



Policy and Research Paper N°6

Evaluation of the Impact of Health Interventions
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Introduction

Policy & Research Papers are primarily directed to policy makers at all levels. They should also be of interest to the educated public and to the academic community. The policy monographs give, in simple non-technical language, a synthetic overview of the main policy implications identified by the Committees and Working Groups. The contents are therefore strictly based on the papers and discussions of these seminars. For ease of reading no specific references to individual papers is given in the text. However the programme of the seminar and a listing of all the papers presented is given at the end of the monograph.

This policy monograph is based on the seminar on 'Evaluation of the Impact of Health Interventions' organized by the IUSSP Committee on Population and Health, the Brazilian Association for Population Studies (ABEP), the Minas Gerais State Secretary of Health, the Minas Gerais State Foundation for Research Support (FAPEMIG) and the Pan American Health Organization (PAHO), held in Belo Horizonte, Brazil, from 12 to 16 April 1993.

Main Summary Points

Policy makers and health programmers are frequently faced with two conflicting positions in regard to health interventions. The first position links particular health interventions with significant anticipated reductions in mortality and morbidity. The second position reflects scepticism regarding the scope of health improvements that can be achieved from these interventions.

Underlying the two positions are widely different interpretations of the nature of health problems in developing countries and of the effectiveness of the adopted approaches. The conflict arises from uncertainty about the ultimate foundations of the possible impact of health interventions.

It should be noted first that there is disagreement about the validity of existing estimates of the expected reductions in cause-specific morbidity and mortality indicators resulting from the interventions under ideal conditions. Secondly, as we move from the discussion of specific effects under ideal conditions to the consideration of the general impact on survival and health, further questions arise about the hypothesized effect as affected by competing morbidity and mortality risks and by the frailty distribution of the population in question. These competing risks reflect possible morbidity and mortality from other causes after survival and/or escape from a specific disease. The frailty distribution refers to the deteriorating health conditions of the population under consideration as a consequence of experience with episodes which tend to increase its susceptibility to other diseases. Third, as the intervention moves from controlled settings to large scale applications, further potential losses in impact efficiency need to be discussed.

This monograph reviews the main aspects of both positions and will present facts and interpretations allowing the clarification of the two conflicting positions. The discussion has been organized under five main themes.

1. The scientific basis for existing statements on large potential effects of health interventions varies considerably among the different health interventions. It ranges from reliance on solid knowledge grounded in well-controlled clinical trials with a clear identification of disease aetiology to research with very weak conceptualization of the mechanisms and the causal paths through which the health interventions operate. Knowledge on the theoretical effects of child health interventions, particularly of the Expanded programme for Immunization (EPI), is much more solid than that of reproductive health interventions.

2. Data on the determinants of measles and survival after vaccination do not support the notion of replacement mortality, whereby deaths averted by measles vaccination are soon replaced by deaths from other diseases, thus reducing the impact of vaccination. Rather, the data suggest that measles do not only kill many children in the acute phase but also weaken other children who are likely to die later from other causes but still as the ultimate

consequence of measles. The beneficial impact of measles vaccination therefore is much higher than can be inferred from estimates of the direct reduction of cause specific mortality.

3. The findings for measles do not necessarily apply to other live vaccines and other interventions. Replacement mortality and the influence of the frailty distribution of the population on the impact of health interventions are important aspects which need to be considered closely for each particular intervention.

4. There are few systematic appraisals of the demographic impact of large scale health interventions which are based on more than circumstantial evidence. It is often misleading to simply extrapolate from field trials to national programmes. Much more effort is needed to test the assumptions underlying the potential effects of many types of common health programmes.

5. The few large scale evaluations that exist, along with the evidence from community studies, demonstrate that many health interventions do not give the results which could theoretically be expected from them. Research and experience show that this outcome cannot be totally blamed on traditional health belief systems, on social constraints that lead to insufficient acceptance of the services or on problems in mobilizing the resources needed for mounting large scale activities. Frequently the fault has to be found in the framework which drives these activities and which remains highly supply oriented and embedded in an exclusively biological interpretation of health problems.

1. The scientific basis for existing statements on large potential effects of health interventions varies considerably among the different health interventions. It ranges from reliance on solid knowledge grounded in well-controlled clinical trials with a clear identification of disease aetiology to research with very weak conceptualization of the mechanisms and the causal paths through which the health interventions operate. Knowledge on the theoretical effects of child health interventions, particularly of the Expanded programme for Immunization (EPI), is much more solid than that of reproductive health interventions.

