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THE ELIMINATION OF HUNGER IN AMERICA

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ABSTRACT

The relationship between the elimination of malnutrition and improved mental and physical performance, and lowered mortality and morbidity rates are examined.

These relationships are used to determine the economic benefits which will accrue to this society and the poverty population if malnutrition is eliminated. These benefits can also be viewed as social costs of continued malnutrition.

Traditional human capital framework is utilized to determine the present value of the benefits which will accrue over the lifetime of the present malnourished poverty population. The most significant gain is from higher educational achievement. In this area, the elimination of malnutrition among 3.3 million poor children will produce a $6.3 to $18.8 billion increase in GNP over the lifetime of these children. The range of total economic benefits from the elimination of malnutrition will be between $14.4 and $50.3 billion.

INTRODUCTION

Hunger and malnutrition have been a key concern for many in this nation. Accompanying this concern about hunger's causes and effects have been a myriad of proposals and programs dealing with the perceived problems.

Any program which attempts to deal seriously with this problem will be costly. On the other hand, it is costly not to take action against hunger. The cost of such inaction can be viewed as the potential economic benefits from the elimination of malnutrition.

This paper examines certain of these benefits which may come from the elimination of malnutrition among America's population under the poverty line. Only the effects on economic performance of the poverty population were calculated in this study. These benefits can be broken down into five categories. Excluded are the external benefits to the nonpoverty population and numerous nonquantifiable benefits to the poverty population.

These categories are presented below with their cumulative economic benefits in parentheses.[1]

1. Education--Improved nutrition improves learning through what we believe are structural changes in the brain, prevents an interruption of cognitive development, and increases the ability to concentrate and work ($6.4 - $19.2 billion).
2. Physical Performance--Improved nutrition increase the capacity for prolonged physical work, raises the productivity of workers and increases the motivation to work ($6.4 - $25.8 billion).

3. Morbidity--Improved nutrition results in higher resistance to disease, and lowers the severity of disease ($201-$502 million).
4. Mortality--Improved nutrition decreases fetal, infant, child and certain types of maternal mortality ($68-$157 million).
5. Intergenerational Effects--Improved nutrition makes healthy mothers who have healthy children. Also, better educated parents lead to better educated children ($1.3-$4.5 billion).

These computation indicate that if malnutrition among members of the poverty population were eliminated, the present value increase of national product, conservatively estimated, would be between $14.4 and $50.3 billion, assuming that motivation, training level, need achievement, and time horizons would remain the same. It should be noted that although all these relationships between the various categories such as physical and mental performance are quite clear, many of the specific interrelationships have not been examined for their effects on large populations. These relationships are mainly based on small studies and interferences drawn from laboratory and clinical findings.

This study consists of three parts, first, estimation of the number malnourished; second, determination of the economic effects if malnutrition were eliminated; and third, evaluation of the biases of the analysis.

I. Estimation of the "Malnourished Population"

Nutritional status tends to be closely linked with income. Thus the highest concentration of malnourished people is found in the poverty

popualtion below the poverty line. In fact, the poverty line is based on an income level necessary to avoid severe malnutrition. However, the amount indicated is not adequate for urban families where a family of four with an income of $5,500, or $1,000-$2,000 above "poverty," probably would not be able to purchase enough foods. Actually, these families should be classified as poor under a poverty budget based on a realistic food plan.

Biochemical studies of blood and urine were used to determine the percent malnourished in various age-race-geographical groupings. In general, biochemical findings are quite valid as a measure of nutritional status.

As no comprehensive national study has been made to determine the percent of malnutrition among the poverty population, the data used here to provide a picture have been put together from many sources.[2] Among these are small scale studies such as those done by OEO on Head Start mothers and children. Much of the data used is taken from unpublished reports made by OEO or the Senate Committee on Nutrition and Human Needs. Table 1 shows the poverty population; Table 2, the percent malnourished; and Table 3, the malnourished population.

TABLE 1

Poverty Population

Age	Non-South				South			
	Urban		Rural		Urban		Rural	
	White	Non-White	White	Non-White	White	Non-White	White	Non-White
786,000 0-1	180,810	183,520	141,120	2,960	53,900	44,992	114,170	64,528
3,657,686 1-5	665,173	1,150,621	519,551	19,654	198,433	281,591	418,824	403,839
7,387,327 6-17	1,650,610	937,870	1,166,022	64,398	570,102	607,625	1,248,728	1,141,972
*14-65+ Working Males	1,444,000	348,516	1,053,192	42,339	562,522	288,106	1,150,208	602,571
*14-65+ Working Females	2,007,796	505,787	896,074	42,209	547,103	313,090	679,049	363,150
Pregnant Women 14-44	559,341	299,649	203,265	16,683	144,630	146,556	149,840	100,348

Source: 1967 Current Population Survey with poverty level based on the USDA's lowest priced food plan (economy plan).

