93	4.37	2.85	52.86	100
1978-79	40.11	3.61	3.20	53.09	100
1982-83	51.14	4.58	2.91	41.37	100
1986-87	52.41	3.44	3.34	40.70	100
1990-91	58.97	2.58	2.97	35.47	100

The above table shows that salaries accounted for about 60% of total expenditure (on medical relief, hospitals and family welfare) in 1990-91, it's share having increased substantially over the years from about 40% in 1974-75. The share of machinery and equipment expenditure has been small and has increased marginally over the years. And the share of 'others' which includes expenditure on medicines/drugs, hospital accessories etc., in addition to other expenses has declined over the years. Factors in this latter head are the ones which are actually required to substantially improve health services. A state-wise study of the composition of government health spending (Rao et al 1987, Berman, 1991) also shows that in all the states, salaries constitute the major proportion of

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total expenditure on health (Table C)[*]. Bihar showed the highest share of salary (66.3%) and Gujarat the smallest (29.5%) (1982-83). In most states, over 50% of the total expenditure was accounted for by salaries. And, as has been pointed out in the previous section, salaries and budgeted posts do not necessarily ensure that the services are being provided. The study also found that in the case of family welfare, the percentage of resources allocated to drugs supply etc., was particularly low. All this implies that there has been little increase in the provision of services which are for the direct welfare of people. An increase in expenditure would have no effect on child health if a substantial proportion of it is eaten up by salary and wages and other expenditures.

3. Provision of Private Health Services

A further reason for the absence of a causal link between public expenditure and mortality could be the simultaneous presence of the private sector in providing health services. It is believed that only about 20% of the total population utilises the public sector services while the rest depend on private sources (Gill, 1987). Several studies have found private expenditure to be the major source for providing health services in India (Gill, 1987). This is probably more true for urban areas. It would be

* on page 228

an interesting exercise to examine state wise, the dependence of people on public services vis-a-vis private services. It has been pointed out that, "the private sector is by far the largest sector and is responsible for three quarters of all medical care whether rural or urban....." (Gill, 1987). However, data on private sources of expenditure is virtually non-existent which makes it difficult to carry out a state-wise analysis. Hence to examine the causal link between expenditure and child health, both public and private expenditure must be considered. If public expenditure plays a relatively less important role, then by considering it alone one may not be able to capture the full impact of expenditure on health. This would specially be the case in the economically better off states.

In Maharashtra, for example, (Duggal and Amin, 1989) 77% of all illnesses were found to be taken to private practitioners. This was true for both rural and urban areas. Regarding medical attention at birth, the study on Jalgaon district found that 41% people in rural areas and 35% people in urban areas went to private practitioners. In the same study, as high as

42% of children were found to be immunized from private sources even though immunization is primarily a government activity (Berman, 1991).

Thus, in order to understand the causal link between expenditure and health one needs to take into account both public as well as private expenditure.

4. PERSONAL FACTORS

Finally, health status is not a function of the "supply" of services alone but depends upon the demand for the services also. Even if health services are available, whether they are utilized or not, would depend to a great extent on the willingness and the ability of household members to avail of the facilities and to take actions that would help to promote health (Berman et.al, 1988). As was pointed out by Tulasidhar (1990) also ⁻⁻⁻⁻ utilization was an important factor in determining the effect of health expenditure on child mortality.

This is where in fact socio-economic factors gain importance. Income level, level of education specially of the female, cultural factors, the indirect costs involved in availing the 'free' public services (e.g. costs of transportation) etc., are all important factors in determining the demand for health services.

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Simply providing various services does not ensure their utilization. People need to be informed about the services and their benefits to ensure proper utilization. Health status is determined not only by the "supply" of health services but also by the demand for the services.

In brief, our cointegration and causality tests revealed that a causal link between expenditure on health and child health status could be established only between expenditure on nutrition and health status. In most states expenditure on MCH and ICDS were not found to "cause" child health (though the reverse causality did exist in many states). However this does not mean that the programmes should be discontinued. What is important from the policy point of view is to, first see why the programmes have not been effective in improving child health status in the different states. If it is a problem of implementation, then efforts should be made to ensure that there is better implementation and that the services reach the children who are to benefit from them. Also, efforts should be made to see that there is a better balance in the composition of expenditure by economic categories (that is between salaries, wages and other expenditures).

In the following chapter, a health status index for children has been constructed using as cause variables both expenditure and non-expenditure variables. This allows one to compare the relative position of different states according to their health status of children.

TABLE 5.1: Results of Unit Root, Co-integration and Causality Tests for India

TABLE A: Dickey-Fuller test for Unit Root							
Variable	IMR	U5MR	MPH	FW	MCH	NUT	ICDS
τ	-1.22	-1.52	-3.64	-2.13	-2.86	-2.95	-1.29
ϕ_3	1.15	1.30	_	2.46	4.21	4.36	2.54
Inference	I(1)	I(1)	I(0)	I(1)	I(1)	I(1)	I(1)
Lags	1	1	1	1	1	1	1

TABLE B: Engle-Granger test for Co-integration				
Variable	Lag 1	Lag 2	Lag 3	Inference*
IMR & FW	-2.48	-	-	NC
IMR & MCH	-1.56	-1.51	-1.57	NC
IMR & NUT	-3.35	-3.16	-1.51	C
IMR & ICDS	-	-1.19	-1.18	NC
U5MR & FW	-1.97	-	-	NC
U5MR & MCH	-1.82	-1.87	-1.94	NC
U5MR & NUT	-2.75	-3.09	-1.44	C
U5MR & ICDS	-	-1.57	-	NC
* NC: non cointegrated				
C : cointegrated				

TABLE C: Granger's test for Causality				
	Lag 1		Lag 2	
Null Hypothesis	F	Probability	F	Probability
IMR is not caused by NUT	0.64	0.44	4.27	0.05
NUT is not caused by IMR	1.83	0.04	7.94	0.01
U5MR is not caused by NUT	0.79	0.39	0.65	0.54
NUT is not caused by U5MR	1.22	0.03	9.10	0.01

TABLE 5.2: Results of the Unit Root, Co-integration and Causality Tests for Andhra Pradesh

TABLE A: Dickey-Fuller test for Unit Root							
VARIABLE	IMR	U5MR	MPH	FW	MCH	NUT	ICDS
τ	-1.56	-1.98	-4.71	-2.69	-1.53	-2.08	-2.10
ϕ_3	2.26	1.96	-	-3.90	2.39	2.21	2.31
Inference	I(1)	I(1)	I(0)	I(1)	I(1)	I(1)	I(1)
Lags	1	1	1	1	1	1	1

TABLE B: Engle-Granger test for Co-integration				
VARIABLE	Lag 1	Lag 2	Lag 3	Inference*
IMR & FW	-2.04	-3.77	-2.64	C
IMR & MCH	-1.74	-1.94	-1.98	NC
IMR & NUT	-2.32	-1.96	-2.02	NC
IMR & ICDS	-1.89	-1.34	-1.32	NC
U5MR & FW	-	-3.05	-2.92	C
U5MR & MCH	-1.88	-1.54	-1.49	NC
U5MR & NUT	-1.76	-1.68	-1.52	NC
U5MR & ICDS	-1.97	-1.13	-0.89	NC
* NC: not cointegrated				
C : cointegrated				

TABLE C: Granger's test for Causality				
	Lag 1		Lag 2	
NULL HYPOTHESIS	F	Probability	F	Probability
IMR is not caused by FW	0.34	0.57	2.12	0.18
FW is not caused by IMR	6.53	0.03	36.16	0.00
U5MR is not caused by FW	1.38	0.26	0.64	0.55
FW is not caused by U5MR	6.60	0.02	4.39	0.04

TABLE 5.3: Results of the Unit Root, Co-integration and Causality Tests for Assam

TABLE A: Dickey-Fuller test for Unit Root							
VARIABLE	IMR	U5MR	MPH	FW	MCH	NUT	ICDS
Υ	-2.11	-2.03	-2.05	-1.65	-3.09	-3.30	-3.92
$\emptyset_3$	2.03	2.07	2.31	1.37	4.83	6.11	-
Inference	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(0)
Lags	1	1	1	1	1	1	1

TABLE B: Engle-Granger test for Co-integration				
VARIABLE	Lag 1	Lag 2	Lag 3	Inference*
IMR & MPH	-1.9	-2.32	-1.67	NC
IMR & FW	-1.66	-2.68	-1.89	NC
IMR & NUT	-1.63	-2.06	-1.77	NC
IMR & ICDS	-1.88	-3.09	-1.87	C
U5MR & MPH	-2	-1.82	-	NC
U5MR & FW	-1.98	-2.21	-1.72	NC
U5MR & NUT	-2.2	-2.05	-1.37	NC
U5MR & ICDS	-	-1.86	-	NC
* NC: not cointegrated				
C : cointegrated				

TABLE C: Granger's test for Causality				
	Lag 1		Lag 2	
Null Hypothesis	F	Probability	F	Probability
IMR is not caused by NUT	2.49	0.01	3.20	0.04
NUT is not caused by IMR	0.74	0.40	1.21	0.72

TABLE 5.4: Results of the Unit Root, Co-integration and Causality Tests for Gujarat

TABLE A: Dickey-Fuller test for Unit Root							
VARIABLE	IMR	U5MR	MPH	FW	MCH	NUT	ICDS
γ	-2.91	-2.30	-3.26	-2.01	-3.72	-2.00	-2.59
$\emptyset_3$	4.24	2.73	5.55	2.05	-	1.99	3.38
Inference	I(1)	I(1)	I(1)	I(1)	I(0)	I(1)	I(1)
Lags	1	1	1	2	1	1	1

TABLE B: Engle-Granger test for Co-integration				
VARIABLE	Lag 1	Lag 2	Lag 3	Inference*
IMR & MPH	-1.8	-1.81	-1.99	NC
IMR & FW	-2.84	-2.00	-1.53	NC
IMR & NUT	-3.2	-2.62	-1.96	C
IMR & ICDS	-1.92	-2.92	-2.15	C
U5MR & MPH	-1.77	-2.07	-2.16	NC
U5MR & FW	-2.66	-2.10	-	NC
U5MR & NUT	-2.67	-2.45	-2.61	NC
U5MR & ICDS	-1.4	-1.29	-1.47	NC
* NC: not cointegrated				
C : cointegrated				

TABLE C: Granger's test for Causality				
	Lag 1		Lag 2	
Null Hypothesis	F	Proability	F	Proability
IMR is not caused by NUT	6.88	0.02	4.49	0.04
NUT is not caused by IMR	0.38	0.54	1.51	0.27
IMR is not caused by ICDS	1.59	0.23	0.19	0.83
ICDS is not caused by IMR	6.15	0.03	1.68	0.02

TABLE 5.5: Results of the Unit Root, Co-integration and Causality Tests for Haryana

TABLE A: Dickey-Fuller test for Unit Root							
VARIABLE	IMR	U5MR	MPH	FW	MCH	NUT	ICDS
τ	-4.27	-4.43	-4.30	-2.08	-2.14	-2.59	-18.53
$\emptyset_3$	-	-	-	2.19	0.27	3.45	-
Inference	I(0)	I(0)	I(0)	I(1)	I(1)	I(1)	I(0)
Lags	1	1	1	1	1	2	1

TABLE B: Granger's test for Causality				
	Lag 1		Lag 2	
Null Hypothesis	F	Probability	F	Probability
IMR is not caused by MPH	43.20	0.00	18.50	0.01
MPH is not caused by IMR	3.25	0.09	9.17	0.07
IMR is not caused by ICDS	0.07	0.78	0.28	0.75
ICDS is not caused by IMR	17.17	0.00	19.16	0.00
U5MR is not caused by MPH	15.64	0.00	6.12	0.02
MPH is not caused by U5MR	3.35	0.09	3.52	0.07
U5MR is not caused by ICDS	0.27	0.61	0.33	0.72
ICDS is not caused by U5MR	11.99	0.00	21.72	0.00

TABLE 5.6: Results of the Unit Root, Co-integration and Causality Tests for Karnataka

TABLE A: Dickey-Fuller test for Unit Root							
VARIABLE	IMR	U5MR	MPH	FW	MCH	NUT	ICDS
τ	-0.76	-2.25	-0.67	-3.57	-3.35	-2.80	-1.14
$\emptyset_3$	0.73	2.57	1.18	6.39	5.55	4.16	1.06
Inference	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
Lags	1	1	1	2	1	1	1