The estimation of the theoretical gains from cause-specific health interventions under ideal conditions requires detailed epidemiological information on the nature of the problem (particularly age/sex/cause-specific morbidity and mortality), on the pathways through which the intervention will alter the problem through its effect on risk factors; incidence, severity and case fatality; and on the efficacy of the intervention.

Vaccine Preventable Diseases

For most vaccine preventable diseases such as tetanus, tuberculosis and measles global estimates of specific disease incidence exist. Admittedly the accuracy of some of these estimates could benefit from further research. The pathways through which they operate are well documented and there is reasonable information on vaccine efficacy rates under trial conditions. WHO/EPI provides yearly estimates of cases and deaths without immunization and of those prevented by immunization (see Table 1).

Theoretical estimates of prevented cases and deaths can be calculated on the assumption that all those who need protection against a particular disease are efficiently using vaccines at a given level of known vaccine efficacy. Unfortunately this approach will overestimate the true results. More accurate estimates will allow for the reduced efficacy due to poor quality of use and loss of vaccine potency.

| Table 1: Estimated Morbidity and Mortality (Cases and Deaths) of Preventable Diseases in Absence of Immunizations and Prevented with Immunizations. World, 1991 | | | | |
|--|-----------------------------|---------------|------------------------------------|---------------|
| Disease | Without immunization | | Prevented with immunization | |
| | <i>Cases</i> | <i>Deaths</i> | <i>Cases</i> | <i>Deaths</i> |
| Neonatal Tetanus | * | 1,200,000 | * | 662,000 |
| Disseminated Childhood Tuberculosis | 1,000,000 | 175,000 | 450,000 | 80,000 |
| Pertussis | 100,000,000 | 1,000,000 | 65,000,000 | 650,000 |
| Diphtheria | | | | |
| Non-Neonatal | 100,000 | 50,000 | 80,000 | 40,000 |
| Tetanus <5 | | | | |
| Poliomyelitis | 659,000 | * | 532,000 | * |
| Measles | 132,000,000 | 2,740,000 | 87,000,000 | 1,600,000 |
| Total | 233,759,000 | 5,165,000 | 153,062,200 | 3,032,000 |

* Not available

Table 1, based on estimates by WHO/EPI shows that out of about 234 million cases of diseases (total of column 2) and 5 million cases of deaths (total of column 3), which would occur in 1991 in the absence of immunization, 153 million cases (total of column 4) and 3 million deaths (total of column 5) are estimated to be prevented by immunization. The estimates in Table 1, to a certain extent, understate the theoretical effect because they allow for less than optimal coverage and effectiveness. On the other hand, the estimates do not take full account of problems that reduce the anticipated effects of particular vaccines, such as loss in vaccine potency and the difficulties in reaching the totality of the population which should be vaccinated as interventions move from controlled settings to large scale applications. The estimates in Table 1 therefore do not reflect all the problems in the vaccination of large populations and therefore are close to, although not identical with, the theoretical effects of the intervention.

Nutrition Interventions

The effects of severe levels of malnutrition are well established. If essential nutrients are not available functional impairment and, if deficiency is severe, death will occur. The discussion here is limited to the less severe forms of malnutrition, which can be commonly seen in developing countries.

In studying the effects of malnutrition, two kinds of evidence can be used. The first links anthropometric status to morbidity and mortality resulting from malnutrition. The second evidence is based on impact measures on health conditions of community interventions to reduce malnutrition. Both types of evidence do not provide estimates of the theoretical effects. For example community nutrition interventions can never provide accurate estimates of the theoretical effects because they are affected by the particular nature of malnutrition in the community under consideration. There will be wide differences among communities in the prevalence and degree of malnutrition. Also the efficacy of the intervention and its ultimate success in altering anthropometric status is bound to be different from one community to the other. Both types of evidence have also other weaknesses. For example

linking anthropometric status to morbidity and mortality does not show the exact pathway through which the nutrition intervention will modify anthropometric status.

Anthropometric Status and Subsequent Morbidity and Mortality:

- The findings - based mainly on examining the relation between weight for age and subsequent mortality over a period of about 2 years - show that even mild malnutrition puts a child at increased risk of death. About half of all child deaths attributable to malnutrition in the developing world occur in children who are mildly malnourished. The findings thus negate the existence of a threshold level of low malnutrition under which malnutrition would be inconsequential.

