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FOCUS 5

FEBRUARY 2001

HEALTH AND NUTRITION EMERGING AND REEMERGING ISSUES IN DEVELOPING COUNTRIES

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HEALTH AND NUTRITION EMERGING AND REEMERGING ISSUES IN DEVELOPING COUNTRIES

OVERVIEW

RAFAEL FLORES

FOCUS 5 • BRIEF I OF II • FEBRUARY 2001

A healthy and nutritionally well-fed population is indispensable for economic growth and development. Health and nutritional status affect the capacity to learn, which in turn determines productivity and economic growth. Evidence from developing countries shows that adult productivity depends to a considerable extent on the contribution health and nutrition during early childhood make to educational attainment. Studies also show that a healthy adult with a nutritionally adequate diet has a higher level of economic productivity in both own-farm production and the labor market than one who eats and keeps less well.

There are many examples of the impact of ill health, which is often tied to the vulnerabilities caused by poor nutrition, on economic outcomes. For example, in Tanzania the average cost of treatment of a single HIV/AIDS infection, including the loss of productivity, is estimated to be between 8.5 and 18 percent of per capita income. Countries with severe malaria outbreaks have an average annual economic growth rate that is 1.3 percent lower than those that do not. Tuberculosis (TB) patients are absent from work three to four months out of the year, forfeiting 20 to 35 percent of annual household income.

Given the importance of health and nutrition for development, this collection of policy briefs presents expert perspectives on some of the most significant emerging (HIV/AIDS, obesity, chronic diseases, aging, and neglected micronutrients) and reemerging (malaria and tuberculosis) nutrition and health issues that will influence human development in developing countries in the next decades.

CAUSATION, RISKS, AND EFFECTS

While the interaction of inadequate dietary intake and disease leads to malnutrition, disability, and death, it is also clear that insufficient access to food, inappropriate caring practices, a poor environment, inadequate health services, low women's status, and poverty play a major role in catalyzing the whole process. Each of these factors can be a cause, a risk, and/or an outcome; the pathways toward and away from good health and nutrition go in multiple directions.

Take the impact of poverty on HIV/AIDS and TB. Poverty increases the exposure to, as well as the impact of, HIV/AIDS. It diminishes the perceived value of avoiding HIV/AIDS ("we will die soon anyway"), increases the relative costs of preventing and treating the illness, and worsens the impact of weakened immunity because it commingles with a more hostile bacterial and viral environment. Under these circum-

stances, TB reemerges rather easily, augmenting the negative impact of poverty. Poverty and TB in tandem increase the already deleterious impact of HIV/AIDS on family, friends, community, and state.

Looking at the causal process in reverse, HIV/AIDS and tuberculosis increase poverty in the short to medium run by stripping assets—human, social, financial, physical, natural, informational, and political. Asset rundown leaves individuals, families, and communities more exposed to future health and nutrition shocks. In the meantime, public health resources are increasingly diverted away from prevention and rural primary care to the treatment of HIV/AIDS-infected individuals.

THE GLOBAL BURDEN OF DISEASE

The 1996 World Health Organization study of the global burden of disease predicts that deaths from communicable diseases, maternal and perinatal conditions, and nutritional deficiencies (Group I) are expected to decline by more than half, from 34 percent of all deaths due to disease in 1990 to 15 percent in 2020. The projected decrease reflects the overall improvements in Group I conditions brought about by increased income, greater literacy, and progress in the development of antimicrobials and vaccines. The major exception to this trend is HIV/AIDS, for which global mortality is rising rapidly, from 300,000 deaths in 1990 to 2.7 million in 1999.

While Group I conditions as a whole are expected to decline, deaths from noncommunicable diseases (Group II) are expected to rise from 55 percent of all deaths due to disease in 1990 to 73 percent in 2020. In the developing world Group II deaths are expected to climb from 47 percent of all deaths due to disease to almost 70 percent.

HIV/AIDS, tuberculosis, and malaria. Today, approximately 36 million individuals are living with HIV/AIDS. Sub-Saharan Africa is the region most affected by this disease. Most, if not all, of the 25 million people in Sub-Saharan Africa infected with HIV/AIDS will have died by the year 2020, in addition to the 13.7 million Africans already claimed by the epidemic. HIV/AIDS is also spreading dramatically in Asia, which will overtake Sub-Saharan Africa in absolute numbers before 2010. HIV/AIDS has contributed dramatically to exorbitant health care costs, labor shortages, a declining asset base, breakdown of social bonds, loss of livestock, and reliance on crops that are easier to produce but less nutritious and economically valuable. All of these effects contribute to food and nutrition insecurity.



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TB is the leading infectious killer of young and middle-aged adults in the world. It causes 26 percent of avoidable deaths in the developing world. TB and HIV/AIDS often conjoin to destroy lives. TB kills 30 percent of AIDS victims in Africa and Asia, and HIV accelerates the progression to active TB by up to one hundredfold. The burden of TB is expected to increase, with 80 million deaths over the next three decades. TB's negative impact on the social fabric of families and their nutrition security is enormous.

Malaria is a major health problem in parts of Asia, Latin America, the Middle East, and the Pacific. However, Africa faces the greatest burden of the disease. Each year 300 to 500 million people become ill with malaria and 1.5 to 2.7 million people die. Ninety percent of this mortality is in Africa, in children under the age of 5. Pregnant women are also severely affected, and so are their developing fetuses. Malaria is on the increase due to insecticide resistance, antimalarial drug resistance, and environmental changes. Because malaria often strikes during harvest time, it can threaten food security and agricultural production.

Intrauterine growth retardation, cardiovascular and endocrine diseases, and obesity. IUGR refers to fetal growth that has been constrained in the uterus. It results in newborns that have not attained their full growth potential and are already malnourished at birth. Recent estimates suggest that about 11 percent of newborns, or 12.6 million infants, suffer from low birth weight at term (the IUGR proxy). Low birth weight at term is especially common in South Central Asia, where 21 percent of newborns are affected. Low birth weight at term is also common in Middle and West Africa.

The "Barker hypothesis," which remains controversial, is founded on the concept that maternal dietary imbalances at critical periods of fetal development affect fetal structure and metabolism in ways that predispose the individual to later cardiovascular and endocrine diseases. This hypothesis may have major implications for public health, especially in developing countries. This is because in the developing world a high proportion of births occurs in the birth-weight range with the highest risk of developing adult disease. In addition, the prevalence of risk factors, such as obesity, that might lead to high blood pressure, cardiovascular disease, non-insulin-dependent diabetes, and some cancers is increasing rapidly in some developing countries.

Obesity remains rare in Sub-Saharan Africa and South Asia. But in the more developed countries of Latin America, the Middle East/North Africa, and Central Eastern Europe/Commonwealth of Independent States, obesity in women and children is as common as it is in the United States. Some countries with high levels of obesity still report significant rates of childhood stunting and nutritional deficiencies. The existence of a dual nutrition agenda of obesity and undernutrition presents a difficult challenge because resources are limited.

Aging, health, and nutrition. The percentage of the world's population over 60 years old in 1980 was 8.5 percent. It now stands at 11 percent, or 613 million people. By 2020 there will be 1 billion elderly, with 71 percent living in developing countries. The elderly will be susceptible to the health problems traditionally associated with low-income societies, including infections and accidents, and their diet and nutritional status will interact with these conditions. Infections that traditionally produced mortality in early life, such as malaria, TB, respiratory infections, or diarrhea, may reemerge in the lives of the elderly in developing countries.

Neglected micronutrients. Poorer populations usually consume few animal products, so their intakes of vitamin A, iron, zinc, riboflavin, vitamin B-12, vitamin B-6, and calcium are inadequate. Poor diets may also contain few fruits and a limited variety of vegetables and, therefore, low amounts of B-carotene, folic acid, and vitamin C. Failure to address the problem of these neglected micronutrients means that a high proportion of the world's population—especially infants, children, women of reproductive age, and the elderly—will continue to suffer the illnesses and debilities associated with this form of malnutrition.

CONCLUSION

A positive relationship exists between health and nutrition and economic productivity. The benefits of good health and nutrition on economic growth cannot be overstated. But to harness these benefits, the interactions of risk, causation, and consequences among poverty, food insecurity, health, and nutrition need to be understood.

At the end of this collection, Stuart Gillespie elaborates on the crosscutting policy themes and actions for implementing prevention, promotion, treatment, care, and mitigation programs to advance good health and nutrition. Only by responding to the emerging and reemerging health and nutrition concerns discussed in these briefs can the developing world make significant progress in escaping the trap of hunger and poverty. ■

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HEALTH AND NUTRITION

EMERGING AND REEMERGING ISSUES IN DEVELOPING COUNTRIES

THE GLOBAL BURDEN OF DISEASE

ALAN D. LOPEZ

FOCUS 5 • BRIEF 2 OF 11 • FEBRUARY 2001

Reliable, timely information on the causes of disease and injury is required at all levels of the health system in order to formulate policy and to evaluate interventions. Because reliable data on causes of death and disability are unavailable for many countries, the information base for public policy, at least at the global level, is fragmented and incomplete.

Nonetheless, sufficient data sets and research results exist to cautiously assess global health conditions. The first such assessment was The Global Burden of Disease (GBD) study, which began in 1992. This was the first comprehensive effort to provide comparable regional and global estimates and projections of disease and injury burden based on a common methodology and denominated in a common measure (see box).

MAJOR CAUSES OF DISEASE BURDEN

In 1990, approximately 1.3 billion Disability-Adjusted Life Years (DALYs) were lost worldwide as a result of new cases of disease and injury. Sub-Saharan Africa and India together accounted for more than 40 percent of the total global burden of disease in 1990, although they have only 26 percent of the world's population.

By contrast, the established market economies and the former socialist economies of Europe, with about a fifth of the world's population, together bore less than 12 percent of the total disease burden. China emerged as the healthiest developing region, with 15 percent of the global disease burden and a fifth of the world's population. In summary, the poor in developing countries share a disproportionately large burden of ill health.

The traditional causes of disease burden in developing societies are communicable infections, maternal and perinatal conditions, and nutritional deficiencies, labeled Group I. They accounted for only 7 percent of the burden in the established market economies and less than 9 percent in the former socialist economies, but they represented more than 40 percent of the total global burden of disease in 1990 and almost half the burden (49 percent) in developing regions. In Sub-Saharan Africa, two out of three years of healthy life lost were due to these causes. Even in China, where the epidemiological transition (the transition from high prevalence of infectious diseases, primarily at younger ages, to a high prevalence and mortality from chronic diseases, especially at older ages) is far advanced, a quarter of the healthy years of life were lost. Worldwide, 5 out of 10 leading causes of disease burden (measured by DALYs) are Group I

MEASURING DISEASE BURDEN

Incorporating the burden of premature mortality and disability into one summary measure requires a common metric. Since the late 1940s, researchers have generally agreed that time is an appropriate metric: time (in years) lost through premature death and time (in years) lived with a disability, adjusted for its severity.

A range of such time-based measures, many of them variants of the Quality-Adjusted Life Year (QALY), have been used in different countries. An internationally standardized form of QALY, called the Disability-Adjusted Life Year (DALY), was developed for the global burden of disease study, published in 1996. DALY combines years of life lost to premature death with years lived with a disability of specified severity and duration. One DALY is thus one lost year of healthy life. A premature death is defined as one that occurs before the age to which a person could have expected to survive if he or she were a member of a model population with a life expectancy at birth approximating that of the Japanese, the world's longest-living population.

To calculate total DALYs for a given condition in a population, years of life lost and years lived with disability for that condition are estimated, then combined. For the GBD study, 1990 was chosen as the base year for estimating disease burden.

conditions: lower respiratory infections (pneumonia), diarrheal disease, perinatal conditions, tuberculosis, and measles.

The burden of injury in 1990 was highest in the former socialist economies, relative to their total disease and injury burden. China had the second-largest injury burden, followed by Latin America and the Caribbean with the third largest. Even in the established market economies, the burden of injuries—dominated by traffic accidents—was almost 12 percent of the total disease and injury burden for this group.



