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EVALUATION OF THE ECONOMIC CONSEQUENCES
OF MALNUTRITION

by

David L. Call and Richard Longhurst

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EVALUATION OF THE ECONOMIC CONSEQUENCES OF MALNUTRITION

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I. Introduction

At this stage in the proceedings of this congress it does not seem appropriate that an economist should lecture nutritionists on the impact of malnutrition on individual well-being. Certainly this is a topic that has been well researched and discussed at this meeting and many others. It is clear that malnutrition in the western hemisphere is considered a major public health problem by most of the countries. In addition, the concept that malnutrition is an important limiting factor in the development of human resources now seems to be fairly well accepted, particularly when we are talking about groups from the lower socio-economic segment of a society. In fact, the major goal of nutrition intervention programs should be the removal of dietary inadequacy as a limiting factor in the development of human resources. In more recent years, particularly in the last two, this general underlying knowledge of the impact of malnutrition upon the individual plus the increasing suspicion and knowledge about the possible effect of severe malnutrition in early age on the mental development of an individual has pushed nutrition into prominence as a major social problem in many countries. The fear of impaired mental development in a substantial segment of a population due to malnutrition seems to be the catalyst which has gathered the attention of the politicians and other concerned individuals throughout the hemisphere. Therefore we find ourselves today with a situation where the eradication of malnutrition, real or imagined, has become a major public policy issue in many countries of the hemisphere. Many countries are developing national nutrition plans or integrated food and nutrition policies, and in other ways are making known the higher priority which they now put upon nutrition. Along with this increased attention and concern have come pleas for increased funding for nutrition intervention programs. It is well recognized that poverty and malnutrition are highly correlated but in many cases people are not willing to wait for gradually rising standards of living to solve the nutrition problem and this, in fact, may never occur. Obviously then what we all seek is an efficient, workable, politically acceptable intervention program for right now.

This increased interest in nutrition at the public policy level seems to be predicated upon two basic hypotheses. First is the hypothesis, or a concept if you wish, that malnutrition is in and of itself a major deterrent to economic development. This hypothesis would indicate that solution of malnutrition problems will directly lead to a faster rate of economic development within a given country. Debate in this general area has started and will continue for some time on the relative importance of nutrition as a deterrent to economic development, and if there are economic payoffs to investments in nutrition programs this could be labeled the objective economic hypothesis. A second major hypothesis reflects a different train

* H. E. Babcock Professor of Food Economics and Research Associate, respectively. Delivered at the closing plenary session, Western Hemisphere Nutrition Congress, Miami, Florida, September 1971.

of thought. This is that malnutrition in a society results in a degradation of the human being which in and of itself is a social problem that cries for a solution. Regardless of the economic payoffs, a society should do all within its power to improve the nutrition and health status of its population which is an indicator of development in and of itself. In so doing, such a policy should lead to a more equitable distribution of resources within a country since the lower socio-economic classes would be the principal beneficiaries. The nub of the issue is whether there are sufficient resources available in low income countries to achieve this social goal and whether allocation of resources for these consumption expenditures would deleteriously affect long term growth. Some would label this the subjective humanistic hypothesis. We would like to examine each of these hypotheses and their underlying assumptions in some depth and then discuss them in terms of what appears to us to be the major nutrition research needs in developing countries in this hemisphere.

II. The Concept of Nutrition and National Development

In recent years there has been increasing interest in developing linkages between malnutrition and the economic consequences of this social problem in the developing countries. Basically this discussion centers upon the possible adverse economic effects of a malnourished population measured primarily in terms of national income. It is important to realize that this discussion is based primarily on an efficiency criterion which dictates that national income and growth thereof is the important variable which we are trying to influence. The impact of malnutrition on economic development obviously surfaces through the quality of the human resource which is available in a society. Malnutrition has been positively linked to poor health status, to reduced physical development, to the possibility of reduced mental capacity, to high infant death rates and through them a possible effect on fertility rates and therefore population growth and directly with work output. All of these factors can ultimately influence the productivity of an individual which then is theoretically directly related to the earning stream of an individual which is his part of the total national income of a country. Ideally to prove this hypothesis one should be able to describe and quantify the linkages between the various effects of malnutrition and the contribution of the individual to national income. It implies that with all other factors held constant the malnourished individual does not make as great a contribution to national income as measured by wages or expected earnings as his more well nourished counterpart in the society.