- There is also evidence which shows that the effect of malnutrition on mortality depends on the underlying levels of mortality in the general population. This strongly indicates the existence of synergistic interactions between nutrition and infection as documented in biomedical studies. The implication for interventions is, that while reduction in mortality may be achieved through either improvements in nutritional status or reductions in infection, simultaneous improvements in both will have a synergistic effect.

- Other anthropometric indicators (height for age, weight for height, arm circumference) can be used. Although data based on these indicators are less complete, generally patterns very similar to those observed with weight for age are found.

- The studies of the relationship between anthropometric status and diarrhoea suggest that nutritional status does not seem to increase the risk of infection but it does affect its response, as measured by the duration of episodes.

- The relationship between anthropometric status and measles remains unclear. Opposing views exist. On one hand, a number of community studies have reported a high risk of measles mortality among children with poor anthropometric status. On the other hand, numerous studies have been unable to document such association. Weaknesses in design and analysis seem to have led to the positive associations reported in a number of studies. Other factors such as clustering of cases and intensity of exposure to the disease are better explanations for the patterns of incidence of measles.

- While the association between anthropometric status and measles remains uncertain, the relationship between vitamin A status and measles appears strong. Administration of vitamin A to children with measles has consistently been found to reduce complications and enhance survival.

Nutrition programmes and Changes in Mortality and Morbidity:

- Though there are few well designed evaluations of the effect of nutrition programmes on morbidity and mortality in developing countries, the results are consistent. Food supplementation interventions have been shown to decrease infant mortality rates by 23 to 64 percent when carried out alone and by 25 to 77 percent when combined with health care interventions. The small difference between the two types of interventions is unexpected. In fact a larger difference had been expected.

- Vitamin A studies generally overcome the many experimental weaknesses of the food supplementation studies. In the placebo-controlled, randomized trials of vitamin A, a decline in mortality rates of more than 20 percent can be unequivocally attributed to the effects of improved vitamin A intakes.

Safe Motherhood

It has been documented that socio-economic development alone does not automatically reduce maternal mortality and that populations with lower mortality have several fairly constant features: lower fertility, professional delivery care with access to modern technology and higher coverage of antenatal care. Provision of contraception and better antenatal and delivery care are basic components of **Safe Motherhood** interventions.

The evidence linking maternal health programmes to the health of mothers remains mainly correlational and at the aggregate population level. Such evidence does not prove causality, as the observed relationship may be due to the presence of known or unsuspected confounding factors or to bias.

Antenatal Care and Mother Health:

Assessment of the impact of antenatal care programmes at the population level are too crude to answer the question whether interventions during pregnancy can improve maternal health. There are a number of reasons for this uncertainty:

- Antenatal care is not a single well-defined intervention but involves many components. The biological efficacy of only a few of these components has been demonstrated and no formal studies relating systematically the contribution of each component are available.
- The appropriate outcome measure is not well specified. Total maternal mortality is too crude and depends on too many other uncontrollable variables, including access to other health services. Utilization of antenatal care and of medical delivery services are highly correlated. It should be noted that the latter is considered a key determinant of maternal mortality.

The answer to the question: Is antenatal care effective? requires well designed studies which show the separate contribution of each component.

Delivery Care and Maternal Mortality:

Although it may be difficult to assign a single underlying cause for a maternal death, it is clear that most obstetric deaths are due to one of four major causes or a combination of them: haemorrhage, obstructed labour, sepsis and hypertensive disorders of pregnancy. Obstruction is clearly a problem in labour. A large proportion of haemorrhage cases are post- or pre-partum. Puerperal sepsis is largely a result of the type of delivery practice or of delivery complications. Care during delivery is, therefore, likely to be a strong determinant of maternal mortality.

Historical data show that maternal mortality only decreased with the introduction of quality delivery services. This is in marked contrast with infant mortality. Its reduction was clearly related to improvements in socio-economic circumstances and in living conditions. There is also ample evidence for the biological efficacy of basic obstetric interventions.

Family Planning and Reproductive Health:

There is a range of contraceptive methods with well-known efficacy. Contraception may directly affect reproductive health. For example, the use of a particular contraceptive may increase or decrease a women's risk of having a specific medical condition. Examples are negative side effects or protection from sexually transmitted diseases resulting from the use of certain contraceptives.

