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Cost Effectiveness of Child Survival Initiatives

A Literature Review

by

Kathryn J. Stewart, M.D., M.P.H.
United States Agency for International Development

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EXECUTIVE SUMMARY

USAID has made a large effort toward child survival in the developing countries. In an era of cost constraints, it becomes necessary to evaluate all expenditures for their "efficiency". Toward this goal, this literature search was undertaken to summarize the work done in cost effectiveness analysis relative to the major Child Survival initiatives - immunizations, oral rehydration therapy, breast feeding and child spacing.

Because the methods of analysis were very unstandardized, and important factors were excluded from consideration, the results are lacking in sensitivity for fine comparison and therefore no policy discussions can be made from the results presented here. However, the enormous difference between the costs of a death averted ($250,000 - 500,000) for programs in the U.S. and the costs of a death averted (less than $200) by an immunization or ORT program in a developing country, shows the extremely efficient use of resources in a developing country.

The review of these papers elicits several important points if this economic tool is to be used to its best benefit: 1) the value of CEA is the process more than the result, 2) omission of non-monetary costs/benefits may lead to false conclusions, 3) more literature needs to be widely available to elicit discussion and consensus by experts on the calculation and application of CEA, 4) a generally useful outcome indicator needs to be agreed

upon and a standardized methodology developed which is available on microcomputer, and 5) more research done to understand the value of time and health to people in developing countries.

ACRONYMS

A.I.D.	= (United States) Agency for International Development
B - C	= benefits minus costs, net benefits number
B:C	= benefit to cost ratio
BCG	= Bacille Calmette Guerin (tuberculosis vaccine)
CBA	= cost benefit analysis
CEA	= cost effectiveness analysis
CYP	= couple year of protection
DPT	= diphtheria, pertussis, tetanus vaccine
EPI	= Expanded Programme on Immunization
FVC	= fully vaccinated child
GNP	= gross national product
IUD	= intra-uterine device
LDC	= less developed country
OPV	= oral polio vaccine
ORT	= oral rehydration therapy
Rs	= rupees
TIPPS	= Technical Information on Population for the Private Sector
UNICEF	= United Nations International Children's Emergency Fund
WS and S	= Water Supply and Sanitation

DEFINITIONS

1. ceteris parabus - the condition that all other factors except the one examined remain the same.
2. cold chain - the necessary refrigeration of certain vaccines so that they retain their efficacy.
3. "community" effectiveness - the user efficacy of an intervention given the diagnostic accuracy of the problem, efficacy rate of the intervention in practice, provider compliance and patient compliance.
4. cost benefit analysis - an economic analysis where all project costs and benefits are computed in dollar values and reported as a positive or negative net benefits number or a benefit to cost rates.
5. cost effectiveness analysis - an economic analysis where all project costs are computed in dollar values and the project effect is evaluated by a measurable indicator and a ratio of cost per unit of outcome in generated.
6. discounting (discount rate) - the rate of change of valuation of future benefits/costs; assumes that consumers prefer benefits today and costs deferred to the future.
7. "economic" costs - the all-inclusive costs of a good including the direct ("financial") cost and the indirect costs such as opportunity costs, costs of adverse effects,

intangible costs and externalities.

8. encephalitis/encephalopathy - an inflammation of the brain which can occur from multiple etiologies including measles or measles vaccine.
9. externalities - the public (non-personal), positive or negative benefit of a consumer good which has a value not included in the price.
10. "financial" costs - the direct costs of a good, such as those considered by accounting methods.
11. group (herd) immunity - the level of disease immunity which must exist in a society to substantially prevent transmission of disease.
12. joint production - the ability to produce two goods at the same time; in this context referring to the ability of a mother to breast feed and perform other economically productive tasks simultaneously.
13. "marginal" costs - the change in total cost associated with producing an additional unit of output.
14. "marginal" effectiveness - the measure of the "marginal" cost of delivering a service/good to an additional beneficiary.
15. mortality after 72 hours - a measure of neonatal mortality from causes more amenable to medical care intervention than those which occur during the first 72 hours of life.
16. opportunity costs - the subjectively determined value of forsaking the next best opportunity to the chosen option when allocating limited resources such as time or money.

17. outcome indicator - a measure of the desired benefit of a chosen intervention; in this context, usually deaths or births averted.

18. oxytocin - a drug used after delivery to prevent postpartum hemorrhage.

19. proxy - a measurable indicator which closely approximates the desired outcome of an intervention.

20. sensitivity analysis - the process of submitting an economic analysis to testing the range of value assumptions by repeated recalculation to determine "best case" and "worst case" results.

21. "shadow" prices - the corrected price used in an economic analysis for a good which is inherently over or undervalued because of the externalities it produces.

22. subacute sclerosing panencephalitis - a rare, chronic, degenerative condition of the nervous system resulting from failure to completely eliminate measles virus after the disease or vaccination.

23. "theoretical" effectiveness - the level of efficacy assumed to occur from an intervention based on optimum application (compare to "community" effectiveness).

INTRODUCTION

Cost effectiveness analysis (CEA) and cost benefit analysis (CBA) are tools used by economists and policy makers to investigate the efficiency of projects, prospectively in health sector planning and retrospectively for monitoring and evaluation. The United States Agency for International Development (A.I.D.) is a major international donor for child survival in less developed countries (LDCs). The major initiatives of the A.I.D. Child Survival program are the "twin-engines" of 1) immunizations and 2) oral rehydration therapy, as well as 3) breast feeding and 4) child spacing. A literature review was done to evaluate the "state of the art" of CEA and CBA relative to the Child Survival initiatives.

Large variations in the techniques used by the various authors working on CEA/CBA have resulted in the lack of comparability of the studies. There are many valid considerations in the methodologies used, so the first section of this paper develops an understanding of the fundamental economic concepts used in analyses and then compares and contrasts the methodologic differences found in the articles reviewed.

The second section examines the general costs and benefits of health projects as considered by economists. This is a narrative review of both the universally accepted and the controversial cost and benefit considerations.

The third section examines each Child Survival initiative separately for specific costs and benefits and presents a narrative discussion of the factors considered in the analyses of each. Where data has been provided, the results of the CEA/CBA are presented with the admonishment that they must be interpreted in light of the preceding discussion. Some rather imprecise generalizations can be made about the relative efficiency of immunizations, oral rehydration therapy and child spacing compared to American health projects. For breast feeding, there is much controversy as to what the costs and benefits are and an inability to give monetary value to something which has yet to be defined. A thorough discussion of the literature on the economic considerations of breast feeding has been done.

