INTRODUCTION AND CONCEPTUAL FRAMEWORK

Child Survival: Research and Policy

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In the developed countries of the world, over 97 percent of all children survive through the preschool years. By contrast, in many poor countries 20 to 25 percent of the children die before reaching their fifth birthday, resulting in an estimated 15 million deaths annually (UNICEF, 1984). Many of these deaths are preventable with available health technology (UN Population Division, 1983). A rising global awareness of the unrealized potential for improving health conditions has led national governments and international agencies to reevaluate health service strategies.[1] Community-based programs have been seized upon by the international health community as the key strategy to make health services accessible, affordable, and socially acceptable.

Yet only two kinds of community-level initiatives are currently undertaken by most health ministries. The first is to extend curative and preventive services to communities through the use of minimally trained paramedical personnel. The second is to concentrate on making a few simple but effective health technologies widely accessible. The latter course of action has particularly captured the attention of the international donor community because of its economy, potential effectiveness in saving lives, and ease of implementation. UNICEF (1984) has been at the forefront in the global promotion of a ''child survival revolution'' based on what is referred to as the GOBI-FF strategy, an acronym for growth monitoring, oral rehydration therapy for diarrhea, breastfeeding, immunization, food supplements, and family planning.

Recently, this concentration of attention and resources on the delivery of a few technologies to the general population has increasingly come under question (Mosley, 1983; Misra, 1983; UN Population Division, 1983; Chen, 1984). The primary concern is that such a strategy is so strongly supply oriented that it tends to ignore the social constraints to demand for and effective

use of health services.[2] This criticism is particularly apposite with respect to efforts to improve child survival. The social factors that constrain families in the use of new technologies may well be the same factors that predispose to higher risks of infant mortality. If so, then limited technology-oriented health intervention programs may be far less cost-effective than their promoters anticipate in the absence of broader development efforts, including investments in education, particularly for women, and in improved economic opportunities for families (Caldwell et al., 1983).

The debate on appropriate program priorities highlights the problems that the international development community faces in trying to determine the best mix of strategies to promote child health. Underpinning this debate are the two dimensions to child survival, the biomedical and the social. Since any health intervention program involves both dimensions, policy-relevant research on child survival should look at both simultaneously (Miró and Potter, 1980: 84). Most health-related field studies in developing countries, however, are carried out by either biomedical or social scientists, each approaching the problems from their own disciplinary perspective with very little recognition accorded the biosocial interrelationships.[3]

The papers in this volume form part of a growing effort to bridge the disciplinary gap between biomedical and social scientists in the study of the determinants of mortality in human populations.[4] The focus is on child survival in the developing world. The purpose is threefold: to propose a simple framework for interdisciplinary communication; to identify key determinants of morbidity and mortality and the methods of analyzing them developed by biomedical and social scientists; and to consider research needs and strategies for multidisciplinary studies on child survival. The comments in this introduction place the volume in the context of current research and highlight programmatic and policy issues that need to be addressed in the future.

Conceptual framework

The barriers to cross-disciplinary communication are almost as great as those across different cultures (Snow, 1971). The difficulties lie in both language and ways of looking at problems. To overcome these hurdles, scientists in the respective disciplines need either to master the jargon and concepts of others, or to define common terms of reference. The paper by W. Henry Mosley and Lincoln C. Chen attempts the latter.

The key concept in the Mosley/Chen framework involves a redefinition of ''cause of death.'' Most biomedical and social scientists identify such conditions as infectious diseases and malnutrition as the main ''causes'' of high infant and child mortality in poor populations. Biologically that is correct, but the observation is not much more useful than to say that pregnancies are a ''cause'' of birth rates. It is important to note that both pregnancies and diseases are consequences of biosocial interactions. A fruitful approach to a study of the ''causes'' of either fertility or mortality in populations is to define and measure these interactions.

In the case of fertility research, Davis and Blake (1956) set the stage for rapid advance by formulating a framework in which live births were viewed as the consequence of a few "proximate determinants," or basic biosocial mechanisms affecting: (1) exposure to intercourse, (2) exposure to the risk of conception, and (3) successful gestation and delivery.