Contraceptive use affects the number, timing and spacing of pregnancies. The resulting reproductive pattern may affect women's health directly through the reduction in the frequency of exposure to the increased health risk associated with pregnancy, the reduction in the number of at risk pregnancies (for example those at very young or very old ages or in pregnancies which are terminated by unsafe induced abortion). Although a number of researchers have hypothesized a maternal depletion syndrome (inferior health of mother due to the timing and frequency of pregnancies) associated with short intervals, no good study showing a relationship between length of birth interval and maternal mortality has yet been identified.

Available evidence for developing countries shows very high national maternal mortality rates, ranging from 100 to 700 or more, maternal deaths per 100,000 live births. The World Health Organization estimates that around 500,000 women die from pregnancy-related causes each year, 98 per cent of them in the developing world. Also, unsafe abortion is one of the top five causes of maternal mortality worldwide.

Contraceptive practice is expected to reduce maternal mortality. However, under the assumption that the risk per pregnancy is not altered, the effect on the maternal mortality rate will depend on the relative proportion of high or low risk pregnancies prevented. For example, avoidance of pregnancies at extreme ages will reduce the rate. On the other hand fertility control increases the proportion of first pregnancies among the total number of pregnancies. It is known that first pregnancies present comparatively higher risks.

Any statement on the estimates of the theoretical effects of contraceptive use on maternal mortality and the well-known conclusion that the potential health risks associated with contraception are very small compared to the risk of unregulated fertility should take into consideration the following aspects:

- Individual and societal decisions about childbearing are not made primarily on the grounds of maternal safety.

- It is possible to have low rates of maternal mortality with fairly high fertility.
- First pregnancies appear to have one of the highest risks.
- Contraception is not infallible in preventing unwanted pregnancies.

Family planning programmes should have the extension of reproductive choice as one of their principal aims. The health rationale of contraceptives does not lessen the importance of improving the safety of pregnancy and delivery. Nor should it stand in the way of the provision of safe abortion services.

2. Data on the determinants of measles and survival after vaccination do not support the notion of replacement mortality, whereby deaths averted by measles vaccination are soon replaced by deaths from other diseases, thus reducing the impact of vaccination. Rather, the data suggest that measles do not only kill many children in the acute phase but also weaken other children who are likely to die later from other causes but still as the ultimate consequence of measles. The beneficial impact of measles vaccination therefore is much higher than can be inferred from estimates of the direct reduction of cause specific mortality.

Many researchers have argued that specific interventions against measles may have a limited impact on survival because the 'weak' children prevented from dying of measles are the ones who are more likely to eventually die from other infections.

At the other extreme, it has also been suggested that measles infection through its effect on the immune system or through malnutrition may have a long-term negative impact on survival after the acute phase. Immunization against measles might, therefore, reduce total child mortality in more ways than by reducing deaths directly by immunization. The potential impact of immunization programmes therefore is not a simple question of estimating the incidence and case fatality of measles and the immediate efficacy of measles vaccination.

Earlier studies did support the notion that deaths prevented through measles immunization were replaced by deaths from other subsequent diseases. Under this condition there evidently would be no justification for allocating scarce resources to measles immunization. However, more recent studies have conclusively shown that measles vaccinations increase child survival, in excess of that predicted by cause-specific mortality estimates.

The explanation of these recent findings is that transmission factors are the key determinants in measles' severity and subsequent mortality. Host factors seem to be of little importance. The host factor approach, which is based on the premise that there is something distinctive - the physical weakness and malnourishment - in the individuals which substantially increases the risk of mortality is not supported by current evidence. The thesis that it is mainly weak children who die of measles seems to be incorrect. Therefore the current figures for the theoretical effect of measles intervention are not overestimates. Further support for the important long term beneficial impact from concrete measles intervention programmes comes from the elimination of delayed and long term consequences of measles infection.

The much larger impact of measles vaccination than that following directly from the protection against acute consequences may be due to the positive stimulation of the immune system by the measles vaccine either through the mobilization of general defence mechanisms or through 'teaching' the organism a lesson in how to handle the infection. The idea that limited infection may be beneficial and not always detrimental or at least harmless requires further investigation and has several theoretical and practical implications which warrant further consideration.