TABLE B: Engle-Granger test for Co-integration				
VARIABLE	Lag 1	Lag 2	Lag 3	Inference*
IMR & MPH	-1.55	-2.09	-	NC
IMR & FW	-1.3	-1.97	-2.09	NC
IMR & MCH	-1.41	-1.59	-2.19	NC
IMR & NUT	-1.3	-1.68	-1.97	NC
IMR & ICDS	-	-2.00	-1.99	NC
U5MR & MPH	-1.37	-1.77	-	NC
U5MR & FW	-1.62	-2.31	-	NC
U5MR & MCH	-2.32	-2.60	-	NC
U5MR & NUT	-2.29	-3.06	-	C
U5MR & ICDS	-	-2.65	-1.39	NC
* NC: not cointegrated				
C : cointegrated				

TABLE C: Granger's test for Causality				
	Lag 1		Lag 2	
Null Hypothesis	F	Probability	F	Probability
U5MR is not caused by NUT	1.88	0.09	1.42	0.28
NUT is not caused by U5MR	0.12	0.73	1.04	0.39

TABLE 5.7: Results of the Unit Root, Co-integration and Causality Tests for Kerala

TABLE A: Dickey-Fuller test for Unit Root							
VARIABLE	IMR	U5MR	MPH	FW	MCH	NUT	ICDS
τ	-2.33	-3.93	-3.27	-2.59	-3.86	-1.22	-0.35
$\emptyset_3$	2.73	-	5.34	6.30	-	1.28	2.86
Inference	I(1)	I(0)	I(1)	I(1)	I(0)	I(1)	I(1)
Lags	1	1	1	2	1	1	1

TABLE B: Engle-Granger test for Co-integration				
VARIABLE	Lag 1	Lag 2	Lag 3	Inference*
IMR & MPH	-1.8	-2.05	-1.38	NC
IMR & FW	-2.12	-	-1.50	NC
IMR & NUT	-0.61	-0.54	0.09	NC
IMR & ICDS	-	0.42	0.92	NC

* NC: not cointegrated

C : cointegrated

TABLE C: Granger's test for Causality				
	lag 1		lag 2	
Null Hypothesis	F	Probability	F	Probability
U5MR is not caused by MCH	1.27	0.28	0.47	0.64
MCH is not caused by U5MR	14.72	0.00	11.84	0.00

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TABLE 5.8: Results of the Unit Root, Co-integration and Causality Tests for Madhya Pradesh

<table>
<tr><th colspan="8">TABLE A: Dickey-Fuller test for Unit Root</th></tr>
<tr><th>VARIABLE</th><th>IMR</th><th>U5MR</th><th>MPH</th><th>FW</th><th>MCH</th><th>NUT</th><th>ICDS</th></tr>
<tr><td>τ</td><td>-2.73</td><td>-2.29</td><td>-4.74</td><td>-2.52</td><td>-2.25</td><td>-3.37</td><td>-1.25</td></tr>
<tr><td>$\varnothing_3$</td><td>3.77</td><td>3.24</td><td>-</td><td>3.49</td><td>2.68</td><td>5.70</td><td>0.84</td></tr>
<tr><td>Inference</td><td>I(1)</td><td>I(1)</td><td>I(0)</td><td>I(1)</td><td>I(1)</td><td>I(1)</td><td>I(1)</td></tr>
<tr><td>Lags</td><td>1</td><td>1</td><td>1</td><td>2</td><td>1</td><td>1</td><td>1</td></tr>
</table>

<table>
<tr><th colspan="5">TABLE B: Engle-Granger test for Co-integration</th></tr>
<tr><th>VARIABLE</th><th>Lag 1</th><th>Lag 2</th><th>Lag 3</th><th>Inference*</th></tr>
<tr><td>IMR & FW</td><td>-2.7</td><td>-2.19</td><td>-1.90</td><td>NC</td></tr>
<tr><td>IMR & MCH</td><td>-2.21</td><td>-1.57</td><td>-1.52</td><td>NC</td></tr>
<tr><td>IMR & NUT</td><td>-2.89</td><td>-1.56</td><td>-1.92</td><td>NC</td></tr>
<tr><td>IMR & ICDS</td><td>-3.03</td><td>-2.21</td><td>-1.95</td><td>C</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>U5MR & FW</td><td>-0.92</td><td>-1.61</td><td>-1.77</td><td>NC</td></tr>
<tr><td>U5MR & MCH</td><td>-0.63</td><td>-</td><td>-0.65</td><td>NC</td></tr>
<tr><td>U5MR & NUT</td><td>-0.92</td><td>-0.77</td><td>-0.81</td><td>NC</td></tr>
<tr><td>U5MR & ICDS</td><td>-</td><td>-2.37</td><td>-</td><td>NC</td></tr>
<tr><td colspan="5">* NC: not cointegrated</td></tr>
<tr><td colspan="5">C : cointegrated</td></tr>
</table>

<table>
<tr><th colspan="5">TABLE C: Granger's test for Causality</th></tr>
<tr><th></th><th colspan="2">Lag 1</th><th colspan="2">Lag 2</th></tr>
<tr><th>Null Hypothesis</th><th>F</th><th>Probability</th><th>F</th><th>Probability</th></tr>
<tr><td>IMR is not caused by ICDS</td><td>0.84</td><td>0.38</td><td>1.08</td><td>0.05</td></tr>
<tr><td>ICDS is not caused by IMR</td><td>1.57</td><td>0.04</td><td>0.45</td><td>0.65</td></tr>
</table>

TABLE 5.9: Results of the Unit Root, Co-integration and Causality Tests fo Maharastra

TABLE A: Dickey-Fuller test for Unit Root							
VARIABLE	IMR	U5MR	MPH	FW	MCH	NUT	ICDS
τ	-5.35	-3.64	-2.89	-1.73	-6.62	-3.29	-7.49
$\varnothing_3$	-	-	4.69	1.70	-	6.50	-
Inference	I(0)	I(0)	I(1)	I(1)	I(0)	I(1)	I(0)
Lags	2	1	1	1	2	2	1

TABLE C: Test for Causality				
	Lag 1		Lag 2	
Null Hypothesis	F	Probability	F	Probability
IMR is not caused by MCH	20.34	0.00	5.59	0.03
MCH is not caused by IMR	3.92	0.07	1.03	0.39
IMR is not caused by ICDS	1.41	0.26	1.77	0.22
ICDS is not caused by IMR	6.08	0.03	14.83	0.00
U5MR is not caused by MCH	7.32	0.02	2.41	0.15
MCH is not caused by U5MR	4.76	0.50	1.39	0.30
U5MR is not caused by ICDS	0.02	0.89	1.53	0.27
ICDS is not caused by U5MR	5.16	0.04	18.33	0.00

TABLE 5.10: Results of the Unit Root, Co-integration and Causality Tests for Orissa

TABLE A: Dickey-Fuller test for Unit Root							
VARIABLE	IMR	U5MR	MPH	FW	MCH	NUT	ICDS
Υ	-2.88	-2.33	-2.51	-3.42	-0.98	-2.48	-14.25
$\emptyset_3$	5.15	2.83	3.27	5.96	1.28	3.38	-
Inference	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(0)
Lags	2	1	1	1	1	1	1

TABLE B: Engle-Granger test for Co-integration				
VARIABLE	Lag 1	Lag 2	Lag 3	Inference*
IMR & MPH	-1.68	-0.95	-1.28	NC
IMR & FW	-1.61	-1.38	-1.13	NC
IMR & MCH	-	-	-0.75	NC
IMR & NUT	-	-0.11	-1.46	NC
U5MR & MPH	-2.22	-1.80	-2.01	NC
U5MR & FW	-2.37	-2.52	-2.27	NC
U5MR & MCH	-2.32	-1.70	-	NC
U5MR & NUT	-2.52	-1.90	-1.57	NC
* NC: not cointegrated				
C : cointegrated				

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TABLE 5.11: Results of the Unit Root, Co-integration and Causality Tests for Punjab

TABLE A: Dickey-Fuller test for Unit Root							
VARIABLE	IMR	U5MR	MPH	FW	MCH	NUT	ICDS
γ	-2.67	-2.54	-3.29	-5.18	-1.61	-3.76	-1.87
$\emptyset_3$	3.62	3.33	5.42	-	2.25	-	2.20
Inference	I(1)	I(1)	I(1)	I(0)	I(1)	I(0)	I(1)
Lags	1	1	1	2	1	1	1

TABLE B: Engle-Granger test for Co-integration				
VARIABLE	Lag 1	Lag 2	Lag 3	Inference*
IMR & MPH	-1.32	-1.42	-1.39	NC
IMR & MCH	-0.82	-1.45	-1.84	NC
IMR & ICDS	-0.84	-1.55	-1.63	NC
U5MR & MPH	-1.86	-1.24	-1.52	NC
U5MR & MCH	-1.42	-0.94	-1.46	NC
U5MR & ICDS	-1.51	-1.08	-1.93	NC
* NC: not cointegrated				
C : cointegrated				

TABLE 5.12: Results of the Unit Root, Co-integration and Causality Tests for Rajasthan

TABLE A: Dickey-Fuller test for Unit Root							
VARIABLE	IMR	U5MR	MPH	FW	MCH	NUT	ICDS
γ	-1.99	-3.32	-2.89	-2.56	-2.64	-2.81	-1.67
ϕ_3	2.18	6.10	4.19	3.29	3.49	4.93	1.58
Inference	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
Lags	1	1	1	1	1	1	1

TABLE B: Engle-Granger test for Co-integration				
VARIABLE	Lag 1	Lag 2	Lag 3	Inference*
IMR & MPH	-1.98	-1.42	-2.52	NC
IMR & FW	-2.42	-2.74	-2.62	NC
IMR & MCH	-2.46	-1.43	-2.44	NC
IMR & NUT	-2.27	-1.69	-3.40	C
IMR & ICDS	-2.09	-1.86	-1.97	NC
U5MR & MPH	-2.23	-1.34	-0.91	NC
U5MR & FW	-2.39	-2.65	-1.67	NC
U5MR & MCH	-4.23	-1.91	-1.11	C
U5MR & NUT	-3.97	-1.88	-1.37	C
U5MR & ICDS	-4.26	-3.26	-1.18	C

* NC: not cointegrated

  C : cointegrated

TABLE C: Granger's test for Causality				
	Lag 1		Lag 2	
Null Hypothesis	F	Probability	F	Probability
IMR is not caused by NUT	4.33	0.06	1.57	0.26
NUT is not caused by IMR	0.13	0.72	0.03	0.97
U5MR is not caused by MCH	11.14	0.01	6.89	0.02
MCH is not caused by U5MR	0.84	0.38	0.72	0.51
U5MR is not caused by NUT	10.80	0.01	5.21	0.03
NUT is not caused by U5MR	0.19	0.67	0.18	0.84
U5MR is not caused by ICDS	0.58	0.46	0.49	0.36
ICDS is not caused by U5MR	6.28	0.03	5.11	0.01

TABLE 5.13: Results of the Unit Root, Co-integration and Causality Tests for Tamil Nadu

TABLE A: Dickey-Fuller test for Unit Root							
VARIABLE	IMR	U5MR	MPH	FW	MCH	NUT	ICDS
τ	-2.45	-6.60	-3.54	-2.26	-6.51	-2.11	-2.45
$\emptyset_3$	3.32	-	6.27	2.55	-	2.24	3.45
Inference	I(1)	I(0)	I(1)	I(1)	I(0)	I(1)	I(1)
Lags	1	1	1	1	2	1	1

TABLE B: Engle-Granger test for Co-integration				
VARIABLE	Lag 1	Lag 2	Lag 3	Inference*
IMR & MPH	-1.38	-0.97	-1.05	NC
IMR & FW	-1.34	-1.89	-1.39	NC
IMR & NUT	-2.65	-1.40	-2.22	NC
IMR & ICDS	0.45	-0.61	-0.16	NC
* NC: not cointegrated				
C : cointegrated				