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MAJOR RISK FACTORS

Exposure to particular hazards, such as tobacco, poor sanitation, and malnutrition, can significantly increase individuals' risk of developing disease.

Until recently, little was done to measure the burden of these risk factors or to express them in a measure that can be compared directly with the burden of individual diseases. The GBD study was the first to assess the mortality and loss of healthy life that can be attributed to each of 10 major risk factors.

Six of these risk factors—malnutrition; poor water, sanitation, and hygiene; unsafe sex; alcohol; tobacco; and occupation—accounted for more than one-third of total disease burden worldwide in 1990 (see table). Malnutrition and poor sanitation were the dominant hazards, responsible for almost a quarter of the global burden.

As might be expected, major inequalities exist between regions and between men and women in the burden of most risk factors. For example, the consequences of unsafe sex—including infections and the complications of unwanted pregnancy—are borne disproportionately by women. In young adult women in Sub-Saharan Africa, unsafe sex accounts for almost one-third of the total disease burden.

The tobacco and alcohol burden was heaviest in men in the developed regions, where the two risk factors together accounted for more than one-fifth of the total burden in 1990. In Asia and other developing regions, the rapid increase in tobacco use over the past few decades is expected to kill many more people in the coming decades than so far have died in the developed regions.

FUTURE DISEASE BURDEN

The GBD study developed projections using income and education as key determinants of disease rates, along with tobacco use as an index of noncommunicable disease trends, and time as a variable to capture technological change. Death rates for all major causes based on historical data for 47 countries from 1950 to 1991 were related to these four variables to generate the projections. A separate model was used for HIV.

Deaths from communicable infections, maternal and perinatal conditions, and nutritional deficiencies are expected to fall from 17.3 million in 1990 to 10.3 million in 2020. As a percentage of total deaths, these Group I conditions are expected to drop by more than half, from 34 percent in 1990 to 15 percent in 2020. This is due, in part, to the relative contraction of the world's young population, those under 15 years. The projection also reflects the overall decline in Group I conditions over the past four decades, due to increased income, education, and progress in developing antimicrobials and vaccines.

CONTRIBUTION OF 10 RISK FACTORS TO THE GLOBAL BURDEN OF DISEASE AND INJURY IN 1990

Risk Factor	Deaths (thousands)	As Percent of Total Deaths	DALYs (thousands)	As Percent of Total DALYs
Malnutrition	5,881	11.7	219,575	15.9
Poor water supply, sanitation, and personal and domestic hygiene	2,668	5.3	93,392	6.8
Unsafe sex	1,095	2.2	48,702	3.5
Tobacco	3,038	6.0	36,182	2.6
Alcohol	774	1.5	47,687	3.5
Occupation	1,129	2.2	37,887	2.7
Hypertension	2,918	5.8	19,076	1.4
Physical inactivity	1,991	3.9	13,653	1.0
Illicit drugs	100	0.2	8,467	0.6
Air pollution	568	1.1	7,254	0.5

Source: See the GBD study listed under further reading.
Note: DALY stands for Disability-Adjusted Life Year.

Deaths from noncommunicable diseases (Group II) are expected to climb from 28.1 million deaths in 1990 to almost 50 million in 2020, an increase of 77 percent in absolute numbers. In proportionate terms, the share of Group II deaths is expected to increase from 55 percent in 1990 to 73 percent in 2020.

It should not be assumed that the progress of the past four decades against infectious diseases will necessarily be maintained. Antibiotic development and other control technologies might not keep pace with the emergence of drug-resistant strains of important microbes such as *Mycobacterium tuberculosis*. But current evidence suggests that, as long as current efforts continue, Group I causes are likely to continue declining. The exception is HIV/AIDS global mortality, which is rising rapidly—from 300,000 deaths in 1990 to 2.7 million deaths in 1999. ■

For further reading see C. J. L. Murray and A. D. Lopez, *The Global Burden of Disease* (Cambridge, Mass., U.S.A.: Harvard University Press for the World Bank, World Health Organization, and the Harvard School of Public Health, 1996); R. Peto and A. D. Lopez, "The Future Worldwide Health Effects of Current Smoking Patterns," in *Global Health in the 21st Century*, ed. C. Everett Koop, C. E. Pearson, and M. R. Schway (New York: Jossey-Bass, 2000).

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HEALTH AND NUTRITION

EMERGING AND REEMERGING ISSUES IN DEVELOPING COUNTRIES

HIV/AIDS

ANTHONY BARNETT AND GABRIEL RUGALEMA

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Slightly more than 20 years ago, the first cases of AIDS (acquired immunodeficiency syndrome) were identified. Since then, scientists not only have identified the human immunodeficiency virus (HIV) that causes AIDS, but also now understand many of the stages in transmission. Naturally, an infection that is transmitted in a predominantly heterosexual manner and that destroys the health and finally the lives of people of prime producing age exerts a considerable socioeconomic impact.

Neither a vaccine nor a cheap, assured, and effective treatment for HIV/AIDS exists. The pandemic continues to grow and to affect millions of people worldwide, particularly the poor in the southern hemisphere, where 95 percent of cases are concentrated. With most illness and death occurring in the 15–50 age group, the disease deprives countries, communities, and households of their strongest, most productive people.

Today, approximately 36 million individuals are living with HIV/AIDS. Assuming that each HIV/AIDS case directly influences the lives of four other individuals, a total of more than 150 million people are being affected by the disease. Sub-Saharan Africa is the region most affected by HIV/AIDS, now that area's leading cause of adult morbidity and mortality (see table). Most, if not all, of the 25 million people in Sub-Saharan Africa who are living with HIV/AIDS will have died by the year 2020, in addition to the 13.7 million Africans already claimed by the epidemic.

HIV/AIDS also is spreading dramatically in Asia. India leads the world in absolute numbers of HIV infections, esti-

mated at 3 to 5 million. China, too, has a growing HIV/AIDS problem, with approximately 0.5 million AIDS cases and, according to private estimates by Chinese specialists, up to 10 million HIV infections. Asia will overtake Sub-Saharan Africa in absolute numbers before 2010; by 2020 Asia will be the HIV/AIDS epicenter.

HIV/AIDS MORBIDITY AND MORTALITY AND HOUSEHOLD FOOD SECURITY

HIV/AIDS is a huge health problem with profound social and economic implications, including its effect on the ability of households to acquire enough nutritious food for members to lead active, healthy lives. HIV/AIDS has created or contributed to exorbitant health care costs, labor shortages, a declining asset base, breakdown of social bonds, and downgraded crops and loss of livestock. All of these effects contribute to food insecurity.

Households are said to be food-secure when the following four elements are in balance with each other: food availability, equal access to food, stability of food supplies, and quality of food. For rural households, the equitable availability of stable quantities of nutritious food depends on food production (using mainly family labor, land, and other resources), food purchase (using household income), assets that can be quickly turned into food or cash as necessary, and social claims on others through custom and societal structures such as family and community networks.

HIV/AIDS morbidity and mortality affect food security by reducing households' ability to produce and buy food, by

HIV/AIDS BY REGION, DECEMBER 2000

Region	Epidemic Started	Adults and Children Living with HIV/AIDS	Adults and Children Newly Infected with HIV	Adult Prevalence Rate (%)	Percent of HIV-Positive Adults Who Are Women
Sub-Saharan Africa	Late 1970s – early 1980s	25,300,000	3,800,000	8.8	55
North Africa and Middle East	Late 1980s	400,000	80,000	0.2	40
South and Southeast Asia	Late 1980s	5,800,000	780,000	0.56	35
East Asia and Pacific	Late 1980s	640,000	130,000	0.07	13
Latin America	Late 1970s – early 1980s	1,400,000	150,000	0.5	25
Caribbean	Late 1970s – early 1980s	390,000	60,000	2.3	35
Eastern Europe and Central Asia	Early 1990s	700,000	250,000	0.35	25
Western Europe	Late 1970s – early 1980s	540,000	30,000	0.24	25
North America	Late 1970s – early 1980s	920,000	45,000	0.6	20
Australia and New Zealand	Late 1970s – early 1980s	15,000	500	0.13	10
Total		36,100,000	5,300,000	1.1	47



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depleting assets, and by reducing the insurance value of social networks as the household calls in favors. Morbidity affects agricultural productivity by affecting labor availability, forcing households to reallocate labor from agriculture to patient care. AIDS mortality permanently removes adult labor from the household. This combination of adult morbidity and mortality and the associated reallocation and withdrawal of labor has led to a number of adverse changes:

Downgraded crops and loss of livestock. Households affected by HIV/AIDS often replace valuable and nutritious crops that are labor-intensive with root crops, which are fast-maturing but less profitable. Household members consume this mainly starchy food, but cannot easily purchase nutritious food because of lower farm income. Chronic food insecurity and high levels of malnutrition among children, especially orphans, are the likely results of these changing crop patterns. Livestock may be sold to generate cash for patient care or as compensation for a labor shortage, may be taken away from survivors, or may be slaughtered for consumption during funerals—or animals may die because of poor management. When households lose livestock, they also lose fertilizing manure, milk for the family, and “ambulatory” savings.

Loss of farm management resources and skills. Subsistence agriculture requires the interaction of human, financial, and physical resources, and all adult household members contribute to this interaction in some way. But HIV/AIDS breaks the chain of knowledge transfer and labor sharing between generations. As a result, survivors—notably orphans and the elderly, who cannot manage the family farm due to lack of knowledge, experience, and physical strength—often remain or become malnourished.

Inability to earn income. By killing young adults, the key earners of nonfarm income, HIV/AIDS dramatically reduces households’ earning power and, therefore, their ability to buy food and related goods and services. Illness and funerals force households to spend most of their cash on care, treatment, and other expenses, with adverse consequences for food availability. Labor shortages force households to forgo cash crops in favor of fast-maturing food crops, curtailing the ability of afflicted households to generate cash. Evidence from eastern and southern Africa shows that households affected by HIV/AIDS not only are eating fewer meals and consuming poorer foods, but also are investing less in the health of surviving members, losing even more labor to frequent morbidity.

Loss of assets. Food security hinges on household assets, which create a buffer between poor production on the one hand and consumption and exchange needs on the other. In times of need, assets such as livestock, land, trees, and even furniture can be readily converted into cash to buy food. Households accumulate assets as an insurance strategy, but HIV/AIDS forces households to dispose of their assets. They are left not only impoverished, but also vulnerable in the long term.

Disruption of social networks. By killing productive adults who are key family providers, HIV/AIDS shatters the

social networks that provide households with community help and support. Survivors are left with few relatives upon whom to depend, and strong evidence shows that gender and age are critical determinants of social exclusion in the face of HIV/AIDS. Widows and their households face critical shortages of food and income, primarily due to disinheritance, lack of sufficient assets, lack of labor supply, and exclusion from wider kinship networks. Orphans, widows, and the elderly find it particularly difficult to depend on other relatives for survival.

Increasing dependency. Households headed by survivors, notably widows, orphans, and the elderly, are more highly dependent on outside sources of support, further compromising their access to food. Moreover, the centuries-old external support structures that guaranteed the interhousehold transfer of food to cushion the needy are collapsing because of HIV morbidity and mortality.

POLICY AND PROGRAM IMPLICATIONS

Few poverty and distributional policies and programs—particularly in Africa, but also in Asia and Latin America—are unaffected by HIV/AIDS. Households that lose labor are less able to earn cash, with implications for income-generating projects. Less purchasing power reduces the standards of long- and short-term dependent care within those households. Any efforts at mitigating the rural impact of HIV/AIDS, however, must be multisectoral and must take account of local circumstances.

Efforts should be made to identify the most vulnerable farming systems and to ensure the food security of the most vulnerable households. Farming systems and households that remain viable should be supported to prevent individuals from resorting to activities that deplete natural resources (such as bush encroachment).

Research and extension programs should contain an HIV/AIDS education component and should encourage rural people to consider how they would respond to the impact of HIV/AIDS. In some communities, farmers’ panels could be established so that those who have coped or are coping with the disease can talk with people from hitherto lightly affected communities.