The framework proposed by Mosley and Chen identifies 14 proximate determinants of child mortality. These behaviorally mediated biological mechanisms can be grouped in five categories related to: (1) maternal fertility; (2) environmental contamination; (3) nutrient availability; (4) injuries; and (5) disease control. These proximate determinants provide a conceptual bridge for linking the epidemiologists' concern with identifying biological causes of diseases and deaths in individuals and then seeking control measures by directly manipulating the risk factors (proximate determinants) in the population; and the social scientists' efforts to measure the associations of socioeconomic factors with health behavior (proximate determinants) and their demographic consequences and to propose policies to affect the underlying socioeconomic factors.

As examination of these two major research strategies illustrates, many of the recommendations for health policies and programs coming from the research by scientists in the respective disciplines are not simply a function of empirical results but follow from unspecified assumptions about biosocial interactions. A recognition of this brings us to the roots of the policy debate noted above; it also should provide the impetus for research strategies that incorporate both sociological and biological components.

Biomedical perspectives

Biomedical scientists work in laboratory and clinical settings; their research focuses on disease agents and host–agent interactions. Their applied research is primarily designed to lead to effective therapies and, where possible, vaccines. Such population-based studies as are undertaken in the biomedical field are typically tightly designed to pinpoint the critical risk factors directly associated with specific diseases that might be targeted for intervention programs. The biomedical literature provides the richest source of information about the relationships between the proximate determinants and disease outcomes but has relatively little to say about social interactions.

Infectious and parasitic diseases

Robert E. Black's review of diarrheal diseases documents that any of over two dozen bacterial, viral, or parasitic agents may cause diarrheal disease, though three, *E. coli, Shigella,* and the rotavirus, are most frequent worldwide. These organisms are so prevalent in poor populations that multiple simultaneous infections are not infrequent. Only longitudinal studies can measure the full extent of the disease and elucidate its sources. Because of the intensity of observations and consequent high costs of longitudinal investigations, the

search for risk factors for diarrheas has been limited to factors related to food preparation, use of water, and personal hygiene.

Black observes that research to date indicates that the most effective interventions for control of diarrheal disease are programs to interrupt the transmission of infectious agents in the home. This conclusion is based on well-documented findings concerning the overwhelming importance of fecal contamination of food and water in the home, and on controlled studies showing the effectiveness of such simple actions as handwashing in preventing infection. But, a review of the international literature on diarrheal disease research reveals almost no field studies designed to learn how to make household hygiene effective in poor countries (WHO, 1981–1983). By contrast, dozens of studies pour forth from medical centers in the developing world testing minute gradations in the electrolyte content of a rehydration fluid therapy that is already almost 99 percent effective in clinical settings.

Not surprisingly in view of the investment in time and effort, the major medical advances to come from diarrheal disease research in the last two decades have been in rehydration therapy. This development has resulted in a predominantly curative orientation to diarrheal disease control strategy. Beginning in the early 1970s, as health professionals were persuaded to adopt oral rehydration as the treatment of choice, diarrhea case fatality rates fell from 20–30 percent to under 2 percent in treatment facilities around the world (PAHO/WHO, 1983). In light of these extraordinary success rates and the technical simplicity of administering the therapy, the logical next step has been to teach mothers to treat their own children at home. The biomedical literature now includes numerous studies on technical questions relating to how to teach mothers to properly make and mix a wide variety of oral fluids at home, but rarely are there investigations of whether mothers actually use oral rehydration therapy, and how effectively, and whether it has any lasting health benefit (PAHO/WHO, 1983).

