CHILD HEALTH DIAGNOSIS

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Introduction — The Production of Health

When governments invest in health they typically direct the bulk of expenditures to the personnel and infrastructure of a sickness care system, e.g., doctors, nurses, and supporting staff along with hospitals, clinics, and dispensaries. While these technical and institutional resources are important for health care, they represent only a very small part of the total "health system" of a country and, in fact, may not even be readily accessible to large segments of the population in many localities.

A country's health system is more appropriately defined to encompass all of the people and institutions in a society responsible for the production and maintenance of good health among its citizens. Since most persons are responsible for their own health and welfare most of the time, the primary "producers" of health in a nation are the people themselves. Consequently, the role of government investments in health should be to assure that its citizens can be as productive as possible in producing health by providing all of them with the necessary knowledge, skills, motivation, and appropriate technologies, as well as assuring that the working and living environments are as safe as possible.

Mothers as Producers of Child Health

The one major exception to the generalization of individuals being responsible for their own health relates to infants and children. In this case, the primary locus of health care is in the family, with the mother as the primary producer of health. Her time, energy, knowledge, skills, and her own health, along with the resources at her command, are critically important to the survival and healthy development of each of her children during the first few years of their lives.

Table 1, depicting the reproductive life cycle of childbearing women, illustrates how a mother's health behavior, sickness care and dietary choices, resources at her command and environmental living conditions at each stage in the development of a child beginning with conception, can influence its growth and development, its burden of disease, and its probability of survival. A fundamental reality coming from this

illustration is that the production of a healthy child is a continuing process; the health status of a child at every age reflects the culmination of its lifelong exposure to good or poor health conditions.

Table 1 also provides insights into how government investments intended to promote the production of health, must extend beyond supporting curative medical services delivered in a limited number of fixed facilities and reach into every household in the nation to enhance the capacities of mothers to produce healthy children. Consequently, health investments should be looked on as social investments which are designed to influence the health beliefs, attitudes, and practices of families, particularly mothers. In order to choose the appropriate investments to promote child health, governments need to be able to measure the health status of children as well to identify the major factors contributing to ill health that are amenable to intervention. The process of making this "child health diagnosis" is the topic of this paper.

Child Health Diagnosis

A physician, before being able to initiate an appropriate course of therapy for an ill patient, must make a proper diagnosis. This requires competency in two areas. First, the physician must have a comprehensive understanding of the diseases among children including their underlying causes and well as their clinical manifestations. Second, the physician must be knowledgeable about the diagnostic tools that are available and their strengths and limitations in identifying and characterizing the disease processes.

The same conditions hold when a health policy maker or program manager wishes to arrive at a "diagnosis" of the causes of morbidity, mortality, and malnutrition in a population, though, in fact, the diagnostic challenge is more complex than that confronting the physician seeing an individual patient. First there must be broad understanding of the chain of social, economic and environmental, as well as biological factors producing the health problems in the population. Second, there is the requirement for "diagnostic instruments" to measure the scope and magnitude of the problem in the population and to elucidate the causal factors that are amenable to cost-effective interventions. Broadly, these diagnostic tools take two forms. First are periodic population sample surveys which can assess a wide variety of health conditions in the population at one point in time; second are continuous surveillance systems which monitor specific health conditions over an extended period of time. Our concern here is with population surveys.

A Framework for Child Health Diagnosis

The complex chain of biological and socio-economic factors underlying the health conditions seen in any population require that survey instruments draw on the insights from many disciplines including

demography, sociology, economics, epidemiology, and the behavioral sciences. The research challenge is to design a questionnaire survey that adequately assesses all of the factors determining the production of health, yet is efficient enough to be implemented on a national scale covering thousands of households. Fortunately, epidemiological and social science research over the past two decades have led to the development of analytical frameworks that can guide the design and implementation of population surveys that will generate the information needed for health policy makers and program planners.

When it comes to measuring the severity of the health problems among children in a population and sorting out some of the critical causal factors, the task of accomplishing this is facilitated by applying a simple analytical framework developed by Mosley and Chen[1]. This framework posits that essentially all the health conditions among children under age five in a population are due to five basic bio-social processes. Four of these determine the risks of exposure to diseases, disabilities, and death while the fifth relates to personal actions that may be taken by the child's caretaker to prevent or treat specific disease conditions.