Development, dissemination, and scaling up of labor-economizing methods of cultivation, food preparation, water supply, and livestock-raising should be encouraged. Agricultural education should be targeted to orphans and out-of-school youth, and land tenure arrangements must safeguard the interests of widowed women and orphaned children.

In general, policies and programs must go beyond HIV prevention and AIDS care to the long-term issues of livelihood maintenance and food security. ■

For further reading see T. Barnett and P. Blaikie, *AIDS in Africa: Its Present and Future Impact* (London: Belhaven Press, and New York: Guilford Press, 1992); T. Barnett with M. Haslswimmer, *The Impact of HIV/AIDS on Farming Systems in Eastern Africa* (Rome: FAO, 1995); and G. Rugalema, “Adult Mortality as Entitlement Failure: AIDS and the crisis of Rural Livelihoods in a Tanzanian Village,” PhD thesis, Institute of Social Studies, The Hague, The Netherlands, 1999.

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HEALTH AND NUTRITION

EMERGING AND REEMERGING ISSUES IN DEVELOPING COUNTRIES

MALARIA

ANDREA EGAN

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As many as 2 billion people—40 percent of the world's population—live in areas of the world where malaria is endemic. The disease, which is mainly rural, is found between the tropics of Capricorn and Cancer. Although malaria is a major health problem in Asia, Latin America, the Middle East, and the Pacific, Africa faces the brunt of the disease (see table).

THE DEVASTATING IMPACT OF MALARIA

Each year, 300 to 500 million people develop malaria and 1.5 to 2.7 million die—a rate of 200 to 300 deaths worldwide each hour. Ninety percent of this mortality is in Africa, among children under age five. Pregnant women also are severely affected, as are their fetuses and infants. The health and economic burdens of malaria are wide-reaching:

Economic Development. Malaria creates a huge economic burden, because of hospital admissions, national malaria control programs and protection from mosquitoes, the cost to individuals of antimalarial drugs, treatment, and lost wages, and other expenses. Many malaria sufferers cannot afford or have no access to medical treatment. Children lose time from school and suffer throughout life from effects on cognitive development and education levels attained. Malaria also impedes economic development by limiting foreign investment, tourism, transport

systems, internal movement of labor, and commerce. Attracting educated people to malarious regions is difficult, limiting the viability of areas with development potential and rich natural resources, such as the frontiers of the Amazon and the mines of South America and Africa. Because malaria strikes during the rainy harvest season, when worker productivity needs to be at its highest, the disease can harm food security and agricultural production.

Work by Sachs and Gallup at the Center for International Development at Harvard University suggests that malaria causes poverty, and is not just a result of it. Controlling for tropical location, colonial history, and geographical isolation, they found that regions that eradicated malaria had substantially higher economic growth rates than neighboring regions. Malaria affects the demography of a region by increasing infant and child mortality, thus preventing a large proportion of the population from reaching working age. Increased child mortality also leads to increased fertility as women have more children to compensate for those lost to malaria.

Pregnant Women's Health. Adults living in malaria-endemic regions develop immunity to its symptoms. Pregnancy reduces a woman's immunity, however, and ensuing malaria may result in severe anemia. Anemia prevalence in pregnant African

ESTIMATED MALARIA BURDEN FOR 1998 BY REGION AND AGE GROUP

	Total	Age 0 to 4 Years	Age 5 to 14 Years	Age 15 Years and Over
Deaths				
Total	1,109,000	793,000	210,000	106,000
Africa	963,000	745,000	169,000	49,000
Southeast Asia	73,000	10,000	22,000	41,000
Eastern Mediterranean	51,000	36,000	10,000	5,000
Western Pacific	20,000	2,000	7,000	11,000
The Americas	2,000	0	2,000	0
Europe	0	0	0	0
Incidence				
Total	272,924,000	102,473,000	46,680,000	123,771,000
Africa	237,647,000	94,930,000	39,089,000	103,628,000
Southeast Asia	15,790,000	2,036,000	3,721,000	10,033,000
Eastern Mediterranean	13,692,000	4,835,000	2,468,000	6,389,000
Western Pacific	3,752,000	439,000	948,000	2,365,000
The Americas	2,043,000	233,000	454,000	1,356,000
Europe	0	0	0	0

Source: World Health Report 1999 (Geneva: World Health Organization).



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women is high. In Malawi, 70 percent of pregnant women in one study were anemic. The main factors causing anemia in this setting are deficiencies of iron and, possibly, folate induced by inadequate diet and malarial and hookworm infections. Severe malarial anemia resulting in hemorrhage is a major cause of death among pregnant women.

Infant Birth Weight, Growth, and Development. Low maternal hemoglobin strongly predicts preterm delivery and low birth weight. Infants with low birth weight are significantly more susceptible to other infections and have a higher risk of dying during infancy. Those who survive are at greater risk for poor growth and development.

Anemia is another major cause of child morbidity and mortality in Africa. Severe anemia is the most common complication of malaria in children ages 6 months to 2 years living in malaria-endemic regions of Africa.

Malaria infection affects weight gain and stunts growth. In three malaria intervention trials in Africa that measured the protective effect of insecticide-impregnated bed nets (ITBNs), malaria mortality decreased along with all causes of child mortality. Weight gain was significantly higher among infants who slept under ITBNs. Other studies show that African children who regularly receive antimalarial prophylaxis improve weight gain.

NUTRITION AND MALARIAL INFECTION

Nutritional status strongly influences the disease burden of malaria; however, this relationship remains unclear and controversial. Many individuals at risk of malaria have micronutrient deficiencies that may hamper protective immunity. Nutrition appears to influence susceptibility to malaria and affects the course of the infection. Vitamin A is important for normal immune function, and supplementation lowers morbidity of some infectious diseases, including malaria. Vitamin A concentration in human serum negatively correlates with malaria parasite density, and Vitamin A inhibits parasite growth in laboratory experiments.

MALARIA'S COMEBACK

Malaria is on the rise due to insecticide resistance, antimalarial drug resistance, and environmental changes. In spite of the resistance the parasite has developed to the cheap and commonly used antimalarial drug chloroquine, ministries of health are slow to change policy to use the second-line drug Fansidar. Resistance to Fansidar is also developing due to improper use of antimalarial drugs.

The number of malaria epidemics is growing too, because of heavier rain patterns in highlands and the new breeding grounds for mosquitoes created by dams and irrigation projects. Refugees of war and natural disasters are particularly vulnerable to malaria: During civil unrest, non-immune people often move into malarious areas, and health services and malaria control programs break down. The potential ban of DDT could have severe consequences for controlling malaria in countries where this is the only affordable and effective insecticide.

MALARIA IN THE FUTURE

Prevention and treatment of malaria and anemia during pregnancy and in children under age five should be a high priority for ministry of health policymakers, development agencies, and agencies that fund research. A number of protective policies could be implemented:

- Vitamin A and zinc supplements for infants and pregnant women protect against the severity of malaria.
- Intermittent presumptive antimalarial drug treatment for all women during pregnancy reduces placental infection, maternal anemia, and the number of low birth weight babies.
- Changing the first-line antimalarial drug to a nonresistant drug and treating the disease with combinations of drugs will preserve the life of the few available antimalarial drugs.
- Insecticide spraying of households and use of ITBNs protect against malaria mortality.

The human immunodeficiency virus (HIV) epidemic further complicates Africa's malaria situation. By impairing the ability of pregnant women to limit malaria-parasite density, HIV increases the risk of premature delivery, low birth weight, and maternal death. Also, unless blood can be screened for HIV, transfusions for infants and pregnant women with life-threatening anemia will be risky. HIV sero-prevalence is commonly greater than 20 percent in antenatal clinic attendees in Africa.

The World Health Organization has launched Roll Back Malaria, an initiative aimed at reducing malaria mortality by 50 percent by 2010. This initiative aims to prevent malaria by using ITBNs and by spraying home interiors, along with improving access to health-care services.

Research is required to develop new and sustainable ways to control malaria. Strengthening the research capacity of scientists in their own countries should be a major focus for controlling malaria in Africa. The Multilateral Initiative on Malaria, an alliance of organizations and individuals, is working toward this goal, facilitating global collaboration, coordination, and capacity-building.

Even if researchers develop a vaccine within the next 10 years, the best chances for malaria control will require a many-sided attack drawing on a variety of prevention and control methods. ■

For further reading see J. L. Gallup and J. D. Sachs, "The Economic Burden of Malaria," unpublished manuscript (Center for International Development at Harvard University, Cambridge, Mass., USA, 1998, http://www.hiid.harvard.edu/pub/other/mal_wb.pdf); K. Marsh and R.W. Snow, "Malaria Transmission and Morbidity," *Parassitologia* 41 (1999): 241–246; A.H. Shankar, "Nutritional Modulation of Malaria Morbidity and Mortality, *Journal of Infectious Diseases* 182 (supplement 1, 2000): S37–53; and the December 1999 supplement of the *Annals of Tropical Medical Parasitology* for the latest reviews of malaria's effect on pregnancy, the fetus, and the infant. In early 2001 a supplement to the *American Journal of Tropical Medicine and Hygiene* will be published entitled "The Intolerable Burden of Malaria: A New Look at the Numbers."

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HEALTH AND NUTRITION

EMERGING AND REEMERGING ISSUES IN DEVELOPING COUNTRIES

TUBERCULOSIS

ARIEL PABLOS-MENDEZ

FOCUS 5 • BRIEF 5 OF 11 • FEBRUARY 2001

Tuberculosis (TB) is the world's leading infectious killer of young and middle-aged adults, causing 26 percent of avoidable deaths in the developing world. The Global Burden of Disease study (see brief 2 in this collection) places TB among the seven leading causes of lost Disability-Adjusted Life Years (DALYs) well into the 21st century.

TB is a highly infectious airborne disease caused by *Mycobacterium tuberculosis*. Crowded homes and congregate settings (such as shelters, hospitals, and prisons) tend to foster transmission. Although pulmonary TB is the most common form, the disease can affect virtually any organ (for example, lymph nodes, brain, and genitals). Classical clinical manifestations include coughing (sometimes bloody), fever, and weight loss. The germ may remain dormant for years before it emerges as "active" disease. While activation of dormant infection is hard to predict, TB emerges most commonly among people with compromised immunity, such as those with malnutrition, diabetes, and HIV/AIDS infection.

Half of HIV-positive people are infected with TB, and TB kills 30 percent of AIDS victims in Africa and Asia. Likewise, the majority of TB patients in Africa are HIV-infected, and HIV accelerates the progression to active TB up to one hundredfold. Caring for AIDS victims is inconceivable without caring for TB. In a ministerial conference in Amsterdam on World TB Day 2000, TB was recognized beyond its health impact as a major developmental issue.

THE BURDEN OF TB

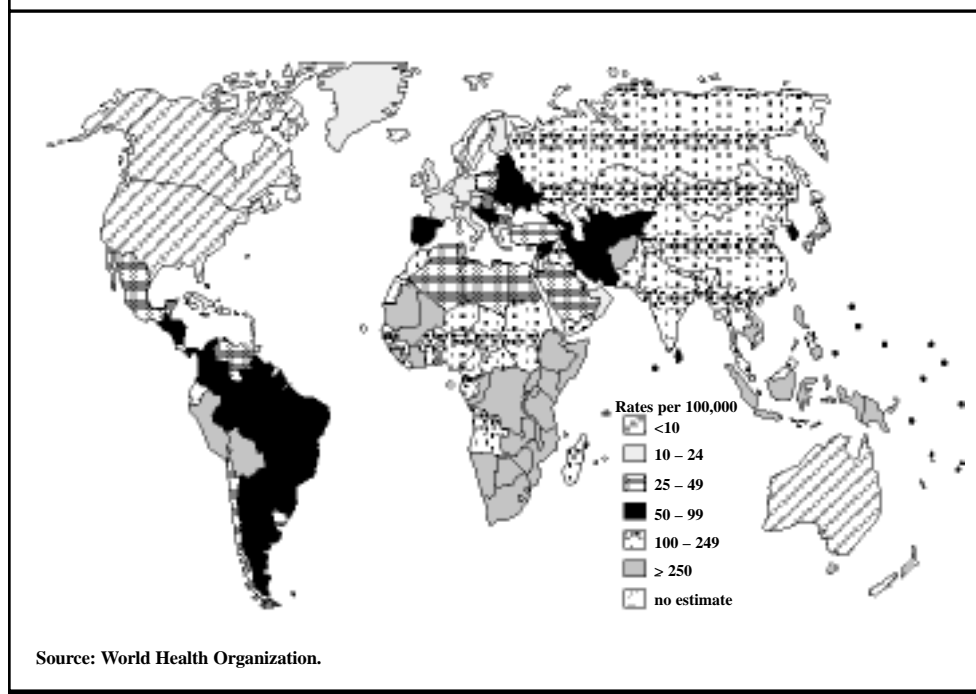
Although considered an ancient killer, TB is at its highest levels in history. TB, the "white plague," was the leading cause of death at the dawn of the 20th century. During the first half of the century, there was a steady decline in incidence, and in many industrialized nations TB was on the brink of elimination. With the introduction of effective drug treatment in the 1950s, society grew optimistic and then overconfident that the disease would be eradicated. However, by 1990 TB had made

an impressive comeback in Europe, North America, and, more recently, Japan, fueled by the HIV epidemic, migration, and the collapse of public health programs targeting TB.