3. The findings for measles do not necessarily apply to other live vaccines and other interventions. Replacement mortality and the influence of the frailty distribution of the population on the impact of health interventions are important aspects which need to be considered closely for each particular intervention.

Frailty, which is sometimes equated with poor nutritional status in children, is an important background determinant in child mortality and is implicit in descriptions of the malnutrition - infection cycle.

Frailty is an important factor in determining the overall impact of particular interventions. Models are one way to gauge the complex dynamics between frailty distributions, disease causation, interventions and survival impact. One of the papers presented at the Belo Horizonte, Brazil, seminar introduced a model which incorporates the impact of several childhood diseases on groups with different frailty distributions and which enables the utilization of empirical data. The model permits the examination of a wide range of interventions either singly or in combination, while appropriately accounting for the influence of competing risks and of the frailty distributions in the populations under consideration. The findings here focus on diarrhoeal disease control programmes as they provide an excellent illustration of how frailty considerations affect the programmes' potential impact.

First, data on the mortality effects of actual health programmes show that the current world levels of measles vaccination and of Oral Rehydration Therapy (ORT) have resulted in a decline of 10 to 20 percent in diarrhoeal mortality and 10 to 14 percent in childhood mortality. Second, it appears that without increasing the quality of treatment, only limited additional declines in diarrhoea-specific or total under-five mortality will be achieved by increasing ORT coverage to 60 percent. On the other hand, greater declines in mortality could be achieved by providing comprehensive high quality diarrhoeal treatment even at the current ORT coverage level. More substantial effects of this high quality treatment would then occur with 60 per cent coverage.

Among preventive interventions, improvements in water supply and sanitation, increased breast feeding and more extensive measles vaccination coverage have beneficial effects on diarrhoea-specific and total mortality. However, greater effects were achieved by two interventions which affect frailty: better nutrition and vitamin A supplementation. These last two interventions have sizable effects on diarrhoea-specific mortality and even larger effects on total mortality, since frailty increases the risk of mortality from other infectious diseases as well. None of the single interventions examined reduced diarrhoea-specific mortality to a degree commensurate with the 50 per cent reduction goal of the declaration of the World Summit for Children, convened by UNICEF in New York in 1990 and on which occasion the world's political leaders adopted a number of goals for the improvement of child health by the year 2000. On the other hand, a relatively simple combination of interventions, such as enhanced coverage with comprehensive diarrhoeal treatment or improved coverage of measles vaccination with tetanus vaccination and vitamin A supplement to half the number of children, could reduce diarrhoeal mortality by half. Furthermore, this package of interventions could reduce childhood mortality to almost one third of its current level close to the target set at the World Summit. Among other possible additions to this package, improved nutrition might be particularly attractive because of its broad effect on child survival.

4. There are few systematic appraisals of the demographic impact of large scale health interventions which are based on more than circumstantial evidence. It is often misleading to simply extrapolate from field trials to national programmes. Much more effort is needed to test the assumptions underlying the potential effects of many types of common health programmes.

To fully grasp the effect of large scale interventions which have already been evaluated in field trials, we need to distinguish among three levels of evaluation studies. The first level determines whether the intervention is effective in individuals.

Effectiveness in individuals is called efficacy. For example a vaccine trial might document that the vaccine prevents disease in individuals who are exposed to the causative organism or that individuals who are vaccinated develop antibodies to the disease. These studies are called clinical trials.

As clinical trials increase in size they begin to resemble field trials. For interventions aimed at infectious diseases, field trials measure both the biological efficacy in individuals and the epidemiological effect on populations. For example, effective vaccination reduces the number of susceptible individuals and, therefore, reduces the spread of the disease. Vaccination programmes (for example, in the case of measles and pertussis) can then change the frequency of epidemics.

Field trials also provide a better appreciation of the role of other factors in modifying the effect illustrated in clinical trials. It allows a more realistic study of the relative importance of competing risks and of the synergistic relation between multiple diseases. Another difference between clinical trials and field trials can be illustrated with the use of oral rehydration. In clinical trials staff generally mix and administer the oral rehydration fluids. In field trials these tasks are performed by unsupervised mothers.

The impact of interventions in large scale health programmes, the third level of evaluation, can be very different from that of field trials. One reason for this is the greater difficulty in insuring the quality of services in large scale programmes. An important example of this is the 'cold chain' required to keep measles vaccine at a low temperature. In large-scale programmes there is probably a higher rate of failure of the cold chain and, therefore, a lower rate of vaccine efficacy.