These five bio-social mechanisms are:

1. **Maternal Factors** — These are maternal conditions affecting the growth and development of the fetus during the course of pregnancy that will determine the health status of the newborn child and its probability of survival, particularly during the early weeks of life. Biologically, powerful predictors of early child survival include maternal age at the time of pregnancy, the time interval between pregnancies, and the birth order of the newborn. In this context, the practice of contraception, particularly as it may directly impact on the age of childbearing, the inter-pregnancy interval, and the total number of children, has important consequences for child survival.

2. **Dietary Intake** — Broadly this can be categorized into two components. The first is the adequacy of protein-energy nutrition which manifests itself in the weight gain and linear growth of the child. If protein-energy malnutrition occurs during pregnancy, the consequence is intrauterine growth retardation (IUGR) resulting in underweight and frail (premature) newborns at high risk of early death. Inadequate breastfeeding early in life and/or inadequate diet later in childhood will result in poor weight gain and a substantial irreversible retardation in linear growth. Repeated infections, particularly diarrheal diseases, will also aggravate protein-energy malnutrition and growth retardation.

[1] W. Henry Mosley and Lincoln Chen, (eds). *Child Survival: Strategies for Research.* New York: Cambridge University Press, 1984

A less visible form of malnutrition is due to deficiencies in micronutrients such as vitamin A, iron, and iodine. While the physical and mental consequences of these deficiencies can be quite severe, (e.g. blindness, anemia, mental retardation, as well as an increased risk of death from acute infectious diseases), the actual diagnosis of these deficiencies in a population requires a careful physical assessment generally accompanied by laboratory tests. Thus these important deficiencies are ordinarily not measured in population surveys limited to household interviews.

3. **Environmental Contamination** — There are myriad of infectious agents whose transmission to infants and children is facilitated by unsanitary household conditions, overcrowding, and poor personal hygienic practices. Household environmental conditions may be assessed by the quality of household construction, sources of water, and presence/types of toilet facilities as well as availability of electricity and fuel for refrigeration and cooking. Indicators of hygiene determining the transmission of infections can involve the use of soap, food handling practices and defecation habits.

4. **Injuries** — Physical injuries in younger children are typically due to burns, falls, and poisoning, often related to household hazards. Among older children outdoor injuries including motor vehicle accidents become more common, with higher frequencies among boys compared to girls.

5. **Personal Illness Control** — There are two types of behaviors in this category. These are: a) preventive measures taken to avoid disease including traditional practices like observing taboos, as well as modern practices such as seeking qualified antenatal and childbirth care, receiving maternal tetanus toxoid immunization, and immunizing the children; b) sickness care, which again includes both the use of traditional medical practices as well as acceptance of modern medicine like oral rehydration therapy and antibiotics.

Utility of the Child Survival Framework for Child Health Diagnosis

The analytical framework described above greatly facilitates diagnosing child health problems from data gathered from population surveys for two main reasons. First, the classification provides for a comprehensive identification of the broad range of socio-economic, environmental, and behavioral factors that can potentially be measured in household surveys. While practical considerations of survey research make it impossible to include measures of all of these factors in any single survey, it is important to measure to some degree the contribution of some of the major factors in each of the five basic categories in order to arrive at a correct child health diagnosis. Failure to do this can result in some very misleading conclusions.

For example, a simple survey looking only at sickness care practices may show that families which take their ill children to hospitals have healthier children than those who do not. This could lead to a policy recommendation to build more hospitals. In fact, a more comprehensive household survey would likely show that mothers who take their children to the hospital also more often immunize their children and have good hygienic and dietary practices at home, and practice contraception for birth spacing. From this simple example, it should be clear that a more complete assessment of the many bio-social factors associated with the "production" of healthy children permits the policy maker to identify a range of cost-effective interventions that potentially could be provided to the entire population.

The example above leads to the second use of the child survival framework. It provides a basis for understanding more clearly how underlying social and economic circumstances like a mother's education, a father's occupation or place of residence, which are strongly associated with large differentials in child health in the population, actually operate and interrelate to affect: a) the risks children have to infections, malnutrition, and injuries; and b) the types and quality of preventive and curative care they may receive. For example, studies around the world have shown that more educated women, even in poor households, will typically have healthier children than less educated women. Operationally, this can be due to a combination of reasons including selecting better care during pregnancy and childbirth, having better hygienic and dietary practices, utilizing modern contraception for birth spacing, and having better access to and more use of modern preventive and curative medical services. However, the utility of this framework becomes clear when seeking explanations for apparently paradoxical observations. In another example, in some countries it has been observed that children of better educated mothers living in urban areas who are employed with higher incomes actually suffer more from diarrhea and attendant malnutrition. Examining the bio-social mechanism reveals that this is occurring because of the substitution of breastfeeding with bottled baby formula which is provided by uneducated caretakers with poor hygienic practices. Under such circumstances, better access to hospitals does not compensate for the high exposure to infection and malnutrition in the home.