Underlying these assumptions are some other theoretical considerations which must be considered. It assumes that the private market system has not and will not solve the nutrition problem in the society. This is not hard to understand since the people who we are concerned with are outside of the market system either as subsistence producers or partake in the market system in a very limited manner. Also in many cases in the socio-economic classes we are concerned with the poverty is so extreme that their interface with the commercial food market system is minimal, and is limited in most cases to almost raw agricultural commodities. If this assumption is accepted then it means that collective action, in other words governmental action, is required to try to solve this problem which is assumed to be a deterrent to economic development. It also implies that resources within the economy are misallocated at present and that theoretically certain public resources can be reallocated to nutrition programs and result in a net benefit to the

society. In other words the ratio of benefits to costs for investments in the nutrition area are higher than alternative investment opportunities elsewhere in the economy. Therefore investments in nutrition intervention programs should result in additional or incremental income to the society as a whole. Theoretically such an analysis under these assumptions would lead to an optimal allocation of resources.

One of the major deficiencies of this strict efficiency approach to allocation of public resources is that it assumes that income growth and social welfare are synonymous. This approach of selecting investments based on the highest benefit-cost ratios within a budget constraint does not consider the distribution of income as a result of the investment nor does it consider non-economic aspects of individual welfare. (By definition economic welfare consists only of income, leisure time and wealth.) It assumes that the various non-economic aspects, e.g. freedom from anxiety, are being encompassed by this efficiency criterion of maximizing national income. Efforts by economists to integrate equity and efficiency in one analytical context or to place values on non-income benefits have been attempted but have been generally unsatisfactory. This efficiency approach to resource allocation usually surfaces under the name of cost-benefit analysis. The concept of cost-benefit is intuitively appealing and has been used throughout many societies with some success in such areas as water resource development and other programs designed to increase future income or more efficiently allocate public resources. In simplest terms, it means that those projects with the highest benefit-cost ratios are funded until the budget limit is realized. But to the nutritionist the concept of cost-benefit relying upon an efficiency criteria implies a number of very severe procedural problems which we would like to identify briefly.

If cost-benefit type analysis using efficiency criteria are to be used to justify and select between nutrition intervention programs, the data needs are tremendous. For example, a means of translating the effect of changes in achievement test scores into equivalent income increases has been developed for the U.S. by Ribich.¹ Hence, if one infers that severe malnutrition in early age has a detrimental effect on IQ (which is, to many, an unsatisfactory measure of intellectual ability), the linkages between nutrition and IQ would need to be identified and quantified; the linkages between IQ and educational performance would need to be identified and quantified; the linkages between educational performance and ultimate productivity would have to be quantified and identified; and then lastly, the linkages between productivity and earnings would have to be identified and quantified. In economic terms this implies that one can construct a demand curve for health and/or some measure of mental development, i.e. IQ. The problems involved in developing these quantitative estimates are obvious, particularly if one wants to use the resulting statistics as a public policy planning device. In a recent evaluation of milk programs for preschool children in Chile, Selowsky² with an admirable

1 Thomas I. Ribich. Education and Poverty (Brookings Institution 1968), pp. 68-72.

2 Selowsky, Marcelo. Infant Malnutrition and Capital Formation. Paper presented at the Research Workshop on Problems of Agricultural Development in Latin America, Caracas, Venezuela, May 1971.

piece of work in view of the state of the art, had to assume that the participation of malnourished children in a free milk program would bring their growth status to that of a well nourished control group, would in so doing equate their intellectual status to that of the control group, that their IQ scores would not erode over time and that this would place them in the category of employed, rather than unemployed, workers. Indeed, heroic assumptions. If one wishes to move to another area, consider the case of pregnancy outcome relative to low birth weight infants. The evidence is strong that infants below 2500 grams will have a higher death rate, higher incidence of mental retardation, will have lowered health status, and many other problems. But if one tries to justify investments in this area through a typical cost-benefit analysis, the first thing that the economist will ask for is for a present value for the life of the infant whose life will be saved through the intervention program. To attempt to arrive at a present value for a life saved in a developing country requires even more heroic and debatable assumptions. In addition a value has to be placed on the change in earning ability due to alleviation of mental retardation; a value has to be placed on the reduction in behavioral deviations in response to improved nutrition in pregnancy. All these values have to be quantified if benefits are not to be understated.