A second reason is that field trials generally include more intensive efforts to provide services to the total population of the intervention areas. Large health programmes rarely achieve the coverage rates found in well supervised field trials. Many large health programmes achieve the highest coverage rates among population subgroups that are more apt to receive other services and are more advantaged in other ways. For example, children of educated mothers tend to receive more vaccinations than children of uneducated mothers. The impact of large scale programmes might be less than that of field trials if those in field trials have below average risks of infection or are less subject to complications.

A recent report which reviewed research on the effectiveness of health programmes in Africa in reducing child mortality found that most of the large studies in Africa have examined the effects of model programmes in special research areas. Although the effects of large-scale programmes can be very different from the effects obtained in field trials, there have been very few efforts to evaluate the effect of national health programmes on mortality.

5. The few large scale evaluations that exist, along with the evidence from community studies, demonstrate that many health interventions do not give the results which could theoretically be expected from them. Research and experience show that this outcome cannot be totally blamed on traditional health belief systems, on social constraints that lead to insufficient acceptance of the services or on problems in mobilizing the resources needed for mounting large scale activities. Frequently the fault has to be found in the framework which drives these activities and which remains highly supply oriented and embedded in an exclusively biological interpretation of health problems.

The shift from clinical trials to large scale applications places the theoretical framework of the intervention within the wider social context of the production of health.

Such movement raises two types of concern. The first reflects preoccupation with the basic causes of the origin of health problems in developing countries. It emphasizes that, since the origin of health problems in most developing countries is structural, their solution cannot be solely obtained from magic bullets but requires a comprehensive approach that fully appreciates the social, economic, ecological and behavioural nature of the problem. This concern which stresses the cumulative nature of health problems and which directs attention to issues such as replacement mortality and the postponement of death, both concepts referring to the fact that persons who did not die from a particular disease, have nevertheless become weaker as a consequence of the disease under consideration and will more likely die from another disease within a relatively short period after having recovered from the disease under consideration. This concern has been touched upon both in main points 2 and 3.

The second concern is more operational in nature and considers the preconditions and other requirements for the success of large scale health interventions. Purely medical approaches, even if they are needed to improve health, cannot be successfully applied in the context of developing countries without making them part of a

process of social transformation. Successful large scale health interventions, while making good use of biomedical advances, require adequate community and household level support systems. The second concern recognizes that such support systems rarely exist in developing countries and that most current health interventions do not make sufficient efforts to eliminate or reduce the various constraints on the needed support systems.

The support systems which will be discussed, because of their importance, are the following: health service systems, family resources and the framework governing health interventions.

Health Service Systems

There are many reasons why progress toward **Health for All**, the goal established for the year 2000 in 1978 at the Alma Ata Conference, organized by WHO and UNICEF, has been less than hoped for. Continuing global population growth surely is one of them. Equally important are the 'small wars' and civil disturbances on almost every continent which significantly contribute to the already precarious economic situation and further aggravate the imbalance in the distribution of resources between the 'have' and the 'have not' nations. Many of the factors behind these disturbances lie outside the full control of a given country. In addition some problems such as population growth are complex and not always easy to address. Other factors, equally important, result from a given country's inability to establish relevant health institutions or to manage and maintain existing basic health services.

Studies assessing the essential prerequisites for the delivery of basic health services and for a minimum level of functional efficiency show that in a number of countries delivery services are a major constraint. A situation analysis, conducted in eight countries: Egypt, Cameroon, Sudan, Uganda, Tanzania, Mali, Yemen and Malawi, gives interesting but alarming information on some of the major constraints. There are: minimal coverage of health services; low levels of knowledge and skills among the health care providers; poor service utilization rates by the population and especially by its most vulnerable groups; the virtual absence of reliable vital statistics in almost every setting; and general unresponsiveness of health services to health needs, largely a consequence of the lack of reliable vital statistics.

With the exception of Egypt, where 95 percent of the population lives within easy reach of a health care facility, none of the countries had a general coverage of more than 35 percent. Multiplying this figure by the health services utilization rates provides an even better idea of the effective coverage. The resulting effective coverage rate, with the exception of Southern Sudan where it comes to 14 percent, did not exceed 10 percent for any of the other locations for which information on both parameters (general coverage and utilization) was available. Furthermore, services in Tanzania, Mali, Yemen and Malawi, if account is taken of their time utilization, are available on the average only slightly over 70 percent of the time that they were supposed to be open. Such low coverage can hardly bring about a durable change in health indicators. Whatever positive changes have occurred seem to have resulted more from externally financed vertical programmes such as EPI, Diarrhoeal Disease Control (DDC), schistosomiasis control and others. And even these changes do not away with many of the constraints which are found to prevail in the average health service of the countries listed above.