The literature reviewed does not allow any except the roughest conclusions to be drawn about the Child Survival initiatives. It mostly points out the weaknesses in methodology, theory, and assumptions and the overall lack of good data to use in an economic analysis. Since no attempt was made to examine the method or calculations of each author, no valid companions between studies can be made. The intention of this paper is to introduce the concept of economic analysis in the health field, examine the inherent differences, omissions and problems with the studies to date, present a concise review of their results without any attempt at individual study analysis, and then make recommendations for the development of health economic analysis as a useful tool.

FUNDAMENTAL ECONOMIC CONCEPTS

Policy makers want to be sure that the money spent on Child Survival initiatives is used efficiently. In an era of cost containment, policy makers want to be able to measure project "efficiency" at achieving a certain objective. "Efficiency" is a measure of the extent that a project reaches its objectives without the waste of resources.

The two best known techniques for the analysis of efficiency are cost benefit and cost effectiveness analysis. These constitute an important practical improvement as compared with decision making based exclusively on either the containment of costs or the maximization of performance alone, approaches which characterize much health sector planning. CEA and CBA are economic analytic tools to investigate the efficiency of projects either under consideration (prospective use) or which have been implemented (retrospective use).

Overview: CEA, which is more commonly used than CBA in the economic analysis of health projects, is an easier analysis to do. Comparisons between projects are more difficult because CEA, unlike CBA, is not unitless therefore, a common outcome indicator must be found. For example, CEA would be used to compare deaths averted between two different interventions that prevent infant deaths, but would not allow comparison between interventions designed to reduce morbidity producing diseases (e.g.

schistosomiasis) and death producing diseases (e.g. measles) because of the lack of a uniform outcome indicator.

CBA is usually considered a special case of CEA. It involves, (in addition to a dollar valuation of costs) a dollar valuation of benefits and the development of an indicator for comparison, such as a net benefits number (B-C), or a benefit to cost (B:C) ratio. Because of the lack of units on the indicator, CBA has a more general usefulness as it can compare projects of a disparate nature, for example a roads project and a maternal health project.

However, the actual ability to place a dollar value on the benefits of health projects where the outcome is a birth averted or a death averted is daunting. Often CBA on health projects shows that the benefits of dollars saved from treatment costs ("financial" benefits) for the disease(s) the project would avert in fact, by themselves, outweigh the costs of the project. In fact the total actual "economic" benefits are substantially higher, as will be discussed. The text that follows will attempt a thorough discussion of the literature relative to CBA and CEA in the area of the Child Survival initiatives.

Uses of CEA/CBA: Historically, CEA and CBA have been used as economic tools to analyze programs which have already been completed. While a B:C ratio as an isolated number has some meaning toward that purpose, CBA has, in fact, rarely been used. CEA has frequently been used inappropriately either as an isolated "academic exercise" or as a means to "justify" a

completed project, with no attempt to compare the result to similar projects in other times, places or of different scenarios (e.g. rural vs. urban setting). A result that a program has a cost effectiveness of "X" dollars per unit of outcome has no meaning without being measured relative to something else.

The appropriate uses of CEA/CBA are twofold. It has been used prospectively, as a method to determine priority ranking between means to accomplish the same ends. A strength of this use is that it forces detailed thinking about the health problem and the interventions under consideration and helps to identify areas in need of more research. Assumptions will need to be made in this application of CEA, however, the use of microcomputers in the analysis allows repeated rapid trials of the possible variations in the assumptions (called Sensitivity Analysis), allowing examination of both "best case" and "worst case" scenarios to find out if these would alter the priority ranking of the chosen interventions.

Retrospectively, CEA is useful as an evaluation tool to determine the effectiveness of a project relative to other times, places or scenarios. A rigorous analysis will elucidate weaknesses in current project methodology, which can then be used to improve the design of future projects.

Strengths: The strength of CEA is its use as a policy making tool. By forcing detailed thinking, it can help delineate definitional difficulties, design weaknesses and areas in need of more research. It can allow the assignment of policy driven

weighted benefits, such as redistributional income effects. For example, Ponnighaus (1980) found that the B:C ratio of an immunization project was favorable in the urban areas where the costs of immunization delivery were less. However the B:C ratio in the rural areas was not favorable to implementation of the project without some weighting of benefits of rural infant lives saved as a policy objective.

In addition, CEA can be used as a measure of the relative efficiency of projects in provision of services if uniform indicators and methodology are used in the analysis. Such analyses almost invariably show a "maturation" effect of projects, i.e. improvements in efficiency of service delivery to the average service acceptor as the program matures.

Some authors have argued that the most meaningful indicator of the success of a project is the "marginal" effectiveness, that is, the cost of delivering services to the marginal beneficiary. If a project is successful at providing good coverage of targeted population, the cost of bringing in one more service acceptor should increase as the program reaches saturation. Although "marginal" effectiveness has been discussed in the literature as a theoretical consideration, there were no examples of this use of CEA found.

Weaknesses: CEA has several methodological weaknesses. One, already discussed, is the lack of a uniform outcome indicator with which compare dissimilar programs. Health economists have been struggling with this limitation on the utility of CEA. A

creative, but very data-demanding and assumption-driven, technique for CEA between projects with diverse outcomes has been suggested but in actuality attempted by few. This is the concept of disability days saved, or days of healthy life gained. Such an indicator is attractive because it allows comparison between diseases which cause disability and diseases which cause death. It also allows comparison between age groups and between preventive and curative interventions. A major weakness of this indicator is the huge amount of data needed for analysis (age specific morbidity and mortality data for a broad spectrum of diseases).

However, lacking a general outcome indicator such as disability days saved or days of healthy life gained, the criterion of effectiveness used will affect priority rankings. For example, in the case of cholera, if decreased mortality is the criterion of effectiveness, rehydration therapy will be found to be more cost effective than the cholera vaccine. However, if decreased morbidity is the criterion of effectiveness, then the priority ranking will favor vaccination.

Another weakness of CEA is that the outcome indicators used are still a "proxy" for the desired outcome. For example, "fully immunized child" is a proxy for decreased disease by immunization-preventable diseases and "couple year protected' is a proxy for decreased fertility rates. In moving from the proxy indicator to the actual desired outcome, several assumptions are made. This is referred to as the "theoretical" effectiveness

versus the "community" effectiveness of an intervention and includes such things as the provider and consumer compliance (e.g. Was the cold chain broken destroying the vaccine's efficacy? Were the birth control pills actually taken as prescribed?).