Diagnosis of Child Health with PAPCHILD Surveys

The PAPCHILD Survey has been explicitly designed as an instrument for child health diagnosis. It is in this context that the discussion below will highlight its utility for health planning and program monitoring. The focus will be on the specific indicators and measurements of mortality, growth, and morbidity, noting how the analytical framework for child survival assists in interpreting the findings. To do this, it is important first

to note what kinds of data are actually collected that measure: a) the health conditions among children; b) the more proximate bio-social mechanisms contributing to health; and c) some of the underlying factors.

Table 2 classifies the measurable indicators for child health diagnosis in the PAPCHILD Survey into three major categories: a) indicators of health status; b) bio-social mechanisms affecting health risks; and c) background socio-economic factors. Noteworthy, the listing in category b) shows that the PAPCHILD Surveys gather measurable indicators of each of the five bio-social mechanisms described above, although the degree of detailed questioning on each varies widely. For example, many items of information are gathered about environmental health risks while questions on dietary practices are limited to breastfeeding, supplementation and the quality of the child's diet at the time of the survey.

In terms of indicators designed to directly measure the health of children as seen in the first category in Table 2, information was collected on 14 specific measures. In the discussion that follows, these are divided into three groups according to whether they measure: 1) the cumulative consequences of health risks; 2) the recent acute disease burden; or 3) health conditions in the past. Appendix 1 summarizes the actual measurements for all 14 indicators as found in the Egyptian PAPCHILD Survey which will be used as an illustrative reference in this paper.

1. Measures of the Cumulative Consequences of Health Risks

a. Mortality

In the first group are the measures of mortality, physical growth, and disabilities. These three indicators, all of which reflect the cumulative impact of the lifelong health conditions on infants and children, are among the most fundamental measures of health in a population. Mortality data are collected by obtaining a lifetime reproductive history from each ever-married woman in the survey through a detailed questionnaire covering the date of birth and, in case of a death, date of death of every live-born child along with some events connected to childbirth and symptoms at the time of death. This information can be used to calculate conventional measures of infant (0-11 month) and child (1-4 year) mortality rates for a 15-year period prior to the survey, ordinarily with the data grouped into 5-year periods. This provides estimates of mortality levels and trends which are the first step in arriving at a child health diagnosis.

Because the birth histories provide information on the age of death and associated symptoms, one can assess in more detail mortality rates in three age groups: neonatal (under 1 month); postneonatal (1 to 11 months); and childhood (1 to 4 years). These age groupings are important programmatically because

different causes of disease and death dominate so that one would expect to see differential reductions in mortality by age, depending upon which health interventions are being implemented. In the neonatal period one is particularly concerned about the risks associated with low birthweight, the care and complications around childbirth, and death due to neonatal tetanus; in the postneonatal period death associated with diarrheal diseases and malnutrition are more prominent because of poor breastfeeding and hygienic practices; in childhood, as children become more mobile, deaths due to respiratory infections as well as injuries will be seen more frequently along with diarrheal diseases and malnutrition.

The next step in analyzing child mortality is to examine the variations in levels among different regional and socio-economic subgroups in the population. This provides a good indicator of the inequities in health conditions in the society. Basic groupings commonly used are: by urban and rural residence and by region to document economic and geographic inequities; and, by level of maternal education to assess social inequities in health conditions in the population. (See Appendix 1).

A typical analysis of urban/rural and regional mortality differentials will show better health conditions in the urban and more highly developed regions as compared to rural and remote regions. In order to unravel some of the bio-social mechanisms that may be involved in these differentials, more detailed cross-tabulations are required. For example, one would expect that environmental exposure to infection would be reduced in the urban area because of better housing conditions. Table 3a, taken from the PAPCHILD Survey in Egypt, shows that this is true. In urban Egypt, 85% of the houses have tile floors as compared to only 43% in the rural areas. The vast majority of the remaining in both areas have dirt floors. Correspondingly 67% of the urban dwellings have a flush toilet as compared to only 11% in the rural areas.