It is the feeling of the authors that at this point in time adequate evidence does not exist to build a strong case for nutrition intervention using the efficiency criterion form and a cost-benefit type analysis strictly as a policy tool on a macro basis, although it can remain useful as an indicative tool. Obviously then we are faced with a dilemma. Since existing data are insufficient should we devote research resources to this problem and attempt to quantify these relationships so that we can gain greater attention in the halls of government throughout the hemisphere? The major problem which has not even been discussed to this point, is that of isolation of a dietary effect in any type of social setting. As nutritionists are well aware the isolation of a dietary effect in and of itself is extremely difficult even in a clinical setting. Now when one moves to social action programs where nutrition is a major component and attempts to isolate the impact of a nutrition intervention from a complex of social problems and often other interventions, he is faced with even greater difficulty. It seems that if large amounts of research money were available, it is theoretically possible that one could build the linkages and quantify the relationship between various nutrition problems and their economic impact and in so doing derive accurate proxies for the output of the cause and effect relationship on the national income of a society. We would maintain that even in the United States which probably has a better data base than most other countries in the world, it has not been possible to develop these linkages with any great degree of accuracy or reliability. Looking at it in a purely pragmatic sense, one also has to consider whether the decision makers, the politicians and the planners will make decisions based upon the results of detailed cost-benefit analyses. Obviously other factors, factors other than economic efficiency, play a more important role in many cases in governmental decisions in this area. Alice Rivlin, a former Assistant Secretary for Planning and Evaluation in the U. S. Department of Health, Education and Welfare in a recent published series of lectures³ has stated:

³ Alice M. Rivlin. Systematic Thinking for Social Action. The 1970 H. Rowan Gaither Lectures at the University of California, Berkeley (Brookings Institution, 1971), p. 59.

"It is my hunch that analysts would be wasting time and effort if they gave high priority to making dollar estimates of the benefits of social action programs, for politicians and decision makers are unlikely to pay much attention to them. They and their constituents have strong, intuitive ideas about the relative importance of health, education and social well-being that are not likely to be shaken by benefit-cost estimates. The ratios are unlikely to sway the choice of a congressman between a reading program and a cancer cure program. He is more apt to be influenced by clear statements of the benefits in physical terms, such as the number of children who will read with specified proficiency or the chances of curing certain types of cancer, and by identification of the probable beneficiaries."

Therefore we do not feel that this type of research should receive high priority within the developing countries. We feel that the scarce research resources, money and brain power should be concentrated on other aspects of the nutrition problem.

III. Nutrition as an Equity Problem

If one rejects the economic efficiency criterion for justifying investments in nutrition programs, we are left with the second general hypothesis which was mentioned earlier, that malnutrition in and of itself is an equity problem; that resources should be reallocated such that every person in the target group has a diet adequate for his or her needs. This line of reasoning holds that regardless of economic payoffs, attempts to solve the nutrition problem should have high priority, since they obviously affect the ability of individuals to survive within their society, and this alone is sufficient reason for high priority. Since the evidence is sound that malnutrition does affect human resource development and our stated goal is to remove nutrition as a limiting factor in the development of human resources, the line of reasoning goes on then that nutrition should rank with education, with health, and other social problems and should be treated in the same manner. In the development of food and nutrition policies in the developing countries, it is implied then that adequate nutrition should have a high priority and should receive funding regardless of its impact on national income. Most countries in the western hemisphere place a very high priority on universal education. We would maintain that equally important and an equally high priority should be put upon the concept of delivering a healthy well nourished child to the school system so that the educational process can move with greater efficiency. Of course, this does not necessarily mean that he is mentally alert since there may have been insufficient intellectual stimulation but nutrition would have been removed as a limiting factor. It may not be possible to prove that this will economically have a payoff to the society but under terms of social justice it seems a reasonable goal that every child has a birthright to proper nutrition. If one accepts this line of reasoning and backs off from the strict interpretation of cost-benefit analysis, clearly another type of approach is called for within a country. This approach becomes a stepwise development of a nutrition intervention program which has been outlined in many other papers. It implies a thorough diagnosis of the nutrition problem within a society and the identification of target groups and the establishment of priorities, since it must be accepted that all problems cannot be solved simultaneously.