CEA models only the simplistic concept of cause and effect and the costs of one intervention to produce one outcome. It has not been refined to the point where it can measure the synergistic effects. Similarly, CEA cannot take into account economic changes. For example, CEA can not distinguish between project specific reduction in infant deaths and infant deaths which were averted because of other health improvements such as would result from an increase in living standard. The "ceteris parabus" (all other things held constant) conditionality at the core of CEA never pertains in the field of health economics.

Lack of agreement on conventions is the largest weakness of CEA in the literature. Most economists used actual "financial" costs (also called direct costs) whereas a few attempted to consider true "economic" costs (direct plus indirect costs). Health projects, by their nature, have considerable indirect costs - "intangible" costs, externalities and opportunity costs. These are usually not considered in the analysis although it is these that, in the long run, probably determine if a project is truly "cost effective" and whether it will be adopted by the host country government and the people and therefore become a sustainable effort.

Virtually no two analyses of the same subject were done in the same way because of the various techniques used by different economists. Some authors considered economic "discounting" of costs and/or benefits in the analysis, others used the "shadow" prices of undervalued local personnel costs. Some authors made corrections for currencies overvalued because of local government policy, others made corrections for the different values of currency exchange to a common unit (usually the American dollar), and corrected for inflation to a standard year (usually the closest previous year that was divisible by 5).

CBA is not commonly attempted. This is in part, because a thorough analysis implies placing dollar terms on a saved human life. Methods which have been used to calculate this value are: 1)the "human capital" method, that is, the productivity value of that life to the society (this method undervalues labor in LDCs and the needs to consider un- and under- employment rates in figuring productivity); 2)the "willingness to pay" method, that is, people are asked how much, in cash terms, they are willing to pay for a specified amount of life; and 3)the "previous decision" method, that is potential project beneficiaries are told the minimum amount a life is worth given the calculated costs and asked if their life is worth that value. All of these methods contain an inherent undervaluation of life in an LDC. This leads to general reluctance to use CBA. As a result, benefits are rarely valued in financial terms.

In order to do CBA, authors have shown the benefits derived

from reduced cost of service delivery, reduced demands on the health care system and other social services. Creative thinking would indicate that the true economic benefits are likely to be much more far reaching. Increased productivity, improved quality of life, potential benefit from "group immunity" or even total eradication of a disease, improved health care infrastructure and increased personal/community involvement in health are only a few examples of benefits which have economic value. This is an areas which could benefit from more research.

Summary: The foremost value of economic analysis is not the numerical result which it generates. This number is like a statistic that can be manipulated to give the impression of the result which the author wants to convey depending on how it is derived. The true value of CEA is the process it forces in the design and development of a project. It forces the identification of that data which is available and what other data will be needed, and how reliable the data is felt to be. It forces analysis of the theoretical basis of the cause and effect relationships of what the project has set to accomplish. It forces the identification of the unknowns, of the other factors which could affect the same result as the project and of the assumptions which must be made. And, with sensitivity analysis, it allows tests of the assumptions to see how they effect the priority ranking of projects under consideration.

Unfortunately, in this time of budget cuts, policy makers want "proof" that health programs are a good economic buy. So

the results of a CEA are frequently used to "justify" a health project. The analyses done to date, discussed in this paper, do not serve that purpose. The major focus of this paper is to develop an understanding of why economic analysis is important and what problems exist with the work reviewed for this paper.

The remainder of this paper will discuss the "state of the art" of CBA and CEA relative to the initiatives of the United States Agency for International Development's Child Survival program. This program encompasses four major project thrusts: 1) the Expanded Programme of Immunization (EPI) 2) oral rehydration therapy (ORT) 3) breast feeding and 4) child spacing. The state of the art varies considerably between these four initiatives, with child spacing (or its close proxy, family planning) fairly well advanced in the study of cost effectiveness. EPI and ORT are refining the technique for CEA and breast feeding is only now defining the costs and the benefits.

GENERAL COSTS AND BENEFITS

The types of costs and benefits involved in any health project are fairly standard and can be generalized before dealing with the costs/benefits specific to the individual initiatives.

To give the following cost and benefit discussion and data a domestic perspective, American data in the area of CEA are shown for comparison. The mandatory seat belt restraint law has a cost effectiveness of about $500,000 per death averted (Walsh and Warren, 1986). Hatziandreu et. al. (1988) given a cost effectiveness of $250,836 per coronary heart disease death averted for an exercise program.

The hypertension control program which is frequently cited as one of the more cost effective interventions in the United States, costs $10,000-20-000 per year of quality adjusted life gained and pneumococcal vaccine costs $4,800 per year of quality adjusted life gained (Walsh and Warren, 1986).

Costs: The costs of a health project are considered as the direct ("financial") costs and the indirect cost. Simplistically, direct costs are those which show up in a bookkeeper's balance for a given project. The indirect costs include the treatment of adverse outcomes from the intervention, the opportunity costs of beneficiaries and LDC governments, and "intangible" costs such as pain or anxiety.

The financial costs of projects are frequently the only costs considered in a CEA. These financial costs include such items as personnel costs/ salaries, equipment and supplies, transportation of staff/ equipment and supplies, capital investments such as buildings and vehicles and the depreciation of these over the life of the project, training, data collection/ surveillance and epidemiologic systems, and marketing/ consumer education. This list is not meant to be all inclusive but to represent examples of the types of items which must be considered. Additionally, factors such as discount rate, "shadow" pricing, exchange rates, inflation factors and other methodological points already discussed need to be considered.

Costs of adverse reactions and the cost of the care for these adverse reactions are another necessary consideration. Very little has been estimated in the literature in this regard for LDCs. Phillips, Feachem and Mills (1987) estimate that for measles vaccine the cases of encephalitis or encephalopathy resulting from the vaccine are about 1 per one million doses and of subacute sclerosing panencephalitis about 0.5 to 1.1 per million doses. No estimate if given of the cost of the care needed for these complications, but they go on to estimate that these complication rates of vaccination are 1000 times and 10 - 20 times (respectively) less than the complication rates of the naturally occurring disease. The costs of care from contraceptive adverse reactions (blood clots, strokes from pills, infertility, etc.), and the adverse reactions from ORT and breast

feeding (e.g. including the theoretically possible transmission of the AIDS virus) should also be given consideration in a thorough CEA.