*Few men and women age 14-17 work. Most of this age group are included in the age 6-17 group.

TABLE 2

POVERTY POPULATION MALNOURISHED

Percent Malnourished

Age	Non-South				South			
	Urban		Rural		Urban		Rural	
	W*	NW**	W	NW	W	NW	W	NW
0-2	30	57	38	25	33	54	30	60
2-5	28	45	19	19	21	40	20	20
5-16	15	40	20	35	30	46	17	25
16-59	30	50	22	65	35	60	20	40
Pregnant Women	35	65	40	63	60	70	70	60

Source: Popkin, Barry M., Economic Benefits from the Elimination of Malnutrition, study prepared for the U.S. Senate Committee on Nutritional and Human Needs, July 1969.

*W - White

**NW - Non-White

TABLE 3

MALNOURISHED POPULATION

AGE	NON-SOUTH				SOUTH				TOTAL
	URBAN		RURAL		URBAN		RURAL		
	White	Non-White	White	Non-White	White	Non-White	White	Non-White	
0-1	54,243	104,606	53,625	740	17,787	24,296	34,251	38,717	328,265
1-5	186,248	517,779	98,715	3,734	41,671	112,636	83,765	121,152	1,165,700
6-17	247,592	375,148	233,204	22,539	171,031	279,508	212,284	285,493	1,826,799
14-65+ Working Males	433,200	174,258	231,702	27,845	196,883	172,864	230,042	241,028	1,707,822
14-65+ Working Females	602,339	252,894	197,136	27,436	191,486	187,854	135,810	145,260	1,740,215
Pregnant Women	195,769	194,722	81,306	10,510	86,778	102,589	104,888	60,209	836,771
TOTAL	1,719,391	1,619,407	895,688	92,804	705,636	879,747	801,040	891,859	

Source: Combination of Tables 1 and 2.

GRAND TOTAL 7,605,572

II. Calculation of Economic Benefits

Quantifiable, economic benefits from the elimination of malnutrition may be realized in the areas of mental performance, physical performance, morbidity, mortality, and intergenerational effects.[3] All of these effects can be estimated. Each aspect will be taken up separately.

A few points must be kept in mind. First, the malnourished who are hospitalized include not only the patients, almost all young children, of course, who are classified in hospital records as suffering from malnutrition but also many of those who are classified under other headings, with illnesses to which mild, moderate, or severe malnutrition contributed to a lesser or greater degree, although their immediate need for aid was precipitated by an intercurrent illness. Just as a man with terminal carcinoma of the bronchus dying of pneumonia should be considered as dying not of pneumonia but of the underlying causes, so a child with moderate or severe malnutrition who dies from gastroenteritis should be considered as dying from malnutrition. In a well nourished child, the gastroenteritis probably would not have been fatal or would not have occurred at all. Second, many economic benefits from the elimination of malnutrition will be excluded from consideration in this study. The major exclusion is the cost incurred in connection with the treatment of the malnourished. Described briefly, that is the cost of medical services including the cost to hospital of in-patient treatment of malnutrition and related diseases and the cost of out-patient and health centers and other clinic treatment, plus the cost to parents or person involved, including the cost of treatment by private doctor, the cost of transport to and from treatment and for

hospital visiting, and the cost to responsible relatives of time lost from work for all these actions.[4]

A. Mental Performance--Education Achievement

If malnutrition among poor children were eliminated, economic benefits would come about because these children would be capable of 10-30 percent higher mental achievement. This higher achievement would result in both a 10-30 percent higher performance in each grade and a 10-30 percent reduction in the number of grades repeated by these same children. The causative relationship between the higher achievement and improved nutritional status is based upon a detailed analysis of the clinical nutrition literature and discussions with many nutritionists. A few of the more significant studies are referred to in this paper.

There are 3.3 million malnourished children living in poverty. The total gain in higher mental performance would produce a gain in lifetime earnings of $6.4 to $19.2 billion, mainly in higher achievement. These figures are present values.

1. Relationship

There are three aspects to this relationship. First, malnutrition increases the incidence of permanent brain damage significantly among children aged 0-4 years.[5] If the under nutrition occurs after the age of three years, there probably will be no permanent damage.