Where studies of use and impact of oral rehydration therapy have been done, the results have often been ambiguous because of inadequate consideration of sociocultural factors.[5] The technique's effectiveness in the clinical setting notwithstanding, any community health benefit gained depends upon use of the health facilities by the population. Yet the problem of underutilization of health facilities plagues rural health systems in developing countries (Mosley, 1983). The distance between the community and the health facility is usually not just geographic, but also economic, social, and cultural. At the community level, a mother may be introduced to the technique, but her decision to use it and her ability to use it effectively are powerfully dependent upon the social support system (Mobarak et al., 1980). Curing a child of an episode of life-threatening dehydration, only to return the child to the home situation that led to the attack, may not improve ultimate survival chances. In Bangladesh a one-year follow-up of discharged diarrhea patients aged 3 months to 3 years revealed that these children subsequently experienced much higher mortality than children at comparable ages in the community at large (Roy et al., 1983). In another rural area of Bangladesh, a community-based

oral rehydration program reduced the diarrhea case fatality rate by about 80 percent but had a negligible impact on overall mortality experience (Rahaman et al., 1979; ICDDR, B, unpublished data).

For some decades now, biomedical scientists have been aware of the limitations of the curative approach to health care in traditional societies (McDermott, 1966; Rowland and McCollum, 1977; Mata, 1978), and anthropologists have described how belief systems influence choices concerning use of health care (Fabrega, 1972). Policymakers promoting oral rehydration therapy and other technologies are not insensitive to the relevant facts, but in the absence of solid research-based findings about the determinants of success (or failure) of various intervention efforts that could provide better guidelines for program strategies, the trial-and-error approach continues.

Ordinarily, biomedical scientists give little attention to socioeconomic determinants of disease except to note them as ''background'' variables, which are considered to be beyond the scope of health intervention programs. Not infrequently, social variables are excluded from consideration altogether through ''controlled'' studies.[6] Yet, as Stanley O. Foster's paper on vaccines implies, there is a need to include consideration of biosocial interactions when new technologies are introduced in mass programs. Three factors that must be considered relate to: (1) acceptance rates; (2) use-effectiveness; and (3) demographic impact—terms familiar to social scientists who have studied the interactions between technology and socioeconomic variables in contraceptive programs. Numerous examples can be cited of the importance of these factors to the success of medical intervention programs. On the point of acceptance, in rural Bangladesh, two-thirds of pregnant women refused to accept tetanus toxoid, even under home delivery (Rahman, 1981). Nor is low vaccine acceptance restricted to underdeveloped countries; measles immunization coverage is less than 20 percent in France and less than 10 percent in Italy (Bart et al., 1983).

Regarding use-effectiveness, medical scientists are acutely aware of biological factors affecting this parameter such as deterioration of vaccines due to poor storage and lack of an adequate immune response in children because of malnutrition. Far less attention has been given to the social constraints to effective vaccine use. For example, for maximum effectiveness, three injections of the ''triple'' vaccine (diphtheria, tetanus, whooping cough) must be taken, but in many programs around the world, as many as 50 percent of mothers refuse to bring their children for all three injections because of febrile reactions among the children vaccinated. Measles vaccine, to be effective, must be given in a critically short period of time after maternal immunity in the child has declined (age 6–8 months) but before the child is attacked by measles. The means to achieve the requisite compliance in national immunization programs has yet to be found.

In terms of demographic impact, measles vaccine is of the greatest interest because of the high mortality associated with measles among malnourished children in poor countries. Two questions are particularly important. First, is the vaccine program reaching the most disadvantaged segment of the

community, those at highest risk of death? Second, among this disadvantaged group, will the elimination of measles lead to improved child survival if poor socioeconomic conditions remain? This latter question was examined in one study in Africa, which found that despite an immediate reduction in measles mortality following immunization, the net gain in child survival over time was very small (Kasongo Project Team, 1981).

These social parameters of vaccine program performance have seldom been the subject of systematic study. In the absence of pertinent data, biomedical scientists make recommendations for mass intervention programs based solely on estimates of the theoretical effectiveness of vaccines. These recommendations consider that the only constraints to program implementation are resources, implicitly assuming that social factors have a negligible influence on program performance.[7]

Parasitic diseases present a special set of problems when it comes to assessing their contributions to child mortality and then determining the priority that should be given to control programs. As David J. Bradley and Anne Keymer report here, although this group of diseases is highly prevalent in poor countries, only a few members of the group, such as malaria, directly cause death; most are characterized by prolonged infestation in the human host that may only indirectly contribute to higher mortality levels in populations.