The risks to child health associated with these living conditions in urban and rural areas are illustrated in Table 3b which shows the under-5 mortality rates (averaged over the preceding ten years). These tabulations make it clear that poor housing conditions are associated with higher risks of death in both urban and rural areas. One can also infer that about half of the almost 50-point difference in mortality between urban and rural areas (73 versus 122) can be associated with the much higher proportion of better quality houses in the urban areas as noted in Table 3a. At the same time, this cross-tabulation indicates that even when these rural housing conditions are the same as in the urban areas, substantial mortality differences still remain. These remaining differences must be related to many other ways that rural residents differ from

urban residents in terms of their health behaviors, etc., as described in the list of bio-social mechanisms noted earlier.

A more detailed analysis to examine how these other bio-social factors may operate to produce the mortality differentials that continue to be seen between urban and rural areas, given that housing conditions are similar, could be attempted by carrying out additional, more detailed, cross-tabulations. If this were tried, however, it would quickly become evident that the numbers of births and child deaths in any particular cell of a larger and more complex table would be too small to reach any meaningful conclusions. The solution to this problem is to utilize more powerful statistical techniques involving multiple regression models where many factors can be examined at the same time. These more complex statistical techniques will not be described further except to note two points below. First, all statistical analyses are limited by the availability and quality of the data; thus, it is most important to ask the right questions in the first instance and to take great care in seeking to get reliable and valid responses. To illustrate how data limitations constrain policy analysis, consider that some of the residual mortality differentials observed between rural and urban areas in houses with a dirt floor may be shown to be related to differentials in the availability of soap. While this is more informative, the matter cannot be pursued further because no questions were asked about household income and expenditures, or about the mother's knowledge of the connection between hygienic practices and infection control. Thus, while the importance of availability of soap might be documented, there would still be insufficient information to determine if the appropriate policy recommendation would be health education, or subsidizing the price of soap, or a combination of the two.

The second point of caution in analyzing survey data is to avoid interpreting statistical associations as causal relationships. For example, in the tabulations given above, the large differences in mortality seen among households with and without flush toilets in both urban and rural areas might lead to the inference that installing flush toilets in every household would result in a comparable improvement in health. Such a conclusion fails to recognize that families that choose to install and use flush toilets will also be different in many other ways from families without flush toilets, both in terms of their overall economic resources and in their health behaviors. A more sophisticated multivariate analysis can attempt to assess the strength of the association of flush toilets with better health, taking into account all of the other bio-social factors that have been measured. It must be recognized, however, that such an analysis can only account for the effects of those bio-social mechanisms that actually were measured in the survey. If there are other important but

unmeasured factors, they would remain in the statistical analysis as an effect attributed to the presence of flush toilets.

b. Physical Growth

Among surviving children, the best single measure of general health status that can be easily obtained in a survey is their physical growth. This is assessed by comparing their measured height-for-age and/or weight-for-age with expected values based on international reference standards. In a healthy population, only 2.3% of children will have a height-for-age or weight-for-age more than two standard deviations below the expected value. While weight can be lost rapidly with a severe illness or temporary food restriction and then gradually recovered in convalescence, if these health insults are recurrent or chronic there is not only a sustained loss of weight but also a retardation of linear growth in height which is mostly irreversible and, over time, leads to progressively severe stunting. Noteworthy, as mentioned earlier, growth retardation can begin during the course of pregnancy if the mother is undernourished so that the newborn will already have a low weight and short stature at birth even though birth follows a full-term pregnancy.

Given the pattern of early acute weight loss followed by longer term stunting in populations where undernutrition and infections are prevalent, we would expect to see in a cross-sectional survey of children the highest prevalence of underweight during the weaning period and early childhood, while the highest prevalence of stunting should be seen later in childhood and be persistent. This, in fact, is the picture in Egypt. The proportion of children more than two standard deviations below the expected weight-for-age reaches a peak of 17% in the 6- to 11-month group, is slightly lower at 15.5% at ages 12- to 23-months, and then drops to 7% at ages 48- to 59-months. By contrast, the prevalence of stunting (more than two standard deviations below expected height-for-age) does not peak until 12- to 23-months where it reaches 35.3%; it remains almost at the same level (34.1%) at 24- to 35-months and is only modestly lower at 30.1% in the 48- to 59-month age group.