Second, malnourished children even if they have not suffered brain damage, may suffer retarded cognitive development. The apathy of nutritional deprivation (especially anemia and protein deficiency) results in poorly developed inter-sensory integrative performance. Often the results

of this apathy and listlessness is questionable but Dr. Joaquin Cravioto sees these aspects of the infant's behavior leading to a progressive withdrawal from the environment.[6] The inactive child does not deal enough with visual and tactile sensations and has fewer contacts with other persons. In total, he does not utilize the stimuli around him. This leads to either a delay in the conditioning or the effective production of conditioned reflexes. "Evidence already exists that the lag in the development of certain varieties of inter-sensory integrations have a high correlation with backwardness in learning to read," and . . . "can interfere with a second primary educational skill--learning to write."[7]

Third, children aged 6-18 cannot utilize fully the potential to concentrate and work displayed by well-nourished children of the same background. Hungry students are unable to concentrate, have poor judgment, are irritable, moody and unable to sustain mental application. Controlled studies done in Asia, Africa and the U.S. have shown that increased food intake produces changes in mental performance.[8]

Two highly, significant and suggestive studies within the U.S. were done, one in rural areas, the other in an urban area. During a three-year study in isolated and stable Kentucky county school districts, children of the experimental schools with improved nutrition gained 30 months in mental age, compared to 15.5 months gained by the children of the control schools--a difference of 14.5 months (a performance 94 percent better than the control group).[9] In 1944, Kugelmass, Poull, and Samuel conducted a study on nutritional performance in normal and mentally retarded children in New York City.[10] Fifty of the children classified as normal malnourished and 50 as normal well-nourished were matched

for chronological age, I.Q., and interval between Kuhlman-Binet or Stanford-Binet tests. Following a period of observation which varied between one, and three and one-half years, the malnourished group with the nutritional supplements showed an average I.Q. increase of +18 points in contrast with an average of 0.9 for the well-nourished group.

2. Economic Benefits

The pertinent economic benefits from higher mental performance were calculated by using the lifetime income differential between high-school drop-outs and high-school graduates.[11] There are two basic assumptions which justify this: First, gains in yearly achievement have the same implication for future earnings as do gains in knowledge resulting from more years of schooling. Second, short-term gains in educational achievement can be maintained over time. Some children with better nutrition will attend school for an extra year while others will gain in achievement. The extra year in school and the gain in yearly achievement will be assumed to have the same impact on a person's earning potential. Among malnourished children aged 0-5 and 6-18, 10-30 percent higher achievement will be gained by eliminating malnutrition.

The income differential between high-school graduates and drop-outs is fairly representative of what additional schooling (or an increase in achievement) is worth in economic terms. ". . . why the drop-out-graduate differential is more appropriate is that average educational attainment for under-privileged children falls within the tenth to twelfth grade range. If more is learned in earlier years and is maintained, it would seem most akin to lengthening the average period in high school, moving it closer to the twelfth grade level . . . ."[12]

In Table 4 the results of those calculations of higher performance can be found. The percentages discussed earlier were used here. The total impact of increased educational achievement from the elimination of malnutrition ranges from $6.3 billion to $18.8 billion. These lower and upper bounds give the range of benefits attributed to higher achievement.

TABLE 4

ECONOMIC BENEFITS OF EDUCATION ($)
Educational Achievement - Children (0-17)

	NON-SOUTH		SOUTH		TOTAL
	URBAN	RURAL	URBAN	RURAL	
White	922,769,720- 2,768,309,159	728,909,486- 2,186,728,459	435,762,503- 1,307,287,510	624,465,180- 1,873,395,540	
Non-White	1,885,935,890- 5,657,807,669	51,070,778- 153,212,333	787,321,464- 2,361,964,392	842,001,397- 2,526,004,192	
Top number corresponds to lower limit. Bottom number corresponds to upper limit. Numbers may not be exact due to rounding.					6,278,236,418 18,834,709,254

Also, there will be a 10-30 percent reduction in the rate of grades repeated by these same children. Table 5 contains the repeating (flunk) rates for the poverty population. The economic benefits received for lowering the failure rate are found in Table 6. The results are determined by taking the number of malnourished children of from 6 to 17 years of age (the school population) and multiplying this by the respective failure rates to determine the number of children who fail at least one year of school. The percentage reduction in this rate was then

applied and, finally, the current income for 18-years old was used to determine economic benefits. It is assumed that the reduction of failure rates means those children who will no longer repeat a grade will now receive income at least one year sooner and, thus, income at age 18 was used. The range of benefits would be between $122,889,901 and $368,669,703.

TABLE 5

RATE FOR REPEATING GRADES AMONG LOW INCOME CHILDREN

	White		Non-white	
	Rural	Urban	Rural	Urban
Male	.2244	.2213	.2730	.2699
Female	.1801	.1770	.2288	.2271

Source: John Conlisk, "Determinants of School Enrollment and School Performance," The Journal of Human Resources, Vol. 4, No. 2, Spring 1969.

The failure rate used is for boys and girls age 10-13. This is approximately the median for the ages 7-9, 10-13, and 14-15. Data were not available for the ages 16-17 when the failure rates tend to be higher.