TABLE C: Granger's test for Causality				
	Lag 1		Lag 2	
Null Hypothesis	F	Probability	F	Probability
U5MR is not caused by MCH	0.14	0.72	0.87	0.45
MCH is not caused by U5MR	4.09	0.01	3.13	0.09

TABLE 5.14: Results of the Unit Root, Co-integration and Causality Tests for Uttar Pradesh

TABLE A: Dickey-Fuller test for Unit Root							
VARIABLE	IMR	U5MR	MPH	FW	MCH	NUT	ICDS
τ	-2.22	-2.25	-2.21	-1.82	-2.79	-2.25	0.09
$\varnothing_3$	2.46	2.57	0.85	1.85	3.93	2.80	1.38
Inference	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
Lags	1	1	2	1	1	1	1

TABLE B: Engle-Granger test for Co-integration				
VARIABLE	Lag 1	Lag 2	Lag 3	Inference*
IMR & MPH	-1.07	-0.96	-1.75	NC
IMR & FW	-1.72	-	-	NC
IMR & MCH	-1.82	-	-	NC
IMR & NUT	-1.6	-1.56	-	NC
IMR & ICDS	-	-0.39	-1.17	NC
U5MR & MPH	-1.24	-0.96	-1.2054	NC
U5MR & FW	-1.55	-	-	NC
U5MR & MCH	-1.74	-	-	NC
U5MR & NUT	-	-	-	NC
U5MR & ICDS	-0.91	-0.69	-1.57	NC

* NC: not cointegrated
C : cointegrated

CRITICAL VALUES FOR THE UNIT ROOT

AND COINTEGRATION TESTS

		Sample Size	Significance Level		
			1%	5%	10%
UNIT ROOT TEST	τ^{*}	25	−4.38	−3.60	−3.24
	ϕ_3	25	10.61	7.24	5.91
COINTEGRATION TEST		50	4.12	3.29	2.90

τ^{*} : includes intercept and time-trend

CHAPTER 6

ESTIMATION OF HEALTH STATUS INDEX FOR CHILDREN

The most widely used method for computing health status index has been the MIMIC model, developed originally by Goldberger (1974). In the literature on health, health is treated as an unobservable variable. It is assumed to be influenced by a number of "causes" and gets reflected in some "indicators", the causes and the indicators being the observable variables. The MIMIC model allows the estimation of the unobservable variable health, based on observable causes and indicators. The purpose of this estimation is to see whether the chosen expenditure and non-expenditure variables, can be used to explain health status index for children and to compare the relative position of each state in terms of the health status of children. The chapter has been divided into 3 sections. In Section 1 the MIMIC model has been specified. In Section 2 a brief review is given of the studies that

have used MIMIC model to estimate health status index. In Section 3 the results of our estimation has been presented.

SECTION 1

Specification of the MIMIC Model

One of the commonly used models for estimating unobservable variables has been the Multiple Indicator - Multiple Cause (MIMIC) model. It was first introduced by Goldberger (1974) and later developed further by Jörskog and Goldberger (1975). In this section the basic structure of the model has been explained.

Let H* be the unobservable health status index for children; $Y_1 \ldots Y_N$ are a set of indicators of child health and $X_1 \ldots X_M$ are a set of controllable causes. Then, the latent variable H* may be expressed as a linear function of a set of observable exogenous causes, subject to a disturbance ϵ, such that

$$h* = \alpha x + \epsilon \qquad (1)$$

At the same time, the latent variable determines, linearly, subject to the disturbance U, a set of observable endogenous indicators, such that

$$y = \beta h^* + U \qquad . \qquad (2)$$

y is the N x 1 vector of deviations of N indicators from their respective means, h* is the health status index for children measured as deviations from its mean; X is a M x 1 vector of deviations of the M observable causes from their respective means; α and β are the vector of parameters and ϵ and U are the vector of random error terms.

Further, it is assumed that,

$$E(XU)' = 0; \quad E(X\epsilon) = 0; \quad E(\epsilon U)' = 0;$$
$$E(UU') = \theta \text{ diagonal.}$$

The reduced form of the model may be written as follows:

$$y = \beta\alpha'x + \beta\epsilon + U$$
$$y = \pi'x + V \qquad (3)$$

where $\pi = \alpha\beta'$; $\quad V = \beta\epsilon + U$

The covariance matrix of V is given by

$$E(VV)' = \Omega = E[(\beta\epsilon + U)(\beta\epsilon + U)']$$
$$= \beta\beta' + E(UU')$$
$$= \beta\beta' + \Theta \qquad (4)$$

adopting the normalization $\sigma\epsilon^2 = E(\epsilon\epsilon) = 1$.

The MIMIC model implies restrictions of two types:

a.   the regression coefficient matrix has rank one and

b.   the residual variance covariance matrix satisfies a factor analysis model with one common factor.

The reduced form coefficients, π_{ij}, measure the marginal impact of a unit change in one of the cause variables on the indicator variable. Maximum Likelihood Estimation procedure is followed to obtain consistent estimates of the reduced form coefficients.

Under normality, the likelihood function for a sample of T joint observations on y and x is given by,

$$L^* = |\Omega|^{-T/2} \exp. \left(-1/2 \sum_{t=1}^{T} [V'(t)\Omega^{-1}V(t)]\right)$$

$$= |\Omega|^{-T/2} \exp. [-1/2\, T\, tr\, (\Omega^{-1}\, W)] \qquad (5)$$

where,

$$\sum_{t=1}^{T} \frac{V'(t)V(t)}{T} = W = (Y-X\pi)' \ (Y-X\pi)$$

W is the sample covariance matrix of reduced form disturbances.

Maximizing L* is the same as minimizing F, where

$$F = \log |\Omega| + tr \ (\Omega^{-1}W) \tag{6}$$

Now $\Omega = \beta\beta' + \Theta$ implies

$$|\Omega| = |(\beta\beta' + \Theta)|$$

$$= |\Theta| \ (1+\beta' \ \Theta^{-1}\beta) \ \text{and}$$

$$\Omega^{-1} = \Theta^{-1} - (1 + \beta'\Theta^{-1} \beta)^{-1} \ \Theta^{-1} \ \beta\beta' \ \Theta^{-1}$$

Further, $\pi = \alpha\beta'$ implies

$$W = (Y'Y-Y'X\alpha\beta')' - \beta\alpha'X'Y + \beta\alpha' \ X' \ X\alpha\beta'$$

Then equation (6) may be written as

$$F = \log |\theta| + \log (1+\beta' \theta^{-1} \beta) + \text{tr} (\theta^{-1} Y'Y)$$
$$- (1+\beta' \theta^{-1}\beta)^{-1} [\beta' \theta^{-1} Y'Y \theta^{-1} \beta]$$
$$+ 2 \alpha'X'Y (\theta)^{-1}\beta - (\alpha'X'X\alpha\beta' \theta^{-1}\beta)] \tag{7}$$

The derivatives w.r.t α are

$$\frac{\delta F}{\delta \alpha} = -(1+\beta'\theta^{-1}\beta)^{-1} (X'Y \theta^{-1} \beta - \beta' \theta^{-1} \beta X'X\alpha) \tag{8}$$

Setting this equal to zero would give

$$\alpha = (\beta' \theta^{-1}\beta)^{-1} P \theta^{-1} \beta \tag{9}$$

where $P = (X'X)^{-1} X'Y$

Considering $\quad S = (Y-XP)' (Y-XP)$

$$Q = PX'XP$$

and $\quad Y'Y = S+Q$

If we put back α in equation (7), it would give us:

$$F = \log |\theta| + \text{tr} (\theta^{-1}S) + \text{tr} (\theta^{-1}Q) + \log (1+f)$$
$$- (1+f)^{-1} g-f^{-1}h \tag{10}$$

where $f = \beta' \theta^{-1}\beta$; $g=\beta' \theta^{-1}S \theta^{-1}\beta$; $h = \beta' \theta^{-1} Q \theta^{-1}\beta$

The derivatives w.r.t. β would be

$$\frac{\delta F}{\delta \beta} = (1+f)^{-1} \theta^{-1}\beta - (1+f)^{-1} 2\theta^{-1} S\theta^{-1}\beta + (1+f)^{-2}g \theta^{-1}\beta$$
$$- f^{-1} \theta^{-1} Q \theta^{-1} \beta + f^{-2} h \theta^{-1}\beta \tag{11}$$

Setting this equal to zero would give

$$(R \theta^{-1} - dI) \beta = 0 \tag{12}$$

where

$$R = \left(\frac{f}{1+f}\right)S + Q, \quad d = \frac{f}{1+f} + \frac{fg}{(1+f)^2} + \frac{h}{f}$$

Substituting the values of α and β in equation (10) would give

$$F = \log |\Theta| + \text{tr}\ (\Theta^{-1}S) + \text{tr}\ (\Theta^{-1}Q) + \log\ (1+f) - d$$

which is decreasing in d.

In order to minimize F, d should be chosen to be as large as possible. The maximum likelihood estimate of β is a characteristic vector corresponding to the largest root d of $R\Theta^{-1}$.

To estimate α and β, the iterative procedure adopted by Rao and Bhat (1991) has been followed in this paper.

Review of Studies on Estimation of Health Status

One of the earlier studies to use the MIMIC model was that of Wolfe and Behrman (1984) who tried to estimate the health status index of Nicaraguan women in the age group 15-45 years, and study their health care utilization pattern. Health care utilization is considered to be a derived demand for a service which helps to produce better health. Health status, $H*$, is determined by a large number of socio-economic factors which have been classified into four major groups:

1. Locational variables

2. household resources including woman's predicted earnings and other household income

3. women's characteristics such as her age, schooling, labour force participation, region of residence, that is urban or rural etc. These factors are believed to influence the efficiency in production of health

4. specific health related factors, such as availability of medical facilities, social security benefits available, expenditure on water and sanitation etc.

As indicators, self-reported information of respondents such as number of days ill, type of illness etc., have been considered. Measures of health care utilization include type of medical attention at birth, any type of medical examination undertaken in the past six months at the time of survey.

Use of such a latent variable approach in a multiple equation framework has given the authors results which differ substantially from those obtained from single equation models, where an indicator of health is expressed as a function of directly observable causes. However, since there is no one perfect indicator of health and covariances between observed health care and health status indicators are probable without controlling the underlying health status, a latent variable representation seems to give more consistent estimates. There have been studies which for example have shown that schooling has a strong, positive impact on health (Austerm Leveson, Sarackek, 1969)[*]. This study goes on to show that

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[*] [reference in Wolfe & Behrman]
1984

though the impact is positive, it has diminishing marginal effects. Also overall household resources are seen to affect women's health care-utilization at childbirth, but at other times, women's health care is associated more positively with women's own income.

A MIMIC model, has been used by Van Vilet and Van Praag (1987) to estimate the health status of a sample of Dutch population aged 18 years and over. Their model is different from the traditional ones because it is based not directly on the causes of health but on the transformations of health indicators. Such transformations have been undertaken mainly to correct for the effects of variables which do influence health indicators but are assumed not to affect health status itself. Also, the model uses less than complete information on some of the cause variables.

To begin with, unobservable health status H*, is expressed both as a function of cause variables, and as a determinant of health care utilization and health status dimensions such as number of days ill etc. (Health care utilisation and health status dimension are the indicators of health in this model).

Incomplete information relates to some of the cause variables such as drinking and smoking habits of individuals, air pollution, living conditions, etc., on which it is often very difficult to obtain information. The authors have classified the cause variables into three categories, depending upon the ease with which information is available on them.

A Health Status Index for Children (Wolfe and Vander Gaag, 1981) was constructed with the aim to examine health care utilization by them. Using a latent variable approach, the authors have developed a structural model containing indicators of health and causes of health. As indicators two sets of variables have been used - need variables (i.e., a child's need for health care e.g., number of days ill, presence of disease etc.) and health care utilisation variables. As causes, a set of predisposing variables have been used, which include variables such as age, sex, mother's employment status, her education level, marital status etc. A 17 equation model was formulated to estimate the health status index for children and their demand for health care services. The advantage of such a model is that since it examines the underlying relationships

in a health care model, it may be used to evaluate the marginal impact of different public programmes on the health of the children.