Opportunity costs are a forgotten part of many analyses. The time costs to women, such as taking their children for immunizations or administering ORT, are not trivial, and should be included in the analysis. there are, of cause, time savings to be realized from improved health, although the time costs must all be invested before the time savings are realized. Thus, while current CEA shows that outreach clinics are less cost effective for delivery of immunization services based on financial costs (to the government) than are fixed clinic services, "when the time cost to women is taken into consideration, outreach projects may well prove equally or more cost effective than other approaches" (Leslie, 1987).

Other opportunity costs include the financial investment by the beneficiaries. These may include costs of transportation to and from the clinic, costs of child care for the other children while one child is taken to the clinic, and lost wages while time is taken from financially productive work (especially applicable to the breast feeding initiative). Horton and Claquin (1983) argued at these costs, though small relative government costs of services were large enough to provide a deterrent to the use of services.

Finally, opportunity costs (a social value) must be assessed from the perspective of the LDC community. The real value of a

family in an LDC may be the preservation of the working ability of a family's bread winner. Thus, faced with a resource decision (opportunity cost) of spending on something for the bread winner today or something which might prevent disease in an infant, the preference is likely to be for the most immediately beneficial effect. According to Barnum (1987), "neither the community nor the individual are indifferent as to (whom and) when the effects of disease occur". This emphasizes the importance of the use of discount rates when considering costs and benefits.

Opportunity costs also are borne by the host country government or the sponsoring institution. They have a time, financial and personnel investment in the program which exclude investment in other programs. Government priorities are distorted by external donors with offers of assistance for certain types of expenditures but not others. If the government perceives the opportunity costs to be high, that is, if it would expend the same resources on a different type of project without the external influence, the likelihood of the donor assisted project continuing after donor resources are withdrawn are not good. The opportunity costs of the government relate to the crucial issue of sustainability and therefore should not be neglected.

Finally, "intangible" costs such as pain and discomfort of the injection of immunizations, the anxiety of the mother of a child receiving an injection, the mild side effects of contraceptives, etc. are never given a dollar value, although

further research might indicate that these are, in fact, important costs. As an example of an intangible cost, the undignified way in which people sometimes feel are they treated by a health clinic can serve as a barrier to use of services. The loss of dignity acts as a "cost" to the intended recipients of the services.

Benefits: Benefits include the directly measurable intended outcomes of a project, and the less tangible outcomes theoretically linked to the measurable ones. "Intangible" benefits also exist. Externalities exist whenever spillover effects accrue to someone other than the direct beneficiary. Health care has many externalties. These are benefits which have true economic value but are difficult to measure.

The benefits of health projects include the desired outcome which can generally be measured in units of a person protected or a case-year prevented. These benefits (measurable indicators in parentheses) include decreased morbidity (disability days averted or healthy years gained) and decreased mortality (deaths averted) which result in 1) less disability care and associated expense, 2) less acute care and treatment expense and 3) more lifetime productivity, both for the direct beneficiary and the caretaker. With family planning, the benefits are improved maternal and child health (less death and disability) with the benefits already mentioned, and increased use of contraception (couple year protected or acceptor) which results in child spacing (birth averted).

Other benefits include the outcomes that are theoretically linked to the measurable indicators. An example of this is improved child survival resulting in smaller desired family size. If this is true, a reduction in population growth would follow. A smaller family size would result in increased investment per child by parents and society (education, health, etc.). Healthier children would result in freed parental time for productivity. Overall, these outcomes result in economic growth and development in the society.

"Intangible" benefits include the decreased suffering of the individual and the family due to illness and death. An increased sense of personal ability to affect one's own health out come in another intangible benefit.

Externalities include the general improvement in quality of life in a society where there is less illness and suffering. For certain diseases, especially immunization-preventable polio and measles, there is the possibility of total eradication of the disease, another externality. Should this occur as it has for small pox, there would be a considerable savings from the discontinued need for immunization and surveillance programs.

"Group (or Herd) immunity", that is, the percentage of the society that needs to be disease resistant to significantly decrease transmissibility of the disease in the society, is another externality. This was estimated to be a level of 59% of the population disease resistant for measles in Cameroon (Makinen 1979). Makinen estimated that the B:C ratio (the cost savings of

disease treatment relative to the cost of the immunization program) of achieving group immunity in the society would be 21:1 over 10 years.

Other extenalities include the improvement in the health are infrastructure and institution building. This has enhanced the management capabilities of the health care system, trained personnel in useful skills, established transportation systems and made it possible to add increased services for only "marginal" costs. There is also the element of increased community awareness and involvement in their own health care, in fact the establishment of a sense that as a community, they can have some control over their own health outcomes. This is believed by this author to create a demand in the society for the preventive health care initiatives of Child Survival, and to "prime" the community for the development of a private sector for such commodities as immunizations, ORT and contraceptives.

Summary: Studies done to date have, almost exclusively, only considered "financial" costs. True economic costs are much larger and what has been left out of these analyses may be more valuable for policy decisions than what has been included. Making a policy decision on only part of the true cost data may lead to false conclusions. Costs of adverse reactions, time and monetary opportunity costs to individuals and governments, and intangible costs need to be considered in project analysis.

While the value individuals place on their time (opportunity cost) is not well understood, the benefits derived from health

projects are even less well understood. A body of theoretical work has been developed linking the directly measurable health benefits (such as reduced infant mortality or better child spacing) to the overall goal of health projects: improved economic status and living standards which are difficult concepts to define and measure. Other benefits are even more elusive. However, these are all important factors to consider in a project design and development and the use of a disciplined framework like CEA forces consideration of these.

SPECIFIC COSTS AND BENEFITS

Immunizations: The costs of immunization programs have been well studied. Although methodologic differences make it difficult to directly compare these data, the CEA results are relatively consistent (within a factor of 10).

The standard outcome indicator for CEA of immunizations is "fully vaccinated child" (FVC) or "deaths averted". However, there are problems with both of these indicators. FVC has been defined differently by various authors, from measles vaccination alone to a full complement of 8 vaccinations (3 DPT, 3 OPV, BCG and measles) in the first year of life and other variations in between. Some authors have made an adjustment in their calculation of FVC to account for the numbers of vaccines given in excess (a fourth or fifth booster dose) or in deficient quantity (only one dose ever given) to contribute to a the outcome of decreasing disease incidence. In the last case, when immunization cards are compared to the total numbers of vaccines given in a country, it is found that only about half contribute to fully vaccinating a child. Other inconsistancies in determining the cost of creating a FVC include the consideration of vaccine wastage (which may be 20-50% for serum left over in the syringe) in the costs, or consideration of the costs of data collection.