Family Resources

The role of family resources (particularly mother's education, time, income and others) in increasing the gains from particular interventions is widely documented in the literature. Almost every empirical study has shown wide differentials in mother and child health by level of education. It has been estimated that each additional year of schooling for women is associated with a decline of between five to ten percent in child mortality. In some cases child mortality can be cut down by half with only a few years of additional education. The mechanisms through which female education translates in such large gains is not fully understood. Part of the explanation lies in the ability of more educated mothers to make full use of existing services.

Frameworks Governing Health Interventions

Despite major constraints of health delivery systems and poor socio-economic status, near-miraculous improvements in delivery and acceptance of interventions have been witnessed. For example, global EPI coverage of children has increased from 5 percent in 1977 to 20-30 percent in 1983 and to nearly 80 percent in 1990. Also, the fact that vaccines were available in 1990 to cover 90 percent of the world's 138 million infants stands out as a global humanitarian miracle. Other major improvements in contraceptive uptakes and utilization of ORT have been documented. Such achievements illustrate the existing room for improving health despite weak individual and community level support systems.

These improvements, significant as they are, remain inferior to what could have been achieved with higher levels of political commitment and better allocation of resources. Missed opportunities can be identified at every level of application. Examples are the large proportion of children who start with initial vaccination but do not complete the vaccination schedules and do not follow the recommended timing; the high proportion of females who do not use contraceptives among those who do not want children; and the high proportions of diarrhoeal cases for which Oral Rehydration Salts are used but with very low quality of use.

Are these missed opportunities an expected consequence of the limited material and social resources discussed earlier or a result of inappropriate intervention strategies?

Before discussing the question, it is worth pointing out that the discussion at this point moves from concerns with the theoretical impact (How much can we expect to achieve by these interventions?) and the actual impact of large scale interventions (What did we really achieve?) to optimal use of the interventions (How can we maximize the benefits of the adopted intervention?).

Case studies of national interventions have documented that they rarely achieve their potential for all mortality savings. Research on ORT interventions, which is widely quoted as an example of a very successful health intervention, shows that there is still a large proportion of needy cases without ORT use and of improper use in regard to timing and dosage. In many cases the reasons for non-use or inappropriate use are not fully understood. Often the ability to recognize the danger signs of dehydration is lacking.

The investigation of the underlying causes of these problems shows that neither low education of mothers or their heavy burdens explain the missed opportunities. On the contrary, females with lower education were more likely to use salts than those with higher education (a finding possibly explained by the television messages used in health campaigns which normally portray poor, rural women). Perceived severity of episodes, regardless of other competing demands on mothers' time, was shown to be the critical factor in the use of salts.

Inadequate mass communication strategies seem to be one reason for the less-than-optimal results. Mass communications programmes, while introducing the salts to mothers and alerting them to the dangers of dehydration focused on prompt use of oral rehydration salts (ORS) at the onset of any diarrhoeal attack, however mild. Messages referred to the actual preparation of salts and others showed severely dehydrated children but did not dwell sufficiently on the critical signs of severe diarrhoea.

The recommendation of prompt action for any diarrhoeal attack in the mass media was also unrealistic given the existing framework of beliefs, knowledge patterns and practices related to health and illness, the heavy morbidity toll in the household and the natural reluctance toward the continuous use of medical fixes as well as the heavy work burden of mothers of young children. Such a recommendation reflects a lack of appreciation of household dynamics and the process of household health production.

The pictures of dehydrated infants, used in campaigns, were interpreted by mothers as the signal for the automatic use of ORS. This reveals a misunderstanding on the part of the mothers in regard to the proper condition for the use of ORS in preventing dehydration. The campaigns focused too much on the supply of technology rather than on the creation of conditions which give more responsibility to the decision maker within the family to define the yardsticks for proper action.