More than 90 percent of TB cases and 98 percent of TB deaths occur in the developing world. The annual risk of TB infection in Sub-Saharan Africa is more than 50 times the rate in Western Europe. In India alone, one person dies of TB every minute. In 1993, the World Health Organization (WHO) declared TB a "global emergency." An estimated 30 million people have died during the 1990s. WHO estimates that 2 billion people—one third of the world's population—are already infected with the tubercle bacillus and at least 5 to 10 percent will become ill in coming years (see figure).

Dramatic outbreaks of multidrug-resistant tuberculosis (MDR-TB) in HIV-infected patients in the United States and Europe recently focused international attention on the emergence of this menace. Patients infected with strains resistant to multiple drugs are difficult to cure, and treatment is long, toxic, and expensive.

ESTIMATED RATES OF NEW CASES OF TUBERCULOSIS, 1997



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Because only a few effective drugs are available against *M. tuberculosis*, drug resistance threatens the standard method of TB control, the DOTS strategy (directly observed treatment, short-course). WHO recently documented the presence of MDR-TB in virtually every country.

The future is not bright for TB victims. The burden of HIV and malaria is expected to decline significantly by 2020. Perinatal and childhood mortality in general will decrease by half in the same period. The burden of TB, however, is expected to increase over the next two decades. Mathematical models predict 225 million cases and 80 million deaths from TB over the next three decades.

TB AND POVERTY

TB has evolved a predilection for the poor and disenfranchised, and today it is considered a barometer of social welfare. During the recent resurgence of TB in New York City and in England, poverty again played a role, and the disease concentrated in minorities and the homeless. TB remains a familiar scourge in Africa and South Asia, where it is the leading cause of death, particularly amongst the poor. In South Africa, the risk of developing TB is 22 times greater for blacks than for whites. Similar gradients are evident in most countries.

TB creates as many orphans as AIDS and more than any other infectious disease. It also kills more women than the direct complications of pregnancy and childbirth combined, with enormous negative impact on the social fabric of families. As poverty fuels TB (through crowding and malnutrition), so TB fuels poverty. Widows and orphans lose not only loved ones but also breadwinners, and in many cases they are left with debts from the medical care of TB victims. TB patients lose three to four months of work and 20 to 35 percent of annual household income. In Asian countries, that translates to a 4 to 7 percent loss of gross domestic product. In India alone, the loss to the economy is estimated to be nearly US\$400 million each year. The world spends almost \$4 billion on TB control every year.

With the advent of AIDS, even previously coping countries are unable to keep up with the increasing burden of TB.

THE STATE OF TB CONTROL

Introduction of effective antituberculosis drugs 50 years ago left behind the era of sanatorium confinement and 50-percent case fatality rates. Antituberculosis treatment is today one of the most cost-effective health interventions. Based on data from Sub-Saharan Africa, the cost per TB death averted by drug therapy can be as low as \$20 and never exceeds \$100. These low costs translate into costs per DALY saved of about \$1 to \$3.

Drug treatment can cure more than 90 percent of patients in developing countries, and the cost is continuing to decrease. Because one patient with TB leads to one to four new cases, the best prevention is curing infectious persons early in the course

of the disease. After introducing DOTS as the breakthrough of the 1990s, WHO set optimistic program goals: detecting 70 percent of TB cases and curing 85 percent of them by 2000. Notable DOTS successes occurred in Bangladesh, China, India, Morocco, Peru, Viet Nam, and New York City.

Half the countries in the world have signed on to the DOTS method. Yet less than 25 percent of patients today have access to DOTS and another 25 percent get no formal treatment. Current efforts detect barely one-third of the estimated number of cases, and drug resistance looms as a threat to effective treatment.

WHO control targets have now been pushed back at least 20 years. Antituberculosis treatment takes a minimum of six months to complete. Without close supervision, up to half the patients default treatment, especially the poorest, fostering contagion and the development of MDR-TB.

A successful program requires adequate infrastructure, a regular supply of drugs, and training and management at district and national levels. This is particularly difficult in rural areas of poor countries undergoing health-sector reform. The urgent need to increase the number of successful programs to control TB requires national commitment and investment as well as international support. WHO has led a growing partnership of international organizations in a global movement to "stop TB" (www.stoptb.org).

A vaccine against TB (BCG) has existed since 1921 and is the most widely administered vaccine in the world. Although it is effective against serious but not contagious forms of TB in children and against leprosy, BCG has not contained the epidemic in developing countries. The National Institutes of Health in the United States is leading an effort to develop a vaccine that could eradicate TB by the close of this century.

Despite the technological revolution of the 20th century, no new diagnostic test has replaced the inefficient chest radiogram and labor-intensive smear microscopy introduced in the 19th century. Likewise, no new antituberculosis drug has been developed in 30 years. But the sequencing of the genome of *M.tuberculosis* has brought unprecedented opportunities and new initiatives are addressing these gaps.

Although the number of TB cases is greater today than in any other time in history, the opportunities and the will to fight the disease are great. TB can be controlled, and eradication will be possible one day. ■

For further reading see A. Pablos-Mendez, M. Raviglione, A. Laszlo, et al., for The WHO/IUATLD Global Working Group on Anti-tuberculosis Drug Resistance Surveillance, "Global Surveillance for Antituberculosis Drug Resistance, 1994-1997," *New England Journal of Medicine* 338 (23, 1998): 1641-49; and C. Dye, S. Scheele, P. Dolin, V. Pathania, and M. Raviglione for the WHO Global Surveillance and Monitoring Project, "Global Burden of Tuberculosis: Estimated Incidence, Prevalence, and Mortality by Country," *Journal of the American Medical Association* 282 (7, 1999): 677-86.

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HEALTH AND NUTRITION

EMERGING AND REEMERGING ISSUES IN DEVELOPING COUNTRIES

INTRAUTERINE GROWTH RETARDATION

MERCEDES DE ONIS

FOCUS 5 • BRIEF 6 OF II • FEBRUARY 2001

Intrauterine growth retardation (IUGR) refers to fetal growth that has been constrained in utero. It results in newborns that have not attained their full growth potential and are already malnourished at birth. Fetuses that suffer from growth retardation have higher perinatal morbidity and mortality and are more likely to experience poor cognitive development and neurologic impairment during childhood. Research shows that as adults IUGR babies have increased risk of cardiovascular disease, high blood pressure, diabetes, and related diseases. Moreover, IUGR contributes to the cycle of malnutrition between generations. The implications of this cycle for both human and socioeconomic development of the affected populations are enormous.

SITUATION IN THE DEVELOPING WORLD

Human growth is defined as an increase in size over time, not only in the fetus, but throughout childhood until the time of skeletal fusion. Size at the time of birth, therefore, is a function of two factors: the rate of fetal growth and the duration of gestation. But because valid assessment of the duration of pregnancy is difficult to obtain in developing countries, the prevalence of low birth weight has been often used as a proxy to determine the magnitude of IUGR. The availability and quality of birth-weight data is also problematic. Despite these constraints, recent estimates suggest that currently about 11 percent of newborns, or 12.6 million infants, suffer from low birth weight at term (the IUGR proxy). The magnitude of the problem varies widely across countries and geographical regions (see table).

Low birth weight at term is especially common in South Central Asia, where 21 percent of newborns are affected, accounting for about 64 percent of all affected newborns worldwide. Low birth weight at term is also common in Middle and Western Africa, but much less so in Latin America and the Caribbean. It is important to note that in the poorest developing countries, a large proportion of newborns, and not just those below an arbitrary cutoff point, are likely to suffer some degree of prenatal growth retardation.

DETERMINANTS OF IUGR

In developing countries, the major determinants of IUGR are related to the mother's nutritional status: inadequate nutritional status before conception, short stature (primarily due to under-nutrition and infection during childhood), and poor nutrition during pregnancy (low gestational weight gain due primarily to inadequate diet). Micronutrient deficiencies play a part but their specific role in IUGR remains an important research question. Gastroenteritis, intestinal parasitosis, and respiratory infections are prevalent in developing countries and may also have an important effect. Malaria is a major determinant in

INTRAUTERINE GROWTH RETARDATION IN DEVELOPING COUNTRIES, 2000

Region	Intrauterine Growth Retardation- Low Birth Weight ($\leq 2,500$ grams and ≥ 37 weeks)	
	Percent	Total Number (thousands)
Africa	8.9	2,590
Eastern Africa	NA	NA
Middle Africa	15.1	628
Northern Africa	NA	NA
Southern Africa	NA	NA
Western Africa	11.1	974
Asia	12.2	9,248
Eastern Asia	1.9	395
South Central Asia	21.0	8,057
Southeastern Asia	5.3	600
Western Asia	3.8	196
Latin America and the Caribbean	6.6	767
Caribbean	6.9	53
Central America	7.3	250
South America	6.3	464
Oceania	8.8	20
Melanesia	9.9	19
Micronesia	NA	NA
Polynesia	0.2	0.03
Developing countries	10.8	12,625

Source: World Health Organization, Department of Nutrition for Health and Development.

Note: NA stands for not available.

countries where that disease is endemic. Cigarette smoking is becoming an increasingly important factor in some parts of the developing world.

The immediate causes of IUGR often operate simultaneously with deeply rooted underlying causes related to the status of women in society, access to quality health services, sanitation, household food security, education, and poverty.

CONSEQUENCES OF IUGR

The health and social consequences of being born malnourished are severe and long-lasting. For infants weighing 2,000–2,499 grams at birth, the risk of neonatal death is



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4 times higher than for infants weighing 2,500–2,999 grams and 10 times higher than for infants weighing 3,000–3,499 grams. The increased risk of mortality extends into the postneonatal period and includes sudden infant death syndrome.

Where diarrheal diseases and acute respiratory infections are the major causes of mortality, IUGR infants have shown an increased risk of morbidity. This is because most of these infants' immune functions are impaired.

Interventions that reduce the incidence of IUGR, therefore, can be expected to reduce neonatal as well as postneonatal mortality. In developing countries with high rates of IUGR, this reduction in mortality could be substantial.

The effects of growth retardation on cognition vary with age at the time of assessment. Deficits tend to be larger in more severely growth-retarded children and are aggravated by high levels of infection, inadequate nutrition and stimulation, low levels of parental education, and other environmental conditions. Poor school performance has been reported in more than half of the studies in which it was examined. Very little is known about the short- and long-term effects of IUGR on body composition and on physical performance and maturation. The impact of IUGR on physical work capacity, work productivity, reproductive performance, and obstetric risks also must be assessed.