Once target groups have been established in some detail and the nature of the underlying causes of malnutrition are well understood, it then is necessary to establish some sort of goals, time goals as well as standards for measurement for these various target groups. For example, the postweaning period seems to be the most critical period nutritionally in the development of the preschool child. This then may become the target group with the highest priority. A goal of reaching a certain number of these children within a 3 to 5 year plan and standards established for nutritional adequacy present a reasonable target for program design. Design and evaluation of nutrition intervention programs becomes the final segment of this stepwise approach. Here is where the major needs seem to exist. Given a target with specific goals the job now becomes a very critical one of program design and testing so that various alternatives are examined in the framework of a cost effectiveness type analysis to select the program which seems to solve the problem at the least cost. The cost effectiveness analysis is a means, given predetermined objectives, of deriving the maximum benefits for a fixed expenditure or finding the least cost solution for a fixed level of benefits. This again obviously is not an easy problem. Few nutrition intervention programs have been properly evaluated so that the impact on the beneficiaries is well established. It seems only reasonable for the planner, for the economist, or for the government official to ask if a program is implemented will it work, how do we know it has worked, and will it continue to work in the future. The evaluation of applied nutrition intervention programs is an area sorely in need of additional research. Since nutrition intervention programs are generally country specific, it means that this research in most cases must be done within a given country.

The need for objective evaluation is obvious but again problems arise relative to criteria for success. When is an intervention program successful? Is it necessary to prove that biochemical values in the target group are improved? that growth has improved? Or is mere evidence of improved consumption patterns sufficient? For example, a recent evaluation of the U.S.D.A. Pilot Food Certificate Program by the Graduate School of Nutrition at Cornell University⁴, at the request of the U.S.D.A., showed that although participation rates in the program of providing milk to poor pregnant mothers and infant foods to their children in the postweaning period were high; although the program was popular among retailers, participants and local officials; was politically visible and was easily administered through existing institutional outlets; the program was a failure with respect to achieving its nutritional purpose. The program did not significantly increase either the quantity of milk and/or formula intakes of infants age 1 through 5 months, nor did it increase their nutrient intakes; it did not significantly increase the quantity of milk and formula intakes of infants 6 through 12 months of age, nor did it increase their nutrient intakes; and it did not successfully increase the milk intakes of either pregnant women or mothers of infants in a consistent fashion. It did function quite well as an income maintenance program but of course this was not its main purpose.

From this discussion it should be clear that the authors are placing a heavy emphasis on the so-called targetted approach or rifle approach to solving nutrition problems but that evaluation of such programs is absolutely

⁴ Robert E. Wunderle and David L. Call. An Evaluation of the Pilot Food Certificate Program in Chicago, Illinois and Bibb County, Georgia, April 1971, Monograph, Food and Nutrition Service, United States Department of Agriculture, Washington, D. C.

essential. Broad scale programs of nutrition education, enrichment and fortification may not receive high priority, unless the programs are extremely low cost on a per capita basis in which case they may be the most efficient way to reach a target group.