TABLE 6

ECONOMIC BENEFITS OF EDUCATION
Failure rate reduction (6-17) ($)

	NON-SOUTH		SOUTH		TOTAL
	URBAN	RURAL	URBAN	RURAL	
White	14,637,187- 43,911,561	14,517,143- 43,551,429	10,111,040- 30,333,119	13,214,856- 39,644,568	
Non-White	27,137,673- 81,413,019	1,686,794- 5,060,381	20,219,211- 60,657,632	21,365,997- 64,097,991	
Top number corresponds to lower limit. Bottom number corresponds to upper limit. Numbers may not be exact due to rounding.					122,889,901 368,669,703

B. Physical Performance--Worker Productivity

Economic benefit from the elimination of malnutrition will affect worker productivity. Malnourished working people in poverty (1.71 million men and 1.74 million women) will experience a 10-40 percent increase in their productivity. The resultant lifetime economic benefits to this society from this productivity-gain will range from $6.5 to $25.9 billion.

1. Relationships

Caloric requirements for work are one of the three major requirements that must be satisfied by the energy produced from food. The other two are basal metabolism requirements to keep up the life processes (1600-1800 calories) and growth requirements for children, adolescents, and expectant mothers. There is a close correlation between adequacy of work calories and work productivity. If the work calories are below

the required amount for the activity being undertaken, two things will happen. First, the body will adapt somewhat to this lower food intake by avoiding effort. Second, the body will lose weight.

Numerous studies done in the U.S. and other Western industrial countries illustrate the significance of this relationship between improved nutrition and physical performance.[13] One of the best controlled studies was done with aircraft workers in Southern California. "One group of workers was given large doses of several vitamins five days a week for 9-13 months; a control group was given placebo. During the last six months the vitamin group showed statistically significant superiority over the placebo group in absenteeism (3.90 days compared with 4.79 days), in turnover of labor force (8.4 per 100 as compared with 13.5), and in merit ratings based on a careful appraisal of efficiency."[14]

Table 7 shows the relationship between additional protein intake and an improved capacity for work. These studies had poor controls and leave much doubt of the significance of this relationship.

TABLE 7
PROTEIN INTAKE AND CAPACITY FOR WORK[15]

Year	Occupational Groups	Intake of cal/day	Intake of g protein/kg	"performance capacity"
1939-41	miners (Germany)	3,800	1.0-1.2 below 1.0	rising falling
1942	gardeners (England)	3,000	1.0 0.7	unchanged falling
1946	scientists (United States)	3,000	0.8 1.6	unchanged steep rise after 6 weeks
1951	students (United States)	4,000	2.0	doubling of muscle power in 12 weeks' training period
			1.0	slight increase in 12 weeks
			0.8	no change in 8 weeks

2. Economic Benefits

The pertinent economic benefits were calculated only for the malnourished working population between the ages of 14 and 64. The increase in worker performance of 10-40 percent depends on the degree of labor intensity and the previous nutritional status of the worker.

The calculation of benefits is based on one assumption: The employment picture of each worker from each race-sex-region cohort is assumed to be constant. Thus, his productivity will increase but his job and salary will not change so each worker will not capture his increase in productivity.

Then, the benefits to society for each workers' improved productivity are the 10-40 percent increase in productivity, times the present value of lifetime earnings for his sex-race-region-group. Benefits of $6.5 to $25.9 billion will necessarily accrue to society in terms of increased productivity. These benefits are calculated in Table 8.

TABLE 8
ECONOMIC BENEFITS PHYSICAL PERFORMANCE ($)
Workers 14-65+

		NON-SOUTH		SOUTH		TOTAL
		URBAN	RURAL	URBAN	RURAL	
Male	White	$ 873,634,440- $3,494,537,760	$ 477,931,715- $1,911,726,862	$ 432,866,964 $1,731,467,855	$ 488,632,212 $1,954,528,848	
	Non-White	$ 459,710,030- $1,838,840,119	$ 64,940,109- $ 259,760,436	$ 430,569,651- $1,722,278,604	$ 582,998,526- $2,331,994,106	
Female	White	$ 787,377,540- $3,149,510,163	$ 242,496,994- $ 969,987,974	$ 227,542,814- $ 910,171,255	$ 152,283,753- $ 609,135,021	
	Non-White	$ 610,637,852- $2,442,551,410	$ 51,184,602- $ 204,738,406	$ 363,722,915- $1,454,891,659	$ 216,350,244- $ 865,400,976	
						6,462,880,361 25,851,521,454

Top number corresponds to lower limit. Bottom number corresponds to upper limit. Numbers may not be exact due to rounding.

C. Morbidity and Resistance to Disease

As a result of better nutrition, fewer work days will be missed due to illness by the 3.45 million working poor. The days lost from work (morbidity rate) will be reduced 10-25 percent. The economic benefits from this will be $200 to $500 million.