FETAL ORIGINS OF ADULT DISEASE

The "fetal origins of adult disease" hypothesis originated in the 1980s, when a link between low birth weight and the incidence of cardiovascular disease was noted among middle-aged U.K. men and women by a group of researchers from the University of Southampton. A number of studies have also indicated that low birth-weight term infants have a higher incidence of hypertension and non-insulin-dependent diabetes (NIDDM) in later life than do those with normal birth weight. The so-called "Barker hypothesis," which remains controversial, is founded on the concept that maternal dietary imbalances at critical periods of fetal development affect fetal structure and metabolism in ways that predispose the individual to later cardiovascular and endocrine diseases.

Some of the uncertainties that surround this hypothesis will be resolved when research progresses beyond epidemiological associations to greater understanding of the cellular and molecular processes that underlie them. The Barker hypothesis potentially has major implications for public health, especially in developing countries. This is because in the developing world a high proportion of births occurs in the birth-weight range with the highest risk of developing adult disease. In addition, the prevalence of factors, such as obesity, that might lead to high blood pressure, cardiovascular disease, and NIDDM is increasing rapidly in some developing countries. The fetal origins of disease provide even greater justification for prioritizing interventions that improve nutritional status, especially of girls and women, and they call for a life-cycle approach to improving nutrition.

POLICY IMPLICATIONS AND CONCLUSIONS

As we enter the new century, the quality of life of infants and young children, as opposed to mere survival, is becoming increasingly important. As more children survive, paying closer attention to the strong relationship between nutritional status and children's ability to achieve their optimal physical growth and psychological development becomes critical. The period of intrauterine growth and development constitutes one of the most vulnerable in the life cycle, with lasting, profound consequences that can compromise the ability to contribute to society. Investment in interventions to improve fetal growth and development not only will decrease the prevalence of IUGR, but will also prevent its negative consequences throughout the life cycle.

But the complex interaction among the multiple causes of IUGR explains the modest benefits achieved so far by nutritional interventions to prevent fetal malnutrition. In poor societies, where multiple pathologies coexist, it is unrealistic to expect that the intergenerational and intragenerational effect of longstanding social and nutritional deprivation on maternal and fetal health can be overcome by a single nutritional intervention during a few months in the course of pregnancy. Simple solutions will not resolve the complex problem of fetal malnutrition.

On the basis of current scientific evidence, strategies to reduce maternal smoking—using a range of approaches, from behavioral remedies to taxation—should be encouraged; efforts to improve women's nutrition should be made a priority, especially in developing countries, although the expected effect of maternal nutrition supplementation on birth weight may be modest; and antimalarial chemoprophylaxis should be considered for women who are pregnant for the first time, although more research is needed to determine the ideal timing and combination of agents.

Priority research areas include a number of promising interventions that merit further investigation following rigorous research methods. Zinc, folate, and magnesium supplementation should be evaluated. And appropriate combinations of interventions (for example, antianemic and antimicrobial/antiparasite agents) that can be tested in population-based trials should also be made a priority.

The greatest need for research is in the developing countries, where IUGR is much more widespread and its multifactorial nature more diverse and less well understood. There is also a need to focus the attention of policymakers on prenatal and early childhood nutritional status as one of the key indicators of development, and as a precondition for the socioeconomic advancement of societies in any significant long-term sense. ■

For further reading see "Causes and Consequences of Intrauterine Growth Retardation: Proceedings of an IDECG Workshop," *European Journal of Clinical Nutrition* 52 (Supplement 1, 1998).

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HEALTH AND NUTRITION

EMERGING AND REEMERGING ISSUES IN DEVELOPING COUNTRIES

OBESITY

REYNALDO MARTORELL

FOCUS 5 • BRIEF 7 OF 11 • FEBRUARY 2001

Obesity is a disease of complex, multiple causes leading to an imbalance between energy intake and output and to the accumulation of large amounts of body fat. It is measured most often as excessive weight for a given height, using the body mass index (BMI)—weight in kilograms (kg) over height squared (m^2). The World Health Organization (WHO) defines overweight as a BMI between 25.0 and 29.9 kg/m^2 and obesity as a BMI of 30.0 kg/m^2 or greater.

A GROWING PUBLIC HEALTH PROBLEM

The consequences of obesity for adults are well known. Obesity contributes to the development of many diseases, including diabetes, hypertension, stroke, cardiovascular disease, and some cancers. Obesity also increases mortality from all causes, including cardiovascular disease and cancer.

Childhood obesity is a problem because it is an important predictor of adult obesity. About one third of obese preschool children become obese adults, and one-half of obese school-age children become obese adults. Most obese adults, however, were not obese children.

Obesity also affects child health. The risk of hyperlipidemia, hypertension, and abnormal glucose tolerance is somewhat higher among obese children. In the United States childhood obesity has important psychosocial consequences: Obese children frequently are targets of systematic discrimination and, by adolescence, many suffer from low self-esteem.

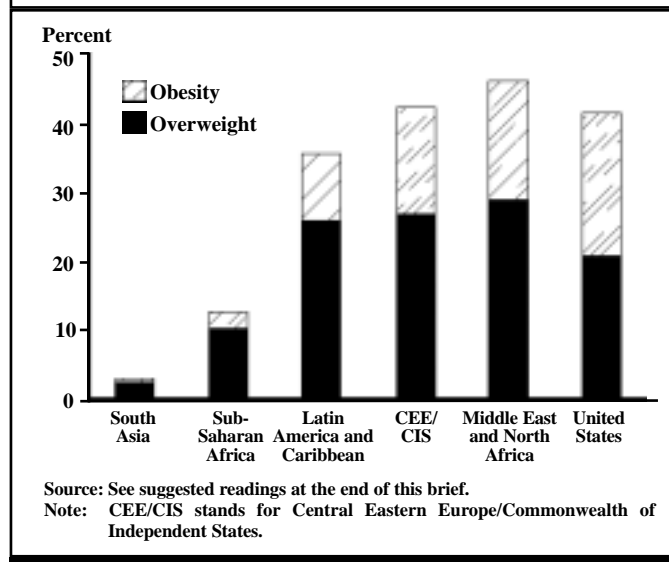
According to WHO, obesity is increasing worldwide at an alarming rate, in both developed and developing countries. WHO issued this conclusion despite the limited availability of nationally representative data and scarce information about trends. The note of alarm led a U.S. team from Emory University (Reynaldo Martorell and Morgen Hughes) and the Centers for Disease Control and Prevention (CDC) (Laura Kettel Khan and Lawrence Grummer-Strawn) to analyze data from national nutrition surveys in the last 15 years to determine obesity levels and trends in developing countries. Most of these surveys focus only on preschool children and women of reproductive age and, therefore, provide limited information about obesity patterns.

OBESITY IN WOMEN

The study compared overweight and obesity rates in women from 38 developing countries with rates in the United States (Figure 1). Levels of overweight and obesity were extremely low in South Asia. In poor countries, such as those in Sub-Saharan Africa, obesity levels were low, with the condition concentrated among urban and educated women.

In more developed countries, including those in Latin America and the Central Eastern Europe/Commonwealth of Independent States (CEE/CIS) region, obesity levels were

FIGURE 1
OVERWEIGHT AND OBESITY IN WOMEN 15 TO 49
YEARS OLD IN DEVELOPING COUNTRIES
AND THE UNITED STATES



higher and more equally distributed in the general population. Obesity ceased to be a distinguishing feature of high socioeconomic status in Brazil, and in Mexico it is emerging as a marker of poverty, as it is in developed countries.

OBESITY IN CHILDREN

Data regarding obesity in children 12 to 60 months old were available from 50 countries (Figure 2). Obesity was defined as greater than two standard deviations above the mean, using the international reference population recommended by WHO. The prevalence of obesity in the reference population is 2.3 percent. With the exception of Pakistan, where 2.6 percent of children were obese, obesity was rare in South Asia (including India) and in Thailand. The countries examined in Sub-Saharan Africa had low levels of obesity, except Malawi, with 5.2 percent. Seven of 13 countries in Latin America and the Caribbean, 1 of 2 countries in the CEE/CIS region, and all 4 Middle Eastern and North African countries exceeded 2.3 percent. In the United States, 3.1 percent of children were obese.

Obesity was more common in urban areas, and was more prevalent in girls and in children of mothers with higher education. At the country level, child obesity was positively related to gross national product and negatively related to stunting.



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ASSESSING OBESITY TRENDS

In assessing trends in obesity, the research team was severely constrained by lack of data. Only a few countries, mostly in Sub-Saharan Africa and Latin America, had repeat surveys: 6 for women and 17 for children. In the repeat surveys, obesity levels in children in 7 countries in Sub-Saharan Africa did not appear to change over time. By contrast, in Latin America, levels increased in most of the 9 countries with data. In Egypt, obesity levels decreased slightly, but remained among the highest in developing countries.

Other sources suggest that obesity, particularly among adults, is increasing in Micronesia, the Middle East, and Latin America as it is in the United States and Europe. Better data are needed, however, to confirm trends in developing countries.

The results of this study of obesity in women and children in developing countries need to be interpreted with caution because of insufficient data as well as methodological concerns. The reference population used to assess obesity in children is derived from measurements of U.S. children, who may have higher than desired levels of fatness. No consensus on how best to measure obesity in children exists, and the interpretation of weight-for-height indexes in populations with significant levels of stunting has been questioned. There is consensus, however, that a BMI over 30 in adults represents a serious clinical concern. Moreover, risk appears at much lower levels of BMI, and just being overweight (BMI of 25 to 29.9) increases health and mortality risks.

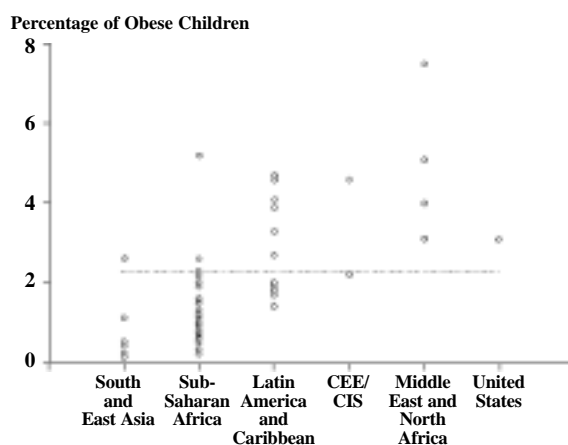
Some countries with high levels of obesity also report significant rates of childhood stunting and nutritional deficiencies. Maintaining a dual nutrition agenda—preventing obesity and related chronic diseases while eliminating nutritional deficiencies—presents a difficult challenge to countries with limited resources. In addition, many countries are unprepared to address the changing epidemiology. Because information about the occurrence of obesity and related chronic diseases in the population is limited, these issues are not considered public health problems. Many countries' nutrition policies continue to focus on undernutrition, limiting experience and expertise with chronic diseases.

PREVENTING OBESITY AND RELATED DISEASES

Obesity is not a problem everywhere in the developing world, but it appears to become a problem as income increases. Developing countries need to take a number of measures to prevent obesity and related chronic diseases. Information systems should collect data about chronic diseases to support advocacy activities and to help define policies and programs. These efforts must include schoolchildren, elderly women, and men—not just women of reproductive age and young children. Professionals must be trained to design, monitor, and evaluate programs aimed at preventing chronic diseases.

Nutrition and healthy lifestyles should be addressed in the school curriculum, and physical activity should be promoted in schools and in the general population. In Singapore, for example, the "Trim and Fit Scheme"—a comprehensive 10-year program that began in 1992—features teacher education and training, assessment of students, a program to reduce sugar in children's beverages, and more physical activity for children during

FIGURE 2
OBESITY IN CHILDREN 12 TO 60 MONTHS OLD
IN DEVELOPING COUNTRIES AND
THE UNITED STATES



Source: See suggested readings at the end of this brief.

Note: Obesity is defined as a weight-for-height z-score ≥ 2 . Each circle on the graph represents a country, and the dotted line represents the level of obesity in the reference population, 2.3 percent. CEE/CIS stands for Central Eastern Europe/Commonwealth of Independent States.

school hours. A recent evaluation of the Singapore program shows a marked improvement in fitness and some evidence of reduction in obesity.