The figures above are indicative of a very high level of undernutrition in the population. Given that many of the same bio-social mechanisms producing child mortality also result in undernutrition among the surviving children, we would expect that further analysis of the social and economic correlates of stunting and low body weight would parallel the finding described earlier with child mortality. This, in fact, is the case as seen in Appendix 1. In Egypt the prevalence of undernutrition is approximately twice as great in rural as in urban areas and twice as great among uneducated as compared to educated mothers.

c. Mortality and Undernutrition Interrelationships

It should be clear from the above observations that infant and child mortality and undernutrition are both strongly related to underlying social and economic conditions and, in fact, share some common bio-social determinants such as recurrent diarrheal infections and poor feeding practices. At the same time, there are important distinctions that should be recognized by policy makers and program planners. Most significant is the fact that there are some very powerful preventive and therapeutic interventions such as immunizations, particularly for measles and oral rehydration therapy for severe life-threatening diarrhea that can produce significant reductions in mortality without changing the level of undernutrition seen in these children. In some countries where these interventions have been introduced, substantial declines in infant and child mortality have been recorded without any accompanying gains in nutritional status as measured by physical growth. In fact, in some settings where economic conditions have deteriorated producing food shortages, undernutrition has even increased though mortality rates have declined.

The point being emphasized here is that while the levels of both child mortality and physical growth are indicative of the cumulative health risks in a population (and, in fact, undernutrition predisposes to a higher risk of death) each indicator has some distinctive bio-social determinants such that one should not be used as a proxy for the other. Rather, both indicators should be measured and analyzed to correctly diagnose the health problems among children, and design the most appropriate intervention programs.

d. Disability

The third indicator of the cumulative consequences of insults to health in the population is the prevalence of disabilities by age group. Extensive use of this indicator to assess the general health conditions in children is problematical unless very careful attention is given to measurement. In the PAPCHILD Survey this, in fact, did not occur. Information on disability was not specifically collected for children but was, rather, obtained at the time of the household interview for all family members. Furthermore, the question was vague, asking the respondent if "anyone in this household" has "any long-term condition or health problem" which limits their activities. Since the question neither addressed family members individually, nor were the disabilities specified, the likelihood of under-reporting is high. For example, the Egyptian survey, out of 8,224 children, only 72 were reported to have a disability, giving a prevalence rate of 8.75 per 1,000. Higher rates were reported among urban residents. (See Appendix 1). Unfortunately it

is impossible to compare this finding with data from any other survey because of the vagueness of the question. For the same reason, these data are not likely to be useful for a time-trend analysis.

It should be stressed that when properly done, disability surveys can be critically important. A classical example in children are "lameness" surveys that have been carried out in many developing countries (more often among school children) which were used to assess the magnitude of the problem of paralytic poliomyelitis. Lameness prevalence rates typically reached 3 to 5 per thousand, indicating a far more serious problem with paralytic polio than had previously been appreciated. These data were instrumental in encouraging national governments to initiate polio immunization programs.

2. Recent Illness Episodes

As a second set of measures of health conditions in the population, the PAPCHILD Survey incorporates a module that gathers information on recent episodes of several acute infectious disease conditions. These are diarrhea, respiratory infections, fevers, ear infections, eye infections, and "other" infections. It should be noted at the outset that each of these "diseases" is actually a symptom complex that can be caused by a multiplicity of infectious agents both viral and bacterial and, in the case of diarrhea, parasitic as well, with multiple routes of transmission.

a. Diarrheal Diseases

Agents causing diarrheal diseases are primarily transmitted through food, water, and hand-to-mouth routes which are facilitated by bad sanitation and poor hygienic practices. This is particularly true of the more severe forms of diarrhea and the dysenteries characterized by blood in the stool. In terms of individual risks, the highest rates of diarrhea would be expected during the weaning period.

The diarrhea patterns observed in the Egyptian PAPCHILD Survey are indicative of a significant diarrheal disease problem in the population. The overall percentage of children reporting diarrhea in the past 14 days was 11.6 with a peak prevalence as high as 22.3% observed among children ages 6 to 11 months. The diarrhea rate among children of uneducated mothers was over 30% higher than among mothers with secondary education. (Appendix 1) Furthermore, higher rates of diarrhea are associated with rural residences and poorer sanitary conditions in housing paralleling the patterns seen with mortality described earlier. In all of these cases, the differentials were even greater if only severe diarrhea episodes characterized by bloody stools were considered. (See Appendix 1 for rural/urban and educational

differences.) Intervention programs designed to improve sanitation and hygienic practices would be expected to reduce these differentials.