1. Relationships

R. J. Williams summarizes this relationship when he states that "every amino acid, mineral, and vitamin which contributes to the health and vigor of one's body is in a sense an anti-infective agency because resistance to disease is a sine qua non of continued existence, and resistance is the highest in those in which the cells and tissues most intimately involved in disease-resistance processes are nourished at the highest level of excellence."[16]

Poor nutrition can lead to a greater incidence of bacterial, viral, richettsial and protozoal infections. Some of the mechanisms of this synergism are interference with antibody response, alternation of tissue integrity, interference with non-specific protective substances, non-specific destruction of bacterial toxins, and nutritional alteration of endocrine balance.[17] Protein, iron, vitamins B and C are key nutrients. The following are examples of these relationships.

a. Leithch has called attention to the Tronhein Naval Training School in which over a period of many years one-third of the cadets developed tuberculosis, a rate which was not lowered by better housing but which promptly dropped to less than that for the country as a whole, when fresh milk, meat and fruit were added to the diet. Downes divided 194 Negro families exposed to reinfection with tuberculosis into two groups

matched for family size and supplied one group with vitamins and minerals for five years. The rate per 100 person years was 0.91 in the control group and 0.16 in the group receiving regular vitamin and mineral therapy. Since the numbers were small the difference was barely significant at the 5 percent level. Getz, el al. reports serum levels of vitamin A and C to be lower in 28 persons subsequently developing tuberculosis than in over 1,000 individuals who did not develop this disease.[18]

b. Keller reviewed some of the experiments done with vitamin C. He found that although most of the studies have shown a relationship between vitamin C intake and absences from work, different studies have indicated different doses of this vitamin are needed. Schuenert "saw effects only on doses of as much as 1,000 mg. ascorbic acid per day, while Baker and Winckler (1955) found a reduction in the number of short absences from work on daily supplements of 100 mg. of vitamin C."[19]

c. The International Labor Organization provides an excellent example of the influence of a good lunch on accidents. The UN Food and Agriculture nutrition committee interpreted these results as a reflection of the relation between nutrition and morbidity. In this Canadian study the results before and after the opening of the lunch room per million man/hours worked were determined.[20]

	Number Before	Number After
First Aid Treatment	3,000	2,130
Lost Time Accidents	49	42
	Three years average	

2. Economic Benefits

As with physical performance, economic benefits were calculated only for the working poor although school attendance will increase, also. Table 9 gives morbidity rates for males and females in the overall work force for age groupings, rates less than those for the poor population. A reduction in these rates will produce gains to society which may accrue to the individual or to the corporation. The increase in productive time will produce gains between $200 and $500 million. These benefits are shown in Table 10.

TABLE 9

MORBIDITY RATE

Percentage Days Lost from Work Per Person Per Year

AGE	MALE	FEMALE
17-24	.0132	.0164
25-44	.0256	.0384
45-64	.0532	.0248

Source: U.S. Department of Health Education, and Welfare. Disability Days: U.S. July, 1965 - June 1966. Vital and Health Statistics, Series 10, No. 47, GPO, October 1968.

TABLE 10
ECONOMIC BENEFITS MORBIDITY ($) (14-65+)

		NON-SOUTH		SOUTH		TOTAL
		URBAN	RURAL	URBAN	RURAL	
Male	White	29,528,844 73,822,110	16,154,092- 40,385,230	14,630,903- 36,577,258	16,515,769 41,289,422	
	Non-White	15,538,199- 38,845,498	2,194,976- 5,487,440	14,553,254- 36,383,136	19,705,350- 49,263,375	
Female	White	21,337,931- 53,344,828	6,571,669- 16,429,171	6,166,410- 15,416,026	4,126,890- 10,317,224	
	Non-White	16,548,286- 41,370,714	1,387,103- 3,467,757	9,856,891- 24,642,227	5,863,092- 14,657,729	
						200,679,659- 501,699,148

Top number corresponds to lower limit . Bottom number corresponds to upper limit. Numbers may not be exact due to rounding.

D. Mortality

The loss of years of productive life through premature death results in a significant economic loss to society.[21] The elimination of malnutrition will reduce mortality mainly among two groups, the 328,000 poor malnourished infants and the 837,000 poor malnourished pregnant women. The range of economic benefits from this reduction in malnutrition is between $66 and $156 million.

1. Relationships

Malnutrition directly increases the mortality rate for pregnant women and, indirectly, for infants. During pregnancy, the fetus drains the mother of many nutrients which in malnourished mothers leads to a higher incidence of maternal mortality. Also, maternal malnutrition is a major cause of immaturity and prematurity, both frequently recurring factors in infant deaths.[22] Between one-half and three-fourths of all children who die in the first four weeks of life are premature.[23]

Numerous studies have validated this relationship between improved nutrition, especially increased iron and protein, and reduced mortality in less industrialized countries, but few conclusive studies have been completed in the Western industrialized countries.[24] However, one exemplary study was done in Oslo, Norway, by a famous researcher Toverud.[25] Over six years he showed that improved nutrition caused 50 percent decrease in stillbirths, premature births, and infant mortality.