Urban planners can support increased physical activity by building recreational facilities, such as parks and playgrounds. Public education must be as aggressive and effective as commercial advertisements in promoting healthy diets and lifestyles. Food and agricultural policies can stimulate consumption of healthy diets. Nutrition labeling should be required for all industrially prepared foods to help consumers select food. Industry's role in developing healthier food products and in promoting public health and nutrition should be recognized and encouraged. Agricultural research can help shift the macro- or micro-nutrient composition of the food supply. In the U.S. livestock sector, for example, food processing modifications combined with changes in breeding, feeding, and meat-trimming practices have contributed to lower-fat meat.

In much of the developing world, preventing obesity and related chronic diseases should be a priority of governments, as well as of international, bilateral, and national organizations. At the same time, efforts to eliminate nutritional deficiencies must continue. ■

For further reading see L. Grummer-Strawn, M. Hughes, L. K. Khan, and R. Martorell, "Obesity in Women from Developing Countries," *European Journal of Clinical Nutrition* 54 (2000): 247–252; same authors, "Overweight and Obesity in Preschool Children from Developing Countries," *International Journal of Obesity* 24 (2000): 959–967; and World Health Organization, *Obesity—Preventing and Managing the Global Epidemic* (Geneva, 1998).

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HEALTH AND NUTRITION

EMERGING AND REEMERGING ISSUES IN DEVELOPING COUNTRIES

DIET-RELATED CHRONIC DISEASES

GEOFFREY CANNON

FOCUS 5 • BRIEF 8 OF II • FEBRUARY 2001

Rudolf Virchow, a founding father of epidemiology, wrote in the nineteenth century that “epidemics are great warning signs against which the progress of civilizations can be judged.” A case in point is the rapidly increasing incidence throughout the world of the chronic diseases that are accompanying economic development and urbanization.

Chronic diseases generally are noninfectious and tend to persist and worsen. In economically developed countries in North America, Europe, and elsewhere, these diseases have been the chief causes of morbidity and mortality for many years. Some are disagreeable or debilitating (for example, tooth decay, obesity, and constipation and other gut disorders), some can be or are disabling (adult-onset diabetes, hyperlipidemia, hypertension, angina, and osteoporosis), and some are deadly (stroke, heart disease, and cancer).

ENVIRONMENTAL ORIGINS OF CHRONIC DISEASES

Life expectancy at birth has greatly increased in economically developed countries, largely because of secure food supplies, improved sanitation, and other public health measures. It is sometimes thought that chronic diseases are a price to pay for longevity, but scientific evidence amassed since the 1960s shows that many if not most chronic diseases are caused principally by pathogenic environmental pressures. Although diseases do have genetic aspects, and the prevalence of many diseases increases with age, inborn predisposition generally is “unmasked” and progresses to disease only in certain environmental conditions. Therefore, at least in principle, many chronic diseases are preventable.

Additional evidence that many chronic diseases are principally environmental in origin is their recent explosive increase in developing countries in Africa, Asia, and Latin America. In these regions, endemic, acute nutritional deficiency and infectious diseases, particularly in babies and children, remain massive public-health problems, and largely account for relatively low life expectancy at birth. The pattern of adult diseases has changed dramatically, however, and in many if not most developing countries, circulatory diseases including coronary heart disease, and cancers, have become the leading causes of death. World Bank and World Health Organization studies project steep rises in the incidence of these and other chronic diseases in developing countries.

Even in rich countries, chronic diseases are a colossal social and economic burden. But developing countries do not have the financial or human resources to treat the new epidemics of chronic diseases on a national basis. Moreover, such countries suffer the triple burden of endemic nutritional deficiencies,

infectious diseases, and, now, chronic diseases. The only rational approach to epidemic chronic diseases is prevention.

THE MAIN ENVIRONMENTAL FACTORS

Environmental causes of many chronic diseases include smoking, pathogenic microorganisms, occupational and domestic hazards, and—perhaps most important—unhealthy diets combined with physical inactivity. All of the diseases discussed here are diet-related.

These environmental factors can be changed or controlled to reduce the risk of disease. For example, a healthy diet protects against chronic diseases. Such a diet should be rich in vegetables and fruits; include a plentiful variety of starchy staple foods (preferably in whole form); contain modest amounts of meat and dairy produce, preferably fish and poultry; and include plenty of dietary fiber, unsaturated fats, vitamins, minerals, and other bioactive compounds. The less saturated fat, sugar, and salt that is consumed, the better for health. And no more than one or two alcoholic drinks should be taken in a day.

The nutritional consensus that emerged in the 1990s is vital information for policymakers concerned with food and agriculture because it implies a reorientation of priorities. In effect, it encourages policies designed to create or protect food supplies mainly made up of a rich variety of foods of plant origin. And it also implies new thinking about old practices, because in many parts of the world traditional agriculture produces food supplies that protect against chronic diseases.

Within Africa, Asia, and Latin America, issues of food security, sufficiency, and variety will remain crucial: people need to be sure of getting enough to eat, and monotonous diets based on a few staple foods are unhealthy. But the food supplies developed in the last two centuries in Europe, North America, and other rich regions, on the whole, are not a lesson but a warning to the world.

IMMEDIATE AND ROOT CAUSES OF CHRONIC DISEASES

To determine how to prevent epidemic chronic diseases, both their immediate and root causes must be identified. Policy action plans designed in ignorance of the causes of these diseases are likely to be futile. Solutions that address only the immediate causes, while ignoring the root causes, are likely to be ineffective.

Malnutrition. Poor nutrition is the immediate cause of a number of chronic diseases, including heart disease and many forms of cancer. A root cause of poor nutrition is types of food technology that transform perishable raw materials into products that exploit natural human appetites for fat, sugar, and salt.



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For example, the process of hydrogenation is a root cause of heart disease: in converting volatile oils into hard, stable fats with a long shelf life, hydrogenation increases the proportion of total fats and saturated and trans fatty acids in the human food supply.

Tobacco. Tobacco use is an important immediate cause of heart disease and of cancers of the mouth, throat, esophagus, and lung. But why do so many people smoke? The root causes of these diseases are the political, industrial, and social settings in which tobacco production is subsidized, cigarette manufacture is made lucrative, cigarettes are sold cheaply, smoking is glamorized, and advertising and promotion to young people is sanctioned. Exhortations to quit smoking are effective only when cigarettes are made expensive through taxation and when cigarette smuggling and advertising are minimized. Governments should also encourage industry to quit growing tobacco and making and selling cigarettes, and instead to make other profitable products that benefit human health.

Inactivity. Physical inactivity increases the risk of various chronic diseases. But populations do not become inactive because of individual choice. The root causes of human inactivity include sedentary jobs, households organized around the television set and the computer game, the shift from participant to spectator sports, cities that make life difficult without private automobiles, and urban planning and crime rates that make cycling and walking dangerous.

Displacement. The typical consequences of urbanization—pollution, sedentary occupations, and the pathogenic transformation of food supplies—increase the risk of chronic diseases. Cities in Africa, Asia, and Latin America have not become vast by chance. Instead, social factors magnified by political decisions have increased rural insecurity and displaced rural populations, forcing farmers off the land and into urban environments unfit for human habitation.

Poverty. Other environmental pressures also contribute to chronic diseases. Poverty is a root cause of poor diets: people who live at subsistence levels in rural areas often have no choice but to eat monotonous diets that are poor in nutrients. Impoverished people who live in cities often subsist on cheap fatty and sugary foods. Poverty together with depression are other underlying reasons why people smoke and abuse alcohol.

POLICIES TO PREVENT EPIDEMIC CHRONIC DISEASES

Plans to prevent epidemic chronic diseases involve not only public health, but also finance, agriculture, manufacture, employment, development, trade, transportation, and education. Any public policy may enhance or harm people's health. For this reason, all public policies should be examined in light of their possible effect on public health, as illustrated by these examples.

Health. Major chronic diseases are prohibitively expensive to treat. Strategies to reduce the incidence of chronic dis-

ease should be a vital part of national health-care planning. Strategic policy action plans with quantified targets for specified time periods should include financial projections. Judging from the experience of some countries, effective strategies can significantly reduce health care costs.

Agriculture. Many if not most current agricultural policies that affect price, such as research priorities and production and marketing subsidies, make unhealthy foods artificially cheap and healthy foods relatively expensive. New policies should encourage the production and marketing of vegetables, fruits, legumes, and a variety of other foods of plant origin, and decrease support for the production of fat and sugar and fatty, sugary foods and drinks. Many developing countries have abundant supplies of fruits and other foods of plant origin. Plans to prevent chronic diseases should emphasize the value of traditional farming and food systems as well as encourage food technologies that are beneficial to human health.

Manufacturing. Much food is still preserved by using salt and sugar and by converting oils into hard fats. Food supplies with substantial amounts of hard fat, sugar, and salt increase the risk of many chronic diseases. Industry should be encouraged to preserve the nourishment in perishable foods by using healthy processing methods, whether traditional, well-established, or relatively modern. Such methods include drying, fermenting, bottling, refrigerating, and vacuum-packing.

Transportation. Regular physical activity reduces the risk of a number of major chronic diseases, including obesity, heart disease, colon cancer, and osteoporosis. But people who live in cities are usually sedentary. Urban planning and transportation policies can make cities safe places in which to enjoy physical exercise, such as walking, cycling, and other sports and recreational activities. Such policies also can make public transport an attractive alternative to private automobiles.

Strategies to control and prevent chronic diseases can also help to control nutritional deficiency and infectious diseases. Such strategies can be devised and translated into policy action plans suited to specific regional, national, and local settings. The effectiveness of such plans depends on governments' determination to collaborate internationally and nationally with relevant sectors of society—including industry, the health professions, civil society organizations, and the media—and to act. ■

For further reading see G. Cannon, *Food and Health: The Experts Agree* (London: Consumers' Association, 1992); C. Murray and A. Lopez, eds., *The Global Burden of Disease* (Cambridge, Mass., U.S.A.: Harvard University Press for the Harvard School of Public Health, World Health Organization, and World Bank, 1996); and World Cancer Research Fund, *Food, Nutrition and the Prevention of Cancer: A Global Perspective* (Washington, D.C.: WCRF/American Institute for Cancer Research, 1997).

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HEALTH AND NUTRITION EMERGING AND REEMERGING ISSUES IN DEVELOPING COUNTRIES

HEALTH AND AGING

NOEL W. SOLOMONS

FOCUS 5 • BRIEF 9 OF 11 • FEBRUARY 2001

Population aging and the growing number of elderly persons are two of the most important demographic changes to emerge in the final decades of the twentieth century. An unprecedented proportion of the human population is elderly, and this share will increase rapidly over the next two decades, particularly in developing countries.

ONE BILLION ELDERLY BY 2020

The World Health Organization categorizes as “elderly” all persons over age 60, which is half the maximum human survival age of 120 years (see box on the evolution of aging). In 1980, 8.5 percent of the world’s population was over 60 years, rising to 9.4 percent in 1990 and 11 percent in 2000. By 2020, this age group is expected to represent one billion individuals—13.3 percent of a projected world population of 7.5 billion. Almost three quarters of those one billion elderly will live in developing countries. In fact, 7 of the 10 nations with the largest elderly populations in 2020 will be developing nations: Bangladesh (with a projected 14 million elderly), Brazil (30 million), China (231 million), India (145 million), Indonesia (29 million); Mexico (15 million), and Pakistan (18 million).

The current demographic profile of a typical developing country, with high fertility and low life expectancy, can be visualized as a broad-based pyramid, with up to 50 percent of the population 15 years or under. As longevity increases and birth rates decrease, this pyramid will assume an increasingly cylindrical configuration, with the over-60 population equaling the number of juveniles. This transformation will have dramatic implications for society, particularly in the areas of nutrition and health, for the first two decades of the new millennium.

Aging individuals may be intrinsically vulnerable to undernutrition and its associated infectious diseases, as well as to excessive and imbalanced intakes and the concomitant risk of chronic diseases. The need for research that will develop empirical evidence to support policies and programs to address the health needs of the burgeoning elderly population is critical.