IV. The Nutritionist's Role in the Design of Intervention Programs

It should be obvious at this point that what we are proposing is that the major research emphasis of the nutritionists in the developing countries of this hemisphere be devoted in the next decade primarily to the design, implementation, and evaluation of workable intervention programs. Our knowledge of nutrition in the laboratory, the clinic and with experimental animals seems sufficient and provides a firm enough base so that this area of research does not need major expansion. Within the framework outlined before the role of the nutritionist becomes somewhat obvious. In the identification of target groups and in the establishment of priorities the nutritionist must play a major role. It means that nutritionists may have to make some hard choices which they have been reluctant to make in the past. For example, is protein-calorie malnutrition more serious than iron deficiency anemia? Does a possible vitamin A deficiency deserve higher priority than a calcium problem? Choices will have to be made, since resources are highly limited, if programs are to be effective. In the second step of establishment of goals and standards, again the nutritionists will play a major role. When is a child well nourished? Can we set aside the reams of discussion on growth and development curves and arrive or agree on a common definition of something to aim for as a target for an intervention program?

It is in the third area of program design, testing and evaluation where it seems that the nutritionists will play a major role but an area where many have not had sufficient prior experience. Maybe we need a new breed of people as pointed out by Levinson and Berg⁵ in their article on the demand for a nutrition programmer, but in the intermediate period we cannot train a new group of people to design nutrition intervention programs. Nutritionists must be willing to move into the field and to harshly evaluate attempts to solve nutrition problems. However, in some areas there is a disappointing lack of scientific consensus. For example, one of the authors⁶ recently used the Delphi technique which is generally acknowledged to be the most efficient and accurate means of combining the knowledge and abilities of a diverse group of experts to the task of quantifying variables shrouded in uncertainty to reach some sort of consensus position. A group of 18 eminent U. S. pediatricians, nutritionists and medical doctors were invited to estimate the effect of specific intervention programs on the incidence of low birth weight in a well defined target group by a specified time period (to 1976). This incidence is now 15% and the estimates of the effect of a supplemental feeding program ranged from 10 to 15% low birth weight incidence by 1976; when asked to imagine the effect of a hypothetical program that would provide the optimum diet for most successful pregnancy outcome the estimates ranged from

5 Alan D. Berg and F. James Levinson. A New Need: The Nutrition Programmer. American J. of Clinical Nutrition, 22: 7, July 1969.

6 Richard Longhurst. An Economic Evaluation of Social Welfare Programs with Respect to Pregnancy Outcome and Intellectual Development. Unpublished M.S. Thesis, Cornell University, September 1971.

7 to 13%. Even more surprising was the range of estimates of the effect of a comprehensive health care program - 8 to 14%. Obviously potential effectiveness depends on your expert in this case and only objective evaluation will lead to the true answer.

We must be willing to face up to the fact that if a program does not work then it should be redesigned and we should search for a new alternative which does work. When we move into the area of program comparison the problems are going to be even larger. Recently a study of two alternative programs being carried out in Bombay was completed.⁷ One involved an atta or wheat flour fortification program in which the wheat flour was fortified with 5% peanut flour; and the other was a child feeding program. The atta fortification effort is part of a broader food fortification strategy of the Indian Government Food and Agriculture Ministry. The Ministry expects, for example, to fortify atta in the cities of Calcutta and New Delhi during the coming year, and eventually in all of the 186 roller flour mills in India; the atta is fortified with 5% groundnut flour and with vitamins and minerals. The addition of 5% groundnut flour raises the protein content of the wheat from 10% to about 12%. Thus, a preschool age child in Bombay consuming 40 grams of wheat a day would be getting 0.8 grams of additional protein a day, increasing his protein intake by 5% and meeting about one-fifth of his protein deficiency.

The child feeding program is part of a nationwide effort now reaching over 10 million children and administered by the Ministry of Education. The program aims to provide 0.85 oz. of nonfat dry milk plus 10 biscuits a day which offers a total of 90 plus 70 or 160 calories a day to the child and 9 plus 2 or 11 grams of protein per day. A non-metropolitan program on the other hand provides an average of over 400 calories and roughly 14 grams of protein through its distribution of CSM, bulgar wheat and vegetable oil. As shown in table 1, it is possible to draw comparisons of the nutritional impact of completely different programs based on certain consumption expectations. Unfortunately in neither case has there been an adequate analysis of the nutritional impact of these two programs. No evidence was available that either program had an impact upon the recipients. In table 2 we show some of the other important factors which must be taken into consideration in comparing intervention programs. Although nutritionists may not wish to become involved in the political aspects of various programs, it is obvious that they are very important. The political visibility of a fortification program is obviously substantially less than that of a child feeding program. Which of these two programs should be adopted depends upon the goals that were established ahead of time, but the planner obviously has a dilemma when he has not been provided with information on the nutritional effectiveness of either program.