b. Respiratory Infections

The interpretation of reported symptoms of respiratory infections observed in the past 14 days is more problematical. Coughs and colds can be highly prevalent among all socio-economic groups, given the airborne route of transmission. Furthermore, these infections are highly seasonal so that the prevalence rates will vary according to the time of year of the survey. In the Egyptian study, as many as 31.5% of mothers reported their under-5 children had a cough and, in fact, educated mothers reported a higher frequency of cough than uneducated mothers suggesting this was primarily an observational and reporting difference. (Appendix 1). Intervention programs directed to acute respiratory infection are not expected to reduce reported incidence, but can significantly lower pneumonia mortality if effective therapy is available.

c. Fevers

Fever is a very non-specific symptom of a multitude of infections. Further, recognition of fever does require a more conscientious caretaker. Thus, not surprisingly, in the PAPCHILD Study in Egypt, fever, like respiratory infections, are more commonly reported by more educated mothers. (Appendix 1). Based on the Egyptian experience and the lack of specificity of symptoms of cough and fever, the conclusion is that these questions are not very useful for assessing morbidity levels in the population.

d. Ear and Eye Infections

Two other specific illnesses addressed were ear infections and eye infections as manifested by pus from the ears or the eyes present on the day of the survey. Chronic untreated ear infection can be a significant cause of hearing loss, however, the PAPCHILD survey did not gather information on the duration or severity of these infections or test for any associated hearing loss, therefore making it difficult to put these data into any health perspective for policy and programming. The eye infections were more common in rural and disadvantaged areas as well as among households with uneducated mothers, consistent with this condition being associated with poor sanitation. (Appendix 1). The prevalence of both of these conditions should fall with interventions designed to facilitate improved access to health care and improved hygienic habits.

Specific Past Morbidities

a. Childbirth

The PAPCHILD Survey gathered historical information about six specific morbidities. Of the three connected with childbirth, two ask "yes-no" questions about whether there was a complication at the birth of each child and whether or not it was a C-section delivery, while the third obtains recall information about whether the birth weight was low, normal, or high. Each of these items of information are important indicators of maternity care and pregnancy outcome.

In the Egypt PAPCHILD Survey it is noteworthy that mothers living in urban areas and with higher levels of education reported a much higher frequency of both complicated pregnancies and Caesarian sections than rural mothers. (Appendix 1). This is not an unexpected pattern that is likely to be seen in many developing countries where there are large differentials in the availability of hospital care by region and social class. In Egypt, for example, in the rural areas 82% of the deliveries take place at home and only 12% in a medical facilities. By contrast, in the urban areas only 58% of the deliveries are conducted at home with 42% done in a medical facility. One can expect that qualified providers are more likely to identify complications of childbirth such as unusually prolonged labor which mothers having home deliveries may not appreciate as abnormal. Correspondingly, one would expect a higher proportion of Caesarian sections in urban areas where a higher proportion of mothers have hospital deliveries. In this context, it may be noted that in the Egyptian survey an urban woman was about 3-1/2 times more likely to have a delivery in a medical facility than a rural woman (see above) and, correspondingly, she was about 3-1/2 times more likely to have a Caesarian section (7.8% vs. 2.3%). It thus appears that Caesarian sections may be as much determined by the place of childbirth as by medical necessity because of a complicated delivery. More research is needed on this important question.

The frequency of low birth weight is another important indicator of the health status in the population and it would be valuable to know the level, trends, and differentials in birth weight in the population. In the case of the PAPCHILD Survey, however, birth weight information is only gathered based on the mother's recollection of whether the infant's size was small, normal or large at the time of birth. While some analyses of these types of data have shown that reports of "low" birth weight have been associated with higher rates of neonatal mortality, more research is needed on the validity of these responses before their utility in assessing the level and trends in low birth weight in the population can be determined.

b. Measles

The PAPCHILD Survey gathers historical information on whether the child ever had measles. Given that measles is a well recognized specific disease which is now being combatted with an immunization program, the mother's response can be of use in identifying subgroups of the population with a continuing high incidence of the disease. (Appendix 1). Thus, this question is useful for targeting immunizations as well as to monitor, through repeated surveys, declining trends.

c. Injuries

The questions about injuries cover a long period, asking if the child was ever injured and has sustained an injury in the past 12 months. Again, these non-specific questions are very subject to recall error. Not surprisingly, in the Egyptian PAPCHILD survey, response rates were higher in urban as compared to rural areas and among more educated women as compared to less educated. (Appendix 1). This is indicative of a respondent bias which will make interpretations of levels and trends problematical. Certain patterns found among those cases reported, however, are consistent with other experience and would be of interest to policy makers. For example, the injury rates were about twice as high among males as compared to females. Two-thirds of the injuries occurred in the home and about one-third were due to burns. Burns were particularly common among injuries occurring to children from 12- to 23-months-of-age, a high proportion of which produced long-term complications.