In India, the MIMIC model has been used in two studies (Rao & Bhat 1991; Dev and Rao 1992) to estimate health status index using aggregate state level data. The first study (Rao and Bhat, 1991) was a cross-section study of 15 states in India where the Health Status Index of people was estimated using a number of cause and indicator variables. The study found that of the five cause variables used, literacy, per capita net domestic product, and per capita expenditure on health had a positive effect on the community health status Index, while population/PHC ratio and population/doctor ratio did not appear to have any significant effect on the determination of the index. The study also found states such as Kerala, Haryana, Punjab, Gujarat and Maharashtra doing better than states such as U.P., Orissa and Bihar.

In the Dev and Rao (1992) study health status index has been computed using both cross-section and time series data. A health status index has been generated for each state for every year and the indices have been made comparable across states. This allows one to

analysis the relative positions of the states with respect to each other. As cause variables, the study has considered several physical health infrastructure variables and investment in health. The results show the health status of each state and the change in their relative position over the years. Again, Kerala, Punjab, Haryana etc., were found to be doing better than other states. Our estimation of health status index for children has been in line with the procedures adopted in this study.

Data Sources and Variables

The analysis in this chapter covers 15 major States in India. Time series data has been collected on both indicators and causes of health. Variables have been chosen to include those which are believed to influence child health in particular. However lack of consistent and continuous data, did not allow us to include many other variables which may be thought of as being important determinants of child health. Here briefly we discuss the variables that have been chosen for the purpose of estimation.

The indicator variables being considered are:

1.　IMR　- Infant Mortality Rate

2.　U5MR - Under Five Mortality Rate.

Since all these are basically indicators of `ill health" they are expected to have a negative association with health status.

The cause variables included are:

1.　FW　　- per capita expenditure on family welfare

2.　ICDS　- per capita expenditure on ICDS programme.

3.　MCH　- per capita expenditure on maternity and child health

4.　MPH　- per capita expenditure on medical and public health

5.　NUT　- per capita expenditure on nutrition

6.　LITF　- percentage of females literate

7.　MAB　- type of medical attention at birth

8.　PHC　- no. of primary health centres per million population

9.　PROPHY - prophylaxis against nutritional anaemia

10.　TETIMZ - tetanus immunization of pregnant mothers.

Gaps in the data have been filled up by appropriate intrapolation. It may be argued that since our previous tests show that expenditure on family welfare, medical and public health, MCH, ICDS etc., (except for nutrition) haven't really had a causal impact on child health status, they should not really be used as cause variables here. In fact as our first set of estimation will show, FW and ICDS in particular do not really show the expected positive relationship with health status index. However in the restricted model FW, MPH and NUT all have the expected signs. These variables have been included because logically they should have an impact on child health and also because they reflect various other factors (like state of public health and hygiene) which may affect child health.

The estimation has been carried out in two sets. In the first set, all the above mentioned cause variables have been included to estimate the health status index. In the second set, four variables were chosen from the above and included as cause variables. These variables are FW, MPH, NUT and FLIT.

The major sources of data have been documents of government and other official agencies. Expenditure data have been computed from the budget documents of Central and State governments as explained in the previous chapter. Data on mortality indicators, availability of health services etc., have been collected mainly from the Sample Registration System and Health Information India.

Results and Implications

The results of the MIMIC model estimation have been presented in Tables 6.1 to 6.4, separately for the two sets of variables. The estimated values of the parameters, α, β and π, have been presented in Tables 6.1 and 6.3. The α's give the relationship between the cause variables and the single health status index; the β's measure the relationship between the health status index and the various health indicators; and the π_{ij}'s measure the marginal impact of the various cause variables on the health indicators. They are basically the coefficients from the OLS regression of the causes on the indicators.

Since all the cause variables chosen are expected to help in improving health status of children, the α's are expected to have a positive sign. The β's on the other hand are expected to have a negative sign since the indicators chosen are negative indicators of health e.g., IMR and U5MR. An increase in the health status of children should lead to a decline in them. The π_{ij}'s should also have a negative sign, thus showing that the causes and the indicators are negatively related.

As the results of the first set of estimation, (where all the cause variables have been included) show, the β's have the expected negative sign but all the α's do not have the positive sign. Expenditure on family welfare, ICDS, number of PHCs and Prophylaxis against nutritional anaemia of pregnant women, in fact have a negative sign, thus implying that an increase in these is likely to lead to a deterioration in the health status of children. This is unlikely to be the case. Programmes meant for improving child health may not have a significant effect, but to say that they have a negative effect would require further investigation.

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A reason for the unexpected signs could be the existence of multicollinearity between the cause variables. If there is inter-correlation between the cause variables, then the signs of some of the variables are likely to get disturbed. This may lead one to make wrong interpretations.

Hence, even though the overall fit of the model was reasonably good, with $R^2 = .76$, it was decided to rerun the model, with a limited set of variables, in order to overcome the above problem. Four variables were finally chosen after estimating certain alternative models. These variables which include FW, MPH, NUT and FLIT, are expected to well represent all the remaining variables.

Though the overall fit of the restricted model is marginally less than the original model (with $R^2 = .75$) all the α's, β's and π's now have the expected signs. Since the overall fit is reasonably good, it implies that the variables chosen are fairly good representatives of all other variables. Family welfare for example would incorporate various child health and maternal health care programmes, such as MCH, prophylaxis against nutritional anaemia, tetanus immunization of mothers etc. Aggregate nutrition would

give a fair account of ICDS while MPH would reflect availability of public health services etc. Female literacy has been included since this has been well recognised as a highly significant factor influencing child health.

Given the α's (restricted model), the health status index for children (HSIC), may be estimated in the following manner.

HSIC = .0672 FW + .0260 MPH + .0706 NUT
      + .0212 FLIT

This implies that a 1 per cent increase in say per capita expenditure on nutrition would lead to an improvement in health status of children by .0706 per cent. However, the numerical value of the α's does not say anything about the marginal impact of each variable. Just because in the estimated equation, nutrition has a coefficient with a higher value, $\overset{\text{it}}{\underset{\wedge}{}}$ does not mean that it has a greater impact on child health status. The marginal impact would depend upon the per unit cost of providing each service. If for example,

$Z_i = \underset{\wedge}{\overset{\text{additional}}{}}$ expenditure due to a marginal increase in one of the cause variables, then

$\tau_i = \alpha_i / Z_i$ = contribution of the cause variable to health status of a unit increase in expenditure on the cause variable.

The τ's would be comparable across variables and could be ranked to see the relative contribution of each cause variable to health status.

From the policy point of view this would be extremely helpful, as the planner would be able to allocate resources efficiently, given the limited resources available. However detailed information on the per unit cost of providing the services under each programme are not easily available, because of which such as exercise could not be attempted here.

Using the results of the MIMIC model, a health status index for children (HSIC) has been generated for each state and for the all-India level. The indices are comparable across states. They have been standardized by assigning a value of 100 to the lowest level of health status (which was recorded by UP in 1976). All the indices have been represented in relation to this base value and hence are comparable over time and across states.

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As Table 6.4 (and 6.2 for the unrestricted model) shows, there has been an improvement in the health status of children at the all-India level and in all the States over time, though there have been considerable fluctuations. In 1974, UP, Rajasthan, MP, Orissa and AP were amongst the states with the lowest health status index for children. By 1989, Rajasthan managed to attain a higher health status index for children compared to UP, Orissa and MP. This in fact substantiates our results of the causality tests whereof all the above five mentioned states, only in Rajasthan and Andhra Pradesh, some causation could be found to exist between expenditure and infant/child mortality. Public expenditure in these two states have had a positive effect on improving health status. UP, Orissa and Madhya Pradesh continue to be amongst the states with the lowest health status index for children with there being no equilibrium relationship between expenditure and health.

Kerala has the highest health status index for children. It started off with an index of 199 in 1974, which is greater than the HSIC attained by most states even in 1989. Also, the HSIC has improved at a faster rate in some states compared to others. For

example, Gujarat and Karnataka started off at more or less the same level in 1974, but Gujarat outstripped Karnataka by 1989. Maharashtra had a higher HSIC in 1974 compared Punjab and Tamil Nadu, but the latter managed to attain a higher health status by 1989. Haryana, which started off at a fairly low level in 1974 also managed to attain a high HSIC by 1989; an HSIC higher than the national average of 161. In Haryana both IMR and U5MR were found to be cointegrated with MPH and ICDS.

Though our causality tests show that in Kerala and Punjab, (two of the better-off states in terms of health status of children) no relationship could be established between expenditure and health, the fact that they have done better than most other states suggests that there may be other non-expenditure items, which have played a more significant role. However the percentage improvement in the health status index has been less in case of Kerala (27%) as compared to Rajasthan and Haryana (47% and 42%). This suggests that where public expenditures have played a positive role in explaining child health status, the HSIC has improved at a faster rate.

Table 6.1

Results of MIMIC Model
(Unrestricted)

	α_i	β_i	π_{i1}	π_{i2}
1.	-0.0404	-16.1500	0.6533	0.3023
2.	-0.0311	-7.4738	0.5022	0.2324
3.	1.4604		-23.5848	-10.9145
4.	0.0580		-0.9366	-0.4334
5.	0.0226		-0.3652	-0.1690
6.	0.0705		-1.1387	-0.5270
7.	0.0190		-0.3066	-0.1419
8.	-0.0013		0.0207	0.0096
9.	-0.0029		0.0473	0.0219
10.	0.0041		-0.0668	-0.0309

R^2 = .7636

Regression Equations $y = \beta h^* + \epsilon_i$

$h^* = \alpha X + U_i$

TABLE 6.2

HEALTH STATUS INDEX FOR CHILDREN

(Unrestricted Model)

Year	AP	GUJ	HAR	KAR	KER	MP	MAH	ORS	PUN	RAJ	TN	UP	INDIA
1974	121	134	124	126	190	105	157	110	155	102	140	100	127
1975	123	135	126	128	193	103	154	113	163	100	139	103	128
1976	131	144	126	137	205	107	157	116	156	107	152	102	136
1977	124	147	133	140	209	111	162	119	163	112	155	105	137
1978	131	147	141 ·	145	219	113	169	123	165	112	163	112 ·	141
1979	136	139	144	149	221	114	170	126	178	113	161	116	148
1980	139	155	133	147	223	119	167	128	183	115	164	119	149
1981	138	160	155	157	231	121	176	129	184	117	166	125	152
1982	142	165	157	159	228	148	181	129	166	116	175	126	152
1983	151	166	161	160	235	126	172	122	170	102	166	122	140
1984	152	169	169	167	238	123	186	132	204	119	180	122	155
1985	154	178	172	168	244	128	186	134	200	132	175	123	159
1986	149	178	177	172	244	131	186	138	210	128	181	130	161
1987	156	182	186	176	245	130	194	140	210	126	199	133	165
1988	155	184	180	172	249	134	188	139	195	127	196	139	162
1989	163	187	186	172	265	135	197	140	201	148	197	136	170

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Table 6.3

Results of the MIMIC Model
(Restricted)

	α_i	β_i	π_{i1}	π_{i2}
1.	0.0672	-16.1675	-1.0868	-0.5018
2.	0.0260	-7.4646	-0.4206	-0.1942
3.	0.0706		-1.1415	-0.5270
4.	0.0212		-0.3424	-0.1581

R^2 = .7509

Regression Equations
$$y = \beta h^* + \epsilon_i$$
$$h^* = \alpha X + V_i$$

TABLE 6.4

HEALTH STATUS INDEX FOR CHILDREN

- -

(Restricted Model)

Year	AP	GUJ	HAR	KAR	KER	MP	MAH	ORS	PUN	RAJ	TN	UP	INDIA
1974	116	137	124	132	199	105	157	112	149	104	147	102	130
1975	119	138	127	136	200	104	154	116	159	104	150	103	132
1976	133	142	125	137	210	106	158	114	154	102	154	100	137
1977	124	144	130	137	213	107	159	116	159	105	156	102	135
1978	128	148	137	140	217	110	168	121	161	109	159	104 ·	138
1979	131	149	138	141	219	112	169	125	175	111	159	110	143
1980	133	147	128	140	223	113	162	125	180	110	160	114	142
1981	133	158	154	146	227	117	166	126	182	110	165	119	146
1982	137	163	155	154	225	148	169	127	161	113	177	119	147
1983	150	167	160	155	234	123	165	122	167	103	170	123	148
1984	150	170	171	162	237	121	175	131	202	115	183	118	152
1985	145	179	168	164	242	124	180	132	204	132	182	119	155
1986	147	178	168	168	244	128	178	134	215	122	183	121	156
1987	150	180	173	163	245	127	180	137	213	124	187	125	158
1988	151	182	177	163	247	132	179	137	195	126	189	128	160
1989	152	184	176	165	254	132	177	140	206	153	193	131	161

CHAPTER 7

CONCLUSIONS

In conclusion, we briefly recapitulate the objective and the major findings of the present study. The study basically aimed to test for the possible existence of a causal link between public expenditure on health, (specially on health programmes aimed at children) and the health status of children. Recognizing children to be an invaluable resource in the development process of an economy, the government has been undertaking child health and welfare programmes ever since the beginning of the Planning Process. Expenditure has been incurred on a wide range of health, nutrition and other related programmes for children, with the belief that increased expenditure would help to improve the prevailing health status of children.