Another problem with using "fully vaccinated child" as an outcome measure is that it assumes that this will result in decreased incidence of disease. In fact, if the cold chain has been broken, or there have been other breaks in the transition from "theoretical" to "community" effectiveness, this may not be the case. Finally, it is difficult to prove that the outcome of "deaths averted" is completely an effect of the immunization project making this an imprecise outcome indicator.

Opportunity costs to parents have been considered in a few cases. Belcher (cited in Leslie, 1987) showed that women gave "can't take time form work" as the major reason for not seeking immunizations and Adelkunte (cited in Leslie, 1987) gave data in which 50% of Nigerian mothers identified time constraints as the reason for not getting their child vaccinated. Makinen (1979) tried to include private costs (usually ignored in most analyses) of time spent and bus fare for mothers seeking measles immunization for their children in Cameroon and found that these were a significant consideration.

Almost uniformly, outreach services reach children who would otherwise not receive immunizations. Yet the generally higher "financial" costs of outreach services make them appear less favorable and when resources are constrained, more likely to be discontinued. However, this author believes that if "economic" costs-including the mothers' time and transportation costs were considered, the outreach services would appear relatively more cost effective. Thus ignoring the true "economic" costs may lead

to false conclusions that outreach service are not cost-effective relative to fixed clinics. Outreach services need to be continued until immunizing children becomes a societal "norm". Then perhaps people would seek out these services from fixed clinics. CEA, as an efficiency measure, would be a good way to follow this change to the use of fixed services.

Given the methodologic problems elucidated above, the literature gives many examples of cost per FVC and cost per death averted. Cost per FVC ranges from around $2-6 in the cities to about $30 in the rural areas. Cost per death averted ranges from $30-60 in the cities to about $200-400 in the rural areas (Walsh and Warren, 1986) (see Table 1 for specific studies).

Very few CBA attempts have been made regarding immunization programs. Data is available to calculate declines in mortality for the immunization preventable diseases, however, no one has attempted a comprehensive benefit analysis, even of "financial" treatment costs saved relative to "financial" program costs. There are some examples of isolated analyses based on one or two immunizations. For the case of polio eradication, Musgrove (1988) did a B:C calculation for the eradication of polio in the Americas. He calculated a "best case" and a "worst case" scenario, based on differences in the assumptions of how many people needed immunization, how many cases would actually be prevented, how many of the current cases were actually receiving care and the cost per case in the developing world (he used the cost data of Brazil). He calculated that based on the cost

Table 1
Summary of CEA on Immunizations
(all costs in US dollars)

Study cited	Country	Comment	Cost/FVC	Cost/death averted
Shepard, et al. (1988)	Ecuador	high rate of vaccination and low rate of disease means high cost per death averted	routine $4.39	$1,900.00
			campaign $8.60	$4,200.00
	Columbia		routine $26.60	
			campaign $59.90	
	Ivory Coast		$16.00	$570.00
	Gambia		$14.00	
Shepard, et al. (1986)	Zambia	measles only	$4.55 to 8.51	
Creese (1986)	not specified	measles only	$2.00 to 14.00	
	Cameroon		$9.50	
	Kenya		$16.60	
Creese (1982)	Philippines	BCG and 2DPT	$4.97	
	Indonesia	BCG and 2DPT	$2.86	
	Thailand	BCG and 2DPT	$10.73	
Creese and Henderson (1980)	Philippines	BCG and 2DPT	$1.50 to 6.00	
	Zambia	measles only	$1.30 to 12.00	
Barnum, et al. (1980)	Indonesia	BCG and 2DPT	early program $3.69	$130.00
			mature program $3.37	$122.00
Phillips, et al. (1987)	not specified		$8.80 to 26.00	
Walsh and Warren (1986)	Ivory Coast		$12.30	$479.00
Walsh (1988)	Indonesia			$210.00
	Ivory Coast	measles only - all program costs attributed to measles vaccine		$850.00
Brenzel (1988)	Turkey		$17.00 to 26.00	
Brenzel (1987)	Senegal		$19.00 to 27.00	$1,400.00
Brenzel (1987)	Cameroon	campaign covered twice as many children as routine services	routine $2.19	
			campaign $18.93	
	Mauritania		$8.97	
	Nigeria		$10.84	

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savings for treatment care only ("financial" benefits), even in the "worst case" scenario, there would be a considerable cost savings from the eradication of polio in the 1990s. Musgrove concluded that eliminating polio in the Americas would be justified based only on treatment costs saved.

Barnum, Tarantola and Setiady (1980) estimated that the cost of prevention of disease by BCG and DPT vaccine in Indonesia would be one third the cost of disease treatment. Makinen (1979) estimated that the measles vaccine program savings inclusive of private costs would result ion a 23:1 B:C ratio and for government expenditures alone would result in a B:C of 6:1. Shepard (1986) estimated the B:C ratio for measles vaccination in the Ivory Coast at 11:1.

To summarize, there are many methodologic problems specific to immunizations that prevent comparison between these studies. Yet there are more studies and more theoretical considerations of inclusions in a CEA for immunizations than for any of the other Child Survival initiatives.

Since these studies have almost uniformly only used "financial" costs and opportunity costs for mothers' time to take their children for immunizations is not insignificant, these data should not be used to draw any conclusions about urban vs rural, clinic vs outreach or other such policy decisions.

Finally it is clear that in comparison to U.S. data on the cost per death averted of two of the more successful programs, immunization is a very efficient expenditure of resources to

avert deaths. Also, based on the CBA studies which have been done, all have shown very favorable returns on monies expended.

Oral Rehydration Therapy: Three different outcome indicators in use for ORT: the cost per diarrheal episode treated, the cost per child per year and the cost per death averted. The first two indicators do not measure the desired outcome of reduced mortality and the third is affected by many factors (such as measles immunization and breast feeding) and may not be an accurate outcome indicator for the effects of ORT alone.

CEA for ORT is less well studied than immunizations. Lack of agreement on conventions discussed previously also applies to ORT data. Most studies fail to include the cost of fuel to boil the water to prepare ORT solution, not an insignificant cost.