Most of the research on parasitic diseases has been done by biomedical scientists, but the importance of considering the social dimensions of the problem is being recognized by such agencies as the World Health Organization in their Tropical Diseases Research Program. In this context, it is interesting to note from Bradley and Keymer's paper that many of the biological issues confronting the biomedical scientists have their parallel in the social arena. For example, with the highly prevalent intestinal parasites, an important concern is the biological synergy of malnutrition and infection. The question concerns the degree to which malnutrition predisposes to more severe disease versus the degree to which parasitic infections contribute to growth faltering in children. The answer is important in terms of deciding what role, if any, parasite control may play in nutrition improvement programs. Field studies involving parasite-control activities have not been able to provide a definitive answer to the question because of the effects of ''social synergy''; that is, successful programs may not only reduce parasite loads in the populations, but also initiate other behavioral changes in the affected families leading to better child nutrition.

In the area of long-term control of malaria, the biological problem of emerging resistance of the parasite and the vector to insecticides and drugs can render a technical strategy ineffective. Similarly, public health professionals are often faced with the problem of growing social ''resistance'' in a community after some experience with a new health program intervention—the tendency of the community to revert to former patterns of behavior after the initial enthusiastic reception to the innovation wears off. Both of these

problems require research, inasmuch as either can render new initiatives ineffective in the long run.

Studies of malnutrition and health

Papers by Kenneth H. Brown, by Reynaldo Martorell and Teresa J. Ho, and by Sandra L. Huffman and Barbara B. Lamphere deal with dietary intake, malnutrition, and breastfeeding, respectively. Special attention is given to these subjects because of the frequent lack of clarity in the literature when ''nutritional problems'' are cited as contributing to high mortality. While the expression is used to characterize a population with many malnourished children, it too often also implies that the cause is inadequate food availability. In fact, this may not be the case. Brown stresses that poor dietary intake is only one of several factors influencing the nutritional status of children. (Infection is another factor.) Physical measurements of nutritional status (for example, body weight-for-age) provide an indication of nutrient adequacy in an individual in relation to physiologic needs, but do not reveal how it was produced.

Martorell and Ho describe methods for measuring the nutritional status of children. (While malnutrition can involve deficiencies in any one, or a combination, of many specific nutrients such as vitamins or iodine, or iron, the focus of their discussion is on protein–energy malnutrition). As Martorell and Ho report, among the numerous clinical and biomedical indicators of malnutrition, body measurements of weight and height (anthropometry) have the advantage of being ''sensitive over the full range of malnutrition.'' They are also ''highly reliable and are less expensive and easier to obtain than most nutritional data.''

Although childhood malnutrition is a serious problem, the only way to confirm food deficiency as a cause would be by direct measurement of dietary intake. This, as Brown's paper reveals, is difficult. Yet, failure to establish which proximate determinants are major contributors to malnutrition in a specific population can jeopardize the success of health intervention efforts. For example, in 1979 Indonesia embarked on a national nutrition program that now involves the monthly weighing of almost 2 million children. Coupled with this, mothers are advised about diets, and some food supplements are provided. The program design is based on the assumption that poor dietary intake is the major problem to overcome. Recent assessments have shown little evidence of a nutritional improvement in children since the program began (Pangestuhadi, 1983). Now the program assumptions are being challenged by Kusin and others (1983), whose research in East Java suggests that the predominant cause of malnutrition may not be poor diet, but frequent recurrent infections. If this is the case, the appropriate intervention strategy to combat malnutrition should emphasize infection control rather than dietary advice.

In India, a debate centers around what factors are the major contributors to malnutrition, and what level of malnutrition should be of concern for nutri-

tion intervention programs (Sukhatme, 1982; Gopalan, 1983). Martorell and Ho summarize data that show a clear association of excess mortality with severe degrees of malnutrition. There is less evidence for the adverse biological consequences of mild to moderate malnutrition even when it produces permanent growth stunting. Indeed, Sukhatme (1982) and others have concluded that the present recommended standards for food (calorie) intake needed to support ''adequate'' nutrition are unnecessarily high, based on the reasoning that growth faltering is a normal, rather than pathological, physiological adjustment to a reduced diet. Thus, stunted children are simply ''small but healthy'' (Seckler, 1982). In India, such a redefinition of malnutrition could reduce the estimated number of people who require more food from around 250 million to perhaps 50 million, a difference with major implications for national food and nutrition policies as well as health programs.