However, inspite of the long history of programmes, it is being recognised that the health status of children continues to remain poor. Though

there have been declines in the mortality rates of infants and children, and the nutritional status of children has improved (implying better health), the maximum number of total deaths are still concentrated in the 0-4 age group and major childhood diseases continue to plague children. IMR and U5MR are high compared to some other developing countries (Chapter 3) and there are wide variations in them across states. Some states like Kerala, Karnataka, Tamil Nadu, Gujarat etc., have managed to reduce their IMR and U5MR while others like U.P., Orissa, M.P. and Rajasthan still have high mortality rates. Also, rural children continue to be at a disadvantage compared to the urban children and female children face greater risks of illness and mortality than the male children. These differences in the health status of different categories of children, should have been taken care of, with the help of these programmes. Being external to the system, their effect can be expected to be the same for all children.

All these problems have led one to question the supposed causal link between public expenditure on health and health status. Is it indeed true that increased expenditure would lead to better health status? Analyzing the expenditure patterns, one realizes that, though over the years, per capita

expenditure on child health programmes has increased, there have been wide variation over time and across states. It becomes difficult to ascertain any obvious link between expenditure on health and health status, though some of the better off states do have a higher per capita expenditure.

In this study the concept of Granger Causality has been used to examine the possibility of a causal link between expenditure on health and health status. Though Granger Causality has been commonly applied in studies of macro-variables such as money, prices and GNP, it's use in the area of health has been limited. The basic idea behind Granger Causality is that if a variable X causes another variable Y, then prediction of Y based on past values of X would be better than predictions of Y without using the past values of X.

Since the test basically examines the link between a supposed "input", "cause" or "determinant" of health and the "output" of health, the study begins by discussing some of the indicators of health and some of the "causes" or inputs of health. Chapters 1 and 2, have been devoted to discussing these issues. As Chapter 1 shows, the most commonly used measures of

child health are the age-specific mortality indicators.
Inspite of the fact that these indicators do not
reflect various aspects of child health, it is easier
to collect information on them at the macro level and
hence they are used as measures of child health in most
empirical studies. In addition other indicators, such
as birthweight, nutritional status of children, type of
medical care availed by them are also important
indicators of child health status.

As far as "causes" or "determinants" of child
health are concerned, they can be broadly classified
into two groups - socio-economic determinants and
policy interventions. Of the socio-economic
determinants, characteristics related to the mother
have been found to be of crucial importance in
determining child health (for example, her level of
education, her employment status, her autonomy in the
decision making process within the family etc.). Even
if other favourable socio-economic determinants are
present, the ultimate impact is that of the mother, in
taking care of the health of her child. As far as the
policy interventions are concerned, it is assumed that
they do have a positive impact on improving health
status of children in particular and also the general

population. However as Chapter 2 reveals, not always
have researchers been able to demonstrate the positive
link between expenditure on health and health status.

In Chapter 3, an indepth analysis is done of
the trends and patterns in child health indicators and
expenditures on child health programmes, with a view to
understand the various dimensions of the child health
problem in India. The tests of Causality have been
carried out in two stages in this study. First, the
series chosen have been tested for Cointegration.
Cointegration examines the possibility of a long-term
relationship existing between two variables. It says
nothing about causality but assumes that if two series
are co-integrated, then there must be an underlying
causal relationship between the two. Hence, after
finding two series to be co-integrated, the Granger
Causality Test is applied to test for the direction of
causality.

Unfortunately, due to unavailability of data
on specific child health programmes, only MCH, ICDS and
Nutrition expenditure could be considered for the
study. In addition, aggregate expenditure on MPH and FW

were also considered since both these may directly or indirectly affect child health (Chapter 4). The major findings of the tests may be summarized as follows:

1. Of all the five expenditure heads considered, (i.e., MPH, FW, MCH, NUT, ICDS), nutrition expenditure was found to be the only expenditure which affected child health in many of the states.

2. Though in the individual states, the direction of causality was found to be from expenditure on nutrition to child mortality, at the all-India level, the reverse causal relationship was found to exist.

3. The reverse causality, that is from infant and child mortality to expenditure, was found to exist in case of expenditure on ICDS also. This probably implies that, the "needs" of the children in particular states has guided the allocation of resources to health and nutrition programmes, but once these expenditures are undertaken, they may or may not have the desired effect on child health.

4.   In some of the richer and better-off states
like Punjab and Kerala, no causal relationship could be
established between expenditures and the mortality
indicators (though in Kerala U5MR was found to "cause"
MCH expenditure).   This is probably because in these
states, socio-economic factors may have played a
greater role in improving child health status. Also, in
these states, private sources may have been more
important in providing the health services. Since they
form a substantial part of the total health
expenditure, excluding them from the estimation may
have been responsible for the finding of no causal
relationship between expenditure and health.

5.   At the same time in the relatively worse off
states of U.P. and Orissa, no causal relationship could
be found to exist between expenditure and health. Thus
at the two extremes, in two of the better-off states and
two of the worse-off states, no causal relationship
could be found between expenditure and health.   As
pointed out by Berman   (1991),   health being a state
subject, the poorer states with limited resources may
not be able to allocate resources optimally to obtain
the desired results. At the same time, it could be that
programmes that are   probably being undertaken are not

being implemented efficiently, as a result of which services are not reaching the target groups they are intended for.

6. Surprisingly, in Rajasthan which is in general comparable to U.P., Orissa and M.P., expenditure on nutrition and MCH, both seem to have had a causal effect on health status of children.

What our tests of causality in general reveal is that the effectiveness of a programme depends upon factors that are specific to states. A programme directed at children, cannot be always assumed to have a favourable impact on child health status. This has important policy implications. Before undertaking a programme on health or nutrition, the government must analyze the factors under which the programme has been successful in some state. The absence of causality acts as a pointer to further investigation of the prevailing conditions that may have inhibited the effectiveness of a programme. If a programme does not indeed have any causal effect on child health, then there is no justification for devoting resources to that particular programme.

Also, no programme can be expected to be effective in isolation (Chapter 2). Childhood diseases occur simultaneously. Hence there should be a proper balance between the various programmes so that effectiveness of one does not get nullified due to the absence of some other programme meant to tackle other diseases that are occurring simultaneously.

The estimation of the child health status index gives a further insight into the "cause" and "indicators" of child health. In the restricted model, four cause variables - expenditure on family welfare, medical and public health and nutrition and female literacy - have been considered. Even though, FW and MPH were not found to have a causal effect on child health in most of the cases, they were included here as proxies of many other variables which could not be included. The estimation of the MIMIC model shows that all the four variables have a positive effect on health status of children, though the relative significance of the individual variables could not really be ascertained in the absence of the 't' ratios. However, the overall fit of the model is good with $R^2=.75$.

An analysis of the health status indices across states shows that inspite of there being widespread variations across states, the states where a causal link would be found to exist between expenditure and health, health status index of children improved at a faster rate. This has been the case with Rajasthan and Haryana. Though Rajasthan started off in 1974 at a level similar to that of U.P. and Orissa, by 1989 it had managed to attain a higher health status index relative to the other two states. In Kerala also, the percentage improvement in health status index (27%)d has been less than what it has been in Rajasthan (47%) and Haryana (42%) though Kerala has the highest health status index for children.

APPENDIX 1

REVIEW OF GOVERNMENT POLICIES AND PROGRAMMES
FOR THE WELFARE OF CHILDREN

The need to improve the health status of the
children in an economy, has led countries to formulate
various programmes and policies for the protection,
development and welfare of their children. The Indian
Constitution too contains several provisions for
improving the health of people in general and children
in particular. As early as in 1946, the Bhore Committee
Report recommended the development of a health
infrastructure in the country. The report emphasized
the need to provide adequate medical services to all,
irrespective of their ability to pay for it (Berman,
Peter, 1991). Since independence, planning efforts have
focused on improving the standard of living of the
people so that they may attain a better quality of
life. However, this concern for the human resource
development remained more implicit than explicit for
long (NIPCCD, 1993).

Even though India was one of the first
countries to incorporate the basic needs approach in
the development plans, it was only in the Fifth Five
Year Plan (1974-79) that goals were laid down for the
first time for directly meeting these needs of the
people, especially the poor. The basic needs included
elementary education, health care and the like.

The first few Plans lay greater emphasis on
building the health infrastructure in the country,
often in line with the recommendations of the Bhore
Committee. For instance, some of the priorities laid
down in the First Plan (Planning Commission, 1952)
were:

- provision of water supply& sanitation

- providing preventive health care through
health centres and mobile units

- provision of health services for mothers and
children

- self-sufficiency in drugs and equipment etc.

The Second Plan confined itself to the operational aspects of the health programme. The objectives of this Plan were (Planning Commission, 1956).

-   establishment of institutional facilities to serve as basis from which services can be rendered to people;

-   development of technical manpower through appropriate training programmes

-   initiation of measures of control for communicable diseases and the like.

The Third and the Fourth Five Year Plans only highlighted the shortfalls in the implementation of the programmes initiated during the first two Plans and the deficiencies of these programmes. These two Plans laid particular emphasis on the need to construct Primary Health Centres for effective provision of health care services.

From the Fifth Plan onwards there was a reformulation of the health policy. The National Minimum Needs Programme (MNP) was introduced with the

aim to ensure a minimum uniform availability of public health facilities, safe drinking water and carrying out environmental improvement of slums.

The Sixth Plan continued (1980-85) to emphasize the need to remove poverty, and improve the quality of life through the Minimum Needs Program. The Seventh Plan too (1985-90) recognized the need to improve the standard of living through the satisfaction of basic needs comprising food, clothing, shelter, health and education. Health education and welfare programs in particular received special attention as means of achieving rapid human resource development. The Seventh Plan, in fact, envisaged a long term development strategy for the period 1985-2000. The Eighth Plan recognised "human development" as the core of all developmental efforts (NIPCCD, 1993). A healthy population can contribute better to development, which in turn can further enhance human welfare. The priority sectors recognized as the major contributors to human development were health, education, and basic needs such as safe drinking water, sanitation and other welfare programmes etc.

All the above programmes on human development, recognised the need for a special focus on child welfare. As mentioned earlier, investment in child development may be considered as an investment in the country's future. And since children constitute a vulnerable group, the programmes to take care of their problems need to be specially designed. The first four Five Year Plans perceived child development mainly in the frame of child welfare (NIPCCD 1993). The Central Social Welfare Board established in 1953, has been engaged in promoting child welfare services along with other voluntary organizations. From the Fifth Plan onwards, the emphasis shifted from child welfare to child development, which required meeting some of the basic needs of children. In 1974, the National Policy for Children was formulated. The need to integrate services such as nutrition, health care, immunization, pre-school education, safe drinking water etc. for children was felt. This led to the formulation of various new health care and nutrition programmes for children and integration of some of the existing programmes with the new ones.

The Eighth Plan continues to emphasize human development as the means for attaining overall development. It aims at giving priority to preventive

services, mainly of community based nature, that would help to combat effectively infant and childhood mortality.

The following pages outline a brief review of some of the important programmes for children, specially in the area of nutrition and health that have been launched in the country over the years.

1. MATERNAL AND CHILD HEALTH SERVICES

Improvement of maternal and child health has been given the highest priority in our Health Policy, with a special focus on the less privileged sections of society (Ministry of Health 1993-94). The specific programmes that are being currently implemented under the MCH scheme include:

- the Universal Immunization Programme (UIP)

- the Oral Retrydration Therapy (ORT)

- Prophylaxis Schemes against nutritional anaemia among pregnant women and against blindness due to vitamin A deficiency among children of 3 years of age.