DIET, NUTRITION, AND HEALTH

The biological process of aging begins at conception. Up to the age of reproduction, the changes in physical appearance and metabolic function that accompany aging can be viewed as a genetically guided developmental process. Senescence is the changes in cells, tissues, organs, and their respective functions that continue to occur after midlife. The capacity for physiological functions—from glucose regulation to digestion and absorption to renal function—decreases progressively as an individual ages. The immune system changes, enhancing susceptibility to infections, autoimmune diseases, and neoplasia.

AGING IN EVOLUTIONARY BIOLOGY

All species were originally part of an ecosystem in which their interaction with other species for food and the reproduction and care of offspring were key to individual species’ survival and to the biodiversity of a region. Only the fittest survived to reproduce, and survival beyond the reproductive years was rare. It was only with the cultural evolution of humans from hunter-gatherers to pastoralist herders 40,000 years ago, and then to settled peasant farmers 10,000 years ago, that the preconditions for longer human survival were met. The advent of antibiotics, immunization, and health care advances in the last century finally brought death from acute diseases and accidents under relative control and accelerated the extension of life expectancy. Today’s humans have the longest lifespan of any mammal, with a maximum survival of 120 years.

Aging and communicable disease. Given the diversity of environments, nature of social changes, involvement in globalization, and the genetic and evolutionary experience across regions, it is difficult to generalize about the health of the growing elderly population. What is certain, however, is that the increasing number of elderly people in developing countries will be susceptible to the health problems associated with low-income societies, including infections and accidents, and that their diet and nutritional status will interact with these conditions.

Infections that traditionally produce mortality in early life, such as malaria, tuberculosis, respiratory infections, and diarrhea, may reemerge in later life if the individuals survive. Those who survive the lifelong risk from these infections might have constitutional resistance. However, for other elderly individuals the emergence of widespread drug resistance among the pathogens of malaria, tuberculosis, and respiratory infections, as well as less tolerance to dehydration and hypovolemia for infectious gastroenteritis, could mean an increased risk for these communicable diseases.

The appearance of HIV/AIDS in those over 60 years also may become an issue in the next two decades. The elderly tra-



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ditionally are at lower risk of contracting sexually transmitted diseases, but as antiviral medications begin to become available in Asia and Africa, increased survival will project many chronic HIV cases from midlife into old age. Because of limited experience, the natural history of HIV infection in the elderly is not well understood.

Imbalanced intake and chronic disease. New combinations of nutrition and health interactions with aging, namely, that of noncommunicable (chronic) diseases and dietary imbalances, are now emerging. That these diseases—obesity, diabetes, cardiovascular disease, and cancer—are becoming more common with aging is irrefutable. Equally undeniable is the fact that diet and lifestyle throughout life condition an individual's susceptibility to the eventual onset of chronic diseases.

The traditional rural diets of many tropical developing countries encompass characteristics associated with protection against chronic diseases: high intake of dietary fiber, such as coarse seeds or legumes; low intake of fat and cholesterol; high intake of herbs, fruits, and vegetables rich in carotenoids and phytochemicals; and modest consumption of red meat that comes from game and lean livestock and constitutes a small fraction of dietary protein and lower fat load than meat consumption in developed countries. To the extent that this pattern is maintained, developing-country populations may continue to be spared high rates of some chronic illnesses.

Cataracts and senile macular degeneration also are diet-related. Fresh green, yellow, and red fruits and vegetables, presumably their carotenoids content, delay the occurrence of these two diseases of the aged eye.

Sarcopenia, the progressive loss of lean tissue—especially skeletal muscle—with advancing years, presents an obvious interactive role with osteoporotic bone loss insofar as the risk of fracturing a hip or wrist depends not only on the mineralization of the bone but also on the chance of suffering a fall.

THE NEED FOR RESEARCH

In theory, elderly individuals are vulnerable to both undernutrition and its associated nutritional deficiencies and infectious diseases as well as to imbalanced intakes and the concomitant risk of chronic diseases. Because no empirical evidence of such links exists, however, the major challenge and opportunity in developing countries over the next two decades will be to establish a gerontology and a gerontological nutrition presence and to acquire the evidence necessary to address the policy and program issues represented by the burgeoning population of elderly. The research agenda for the next two decades should focus on the following issues related to nutrition, health, and aging:

Osteoporotic fractures. Developing-country populations appear to be more resistant to osteoporosis than people in developed societies. Research should be conducted to determine (1) if meeting the calcium requirements is essential to preventing bone mineral loss; (2) whether increasing vitamin K intake and decreasing preformed vitamin A can retard the epidemic of osteoporosis; and (3) if a lifelong consumption of

dietary sources of phytoestrogens, as by the soy-eating populations of East Asia or where legumes are staples in south Asia and Latin America, helps reduce menopausal bone loss.

Dementias. Because Alzheimer's and multiple-infarct dementias are less common (on an age-adjusted basis) in developing countries, centenarian studies and epidemiology are required to identify persons at risk of dementias.

Depression. In order to determine whether stronger extended-family bonds in developing societies would limit loneliness, enhance feelings of self-worth, and reduce the risk of depression, culturally sensitive and adapted diagnostic instruments, such as rating scales for depression adopted for developing societies, are required. The role of pharmacological antidepressive medications also should be considered.

Undernutrition and food insecurity. The elderly are thought to be intrinsically at greater risk of dietary and nutritional deprivation. Therefore, the implications of rapid weight loss or low body mass among community-dwelling elderly (as opposed to those who are hospitalized or under other institutional care) need to be assessed. Scientists must also determine if "wasting" in elderly persons who live independently is reversible and how prudent and beneficial it is to reverse low weight. Research is also needed to determine whether the risks of having an underlying malignancy are the same at a given weight deficit in developing countries as they are in western geriatric practice.

Overweight and obesity. Poverty has been thought to protect against obesity. Now, however, persons can be poor, and still have access to abundant calories from poor quality foods. In low-income families, however, obesity and underweight occur simultaneously in the same households as shown in Brazil, China, and Russia. Research is needed to determine whether ethnicity affects the tendency to obesity, the risk of obesity-related morbidity, and the consequences of having more body fat deposited in the abdominal cavity in relation to risk of obesity-related morbidity.

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While improvements in health care and food supply have helped to increase longevity, our understanding of aging and its relation to infectious and chronic diseases lags behind. The research and policy agendas related to health and nutrition need to be reoriented to deal effectively with the unprecedented number of individuals who will be surviving to over 60 years of age in developing countries in the coming decades. ■

For further reading see Noel Solomons, "Nutritional and Demographic Trends in Developed and Developing Countries," *European Journal of Clinical Nutrition* 54 (Supplement 3): S1-S13, 2000 (from a special issue on "Impact of Human Aging on Protein and Energy Metabolism and Requirements," edited by B. Schürch and N. Scrimshaw).

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HEALTH AND NUTRITION EMERGING AND REEMERGING ISSUES IN DEVELOPING COUNTRIES

MICRONUTRIENTS

LINDSAY H. ALLEN

FOCUS 5 • BRIEF 10 OF 11 • FEBRUARY 2001

During the last decade, the international nutrition community has focused on eliminating or reducing three micronutrient deficiencies. At the World Summit for Children in 1990, followed by the Ending Hidden Hunger conference in 1991 and the International Conference on Nutrition in 1992, agencies and governments pledged to eliminate iodine and vitamin A deficiencies by 2000 and to substantially reduce iron deficiency anemia. As a result, about 70 percent of all salt is now iodized and half the countries in the world have vitamin A capsule distribution programs reaching a high percentage of women and children under 5 years. Efforts to reduce anemia have been less successful, but iron-folic-acid supplements are available to millions of pregnant women.

The international nutrition community focused on these three micronutrient deficiencies for logical reasons—they allowed relatively simple, inexpensive solutions with far-reaching health benefits. Iodine deficiency adversely affects intelligence, motor development, and pregnancy outcomes. Common in both industrialized and developing countries, this deficiency can be prevented by salt iodization. Interest in alleviating vitamin A deficiency increased in the 1980s, when researchers found that periodic high doses of vitamin A to young children in developing countries substantially reduced their risk of dying from measles. Iron deficiency is thought to be the most common nutrient deficiency in the world, and iron deficiency anemia slows mental and motor development and reduces work performance and physical activity. Progress in combating iron deficiency has been hindered by technological limits on iron fortification of staple foods and the need to supply iron supplements on an almost daily basis for them to be effective.

FOCUSING ON OTHER MICRONUTRIENT DEFICIENCIES

The focus on these three micronutrients partly explains why relatively little attention has been paid to other, “neglected” micronutrients. Poorer populations, however, usually suffer also from inadequate intakes of zinc, riboflavin, vitamin B-12, vitamin B-6, and calcium because they consume few animal products (meat, fish, poultry, eggs, or dairy products). Poor diets may also contain few fruits and a limited variety of vegetables and, therefore, low amounts of B-carotene (provitamin A), folic acid, and vitamin C. Surveys show that many individuals—especially women and children—are consuming lower than recommended amounts of the neglected micronutrients. But there have been relatively few studies of the prevalence of these micronutrient deficiencies or of how they cluster in specific populations. Limited data show that zinc, riboflavin, and vitamin B-12 deficiencies tend to cluster with vitamin A and iron deficiencies.

Zinc. No good indicators of zinc status exist, although plasma zinc concentrations fall if deficiency is sufficiently severe and/or prolonged. Interest in zinc was stimulated when zinc supplements given to short children and failure-to-thrive infants in the U.S. city of Denver improved growth. Many investigators then mounted zinc intervention trials with children, because intakes of absorbable zinc are often low and growth-stunting occurs nearly universally during the first two years of life in underprivileged populations. Diarrhea also causes the body to lose zinc. An analysis of 27 such trials concluded that zinc supplements are likely to improve the height gain of the most stunted children and to improve the weight gain of those with low plasma zinc concentrations. In recent intervention trials, zinc supplements reduced the prevalence of pneumonia and malaria in children, shortened the duration of acute and persistent diarrhea, and improved neuropsychological performance. Zinc supplements improved birth weight in one U.S. study, although in Bangladesh and Peru they did not.

Riboflavin. In the relatively few studies of riboflavin the prevalence of deficiency has been alarmingly high. Almost all the pregnant and lactating women studied in The Gambia, the majority of lactating women and elderly in Guatemala, and most Chinese adults were reported to be deficient. A high seasonal prevalence of clinical symptoms of deficiency has been reported in Iran. The adverse consequences of riboflavin deficiency are not yet well understood, although the reduced absorption and use of iron for hemoglobin synthesis reported in several studies suggests that riboflavin deficiency may contribute to the global prevalence of anemia. Riboflavin deficiency also may cause night blindness and muscle weakness.

Vitamin B-12. Because vitamin B-12 is found only in animal products, many poor populations, or those that avoid animal products for religious or other reasons, consume little or no vitamin B-12. Low serum B-12 concentration is associated with a higher risk of potentially irreversible harm to memory, cognitive function, and nerve conduction, as well as a higher risk of megaloblastic anemia. Studies among low-income people in Guatemala, Mexico, Nepal, Venezuela, and other countries show that 25 to 50 percent of individuals are deficient. Inadequate B-12 during pregnancy and/or lactation can cause breast milk to have such a low concentration of the vitamin that the infant grows too slowly and is developmentally delayed. In addition to a diet low in animal products, risk factors for vitamin B-12 deficiency include infection with the bacteria *Helicobacter pylori* (a very common infection in populations living in poor sanitary conditions) or the parasite *Giardia*, and an overgrowth of bacteria in the upper intestine. Given that about 25 percent of the elderly in the United States have



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vitamin B-12 deficiency, a very high percentage of the elderly in developing countries must be deficient in this vitamin.

Other B vitamins. The prevalence of other B-vitamin deficiencies is unknown. Due to thiamin (vitamin B-1) fortification programs, this vitamin deficiency is no longer common in populations whose staple food is polished white rice. Poor vitamin B-6 status has been reported among Indonesian schoolchildren and in the Vietnamese population. In an Egyptian study, breast-milk concentrations of this vitamin were low, indicating that lactating women were deficient; mothers and infants both had abnormal behaviors associated with B-6 deficiency. In general, mothers with low stores or intakes of the B vitamins secrete inadequate amounts of these vitamins in their milk to support optimal child health and development.