Research is needed to assess whether a population of children growing under conditions of limited food intake (such that stunting develops) suffers more adverse consequences (mental and emotional, as well as physical) than a better fed group. This will require a longitudinal (cohort) study; one bias of cross-sectional growth data presented to support the ''small but healthy'' thesis is that such data pertain to those small children who have survived.

Breastfeeding versus bottlefeeding is another topic of major concern to policymakers. One much debated issue has been the misleading advertising practices of the baby formula industry to promote their products. As Huffman and Lamphere observe in this volume, the advantages of breastfeeding for the health of young infants are manifold and well documented, but breastfeeding makes heavy demands upon the mother's time and energy, and many mothers, by choice or necessity, divert their efforts to other activities. Thus, questions are raised about what health and other social development strategies can provide the best support for both mothers and their children.

Again, we are dealing with a topic that can only be explored through a multidisciplinary approach. Nutritionists are concerned with measurement of breast milk production; anthropologists with the accurate description of beliefs and values associated with breastfeeding practices; sociologists with the determinants of breastfeeding practices; epidemiologists with the environmental conditions predisposing to infection; and demographers with the mortality and fertility consequences of breastfeeding. And, as emphasized by Huffman and Lamphere, all such studies need to be concerned with the fact that proper interpretation of the findings is especially difficult because of the strong association of declines in breastfeeding, which may be expected to have adverse health effects, with other features of modernization that generally enhance child survival.

Social science perspectives

Like research in the biomedical sciences, social science research ranges from the micro to the macro level. At one extreme are the anthropologists who document the beliefs and behavior of individuals and small groups of people; at the next level are those doing household survey research; while at the macro

level, social scientists analyze aggregate data from regions or nations. Demographers have developed a variety of sophisticated analytical techniques to estimate trends and differentials in mortality from census and survey records, even where data are quite limited.

Macro-level research strategies and policy implications

Classical macro-level demographic research has relied largely upon existing data sets collected for purposes other than the research objective at hand (Palloni, 1981). This creates great economies in a research program, but limits variables available for study. In spite of these limitations, the macro approach has proven invaluable in defining some of the major determinants of mortality trends and differentials in populations, often yielding findings that have major policy implications.

From the end of World War II until the early 1970s, numerous studies documented unprecedented declines in mortality in the less developed countries. These trends were widely attributed to the introduction of modern medical technology, largely dissociated from socioeconomic development (Davis, 1956; Stolnitz, 1965; Arriaga and Davis, 1969). More recently, a series of studies by Preston (1978, 1980b) demonstrated that both socioeconomic development and technology played important roles, each contributing about 50 percent to the overall mortality decline in the post–World War II period.

As the determinants of mortality in developing countries were being identified, it was expected that the decline would be steady and irreversible until high levels of life expectancy were reached. Thus, the development community was surprised when Gwatkin (1980) presented data suggesting that the pace of improvement in mortality levels had slowed considerably during the late 1960s through the mid-1970s. This prompted a more critical consideration of the connections between development, medical technology, and mortality change, aimed at a fuller understanding of their interrelationships for health policy and programming purposes (Ruzicka and Hansluwka, 1982; UN Population Division, 1983).

Several recent macro-level studies provide important clues in this regard. First, there is the empirical observation that Sri Lanka, Kerala, and Cuba experienced substantial mortality reduction under processes of development structured "in such a way as to increase levels of literacy and spread public health and nutrition programs widely among the population" (Preston, 1978). Preston (1980b) subsequently showed in an analysis of mortality differentials among 52 countries that "the mortality risks facing a family earning $10,000 per year or $100 per year are not strongly influenced by the prevailing level of average income in the nation they reside," the point being that it is the economic capability of the individual family that is important to the survival of their children. This analysis also showed the independent contributions of female education and per capita calorie availability as well as income to mortality differentials.

Palloni (1981), undertaking an analysis of infant and child mortality