MCH has been a part of the overall strategy of reducing infant mortality and child mortality to 60 per thousand live births and 10,000 respectively by 2000AD, as per the Alma Ata Declaration.

a.   Universal Immunization Programme

It is believed that neo-natal tetanus, pertussis, measles, diptheria, poliomyelitis and tuberculosis kill about 5 million children every year and cause mental damage and other physical disabilities like blindness, deformation etc., in 5 million more

(Nicolen Guerin,1986) Pertussis (whooping caugh) and measles further precipitate malnutrition which in turn has a negative impact on the health status of children.   Neo-natal tetanus, pertussis, polio and measles may however be prevented with proper immunization of the children within a certain given period of time.   In fact it has been recognized that Nutrition and other Programmes would have a marginal effect on improving the nutritional and health status of children, unless they are simultaneously accompanied by programmes to combat the spread of infectious

diseases. A nutrition program without a simultaneous infection control program is unlikely to be very effective (Bagchi, K. 197).

Initially, immunization in India was a part of Maternal and Child Health Services (MCH). But in 1978 when the Expanded Program on Immunization (EPI) was initiated, it was given the status of an exclusive programme. The main objective was to reduce and prevent morbidity and mortality caused by the six vaccine preventable diseases through immunization. The six vaccine preventable diseases are - neo-natal tetanus, pertussis, diptheria, poliomyelitis, measles, and tuberculosis. Tetanus-toxoid immunization for pregnant mothers was started in 1975-76, which was later integrated with EPI in 1978. Earlier, immunization for the different diseases existed as separate programmes but were all slowly integrated with EPI. For example, immunization against polio was included in EPI in 1979-80, tetanus-toxoid for school children in 1980-81, BCG in 1981-82 and measles immunization in 1985-86 (Gupta and Murali 1989).

The Universal Immunization Program (UIP) was launched in 1985, with the aim to further expand the immunization coverage. It aimed to reach a target of

at least 85% immunization of infants and 100% immunization of expecting mothers by 1990 (NIPCCD, 1993). Under UIP, all pregnant women are to be immunized with tetanus toxoid in order to prevent neo-natal tetanus mortality. Further, within the first year of their lives, infants are to be immunized with BCG (prevent in tuberculosis), DPT, Oral Polio Vaccine and Measles Vaccine. The measles vaccine was introduced in the programme in 1985-86.

Evaluation of the immunization program in terms of incidence of disease does show that there has been significant improvements in the number of cases reported with such diseases (NIHFW 1990). However, there have been some strong criticisms against the immunization programmes. They have been mainly based on the notion that there is no epidemiological evidence to support the contention that the control of the six vaccine preventable diseases would have any significant impact on infant mortality rate, IMR (Gupta & Murali, 1989). These six diseases form a very small proportion of the total number of death causing diseases in children below 5 years of age. According to the Registrar General of India, prematurity, respiratory diseases and diarshoea are responsible for 60-90% of deaths in children below five and none of these

diseases are vaccine preventable . Vaccine
preventable diseases are responsible only for 10-12% of
total deaths among under fives. It is often believed
that the immunization programmis being carried out at
the expense of various other primary health care
services, which probably would have a far greater
impact on mortality and morbidity prevalence amongst
children.

UIP has been dubbed by some as a "selective
primary health care intervention" (Kulkarni, M.N. 1992)
and "an unholy alliance of national and international
power brokers who could impose their will on hundreds
of millions of human beings living in the poor
countries of the world..." (D. Banerjee 1990). However
it may be argued that through UIP, a large number of
infant and childhood deaths can be prevented and this
is bound to have a positive impact in lowering
fertility rate and thus reducing birth rates (Kulkarni
1992). Why the impact has not been felt as yet, it is
argued, is because of the relative neglect of the
Maternal and Child Health Program, of which UIP is a
part, vis-a-vis compared to the family planning
programme.

b.   Oral Rehydration Therapy

The ORT programme aims at controlling deaths due to dehydration caused by diarrhoea. About a million children are estimated to die of dehydration every year, which can be effectively controlled through ORT (Ministry of Health, 1993) Diarrhoeal diseases have always been a major cause of death, specially in children under five. ORT was launched in 1987 as a 100% centrally sponsored scheme.

c.   Prophylaxis Schemes

Anaemia is one of the important causes of death in infants and mothers. Under the Prophylaxis scheme pregnant and nursing mothers and children below five are given a daily dose of iron and folic acid for a period of 100 days. Similarly to combat Vit. A deficiency, which is a major cause of malnutrition and blindness among children, Vit. A tablets are given to children in this age group.

2. NUTRITION PROGRAMMES

The nutritional status of children is an important indicator of the quality of life of the population. It is closely linked to the health status of the individuals, the level of infection and disease in the environment and the like. It is believed that more than half of the 126 million children in India are malnourished (Radhakrishna & Narayana, 1993) and about 40% of pre-schoolers require supplementary feeding in order to overcome malnutrition. Children appear to be suffering the most from protein-energy malnutrition (PEM), micro-nutrient deficiency (i.e. deficiency of iron, Vit. A etc.) and goitre.

In general, the government has been following two broad approaches for fulfilling the nutritional gaps of the population (Subbarao 1989). The first approach has been to undertake direct feeding programmes, specially for children and women. The second approach has been to indirectly reach the target groups through provision of food securing via Public Distribution System. This helps to improve the household access to food by supplying a portion of the foodgrains to the household at a price lower than the market price.

The direct feeding programmes, dominated public policy in the 1950s and 1960s, when various supplementary feeding programmes were introduced. In fact, by the end of the Fifth Five Year Plan (1974-79), all the currently existing direct Nutrition Programmes had been initiated. Since then, whatever further development has taken place regarding Nutrition Programme has been extension and integration of existing programmes. Since mid 1970s, the Public Distribution System has dominated public policy. The long term strategy, at present, is to combat malnutrition by raising people's level of income through employment generation, improve access to food supply through Public Distribution System, provide safe drinking water, immunization, provide health care facilities and the like. The short term strategy is to provide special attention to children and mothers, specially through the Nutrition Intervention Programmes. Here we concentrate on reviewing some of these direct Nutrition Intervention Programmes initiated by the Government.

The major programmes currently existing include:

1. the Mid-day Meal Programme(MDM)
2. the Special Nutrition Programme(SNP)

3. integrated Child Development Services (ICDS).

The first two Five Year Plans did not see the initiation of any major nutrition intervention programme In 1959, the Applied Nutrition Programme(ANP) was started in Andhra Pradesh and Orissa. This programme deals mainly with nutritional education. It was extended to other states in 1973. It was undertaken mainly for pre-school children and pregnant women (Radhakrishna & Narayana, 1993: Subbarao, 1989). This was followed by school lunch programmes which aimed at improving the school attendance along with nutritional status of the children.

The Mid-day Meal Programme (MDM) was started in 1962-63 by some states to provide supplementary food to primary school children, in the age group of 6-11 years. The aim was to improve health and nutritional status of these children by providing them with 300 calories and 8-12 gms. of protein for 200 days in a year. The food material for MDM is often provided free of cost by CARE and the State mainly bears the overhead expenses of transportation, storage etc. (Radhakrishna & Narayana 1993).

Currently, MDM is being implemented in a major way only in a few states like Tamil Nadu, Gujarat and Haryana. Here too, one finds wide inter-state variation in the implementation of the programme. In some states the programme is restricted to covering children only from SC, ST and other socially backward classes. In Andhra Pradesh, the program was resumed in 1984 but has been discontinued since April 1993 (NIPCCD 1993).

The MDM programme too has not been properly evaluated. Only recently evaluation has been undertaken by NNMB for six states implementing MDM, though the findings are not currently available for all of them. The findings for Andhra Pradesh show (Radhakrishna & Narayana 1993) that as far as children's enrolment in schools is concerned, there has been no difference due to MDM. School enrolment remained more or less the same in both MDM and non-MDM villages of Andhra Pradesh. However, in terms of regular attendance and dropout rates, there was definitely an improvement in the MDM villages. Also growth of children, in terms of weight and height for age, was also better in the MDM villages. However, further in-depth evaluation of MDM is required before generalization can be made about the efficacy of the program.

The first three Five Year Plans did not pay much attention to children below the age of 6 years. In the fourth Five Year Plan, priority was given to direct intervention program that benefit infants and pre-school children also. Accordingly, the Supplementary Nutrition Programme (SNP) was launched in 1970-71 for children in the age group of 0-3 years. The following year it was extended to children in the age group of 3-6 years and also to pregnant and lactating mothers.

The SNP has been accepted as the most important supplementary feeding program in most of the states. The program provides 300 calories with 10-12 gms of protein to children and 500 calories with 12-15 gms of protein to women for 300 days in a year. The major aim of the program was to tackle the problem of protein-energy malnutrition, a major cause of nutritional deficiency among children. Priority is given to the vulnerable groups in tribal areas, drought-prone areas and urban slums (Radhakrishna and Narayana. 1993). In states where the ICDS program has been launched, SNP has been integrated with the health and education components of the ICDS. The nutrition component of the ICDS program, which otherwise is a Central govt. program, is funded from the state and

Union Territory budgets. In states not covered by ICDS, SNP has been retained as a separate supplementary feeding programme.

Evaluation of SNP programme carried out in some states has brought out the sad fact that the programme has not been efficiently implemented. Often children were not selected on basis of nutritional deficiencies; the 0-3 years target age could not often be reached due to problems of bringing them to the feeding centres; and worse often food was found to be shared by non-beneficiary members of the family. Moreover the programme appears to be incurring high overhead costs.

The most important nation-wide nutrition-cum-health programme currently in existence is the Integrated Child Development Services Program (ICDS). This programme also aims at improving the health status of pre-school children and their mothers. An integrated package of services is provided under this programme including supplementary nutrition, prophylaxis against anaemia and vitamin A deficiency and nutrition and health education.

During the Fifth Five Year Plan (1974-79), the Committee on Pre-school feeding programmes suggested the integration of supplementary feeding alongwith health care and other related services such as immunization, nutrition and health of the mothers, family planning, provision of safe drinking water etc. This resulted in the formulation of the ICDS programme in 1975 as a composite package aimed at improving both pre-natal and post-natal environment of the child. This is a centrally sponsored scheme, administered by the State. The responsibility of funding ICDS is also shared between the Central and the State governments. The health and education components of the programme are totally centrally sponsored while the nutrition component is funded by the states under the SNP and MDM budgets (Radhakrishna & Narayana, 1993; Subbarao, K. 1989; NIPCCD 1993).

The major objectives of the programme, may be specifically listed as follows:

i) to improve the nutritional status of children in 0-6 years age group via supplementary feeding;

ii) to encourage school enrolment through pre-school educational programme for 3-6 years old;

iii) to improve the mother's knowledge about nutritional requirements and health care of her children through proper education; and

iv) to provide health care facilities and immunization so that morbidity and mortality rates could be brought down over the years (K. Subbarao, 1989).

The ICDS is organized through a chain of projects at the community level in both rural and urban areas. The services are delivered through an "Anganwadi", which is a community centre where children and their mothers assemble to receive the ICDS services. A package of six services are delivered which include (Subbarao K, 1989) -

- health check-up
- immunization
- referral services
- supplementary nutrition
- non-formal education

- nutrition and health education to mothers.

The number of ICDS projects increased from 33 in 1975 to 2594 in 1991. It was estimated that in 1992-93, 15.3 million children and 3.1 million expectant and nursing mothers were receiving supplementary nutrition under the ICDS. Supplementary Nutrition consists of 300 calories and 8-10 gms. of protein for children and 600 calories and 20 gms. of protein for severally malnourished children and 500 calories and and 20-25 gms. of protein for pregnant and lactating mothers. Immunization against diptheria, polio, tetanus for children, tetanus-toxoid for mothers and other diseases, is covered under the health services of the ICDS. Oral Rehydration Therapy (ORT) to combat attacks of diarrhoea is also provided in the Anganwadis under the ICDS scheme.