One major methodologic problem is the failure to include any opportunity cost estimate for the mother's time to prepare and administer ORT. Leslie (1987) estimates that based on the average number of days of illness (3.5), the average number of episodes per year (5.5) and the average number of small children in the home (2), the average mother in an LDC would spend 40 days (10% of her productive time per year) administering ORT to her sick children. Leslie concludes "ORT should be viewed as an interim solution...there can be no doubt that mothers would prefer to avoid episodes of diarrhea entirely than treat them at the cost of several days of their own time".

The debate rages on-financing of ORT versus financing of

water supply and sanitation (WS and S). ORT advocates define success as a lower cost per infant death averted. However, Okun (1988) argues that "if strategies are selected only on the basis of their benefits in preventing disease specific deaths, narrowly focused technologies will almost always appear to be far more cost effective than the broad based program interventions". Authors who argue for WS and S, point out that many people already pay as much as 40 times for poor quantity and quality of water as those who receive piped water service. In some areas of the world, the poor paid up to 30% of their incomes for water (Okun, 1987). Briscoe (1987) argues that the willingness of consumers to pay for water service is a measure of its non-health benefits and therefore the cost attributable to health is the difference between total costs and willingness to pay. Okun (1988) points out that it is the net costs (above what is already paid), not the gross costs, which need to be considered in a CBA/CEA for WS and S.

However, if the goal is reduced infant mortality as is explicitly stated by the Child Survival initiatives, it should be noted that water supply systems have no apparent effect on rates of rotavirus infection (a major cause of diarrhea in infants), little effect on the youngest age groups, depend on proper use for any effect at all and are useless when broken down (Walsh and Warren, 1986). On the other hand, ORT appears to have little impact on mortality resulting from dysenteric or chronic diarrheas which in some areas cause as much as 50% of diarrhea

deaths (Phillips, Feachmen and Mills, 1987). Also, while ORT may save a child from death from this episode of diarrhea, the cumulative effect of many episodes still leave him weakened and likely to succumb to other causes of death. The ability to adequately model the synergistic effects of multiple disease states on risk of mortality and to separate the intervention and its isolated effect toward the reduction in infant mortality still eludes health economists.

Again, this points out that it is important to define program objectives and choose the proper outcome indicator such as "disability days saved." This would allow valid comparison between projects which have their effect across diseases that have differential morbidity and mortality across age groups. It would be interesting to see a CEA for WS and S based on the methods to calculate costs mentioned above and defining effectiveness as "disability days saved" across <u>all age groups</u>. Then compare this to a CEA for ORT including fuel and opportunity costs to the mother, defining effectiveness by "disability days saved" in a lifetime for infant deaths averted, but allowing for treatment failures and debility resulting from chronic recurrent illness.

Unfortunately, the literature contains no example of this use of CEA. Such a qualification of the benefits from WS and S would argue strongly in its favor, especially because WS and S is high on the list of priorities of women in the developing countries and most governments have tight budget constraints. The use of

"disability days saved" may allow a methodologically easier CEA to be done for comparison to ORT rather than a true CBA.

It is apparent that more research is needed for economic analysis of diarrheal disease prevention and control. Table 2 summarizes that average cost per disease episode treated ($0.50-0.75), the costs per child per year ($0.50 to $4.00), and the cost per death averted ($163-2780) for the use of ORT. For the use of simple water supply and sanitation to control diarrheal disease, the cost estimates per infant death averted range between $1250 and $19,200 (Walsh, 1988), to $4000 (Okun, 1988).

Phillips, Feachem and Mills (1987) attempted an interesting, but very assumption-based, CEA of many different interventions designed to reduce the episodes of and deaths from diarrheal disease in infants (see Table 3). Although research is sparse and assumptions abound, it is this type of effort which best shows the strength of CEA. This type of effort forces the modelling of disease and intervention, supports the clarification of definitional problems, shows areas in need of more research and opens up the assumptions which must be made to critique by other experts in the field. The ranges of costs shown in Table 3 represent the sensitivity analyses' outcomes for the "best case" and "worst case" scenarios.

No true CBA for ORT was found in the literature reviewed although the benefits of ORT have been documented in some detail. Leslie (1987) states that ORT reduces the morbidity of infant diarrhea from 5 days to 2.5 days. The mortality of ORT treated

Table 2
Summary of CEA on ORT
(in U.S. dollars)

Study cited	Country	Cost/diarrheal episode	Cost/child /year	Cost/death averted
Shepard, et al. (1986)	Egypt			580.00 to 10,600.00
	Bangladesh			77.00 to 328.00
	Gambia			209.00 to 1048.00
	Honduras			534.00 to 880.00
	Indonesia			163.00 to 291.00
	Global		.50 to 4.00	163.00 to 2780.00
Shepard and Carrin (1986)	Honduras	2.69		
	Gambia	.75		
	Indonesia	.71		
	Swaziland	2.67		
Okun (1988)	Global			200.00
A.I.D. CCCD Project Paper	Global			147.00
World Health Organization (1985)	Global	.71		251.00
Horton and Claquin* (1983)	Bangladesh			187.00(small clinic) 1262.10(hospital services) to 1352.40
Walsh (1988)	Global			230.00 to 540.00

*Used other forms of rehydration in addition to ORT

TABLE 3
Costs to Prevent Diarrhea Deaths by
Methods other than ORS
(all costs in US dollars)

Study cited	Method	Cost/death averted
A.I.D. CCCD Project Paper	simple water project	1400.00
Walsh and Warren (1986)	simple WS and S	1250.00 to 19.200.00
Okun (1988)	simple WS and S	4000.00
Creese (1986)	new cholera vaccine	2000.00 to 5,000.00
Phillips, Feachem, and Mills (1987)	measles vaccine	66.00 to 1,156.00
	rotavirus vaccine	1075.00 to 16,710.00
	breast feeding	400.00 to 10,750.00
	weaning practices	50.00 to 2,000.00
	ORT	100.00 to 8,000.00

cases of infant diarrhea is only one third that of untreated cases (Shepard and Carrin, 1986).

The cost of ORT relative to intravenous rehydration have been given as $0.50 per disease episode for ORT versus greater than $5.00 per diarrhea episode for intravenous rehydration by the World Health Organization. Srivastava (1985), in a study done in India, calculated total hospital costs per child went from Rs 323.08 for intravenous rehydration to Rs 99.61 for almost exclusive ORT (Rs 9 = $1). There was a decrease in average length of stay from 3.6 days before use of ORT to 1.6 days after ORT was adopted.