Conclusion

The health conditions in a population are primarily a product of the social and economic circumstances of its citizens. This being the case, a household social and economic survey incorporating epidemiological questions is the appropriate instrument for a child health diagnosis. In developing a parsimonious survey instrument that will be adequate to correctly characterize the child health status of the population and shed light on the underlying and immediate causal factors, an appropriate conceptual and analytical framework is required. The PAPCHILD Survey utilizes the child survival framework developed by Mosley and Chen which identifies five major bio-social mechanisms through which all socio-economic factors must operate to produce the levels of morbidity and mortality seen among infants and children in populations.

In terms of the direct indicators for child health diagnosis, the PAPCHILD survey gathers some data on 14 items. The two most robust measures of health status in the population are the direct measures of infant and child mortality taken from retrospective pregnancy histories of mothers in the childbearing age and

measures of physical growth (height and weight) of the surviving children. Other useful indicators are the measures of diarrheal episodes in the past two weeks, particularly those associated with severe symptoms (bloody stools) and, in terms of childbirth care, the reported frequencies of Caesarian sections. The latter, however, seem to relate as much to access to hospital facilities as to complicated pregnancies. A number of the other 14 indicators measured have evident problems with recall biases and validity of responses, making their utility for child health diagnosis questionable.

More information to improve the child health diagnosis may be obtained from the PAPCHILD Surveys than is given in the initial report if carefully formulated multivariate regression analyses of the data are carried out. Care should be taken, however, to avoid interpreting a statistical association as a causal relationship. There are some intrinsic limitations in the PAPCHILD questionnaire which should be strengthened in future questionnaires so that planners and policy makers may be better informed in developing and targeting their child survival programs.

Table 1

Stages in the Reproductive Life Cycle
Illustrating Maternal Practices and Environmental Conditions
Influencing Infant and Child Health and Survival

A. During Pregnancy

1. Specific preventive practices to "protect" the pregnancy
   - < traditional practices, e.g., rituals
   - < modern practices, e.g. prenatal care, tetanus immunization

2. Dietary practices
   - < traditional, e.g., food taboos/restrictions
   - < modern, e.g., food/vitamin supplements

3. Sickness care practices
   - < traditional healers/medicines/rituals
   - < modern medicines

4. Work routines/rest during pregnancy

5. Alcohol/tobacco/drug abuse

B. At Childbirth

6. Place selected/hygienic conditions
   - < home
   - < health facility

7. Attendant selected
   - < self/family
   - < traditional attendant
   - < qualified midwife/physician

C. Postnatal and Child Care Practices

8. Breastfeeding practices
   - < use of colostrum
   - < pattern of breastfeeding, e.g., demand or schedule
   - < duration of full/partial breastfeeding/weaning practices
   - < use of bottles

9. Infant and child feeding practices
   - < type/timing/amounts of food
   - < vitamin supplements

10. Maternal diet during breastfeeding
    - < food taboos/restrictions
    - < supplementary food/vitamin

11. Household environment
    - < house size and quality of construction (mud, wood, cement)
    - < water supply/toilet facilities
    - < electricity/refrigerator/hot water
    - < ventilation/screens

12. Hygienic conditions/practices
    - < food preparation/storage
    - < cleaning practices/use of soap
    - < waste disposal
    - < crowding
    - < animals in house

13. Disease prevention practices
    - < traditional, e.g., taboos/rituals
    - < modern, e.g. immunization, vitamins

14. Sickness care practices
    - < traditional, e.g. food restrictions, healers, etc.
    - < modern, e.g. oral rehydration therapy, antibiotics

15. Surrogate childcare
    - < place of care
    - < qualifications of caretaker

16. Conception delaying action
    - < prolonged breastfeeding, abstinence
    - < modern contraception

Table 2

Classification of Indicators for Child Health Diagnosis Measured in PAPCHILD Surveys

A. Indicators of Health and Disease

1. Measures of cumulative consequences of health risks
   - < mortality (deaths by age among all live born children)
   - < physical growth (height, weight)
   - < disability (by type)

2. Recent illness episodes (24-hour and 2-week recall)
   - < diarrhea (by severity)
   - < respiratory infections (by severity)
   - < fever
   - < ear infections
   - < eye infections
   - < other infections

3. Specific past morbidities
   - < childbirth complications (yes or no)
   - < c-section delivery (yes or no)
   - < birth weight (recall — low/normal/high)
   - < measles (ever infected)
   - < injuries (ever and past 12 months by cause)