2. Economic Benefits

The impact of improved nutrition upon maternal mortality will reduce the number of deaths 30-60 percent. Among infants aged 0-1, the

mortality rate reduction will be 20-50 percent. The present infant and age-specific maternal mortality rates are found in Table 11 and 12, respectively.

The range of total economic benefits in present value terms is between $66 and $156 million. This is the income which will accrue to these women and children over their lifetimes. Table 13 gives the benefits for each age-sex-race-region cohort for each category.

TABLE 11

Infant Mortality Rate per 1000 Live Births in 1966

Age	White	Non-White
0-1	20.15	38.8

TABLE 12

Female Mortality Rate per 1000 Women

Age	White	Non-White
14-24	.6	1.0
25-34	.9	2.5
35-44	1.9	5.3

Source: U.S. Department of Health, Education, and Welfare. Infant & Post Natal Mortality in the United States, Vital & Health Statistics, National Center for Health Statistics, Series 3, No. 4, GPO, October 1965.

U.S. Department of Health, Education, and Welfare, Selected Family Characteristics & Health Measures, Vital and Health Statistics, National Center for Health Statistics, Series 3, No. 7, GPO, January 1967.

TABLE 13

ECONOMIC BENEFITS MORTALITY

a) Infant Mortality (0-1) ($)

	NON-SOUTH		SOUTH		TOTAL
	URBAN	RURAL	URBAN	RURAL	
White	4,034,225- 10,085,560	4,443,281- 11,108,202	1,419,776- 3,549,439	3,089,504- 7,723,760	
Non-White	19,475,037- 48,687,592	70,592- 176,481	3,841,516- 9,603,792	6,372,958- 15,932,395	
		b) Maternal Mortality (14-44) ($)			42,746,889- 106,867,223
White	4,902,049- 9,804,098	1,636,225- 3,272,450	1,111,187 2,222,375	1,177,888- 2,355,775	
Non-White	9,211,128- 18,422,257	496,824- 993,647	3,709,904- 7,419,808	2,714,339- 5,428,679	
Top number corresponds to lower limit. Bottom number corresponds to upper limit. Number may not be exact due to rounding.					24,959,544- 49,919,088

E. Intergenerational Effects

The benefits from eliminating malnutrition have been calculated for the poverty population for 1967. It has been assumed that these malnourished persons will be well nourished throughout their lifetimes and significant economic benefits of $13.1 to $45.7 billion will accrue to society. The effects of better health will benefit future generations, as well, in three ways.

1. The children of healthy parents will be healthier and better motivated.
2. Healthy mothers will have an easier time raising children.
3. The children of the better educated will be better educated through informal education which children receive at home.[26]

The financial gains from better income now have been estimated to be at least 14 percent of this generation's financial gains. For this study, the effects are merely assumed to be 10 percent of the total economic benefits received from better mental and physical performance, and lower morbidity and mortality rates. The range of these benefits associated with intergenerational effect is between $1.3 and $4.5 billion. Table 14 sums up all the economic benefits.

TABLE 14
TOTAL ECONOMIC BENEFITS FROM ELIMINATION OF MALNUTRITION
(in dollars 1966)

SOURCE	LOWER LIMIT		UPPER LIMIT	
1. Education				
a. Higher achievement	6,278,236,418		18,834,709,254	
b. Lower flunk rates	122,889,901		368,669,703	
		6,401,126,319		19,203,378,957
2. Physical Performance		6,462,880,361		25,851,521,444
3. Morbidity		200,679,659		501,699,148
4. Mortality				
a. Infant mortality	42,746,889		106,867,223	
b. Materal mortality	24,959,544		49,919,088	
		67,706,433		156,786,311
SUBTOTAL		13,132,392,772		45,713,385,860
5. Intergenerational Effects		1,313,239,277		4,571,338,586
TOTAL ECONOMIC GAIN		14,445,632,049		50,284,724,446

F. Total Benefits

The total economic gain to American society from the elimination of malnutrition as quantified, even by the conservative measures used in this paper, ranges from $14.5 billion to $50.3 billion. Of course, quantifiable benefits are by no means the only benefits accruing to a well-nourished society, or even the most important ones. The fact that by eliminating malnutrition millions more people could live healthy, normal lives involves countless socio-psychological benefits both to the individual and the larger society.

Not all of these economic benefits will accrue to healthy poor people. These economic benefits are the returns to society in general. A secondary question exists regarding the extent to which the value of any welfare program which eliminates malnutrition among the poor will be reflected in income, and, thereby, in private returns to the poor. Improved productivity from higher physical performance and lowered days missed from work will result partially in gains by the worker and partially by corporate America. Benefits from improved education and lowered mortality will accrue first to the poor.