⁷ F. James Levinson. Nutrition Intervention in Low Income Countries: Its Economic Role and Alternative Strategies. Unpublished M.S. Thesis, Cornell University, January 1971. Reported in Cornell International Agricultural Development Mimeograph 34, F. James Levinson and David L. Call, Nutrition Intervention in Low Income Countries: A Planning Model and Case Study, Department of Agricultural Economics and Graduate School of Nutrition, Cornell University, Ithaca, New York, September 1971.

Table 1. Comparative Data on the Bombay Atta Fortification and Child Feeding Programs

	Atta fortification	Child feeding
Number of persons reached	150,000	200,000
Percent of low income persons reached	12%	10% ^a
Number of pre-school age children reached	16,500	0
Percent of low income pre-school age children reached	12%	0
Daily calorie increment per recipient	0	160
Daily protein increment per recipient (grams)	.8 ^b	11 ^c
Daily vitamin A increment (I.U.)	1,220	1,391
Daily thiamine increment (mg.)	.06	.155
Daily riboflavin increment (mg.)	.055	.479
Daily niacin increment (mg.)	.301	.779
Daily iron increment (mg.)	3.84	1.92
Daily calcium increment (mg.)	32	317
Days per year provided	365	195
Total government cost per year	\$109,066	\$706,666 ^d
Cost per child beneficiary per day	1.9¢ ^e	1.9¢ ^{f,g}

a Assumes two-thirds of child feeding recipients are in low income category.

b Per pre-school age recipient; meets 20 percent of the average protein deficiency for that age group but with protein of low biological value.

c Per school child recipient; meets 25 percent of the average protein deficiency for that age group with protein of high biological value.

d If wholly indigenously supported.

e Pre-school child beneficiary.

f School child beneficiary.

g An estimated 3.0 cents per day to reach pre-school age children.

Table 2. Comparison by Other Indices

	Atta Fortification	Child Feeding
Consumer acceptability	High ^a	High
Foreign exchange utilization	None	None
Administrative cost ^b	Low	High
Political "vested interest"	Low	High
Visibility	Low	High
Potential effects on agriculture	Minimal ^c	Minimal ^d
Potential effects on family planning	-- ^e	-- ^f
Potential effects on education	-- ^g	High
Potential effects on income generation	Low	Low

a Assuming resolution of iron discoloration.

b Defined as the opportunity cost of trained administrators.

c Assuming oilseed protein will be obtained by reallocation of supplies for domestic uses.

d Under existing supply arrangements, once the program is wholly indigenously supported, the effect could be significant.

e Depends on the nutrition-family planning relationship postulated in Chapter I, and on the relationship between infant mortality and protein and/or vitamin-mineral deficiencies.

f Depends on the extent to which child feeding can be coordinated with family planning outlets or family planning information dissemination.

g Depends on the improvement in mental facilities resulting from protein supplementation.

V. Conclusion

In conclusion we feel that an approach oriented towards research to investigate the role of nutrition as a component of national growth is inappropriate. This is from the point of view of the nutritionist who will have great difficulty in developing longitudinal studies to indicate cause and effect relationships; from the viewpoint of the economist whose analytical tools are not well enough developed to apply whatever the nutritionist can elucidate and from the point of view of the politician (or decision maker) whose time horizon is traditionally very short. We recommend therefore that research efforts be concentrated on cost effectiveness studies, given an initial demarcation of priorities and objectives. This is a framework within which the nutritionist and economist can quickly make valuable contributions and provide evidence of real value to the planner and politician. Interestingly enough this takes us back to the view of nutrition in the 1950's and 1960's - that malnutrition was a social

welfare problem and need for concern because it indicated a maldistribution of income. Yet we now suggest that if we target programs at pregnant mothers and preschool children for an extended period of time, nutrition will be removed as a limiting factor in economic growth and whatever is detracted from economic growth in terms of impaired human resources will now also be removed.