B. Proximate Bio-social Mechanisms Affecting Health Risks

1. Measures of maternal factors
   - < age at birth of child
   - < birth order of child
   - < interval between births

2. Measures of nutrition and diet
   - < breastfeeding (onset, intensity, duration)
   - < food supplements (timing, types)
   - < quality of diet (at time of survey)

3. Measures of environmental exposures
   a. Housing quality/utilities
      - < floor materials (dirt, tile, etc.)
      - < sanitation (water source, toilet, kitchen)
      - < electricity
      - < appliances (refrigerator, gas stove, hot water)
   b. Hygienic practices
      - < water use (storage, boiling)
      - < soap (availability)
      - < garbage (collected, disposal site)
   c. Other exposures to infection risks
      - < childbirth (place, qualification of attendant)
      - < care of umbilical cord at birth
      - < use of baby bottles

4. Measures of Injury Risks
   - < place and cause of accident

5. Measures of personal prevention and curative care
   a. Personal preventive practices
      - < antenatal care (qualification of provider)
      - < maternal tetanus toxoid immunization
      - < vitamins/iron supplements in pregnancy
      - < childhood immunizations
      - < contraceptive practice (type, effectiveness, continuation, etc.)
   b. Curative practices
      - < diarrhea treatment (ORS, other, providers)
      - < ARI treatment (antibiotics, other, provider)
      - < childbirth care (place, provider)

C. Background Socio-economic Factors

1. Place of residence
   - < urban/rural
   - < region

2. Household wealth
   - < size/quality of house construction
   - < ownership of objects/assets

3. Individual socio-economic factors
   - < education (mother and father)
   - < occupation (mother and father)
   - < family size/desires/approval of F.P.
   - < educational aspirations for children

Table 3

Housing conditions and under-5 mortality rates (10-year average) by housing conditions in rural and urban areas
Egypt PAPCHILD Survey

a. Housing conditions (%)

	Rural	Urban	All
Flooring			
Tile	42.6	85.0	62.1
Dirt/other	57.4	15.0	32.8
Toilet facilities			
Flush toilet	10.9	67.6	33.5
Other	89.1	32.4	66.5
Total	100	100	100

b. Under-5 mortality (rate/1000)

	Rural	Urban	All
Flooring			
Tile	99	69	83
Dirt/other	137	113	135
Toilet facilities			
Flush toilet	95	57	66
Other	125	97	120
Total	122	73	106

(Revised 11/1/95)

Appendix 1

Egyptian PAPCHILD Survey
Summary results for selected indicators of child health
by rural/urban residence and maternal education

		Residence		Maternal Education			
Indicator	**Total**	**Rural**	**Urban**	**None**	**<Primary**	**Primary+Prep**	**Secondary +**
A. Cumulative measures							
IMR/1000 (5-yr avg)	59	68	40	69	59	48	28
<5 MR/1000 (5-yr avg)	82	94	54	96	85	58	34
Stunting (% <2 SD)	30.1	33.6	23.3	35.2	26.6	24.5	18.2
Underweight (% <2 SD)	10.4	12.1	7.0	12.3	8.0	9.9	6.0
Disabled/1000	8.8	7.4	11.5	----	----	----	----
B. Recent illnesses							
Diarrhea (% in 14 d)	11.6	11.6	11.5	12.0	12.9	11.6	9.1
- Severe D. (% in 14 d)	3.7	4.0	3.0	3.9	4.9	3.2	2.0
Respiratory (% in 14 d)	12.5	11.4	14.7	11.2	14.5	14.2	14.6
Fever (% in 14 d)	19.1	17.9	22.4	17.8	23.2	24.1	19.2
Ear pus (% current)	3.9	4.0	3.6	4.1	4.1	4.1	2.9
Eye pus (% current)	3.6	4.2	2.4	4.5	2.5	2.8	2.0
Other infections (%)	2.7	1.8	4.5	2.3	2.6	3.6	4.0
C. Past morbidities							
Complicated pregn (%)	10.8	9.2	14.1	8.9	13.6	14.0	13.6
Caesarian-Section (%)	4.1	2.3	7.8	2.1	4.3	7.0	9.6
Birth weight (% low)	15.4	----	----	----	----	----	----
Measles (% ever infected)	10.5	10.9	9.6	12.3	9.2	7.8	6.9
Injuries (% ever injured)	2.4	1.8	3.5	1.9	3.1	3.7	2.6