An additional benefit is savings on pharmaceuticals, mentioned only in a TIPPS (Technical Information on Population for the Private Sector) project in an isolated rural mining town in Peru where the people receive health care benefits from the company health clinic. A B:C analysis of alternative (mostly inappropriate) treatment modalities used previously for diarrheal and minor respiratory illnesses show that the costs of time spent on patient education and the addition of more staff to institute ORT and other appropriate health care measures outweigh the cost of inappropriate treatment, while simultaneously improving infant mortality rate (Foreit, no date). The potential cost savings of inappropriately used pharmaceuticals for diarrheal disease is an area of significant savings which should not be overlooked.

In summary, while there are not as many studies done, and those that have been have glaring omissions (e.g. opportunity

costs for women), it is clear that ORT is a very efficient use of resources to avert deaths in infants. However, the benefits of WS and S extend beyond prevention of infant deaths and the omission of the signifant opportunity costs to the mother to administer ORT mean that the studies which have been done to date on ORT and WS and S are in no way comparable. A study such as the one recommended would help provide the comparability between these two diverse means to bring about similar ends. Until then, it is only a battle of words and rhetoric to compare ORT and WS and S.

Breast Feeding: The costs and benefits of breast feeding are just beginning to be understood. A utilization indicator serves as the measure of appropriate breast feeding. How that relates to the actual desired outcome of decreased infant mortality has yet to be adequately modelled. There is general agreement that the desired utilization of breast feeding is exclusive breast feeding until two months of age, with supplements added at four to six months of age and continued breast feeding until one year of age. However, there is lack of agreement about whether exclusive breast feeding can adequately nourish an infant between two and six months, especially under the conditions in the LDCs. There may be decreased volume or quality of breast milk form a malnourished mother (Popkin, 1986). On the other hand, Rohde (1982) states unequivocally that in Indonesia, malnourished mothers produced neither deficient quantity nor quality of breast milk. There is an excellent review of this topic in The Infant

Feeding Triad: Infant, Mother and Household by Barry Popkin, et al. (1986).

Popkin, et al.(1986) state that women can meet the increased caloric demands of breast feeding in three ways, by increasing food intake, by decreasing energy output (perhaps effecting productivity in currency generating activities), or by decreasing the volume or quality of their breast milk, perhaps jeopardizing the health of the infant. The costs to maternal health, if marginally nourished prior to breast feeding and unable to compensate by decreased activity or increased food intake may be the development of nutritional deficiency syndromes under conditions of breast feeding. Clearly, this is an area where more research is needed.

The mother's opportunity costs are another area of concern. If an infant is formula fed, someone else in the family can use their (less valuable) time to shop for and prepare the formula, feed the infant and clean the utensils. Non-standardized time estimates for breast feeding have been done. Time costs to breast feed have been variously estimated at 40-48 minutes per day compared to 132-201 minutes for artificial feeding by one author, and 69-116 minutes for breast feeding compared to 22-29 minutes for artificial feeding by another (cited in Leslie, 1987). The age of the child and whether this is the mother's time investment only or the total time invested in child feeding needs to be clarified.

An economic issue is the idea of "joint production", that is,

the possibility that the mother can breast feed and do something else at the same time. Costing out the time for CEA of jointly productive time is a complex issue. Because of restrictive labor laws and working conditions, for many women, the private cost of breast feeding may be unemployment.

Among obvious benefits of breast feeding are the cost savings for purchase of substitutes. Formula feeding also involves a cost of supplies (other than the formula itself), heat and refrigeration and wastage when formula spoils. Gueri (1980) estimates that the extra caloric needs of the mother cost four to five times less than the satisfaction of the infant's caloric needs by infant formulas. Several authors have made estimates of the value of this savings to the national economy. Greiner, et al. (1979) estimated that if all women would breast feed in the Ivory Coast, the savings in currently expended foreign currency over two years would total $16-20 million. Kenya annually spends $11.5 million (about equal to two thirds of the National Health Budget) on breast milk substitutes (Lillig and Lackey, 1982).

Rohde (1982) estimates that the savings to the Indonesian economy of the women currently breast feeding is about $500 million in direct food costs. Savings because of decreased diarrheal disease as a direct benefit of breast feeding amount to about 20% of the total health budget. Additionally, he attributes a savings of about $80 million in contraceptive need. These savings total about 1.5% of the GNP of Indonesia.

The costs to the family of not breast feeding also have been

examined. In Tanzania the cost of adequately formula feeding an infant equalled one half the minimum wage. In Mexico, 2-35% of the family's monthly income went to formula costs (Lillig and Lackey, 1982). Table 4 is adopted from research done by Gueri (1980), shows the estimated costs relative to three income levels in several developing countries. Phillips, Feachem and Mills (1987) state that proper feeding with infant formula for a twelve month period should cost $200-300 in most developing countries, which is approximately the per capita income in many countries. Popkin, et al. (1986) point out that the cost of milk substitutes may mean less food available for others in the home, resulting in less productivity and less income generating potential.

In Honduras, where a large maternity hospital, with about 1000 deliveries per month promoted breast feeding almost exclusively, the cost savings were considerable. The savings on oxytocin alone amounted to about $1000 per year. There was additional savings of $6000 per year on formula and $7500 for bottles (Gibbons, 1987).

The health benefits of breast feeding also contribute considerable savings. There is decreased morbidity and mortality associated with breast fed infants. Two studies have examined the data for selection bias (Habicht, et al., 1986 and Montgomery, et al., 1986) since it is known that healthier infants are more likely to be breast fed. Both studies have found that after controlling for selection bias, there is still overwhelming evidence that breast feeding causes reduced

TABLE 4
Cost of Complete Milk Formula Feeding Expressed as Percentage of Monthly Salary for Selected Occupations and Countries
(from Gueri, 1980)

	Occupation					
	Hospital Orderly/Cleaner		Ministry Clerk		Junior Staff Nurse	
Age of infant (mos.)	0-2	3-5	0-2	3-5	0-2	3-5
Country						
Bahrain	13	19	8	12	7	10
Egypt	28	39	18	26	14	19
Ethiopia	55	77	15	21	7	10
Liberia	20	29	7	10	6	9
Malawi	66	93	57	80	10	14
Malaysia	26	36	14	19	5	7
Pakistan	18	25	12	16	8	11
Sudan	42	50	31	38	31	38
Sweden	3	2	3	2	3	2
Tanzania	29	41	25	35	19	28
United Kingdom (London)	3	4	4	5	2	3

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morbidity and mortality.