III. Downward Bias of Economic Gains--Realism of Analysis

As was indicated earlier, any study of this kind must be viewed as part science, part speculation. In the case of this paper, the projections may reflect, even at the higher levels, conservative bias on several counts. First, the size of the poor population will necessarily be too small (the OEO figures for poverty in 1967 adjust the Current Population Survey data used here upward by some 7.4 million persons). Second,

there are severe problems inherent in the method used to derive our national poverty figures as indicated early in the article. Even the Bureau of Labor Statistics estimates that an urban family of four requires $7,000 to live decently. Finally, morbidity and mortality rates are taken from Department of Health, Education, and Welfare data and reflect the general population rather than the specificially poor population which will experience higher rates.

In addition to the above, it was assumed in this study that the gains to the society and to individuals would be measured by the present value of lifetime earnings for the poverty population. That is, the gains from increased productivity, lower morbidity and mortality etc., would be measured by assuming that the respective population subgroups would continue to function in the same labor markets and to earn only a poverty income.[27] No assumption was made that better-fed people would be better able to break out of poverty. This reflects the socio-economic conditions of the presently malnourished population. Naturally, this may bias total economic benefits downward tremendously.

While no exact numbers can be given for the extent of these biases, a reasonable estimate of their impact seems in order. For the typical benefits analysis, our results must be viewed as minimum (both lower and upper bounds). These results probably underestimate the true economic gains to the society by at least 20-50 percent. This downward bias would suggest that actual benefits from eliminating malnutrition would prove much greater than those presented here.

The reduced costs incurred in connection with treatment of the malnourished are the most important excluded benefits. The reduced costs to schools from lower failure rates would be included in that group. Psychic benefits resulting from better health and education and reduced dependency relationships by a well-fed person also exist.

In addition, external benefits were not discussed. Nutrition programs which would affect millions of people will benefit significantly individuals other than the direct recipients. For example, the well nourished have a lower tendency to transmit communicable diseases and parasites. Adequate nutrition will help to break the chain of many infections.

A positive bias in the results comes from consideration of political economy. The well known existence of racial and class discrimination greatly handicaps the solution to problems of malnutrition and limits the gains which can be made.

CONCLUSION

This study has laid out the potential economic gains from eliminating malnutrition in America. By necessity, this analysis is tentative. The lack of adequate information has necessitated a broad estimation ($14.4-$50.3 billion) of the possible dollar benefits. Given the biases discussed, I suspect the actual dollar benefits would be closer to the top of the range. Even ignoring humanitarian considerations, the elimination of malnutrition would probably be more beneficial to this country than many other types of projects competing for public funds.

FOOTNOTES

[1]The less tangible effects of hunger and malnutrition--listlessness, irritability, depression--were not valuated but cannot be dismissed. Structual problems such as weight, height, fragile bones, and the trainability of muscles were not valuated.

[2]The National Nutrition Survey in 10 states, while completed for purposes of data collection, has not been analyzed and has been only partially released. It is generally accepted that HEW does not want to publish the results because the incidence of malnutrition was found to be so widespread.

[3]Some of the sources are contained in the following section. A detailed 12-page bibliography is available from the author upon request. Medical and clinical nutrition journals and books provided most of the information required for this analysis.

[4]R. Cook, "The Financial Cost of Malnutrition in the 'Commonwealth Caribbean'," The Journal of Tropical Pediatrics, (June 1968):60, 61.

[5]Cravioto and DeLicardie qualify their findings by the duration of the untreated malnutrition and the period of infancy. Also they feel the question of permanent retardation remains open. Also they feel it is difficult to "distinguish the particular contributions of early severe malnutrition, adequate environment, and experimental opportunities to defective cognitive function."

J. Cravioto and E. R. DeLicardie, "The Long-Term Consequences of Protein-Calorie Malnutrition," Nutrition Reviews, 29, No. 5 (May 1971): 111. Also, Joaquin Cravioto, "Malnutrition and Behavioral Development in the Preschool Child," from Pre-School Child Malnutrition, National Academy of Sciences--National Research Council, Publication 1282, Washington, D.C. 1966.

George B. Graham, "Effect of Infantile Malnutrition on Growth," Federation Proceedings, 26, (January-February 1967):139.

[6]Joaquin Cravioto, "Malnutrition and Behavioral Development in the Preschool Child," from Pre-School Child Malnutrition, National Academy of Sciences--National Research Council, Publication 1282, Washington, D.C. 1966.

Joaquin Cravioto, Elsa DeLicardie and Herbert G. Birch, "Nutrition, Growth, and Neurointegrative Development: An Experimental and Ecologic Study," Pediatrics, 38, No. 2, part II (August 1966).

[7]Both of these quotes are taken from Cravioto, el al., "Nutritional Growth," p. 359.

[8]Ethel Austin Martin, Nutrition in Action (New York: Holt, Rinehard, and Winston, Inc., 1963):213.

Nevin S. Scrimshaw, "Nutrition and Mental Development" (Paper delivered at the Twenty-Fifth Anniversary Commemoration of the Nutrition Foundation, Inc., November 17, 1966):13, 14.