A large number of studies, trying to evaluate the ICDS programme have brought out its positive features. For example, there has been an increase in the provision of health and nutrition services specially to the vulnerable groups. This is believed to have had a positive impact on child health, morbidity and mortality. Enrolment of children in primary schools has increased and the programme has reached many of the

beneficiaries from backward classes and tribal areas (though the coverage needs to be further increased) (Radhakrishna & Narayana, 1993).

However, certain shortcomings of the programme remain which need to be removed. There is a lack of participation at the community level and also programme appears to favour older children (Subbarao K, 1989; Radhakrishna & Narayana 1993). The coverage of expectant mothers also needs to be improved. The nutritional needs of severely malnourished children and those below 3 years of age continues to be somewhat neglected. Given the immense potential of the ICDS programme in helping to improve the health, nutritional status and general quality of life of some of the most vulnerable groups in the population, there is an immediate need to look into the proper implementation of the programme.

In the recent years no new nutritional programmes have been introduced, though there has been an emphasis on increasing the number of services under the ICDS program itself. This has been mentioned in the recent Annual Plans (1990-92). Special attention is going to be paid to infants and children below three. Nutrition Rehabilitation Centres (NRCs), vocational

training centres for women, Early Childhood Education Centres etc. have all been merged with the ICDS programme, which has further increased its scope and coverage. To enhance the impact of ICDS on malnutrition and IMR, it has been proposed in the recent Plans to provide safe drinking water, environmental sanitation and other facilities affecting health in general and that of children in particular, in the ICDS areas.

In addition to the three major programmes - the MDM, SNP and ICDS - there are several other programmes being conducted across the country, some by the State Governments and others by voluntary oraganizations. Some of these include -

-    Balwadi Nutrition Programme

-    Wheat-based Supplementary Nutrition Programme

-    Tamil Nadu Integrated Nutrition Programme

The Balwadi Nutrition Programme(BNP) was initiated in 1970-71, through five national level voluntary organizations (NIPCCD, 1993). The programme receives Central assistance for providing supplementary feeding to children, which consists of 300 calories and 10 gms. of protein per child per day for 270 days every year.

The <u>Wheat-based supplementary Nutrition</u>
<u>Programme(WNP)</u> was started in 1986. The programmreceives
Central grant for providing free wheat to children and
pregnant mothers who are the beneficiaries of this
program (NIPCCD, 1993). The nutrition norms followed by
the program are those of the SNP and ICDS.

The <u>Tamil Nadu Integrated Nutrition Programme</u>
<u>(TNINP)</u> was started in ten districts in Tamil Nadu in
1981.It is a World Bank assisted programmfor providing
nutritional surveillance and supplementary food to
children and lactating mothers. Only children in the
age group 6-36 months are covered in the project.
Nutritional education of mothers is an important
component of the project. TNINP is a highly monitored
programmand evaluations of the project have shown that
it has succeeded in bringing down malnutrition rates
from 15-20% to 8-9% over a four year period (Subbarao
1989). There has been considerable decline in the
proportion of children suffering from severe
malnutrition. The category of `normal ' children has
increased by about 20%. The main reason for the success
of TNINP lies in being able to get community-level
participation in the implementation of the program
which the ICDS programme failed to receive.

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TABLE A.1

INFANT MORTALITY RATE

YEAR	AP	ASM	BIH	GUJ	HAR	KAR	KER	HP	MAH	ORS	PUN	RAJ	TN	UP	WB	INDIA
1974	111	125	–	109	102	86	54	137	89	150	97	133	106	172	–	126
1975	123	121	–	154	114	80	54	151	92	149	98	155	112	198	–	140
1976	122	124	–	146	112	89	56	138	83	127	108	142	110	178	–	129
1977	125	115	–	138	113	83	47	148	108	147	105	142	103	168	–	130
1978	117	118	–	122	109	82	42	143	81	133	117	140	105	177	–	127
1979	106	104	–	123	100	83	43	143	86	149	92	109	100	162	–	120
1980	92	103	–	113	103	71	40	142	75	143	89	105	93	159	–	114
1981	86	106	118	116	101	69	37	81	79	135	81	108	91	150	91	110
1982	79	102	112	112	93	65	30	134	70	132	75	97	83	147	86	105
1983	77	94	99	106	91	71	33	125	79	126	80	109	88	156	84	105
1984	78	99	95	106	101	74	29	121	76	131	66	122	78	155	82	104
1985	83	111	106	98	85	69	31	123	68	132	71	108	81	142	74	97
1986	82	109	101	107	85	73	27	118	64	123	68	107	80	132	71	96
1987	79	102	101	97	87	75	29	120	64	126	62	102	76	127	71	95
1988	83	99	97	90	90	74	28	121	68	122	62	103	74	124	69	94
1989	81	91	91	86	82	80	22	117	59	122	67	96	68	118	77	91

TABLE A.2

UNDER 5 MORTALITY RATES

YEAR	AP	ASM	BIH	GUJ	HAR	KARN	KER	MP	MAH	ORS	PUN	RAJ	TN	UP	WB	INDIA
1974	52	52	-	46	41	29	19	52	34	56	32	58	41	77	-	50
1975	49	49	-	58	43	27	20	72	33	54	36	66	42	89	-	55
1976	45	44	-	58	48	30	19	53	33	51	36	56	46	80	-	51
1977	45	36	-	56	47	28	15	69	39	48	37	50	42	73	-	51
1978	44	42	-	47	40	36	14	64	28	46	41	63	41	81	-	48
1979	39	37	-	48	38	31	14	61	31	50	34	47	37	66	-	46
1980	32	36	-	42	37	27	12	56	28	43	27	49	34	61	-	42
1981	30	40	43	41	37	24	12	61	26	42	26	50	39	60	34	41
1982	27	40	46	40	30	25	11	54	24	42	24	42	32	56	33	39
1983	25	39	45	40	30	24	10	54	23	41	23	41	30	55	32	38
1984	29	41	47	37	36	27	9	53	27	48	24	38	27	64	31	41
1985	29	43	49	37	30	25	10	53	23	46	26	46	26	54	27	38
1986	29	40	43	37	29	25	8	50	21	44	24	41	25	54	26	37
1987	27	36	40	33	28	25	8	30	21	48	20	41	23	52	24	35
1988	27	37	38	31	29	24	8	31	22	37	21	52	21	47	22	33
1989	22	30	33	29	24	26	6	43	18	40	22	36	21	41	22	30

TABLE A.3

FEMALE LITERACY RATE

YEAR	INDIA	AP	ASM	BHR	GUJ	HAR	KAR	KER	MP	MHRSH	ORSSA	PUN	RAJ	TN	UP	WB
1971	21.97	18.32	–	10.23	29.00	17.78	24.56	62.53	13.09	31.06	16.25	29.91	10.06	30.92	12.46	26.36
1972	22.65	18.83	–	10.73	29.83	18.53	25.31	63.73	13.58	31.88	17.01	30.76	10.40	31.76	12.87	27.39
1973	23.34	19.36	–	11.26	30.68	19.31	26.08	64.96	14.09	32.78	17.77	31.64	10.75	32.62	13.29	28.24
1974	24.06	19.91	–	11.81	31.56	20.13	26.87	66.21	14.63	33.71	18.53	32.55	11.11	33.51	13.72	29.11
1975	24.80	20.46	–	12.39	32.47	20.98	27.69	67.48	15.18	34.67	19.38	33.48	11.48	34.42	14.17	30.02
1976	25.57	21.04	–	13.00	33.40	21.87	28.54	68.78	15.76	35.66	20.24	34.43	11.86	35.36	14.63	30.95
1977	26.35	21.63	–	13.63	34.35	22.79	29.41	70.10	16.36	36.67	21.13	35.42	12.26	36.32	15.11	31.91
1978	27.16	22.24	–	14.30	35.34	23.75	30.30	71.45	16.98	37.71	22.07	36.43	12.67	37.30	15.60	32.91
1979	28.00	22.86	–	15.00	36.35	24.75	31.23	72.82	17.63	38.78	23.05	37.47	13.10	38.32	16.11	33.93
1980	28.86	23.50	–	15.74	37.39	25.80	32.18	74.22	18.30	39.88	24.07	38.54	13.54	39.36	16.64	34.98
1981	29.75	24.16	–	16.51	38.46	26.89	33.16	75.65	18.99	41.01	25.14	39.64	13.99	40.43	17.18	36.07
1982	30.68	24.98	–	17.07	39.36	28.04	34.14	76.71	19.77	41.87	25.94	40.55	14.36	41.48	17.91	37.08
1983	31.47	25.82	–	17.66	40.29	29.25	35.14	77.78	20.58	42.76	26.77	41.48	15.15	42.56	18.67	38.06
1984	32.37	26.70	–	18.26	41.23	30.50	36.18	78.87	21.42	43.66	27.62	42.43	15.77	43.67	19.46	39.09
1985	33.29	27.60	–	18.88	42.20	31.81	37.25	79.97	22.30	44.57	28.50	43.40	16.41	44.81	20.28	40.15
1986	34.25	28.54	–	19.53	43.19	33.18	38.34	81.09	23.22	45.51	29.41	44.39	17.07	45.98	21.14	41.24
1987	35.22	29.50	–	20.20	44.20	34.60	39.46	82.23	24.17	46.47	30.34	45.41	17.77	47.18	22.04	42.36
1988	36.23	30.50	–	20.89	45.24	36.09	40.64	83.38	25.16	47.45	31.31	46.45	18.49	48.41	22.97	43.51
1989	37.26	31.54	–	21.60	46.30	37.64	41.84	84.55	26.20	48.43	32.31	47.52	19.24	49.67	23.95	44.69
1990	38.33	32.61	–	22.34	47.39	39.25	43.07	85.73	27.27	49.47	33.34	48.61	20.03	50.96	24.96	45.90

TABLE A.4

PER CAPITA EXPENDITURE ON FAMILY WELFARE

	AP	ASSM	GUJ	HAR	KARN	KER	MP	MAHA	ORS	PUN	RAJ	TN	UP	INDIA
1974	1.57	0.91	2.00	1.63	2.49	1.70	1.53	1.47	1.13	1.79	1.64	1.93	1.38	2.88
1975	1.77	1.17	2.00	2.13	3.02	2.31	1.43	1.92	1.60	2.22	1.61	1.91	1.63	3.37
1976	4.19	2.79	3.91	3.95	5.01	3.63	4.57	3.26	3.68	3.48	3.04	3.68	2.96	6.85
1977	2.11	1.12	2.84	1.92	2.57	2.27	1.63	1.40	2.29	0.15	1.56	1.89	1.62	3.47
1978	2.24	1.64	3.16	2.26	2.69	2.31	1.92	1.85	2.35	0.23	1.67	2.13	1.67	3.91
1979	2.24	1.15	3.19	2.08	2.54	2.53	1.97	2.33	2.25	0.24	1.78	1.84	1.62	3.95
1980	2.38	1.28	3.02	2.24	2.38	2.44	2.09	2.09	2.48	2.19	2.31	1.91	1.74	3.96
1981	2.71	1.21	4.16	2.04	2.36	2.46	2.37	2.86	2.94	2.84	0.80	2.07	2.22	4.65
1982	3.37	2.06	4.78	3.91	2.81	2.65	2.74	4.39	4.06	1.15	3.12	2.53	3.92	6.83
1983	4.37	2.90	5.89	5.47	3.28	3.43	3.70	10.08	7.72	1.99	7.18	7.17	4.21	9.13
1984	4.67	4.14	5.93	5.07	4.09	3.20	4.34	4.70	3.61	3.51	4.70	4.17	4.05	8.35
1985	5.16	4.82	6.34	5.95	6.16	6.17	3.84	4.50	3.61	5.42	4.75	3.51	4.46	8.91
1986	3.89	4.53	5.35	4.25	6.25	7.09	5.44	3.90	3.68	7.54	4.70	3.92	4.85	9.03
1987	4.25	4.03	5.23	4.32	6.75	6.87	3.86	3.57	4.23	5.00	4.65	3.94	4.68	8.74
1988	4.53	6.19	4.82	4.73	5.31	5.93	3.12	3.29	4.24	0.88	4.13	4.36	4.85	8.67
1989	4.68	4.52	6.58	4.91	5.32	9.21	4.51	3.50	6.78	6.23	5.63	4.48	3.71	8.73