Leslie (1987) quotes UNICEF as saying that breast feeding can reduce the number of infant illnesses by half. The risk of diarrhea among bottle fed infants is 5-8 times that of breast fed infants (Rohde, 1982). Walsh (1988) states that diarrhea incidence is reduced by 8%, diarrhea deaths by 25% in breast fed infants less than 6 months old.

Daga (1985) shows that in a high risk newborn nursery in India, where the policy to breast feed was abruptly adopted allowing comparison of pre- and post- policy differences, it was found that there was a 22% decrease in "mortality after 72 hours," as well as decreased diarrheal episodes, diarrheal death rates, decreased rate of other infections, and decreased expenditures on milk and other medicines. Even with the improved survivorship and resultant increased average length of stay, the costs were less than before using exclusive breast milk. Because this occurred over a relatively short period of time in which there was relatively little staff changeover and no new technology, the improvements were attributed to the use of breast milk.

Phillips, Feachem and Mills (1987) have made some CEA estimates for cost per diarrhea episode averted by breast feeding of $2.40-143, and costs per diarrhea death averted of $87-10,750. The costs are based on educational programs needed to bring about behavioral change in the society, and the efficiency varies dramatically because it is based on the risks of mortality in the

society and the numbers of infants who would benefit from the change.

Finally, the child spacing benefits of breast feeding have been estimated in Indonesia as mentioned above (Rohde, 1982). Popkin, et al. (1986) state that breast feeding provides an estimated 31 x 10^6 couple years of protection compared to 24 x 10^6 for artificial contraceptives used over one year (geographical frame of reference not specified). This is assuming an average of 8 months of lactational infecundity for rural mothers and 4 months for urban mothers based on observed breast feeding frequencies. The net demographic impacts of breast feeding and child spacing are hard to sort out because both are related to a third variable, improved child survival. Estimates of this type are probably of limited usefulness because of a lack of concurrence about the causality linkages.

In summary, breast feeding is clearly beneficial in many ways: direct cost savings, health of the infant and health sector cost savings, time savings of the mother for caring for a sick infant, reduced infant mortality because of its contraceptive benefits for health of mother and infant and savings from purchase of artificial contraceptives.

The areas of concern about breast feeding's costs are in the nutrition of an already malnourished mother and the quality of milk she produces. It is clear that even if this were the case (which has not been definitively proven), it is considerably less expensive to supplement the mother than to supplement or use

formula substitutes for the infant.

Another concern is the opportunity cost of the mother if she was to give up a formal sector job in order to breast feed because of prohibitive labor laws. These and other costs of breast feeding promotion and protection are certainly inflated because of the necessity to counter man-made barriers to breast feeding such as labor laws and infant formula product promotion.

Child Spacing: Very little has been done which looks at child spacing as an entity separate from family planning. The methodology for such an examination planning was used as a proxy for child spacing.

There has been a lot done in the area of CEA and CBA for family planning. The outcome measures used most often are the couple year protected (CYP) and births averted. The costs are described in the "General Costs and Benefits" section of this paper. The methodology for calculating costs is relatively well established. However, it does suffer from some of the same methodologic differences mentioned previously, i.e. inconsistent use of discount rates, currency exchange rates, valuation to a standard currency and year.

Gillespie, et al. (1983) reviewed over 70 articles and concluded that the cost per CYP varied between $5-60 and tended to decrease as the programs matured. The cost per birth averted (in 1980 dollars) was $20-100. The cost is dependent on the method of family planning used. The cost per birth averted (Barnum, 1983) was lower for the more expensive but more reliable

procedures (e.g. sterilization), presumably because of the high discontinuation rates of the temporary methods of contraception. Costs were: for vasectomy, $30 per birth averted; female sterilization, $44; condoms, $112; pills, $77; IUD, $82; and depoprovera, $44. Other studies show similar results. Programs regularly show the maturation effect, with a decline in cost per CYP over time.

Several examples of CBA exist. In a study done by Chao and Allen (cited in Simmons, 1987), the benefits were measured just in terms of the savings to other government programs. The average return on a dollar invested in family planning was $7 over the first nine years and $16 over forty years. The Mexican Social Security System estimated savings from maternal and infant care services are 4-8 times the cost of family planning (cited in Simmons, 1987). Several other studies estimated the B:C of family planning to exceed 10:1 (cited in Simmons, 1987).

The major benefit of family planning (child spacing) is decreased infant mortality which is not directly measurable. Closely spaced births and high infant mortality rates are linked. Births spaced at least two years apart allow the mother to improve her baseline health for a healthier pregnancy and give her more resources to expend on her child. No values for these benefits of family planning have been calculated yet.

In summary, family planning projects have been well studied by economic analysis. CBA has shown repeatedly a favorable return on monies expended for family planning in terms of monies

saved on other health and social sector expenditures.

It is also clear that child spacing and decreased infant mortality are linked. Child spacing, ORT, immunization and breast feeding are all clearly very cost-effective means to promote Child Survival.

SUGGESTIONS FOR FUTURE RESEARCH

If CEA/CBA is to become a useful tool in policy making and evaluation of the efficiency of the Child Survival initiatives several efforts need to be made. For example, much of the unpublished material reviewed here contained new ideas that contributed to the shaping of the concepts presented. These studies should be made more widely available. Perhaps the development of an International Health Economics journal should be pursued to provide a single authoritative resource.

Secondly, consensus groups need to be develop a more universal outcome indicator. A good candidate is the concept of "healthy days saved" (Dunlop, 1986). Careful review of this concept should be considered. Also, methodologic conventions for calculations of costs and measures of outcome need to be adopted to allow comparability between studies by different authors, different times and places.

Finally, more interdisciplinary work needs to be done. Anthropology, sociology, economics and epidemiology overlap when concepts of opportunity costs for women, for families, for individuals and the values they place on their time and health

are considered. These interactions are so poorly understood that these concepts cannot be incorporated into a cost analysis. The fact that these costs exist but are not included int he analysis may lead us to false conclusions about the Child Survival initiatives.

The development, testing and wide dissemination of a simplified, uniform, microcomputer compatible tool for CEA needs to be done through consensus building. Its widespread use must be encouraged. Health project managers need to become more aware of the value of economic analysis and how it can help them. Economists need to be made aware of the special circumstances of health care issues so that they can assist health project managers in economic analysis. Efforts should be made to train host government officials in the use of health economics, also. The use of this tool in a day of limited health care resources is a valuable one. It can aid in both policy making and evaluation.

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