Roger J. Williams, Nutrition in a Nutshell (New York: Doubleday and Company, Inc., 1962).

[9]Maurice F. Seay and Leonard E. Meece, "Sloane Experiment in Kentucky," Bulletin of the Bureau of Social Service, College of Education, V. 16 (University of Kentucky, June 1944):68.

[10]Scrimshaw, "Nutrition and Mental Development."

[11]Income data was available for each grouping from the Current Population Survey. Present values were calculated using standard rates of survival, a 6 percent interest rate and a 2 percent growth rate (4 percent discount rate). An explanation of the present value concept and the tables of present values for various education levels can be obtained from the author.

[12]Thomas I. Ribich, Education and Poverty, (Washington, D.C.: The Brookings Institution, 1968):68-70.

For a further discussion of this subject see chapters 1 and 4. This income differential was calculated from the Current Population Reports. Series P-60, No. 56 which gives the present value of lifetime incomes for a normal population and the present value for the poor.

The poverty population values were not used due to peculiarity of the data for high-school graduates and above. Much research has indicated the difficulty with education and poverty linkages. These values were then deflated by about 20 percent. The reasons for this are straight-forward. The income differential between dropouts and graduates for the normal population must overstate this differential since persons in the poverty subgroup would have lower average and lifetime income. It is the ratio of the high school graduate differential for people with less than $3,000 income versus people with income of $3,000-$6,000. Due to the fact that education is less important for poor people, their differential will peak earlier than the normal population. Thus, the results of the deflation are somewhat conservative. The 20 percent figure was obtained from unpublished research by Professor Robinson Hollister, formerly of the University of Wisconsin, now a visiting professor at Princeton University. The conclusions of Lester Thurow's Brookings publication, Poverty and Discrimination, reinforce this technique.

[13]The Keller and Kraut and the UNFAO articles summarize many of these studies.

W. D. Keller and H. A. Kraut, "Work and Nutrition," Geoffrey H. Bourne, ed., World Review of Nutrition and Dietetics, V. 3,(New York: Hafner, 1962).

W. W. Tuttle and Edward Herbert, "Work Capacity with No Breakfast and a Mid-Morning Break," Journal American Dietetic Association, 37, (August 1960).

United Nations Food and Agriculture Organization, Nutrition and Working Efficiency (Rome: UNFAO, 1962).

C.E.A. Winslow, The Cost of Sickness and the Price of Health, World Health Organization (Geneva, 1951).

[14]Winslow, The Cost of Sickness, p. 35.

[15]Keller and Kraut, "Work and Nutrition," p. 73.

[16]Williams, Nutrition in a Nutshell, p. 49.

[17]Dr. Nevin Scrimshaw, one of the leading American nutritionists, has written extensively on this subject. For example,

Nevin S. Scrimshaw, "Nutrition and Infection," in J. F. Brock, ed., Recent Advances in Human Nutrition, (Boston: Little Brown and Company, 1961).

[18]Ibid., p. 376.

[19]Keller and Kraut, "Work and Nutrition," p. 75.

[20]UNFAO, p. 26 from ILO Studies and Reports, New Series, N. 4, Nutrition in Industry, 1946, p. 41.

[21]There is a large literature on this subject. For example, see

Dorothy P. Rice, Estimating the Cost of Illness, U.S. Department of HEW Public Health Service, Health Economic Series #6, (Washington, D.C.: G.P.O., 1966).

Another way of valuating the benefits from reduced mortality looks at the waste of money invested in the education, training, clothing, feeding, and health care of the individual. For less developed economies where each individual's future is more doubtful, this "what's put in" approach is more relevant.

[22]Mark Abramowicz and Edward H. Kass, "Pathogenesis and Prognosis of Prematurity," The New England Journal of Medicine, 275, (1966):878.

A premature infant is born with a weight of less than 2500 grams.

[23]Ibid., p. 880.

[24]For example,

Report of a Study Group on Iron Deficiency Anemia, World Health Organization Technical Report Series No. 182, (Geneva, 1959).

W. A. Krehl, "A Concept of Optimal Nutrition," The American Journal of Clinical Nutrition, 4, No. 6, (1956).

[25]Williams, Nutrition in a Nutshell, p. 48.

[26]Theodore Schultz and Burton Weisbrod have written on this subject.

T. W. Schultz, "Education and Economic Growth," Social Forces Influencing American Education, (Chicago: University of Chicago Press, 1961):74, 75.

Burton A. Weisbrod, "Education and Investment in Human Capital," The Journal of Political Economy, 19, Supplement, No. 5, part 2 (October 1962):117-118.

[27]Structually different labor markets fact the poor and nonpoor in our dual economy.

For example,

Piore, Michael J., "Manpower Policy" in S. Beer and R. Barringer, eds. The State and the Poor, (Cambridge: Winthrop Publishing, 1970).