The analysis reveals that mothers are willing to listen to reasonable advice and to use as efficiently as possible the salts when they perceived their use to be necessary. However, as a consequence of the simplistic nature of the campaigns which did not fully explain the treatment process, their attention was only directed to the presence of dehydration. The campaign did not properly improve their understanding of the threshold for action and their ability to differentiate between a common mild symptom and an episode requiring attention.

Also, the total dependence on mass media messages with neglect of inter personal communication and support systems is another contributory factor to the missed opportunities identified earlier. Interpersonal communication campaigns are more difficult than simple television campaigns. Face-to-face communication, because of its opportunities for interaction and personal counselling, however gives more psychological support to mothers while improving their management skills. Their effect is more lasting, in contrast to the barrage of television messages which change their focus from one intervention to another.

The communication strategy adopted by the intervention clearly needed different approaches and different plans of action. An approach that is based on the understanding of the household process of health production, picks up the key changes which are needed, how to put them into effect and the reasons why the changes have to be made. It also appears that a satisfactory approach cannot do away with the interpersonal communication mechanism and community support systems.

The most important conclusion of this monograph therefore points to the urgent need to supplement the large scale, high cost medical interventions in developing countries with a programme of health research capable of viewing health interventions within the framework of household dynamics and of the need to address the wide gaps in information and understanding with proper communication strategies.

Evaluation of the Impact of Health Interventions

List of the papers presented at the Seminar on 'Evaluation of the Impact of Health Interventions' organized by the IUSSP Committee on Population and Health, the Brazilian Association for Population Studies (ABEP), the Minas Gerais State Secretary of Health, the Minas Gerais State Foundation for Research Support (FAPEMIG) and the Pan American Health Organization (PAHO), held in Belo Horizonte, Brazil, from 12 to 16 April 1993.

Session 1: Potential Impact of Health Interventions

- 'The Morbidity and Mortality Effects of Nutrition Interventions' by Reynaldo Martorell
- 'Potential Impact of STD Prevention programmes' by Alan Hinman and Judith Wasserheit
- 'Maternal Care' by Cleone Rooney
- 'Potential Health Impacts of Family Planning' by Julie DaVanzo

Session 2: Quantitative Modeling of Health Interventions

- 'The Demographic Impact of Child Immunisation programmes in Developing Countries: A Strategy for Assessment' by Zoe Matthews and Ian Diamond
- 'Models of Determinants of Childhood Morbidity and Mortality' by Stan Becker et al.
- 'Modeling Malaria Health Intervention' by Claudio J. Struchiner, Robert Brunet and M. Elizabeth Halloran

Session 3: The Social Context of Health Impact Evaluation

- 'Impact of Health Services: Models, Indices and Methods' by Peter Kunstadter
- 'Care-seeking for Fatal Illnesses in Young Children in Indramayu, West Java, Indonesia' by Bambang Sutrisna et al.
- 'Availability and Utilization of Health Services in Brazil: A Socio-economic Profile of the Demand for Health Services' by André Medici and Kaizô Beltrao
- 'The Impact of Health Services and Determinants of Its Utilization: A Comparative Analysis' by Fatima Juarez

Session 4: Objective Evaluation (Evaluation of Integrated programmes)

- 'Inter-country Comparative Analysis of Vertical and Integrated programmes on Tropical Diseases' by Bernhard Liese
- 'Demographic Approaches to Evaluation of Child Survival programmes' by Douglas Ewbank
- 'Assessing the Mortality Impact of Health Interventions: Lessons from the Matlab programme' by Michael Koenig and Michael Strong
- 'Health Services for All by the Year 2000, Can it Be Reached?' by Arnfried Kielmann, D. Neuvians and R. Korte

Session 5: Objective Evaluation: (Evaluation of Vertical programmes)

- 'The Expanded Programme on Immunization in Bangladesh' by Sajeda Amin
- 'Assessing the Options for Maternal Tetanus Immunization in Indonesia: A Cost-effectiveness Analysis of Field Experiences' by Peter Berman et al.
- 'Impact of Oral Rehydration Intervention: Critical Concerns' by Hoda Rashad and Laila El Zeini
- 'Development Interventions and Malaria' by Burt Singer
- 'Malaria Mortality in African Children: Problems of Identification and Definition During Community Surveys' by Robert Snow
- 'Evaluation of Breastfeeding: Educational Programme in Brazil' by Elza Berquó and Marina Réa

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3. promotion of exchange between population specialists and those in related disciplines;
4. wide dissemination of scientific knowledge on population.

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