TABLE A.5

PER CAPITA EXPENDITURE ON MCH

	AP	ASSM	GUJ	HAR	KARN	KER	MP	MAHA	ORS	PUN	RAJ	TN	UP	INDIA
1974	0.06	0.16	0.01	0.00	0.02	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.04
1975	0.07	0.12	0.04	0.00	0.03	0.02	0.00	0.03	0.00	0.02	0.02	0.02	0.10	0.06
1976	0.07	0.16	0.05	0.00	0.05	0.01	0.03	0.00	0.00	0.04	0.04	0.00	0.07	0.08
1977	0.05	0.18	0.07	0.00	0.05	0.01	0.04	0.07	0.00	0.06	0.06	0.00	0.02	0.08
1978	0.05	0.16	0.00	0.08	0.06	0.10	0.05	0.07	0.00	0.00	0.00	0.00	0.04	0.10
1979	0.06	0.14	0.00	0.07	0.10	0.04	0.00	0.08	0.00	0.00	0.00	0.00	0.03	0.16
1980	0.05	0.17	0.06	0.07	0.08	0.01	0.00	0.04	0.00	0.00	0.00	0.04	0.02	0.12
1981	0.05	0.19	0.00	0.00	0.09	0.08	0.00	0.09	0.00	0.00	0.00	0.06	0.05	0.11
1982	0.05	0.20	0.00	0.00	0.11	0.06	0.00	0.16	0.00	0.00	0.00	0.00	0.05	0.14
1983	0.05	0.18	0.00	0.13	0.12	0.06	0.00	0.22	0.01	0.00	0.00	0.00	0.10	0.15
1984	0.05	0.00	0.00	0.00	0.13	0.06	0.00	0.26	0.00	0.14	0.14	0.01	0.06	0.15
1985	0.27	0.17	0.01	0.18	0.17	0.15	0.00	0.13	0.01	0.00	0.00	0.01	0.11	0.19
1986	0.06	0.34	0.03	0.25	0.26	0.02	0.02	0.25	0.04	0.08	0.08	0.03	0.18	0.22
1987	0.09	0.31	0.07	0.36	0.38	0.04	0.02	0.30	0.02	0.05	0.05	0.34	0.18	0.28
1988	0.12	0.67	0.11	0.12	0.26	0.13	0.02	0.19	0.02	0.00	0.00	0.32	0.32	0.19
1989	0.41	0.30	0.23	0.39	0.20	0.59	0.10	0.64	0.04	0.03	0.03	0.21	0.07	0.42

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TABLE A.6

PER CAPITA EXPENDITURE ON MPH

	AP	ASSM	GUJ	HAR	KARN	KER	MP	MAHA	ORS	PUN	RAJ	TN	UP	INDIA
1974	11.16	11.73	15.41	15.38	12.97	16.07	9.79	24.99	9.30	16.27	13.04	14.54	7.58	14.72
1975	11.83	12.33	15.24	16.12	14.56	18.36	8.76	21.49	10.93	18.17	13.76	16.34	8.00	15.67
1976	21.97	11.67	16.57	16.36	14.43	20.10	10.99	23.84	11.51	17.43	13.81	17.02	8.30	17.58
1977	15.18	12.67	17.63	17.85	14.43	20.12	11.72	23.91	12.29	19.41	15.47	16.89	9.38	18.20
1978	16.50	13.86	19.48	19.36	15.70	21.69	12.39	29.02	14.14	19.32	16.54	17.31	10.14	19.65
1979	16.95	11.55	19.45	16.65	14.82	21.37	11.48	28.47	13.86	25.24	16.11	16.86	10.02	19.04
1980	17.48	14.07	15.38	17.37	14.67	21.50	12.16	21.57	14.07	29.17	15.52	17.34	12.73	18.07
1981	16.44	13.30	19.20	19.67	16.53	22.48	13.84	23.22	14.27	27.28	14.44	18.96	14.13	19.21
1982	17.59	14.20	19.45	17.22	18.15	19.04	14.16	24.07	13.19	8.78	16.37	20.71	13.21	19.12
1983	23.39	14.00	19.95	17.99	15.74	22.35	14.09	18.18	8.78	10.13	7.39	11.65	17.16	17.89
1984	23.06	17.93	21.23	24.58	18.99	22.72	13.37	24.66	14.53	33.53	16.59	20.17	12.23	20.30
1985	17.05	16.31	22.82	20.48	18.57	25.05	14.45	26.37	14.10	34.03	28.44	21.01	12.43	21.13
1986	17.99	21.03	21.49	19.07	19.27	24.68	15.43	23.75	15.40	40.93	19.91	19.63	12.11	20.58
1987	18.54	22.51	20.92	20.35	13.63	23.10	14.76	24.44	15.34	37.48	20.19	21.50	14.10	20.52
1988	17.61	18.04	22.51	22.10	12.68	23.59	16.80	22.99	15.00	25.83	20.03	21.33	15.13	20.45
1989	17.36	15.12	22.56	19.10	12.49	27.39	15.97	19.88	15.92	32.38	21.48	20.99	16.43	20.61

TABLE A.7

PER CAPITA EXPENDITURE ON NUTRITION

	AP	ASSM	GUJ	HAR	KARN	KER	MP	MAHA	ORS	PUN	RAJ	TN	UP	INDIA
1974	0.48	0.26	0.49	0.19	0.66	0.47	0.26	0.53	1.09	0.33	0.17	0.81	0.19	0.44
1975	0.36	0.17	0.61	0.17	0.69	0.45	0.43	0.67	1.13	9.50	0.15	1.60	0.22	0.81
1976	0.45	0.57	0.95	0.57	0.79	0.44	0.63	0.72	0.90	0.43	0.27	1.57	0.25	2.08
1977	0.35	0.67	0.91	0.37	1.05	0.47	0.64	0.44	0.83	0.41	0.33	1.33	0.26	1.74
1978	0.39	1.31	1.10	0.85	1.45	0.66	0.39	0.59	0.99	0.13	0.33	1.47	0.26	1.15
1979	0.30	0.73	1.02	0.65	1.63	1.02	0.69	0.52	0.95	0.47	0.43	1.49	0.31	0.90
1980	0.66	1.16	1.02	0.78	1.89	1.25	0.60	0.51	1.22	0.43	0.68	1.54	0.61	0.87
1981	0.42	0.97	1.11	0.77	1.68	1.24	1.24	0.51	0.79	0.37	0.84	1.51	0.32	0.74
1982	0.29	0.77	1.86	0.81	1.70	1.12	0.79	0.85	1.29	0.29	0.61	17.40	0.43	1.98
1983	0.29	1.32	1.49	0.84	2.85	1.59	0.91	1.39	0.88	0.21	0.69	19.31	0.44	2.26
1984	0.96	1.45	2.19	1.12	3.47	1.16	0.40	1.36	0.60	1.06	0.70	19.43	0.79	2.49
1985	1.26	1.14	11.79	1.60	3.62	1.01	1.65	1.70	0.81	0.63	1.48	13.36	0.99	3.09
1986	1.42	2.33	9.70	2.56	7.48	0.87	0.72	1.50	2.41	0.47	1.35	14.47	0.95	3.14
1987	1.99	3.26	11.30	3.56	7.88	1.22	1.03	1.86	2.90	1.36	2.49	15.11	0.89	3.49
1988	1.38	1.39	9.17	3.33	6.59	0.94	1.84	2.02	1.73	1.09	2.44	12.51	1.30	3.18
1989	1.30	1.68	8.99	3.33	7.39	1.05	1.77	1.77	2.04	1.18	1.71	17.26	0.50	3.67

TABLE A.8

PER CAPITA EXPENDITURE ON ICDS

	AP	ASSM	GUJ	HAR	KARN	KER	MP	MAHA	ORS	PUN	RAJ	TN	UP	INDIA
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
1975	0.03	0.02	0.00	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.01
1976	0.03	0.02	0.01	0.03	0.02	0.02	0.01	0.03	0.01	0.00	0.02	0.00	0.01	0.01
1977	0.04	0.02	0.01	0.03	0.01	0.02	0.01	0.03	0.01	0.00	0.01	0.00	0.03	0.02
1978	0.06	0.00	0.06	0.08	0.04	0.03	0.02	0.03	0.05	0.03	0.03	0.02	0.06	0.04
1979	0.08	0.17	0.07	0.15	0.00	0.08	0.02	0.07	0.08	0.00	0.06	0.03	0.10	0.06
1980	0.11	0.22	0.00	0.29	0.06	0.17	0.03	0.13	0.11	0.06	0.10	0.00	0.11	0.10
1981	0.00	0.00	0.10	0.30	0.08	0.23	0.07	0.11	0.12	0.13	0.09	0.03	0.10	0.10
1982	0.35	0.02	0.27	0.47	0.20	0.32	0.15	0.40	0.24	0.18	0.21	0.19	0.25	0.32
1983	0.49	1.13	0.09	0.69	0.58	0.89	0.25	1.65	0.71	0.00	0.81	0.69	0.71	0.64
1984	0.61	0.44	0.58	0.59	0.65	1.63	0.00	0.39	0.30	0.00	0.49	0.39	0.00	0.42
1985	0.83	0.17	1.19	1.15	1.15	1.30	0.00	1.33	0.84	0.00	0.76	0.39	1.00	0.78
1986	1.19	1.16	1.04	1.42	1.19	1.77	0.00	1.83	0.00	0.00	0.96	0.37	1.05	0.91
1987	0.90	1.23	2.71	2.32	0.28	1.98	1.00	1.60	1.20	0.00	1.15	0.60	0.94	0.97
1988	1.18	1.15	2.49	2.78	0.09	0.14	1.11	2.10	1.46	0.00	1.22	0.67	0.13	0.98
1989	1.22	1.82	3.52	3.08	0.13	0.11	1.30	3.09	2.25	0.00	1.63	0.72	0.10	1.09

Table C :   Relative Allocations to Important Budget Line Items 1982-83

| State | % of total expenditure to : | | | | % of total family welfare expenditure to: | | | | |
	Salary	Travel/ vehicles	Drugs/ supplies	% not allocable	Salary	Travel/ vehicles	Drugs/ supplies	Compen- -sation	% not allocable
Haryana	51.6	3.4	14.8	0	33.1	1.8	9.5	27.5	0
H.P.	45.7	4.1	16	.1	25.5	4.2	5	12.5	.3
J&K	58.6	2.1	13.7	14.9	53.7	3.3	1.1	17.8	13.8
U.P.	54	2.7	6.5	3.7	54.5	4.3	2.7	15.9	.5
Orissa	68.5	3.3	14.6	.6	39.8	3.8	9.1	17.8	2.5
Sikkim	42.5	18.3	27.9	9.6	N.A.	N.A.	N.A.	N.A.	N.A.
Tripura	59.8	2.4	N.A.	.2.4	48.1	2.8	N.A.	6.4	0
W.Bengal	52.6	1.2	18.2	.5	39.8	1.5	N.A.	33.2	0
Assam	55.6	3.2	25.1	27.4	15.1	6.8	N.A.	37	41.4
Bihar	66.3	2.5	2.2	.1	45.5	2.2	N.A.	36.4	0
Nagaland	55.2	7.3	12.4	1.6	64.6	16.2	15.7	N.A.	7.9
Gujarat‡	29.5	.9	18.9	0	5.6‡	.6	.6	N.A.	0
M.P.	56.1	3.3	19.9	12.1	48.9	8.5	.6	48	0
Maharashtra	41.2	2.5	23.9	5.2	38.1	3.4	18.9	N.A.	0
Rajasthan	59.5	2.5	17.6	2.2	49.6	4.6	2.7	34.8	12.9
A.Pradesh	57	3.1	15.6	.4	47	9.1	.8	28.1	0
Karnataka	53.8	2.7	14.5	7.7	45.8	3.9	9.5	34.5	14.4
Kerala	58.3	2.1	24.9	8.2	54.9	4.1	N.A.	38.2	3.6
Tamil Nadu	52.8	3.8	22.5	.9	48.1	11.7	2.7	31.6	.1

‡ For Gujarat: 79.5% of FW Expenditure listed as "grants-in-aid";
i.e. funds passed onto districts under control of Local Government.

Source : ORG (1987) Pages 49a, 53.