Folic acid. The global prevalence of folic acid deficiency is uncertain. Folate consumption by the poor in developing countries actually may be better than in industrialized countries because legumes and many leaves are rich sources of this nutrient. Folic acid has long been included in iron supplements for pregnant women in developing countries, based on limited evidence that folic acid improved hemoglobin response to iron in Africa and India. Subsequent trials, however, failed to show that adding folic acid improved anemia more than iron alone. Folic acid supplements for pregnant women can reduce the risk of infants' having neural tube defects, but only if the supplements are taken by susceptible women around the time of conception. Recent evidence suggests that poor maternal folate status is also associated with a higher risk of abnormal pregnancy outcomes, including eclampsia, premature delivery, and birth defects such as club foot and cleft palate. Consuming more folic acid from supplements or folate from foods can also lower plasma homocysteine and potentially lower the risk of cardiovascular disease in adults and dementia in the elderly.

Calcium, vitamin D, and selenium. The extent of calcium, vitamin D, and selenium deficiency in developing countries is uncertain. Calcium consumption is extremely low in many locations where dairy products and fish are not eaten, but humans have the capacity to absorb calcium more efficiently in these situations. Very low calcium consumption does not seem to impair children's growth, but may reduce their bone mineralization. Low dietary calcium may be the explanation for non-vitamin D rickets in Nigeria, South Africa, and several other countries. Calcium deficiency is certainly a risk factor for osteoporosis in later life. Vitamin D deficiency, which is caused primarily by low exposure to ultraviolet light, is common in more northern and southern latitudes and in regions where infants and women are heavily clothed for cultural or religious reasons. In Europe and China, where few foods are fortified with vitamin D, infants born at the end of winter commonly show evidence of vitamin D deficiency. Selenium deficiency is

localized in specific but large geographic regions, including China and parts of Africa, where it can exacerbate the symptoms of iodine deficiency and interfere with the anti-goiter benefits of iodine supplements.

Focusing on the elimination or reduction of iodine, vitamin A, and iron deficiencies has motivated many agencies and governments to work together and has demonstrated the benefits of intervention programs. Clearly, efforts are also needed to assess the prevalence of other micronutrient deficiencies. Several ongoing trials will evaluate the impact of providing multiple micronutrients to children and women in developing countries. The addition of other micronutrients adds relatively little to a supplement's price, most of which reflects the cost of packaging and distribution. The same obstacles to lowering the prevalence of iron deficiency, however, will plague the effectiveness of multiple-micronutrient programs.

SUSTAINABLE SOLUTIONS

The sustainable solution to multiple micronutrient deficiencies must be the discovery and implementation of innovative, affordable ways to improve poor people's diets. This probably will require consumption of more animal products, where these are culturally acceptable. Fortified foods are another logical strategy. Even in the United States, flours and cereal products are enriched with iron, riboflavin, niacin, folic acid, and sometimes calcium. The importance of food-based strategies to reduce micronutrient malnutrition is recognized by agencies and governments; however, there has been little effective communication between the nutrition community and agricultural producers. The latter group tends to believe that the answer to good nutrition is to produce more income-generating crops, when it would be more effective to consider the impact of agricultural products themselves on the nutritional needs of populations. Additional interaction is needed to bridge the gap between food production and nutrition security.

Failure to address the problem of these neglected nutrients will mean that a high proportion of the world's population—especially infants, children, women of reproductive age, and the elderly—will continue to suffer the consequences of micronutrient deficiencies. When the potential improvement in human capital is considered, investing in the prevention of micronutrient deficiencies is indeed cost-effective. ■

For further reading see L.H. Allen, "Nutritional Influences on Linear Growth: A General Review," *European Journal of Clinical Nutrition* 48 (Suppl. 1, 1994): S75–89; R.E. Black, "Zinc for Child Health," *American Journal of Clinical Nutrition* 68 (1998): 409S–516S; and U. Ramakrishnan, "Micronutrients and Pregnancy Outcome: A Review of the Literature," *Nutrition Research* 19 (1999): 103–159.

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HEALTH AND NUTRITION

EMERGING AND REEMERGING ISSUES IN DEVELOPING COUNTRIES

POLICY PRIORITIES: THEMES AND ACTIONS

STUART GILLESPIE

FOCUS 5 • BRIEF II OF II • FEBRUARY 2001

Significant progress in human development will not be made during the next two decades unless the nutrition and health issues discussed in this collection of policy briefs are addressed head-on. As described in the overview by Rafael Flores, some of these issues are emerging (HIV/AIDS, obesity, chronic disease, and neglected micronutrients) and others are reemerging (malaria and tuberculosis [TB]). These nutrition and health issues may cluster in populations, particularly among the poor and marginalized. And many of these issues interact with regard to risk, causation, and consequence.

Such interaction often is embedded within the “malnutrition-infection complex” that accounts for much of the preventable mortality in the developing world. In this vicious circle, underlying risk factors such as gender discrimination and poverty can be both determinants and outcomes.

Consider the interaction between HIV/AIDS and poverty, for example: Poverty increases people’s exposure to HIV and heightens the disease’s impact. At the same time, HIV/AIDS impoverishes households and communities.

POLICY THEMES

Many of these nutrition and health issues must be considered as fundamental development problems—not just the domain of the health sector. Such a shift in perception seems to be occurring with HIV/AIDS. The issue of HIV/AIDS, a disease that threatens the survival and well-being of entire populations, is slowly being mainstreamed into development-policy discourse, as agencies like the World Bank begin to retrofit ongoing projects with AIDS prevention or mitigation components.

Just as the determinants and effects of these health and nutrition problems often interact, so too there are potentially synergistic approaches to solving them. The following cross-cutting themes should be considered when selecting and implementing appropriate policies and programs.

Integration and collaboration. When problems interact and coexist among certain populations, integrated solutions can achieve multiple benefits and be more cost-effective. For example, to prevent intrauterine growth retardation (IUGR), food supplements for nutritionally vulnerable pregnant women may be linked to prenatal care at community health centers. There is evidence, moreover, to justify multiple, as opposed to single, micronutrient supplementation, which has potential not only for combating micronutrient deficiency, but also for preventing IUGR and even protecting against malaria. Food-based strate-

gies to control micronutrient deficiency also should be pursued within agricultural development and extension programs.

Integration is best promoted through collaborative approaches. Collaboration does not refer to multisectoral coordination by any one organization; it means bringing concerned organizations together to consider how best to use their resources to meet common goals. Collaboration might involve different sectors of the government, civil society, the private sector, and the media; governments and international organizations; or regional and international alliances.

Information, education, and communication. More and better information is required at many levels. There is a need for improved diagnosis of some illnesses (for example, TB). More information is needed about the prevalence and distribution of various health and nutrition outcomes, including the “neglected” micronutrient deficiencies, IUGR, overweight/obesity, and chronic diseases. A database on the nutritional problems of the elderly will help provide evidence for policy and programmatic changes. Better nutritional labeling of foods will increase consumer awareness of the effect of diets.

More effective communication is needed between the nutrition and agriculture communities regarding micronutrients; between those who are coping with HIV/AIDS and people more recently affected; and between health care providers and TB patients on patients’ need to complete drug treatment and thus avoid building resistance to drugs. One often-overlooked result of premature adult death is the loss of the patient’s knowledge and skills. Teaching survivors, particularly orphans, how to manage households and farm resources is critical in AIDS-affected communities.

Advocacy and social mobilization. Advocacy is a communication strategy aimed at convincing decisionmakers to give a higher priority to combating a certain problem or to adopting a particular approach. Advocacy efforts should be based on an assessment of the values, beliefs, and interests of decisionmakers that—along with information—will determine their choices. Within the set of health and nutrition issues addressed in this series of briefs are clear areas for greater advocacy. The need to raise the status of low birthweight as a critical indicator of human development and the need to ensure gender-equitable land tenure arrangements for widows of AIDS victims are just two examples.

Social mobilization is a process of generating bottom-up demand for action and ownership of solutions. Through social



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mobilization, the advantages of local diversity and existing capacity are maximized and sustainability is enhanced.

Capacity development. The capacity to achieve a sustained impact must be assessed at the early stages of program planning. What level of effort will be required? Over what period of time will such efforts be expended? The capacity to measure the dimensions of these nutrition and health issues, assess trends, analyze causes, and act with appropriate levels of resources may be significantly lacking, particularly in areas and among populations that are most affected. Capacity development should be a priority for external agencies and donors as well as governments, and it should be pursued proactively.

Research. Research into ways of diagnosing disease, combating drug resistance, and developing vaccines must run parallel with research into improving approaches to disease control. The Multilateral Initiative on Malaria is an alliance of African organizations and individuals that aims (1) to strengthen and sustain the capability of malaria-endemic African countries to carry out research for developing and improving tools to control malaria and (2) to strengthen the research-control interface. With operational research, priorities should flow from management information systems built into programs. Evaluation must be made a priority and funds must be budgeted for this process. The results of evaluations need to be proactively fed into advocacy strategies to ultimately improve action.

POLICY ACTIONS

Policy actions governing these nutrition and health issues vary widely. Malaria, TB, and HIV/AIDS are currently the subjects of major campaigns backed by international organizations, including the World Health Organization and UNAIDS (Joint United Nations Programme on HIV/AIDS). By contrast, the dual agendas for undernutrition (IUGR and micronutrient deficiencies) and overnutrition (obesity and related chronic disease), where these two problems coexist, have been given little attention—though there are some signs of positive developments.

During the next two decades, the major strategic areas for action are clear: (1) prevention and promotion, (2) treatment, and (3) care and mitigation.

Prevention and promotion. Prevention will require accelerated efforts to develop vaccines (HIV, malaria, and TB), to increase access to effective antimalarial drugs and insecticide-impregnated bed nets (malaria), to make quality prenatal care more widely available (IUGR), and to expand use of recreational facilities (obesity and chronic disease).

To prevent or forestall the emergence of many of these problems, various promotional efforts will be required. People must be made more aware of the need to maintain a healthy

diet, use preventive health services, increase physical activity, and adopt safe sexual practices. Such behavioral changes should be facilitated through appropriate channels—from interpersonal communication between a community-based worker and a mother to mass-media messages on television and radio. Adults are not the only target group; children should be targeted directly by these methods and through school curricula.

Treatment. The availability and affordability of effective drugs (for malaria, TB, HIV/AIDS, and adult chronic disease) must be a priority. The importance of this issue is starkly evident in the easy access to retroviral drugs by HIV patients in industrialized countries compared with the inability of patients in Sub-Saharan Africa to obtain such drugs. Public-private partnerships are key: Private multinational drug companies have an ethical responsibility in regard to pricing, and the public sector must improve distribution and access. In addition, the search for new drugs must be intensified to counteract increasingly drug-resistant diseases, particularly TB and malaria.

Care and mitigation. Care and mitigation efforts need to focus on buffering individuals, families, communities, and countries from the impact of these nutrition and health problems. The care of adolescent girls and pregnant women must be emphasized, to protect their own health and that of their future children. Nutrition interventions in particular need to adopt such a life-cycle approach to targeting. Care for the elderly also will become increasingly important. The most urgent need is care for Africa's hundreds of thousands of "double orphans"—children who have lost both parents to AIDS. Widows of AIDS victims also need to be protected and supported. In several countries in Latin America, such buffers are institutionalized in the form of social safety nets designed to protect the most vulnerable.

Mitigation efforts initially should focus on strengthening local strategies for coping with premature adult deaths due to TB, malaria, and HIV/AIDS, rather than externally pre-packaging solutions. This will require more action research on livelihoods, with the aim of understanding such strategies.

CONCLUSIONS

Progress in human and economic development over the next 20 years will be determined largely by the manner in which households, communities, governments, and the international community react to the emerging and reemerging nutrition and health issues described in these policy briefs. Many of these problems affect public health, but they also demand larger, development solutions from the public and private sectors. In many cases, large-scale improvements will take time. But if the appropriate foundations are laid now, the gains will be wide-ranging and sustainable. ■

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