Vitamin and Mineral Deficiencies Technical Situation Analysis

TEN YEAR STRATEGY FOR THE REDUCTION OF

VITAMIN AND MINERAL DEFICIENCIES

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Global Alliance for
Improved Nutrition

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Acronyms and Abbreviations

A2Z	USAID Micronutrient and Blindness Project
ADB	Asian Development Bank
AED	Academy for Educational Development
ARI	acute respiratory infection
BAFF	Business Alliance for Food Fortification
CDC	Centers for Disease Control and Prevention
CDD	control of diarrhoeal diseases
CHD	coronary heart disease
CHW	child health week
CI	confidence interval
CIDA	Canadian International Development Agency
DALY	disability-adjusted life year
DFID	Department for International Development (UK)
DHS	Demographic and Health Surveys
ECSA	Eastern, Central and Southern Africa
EDTA	ethylene diamine tetra acetic acid
EPI	Expanded Program of Immunization
FCHV	Female Community Health Volunteer (Nepal)
FDA	Food and Drug Administration
FFI	Food Fortification Initiative
FTE	full-time equivalent
GAIN	Global Alliance for Improved Nutrition
GAVI	Global Alliance for Vaccines and Immunization
GDP	gross domestic product
GI	gastro intestinal
GNP	gross national product
HH	household
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HKI	Helen Keller International
ICCIDD	International Council for Control of Iodine Deficiency Disorders
ICDS	Integrated Child Development Services (India)
IDA	iron deficiency anemia
IDD	iodine deficiency disorders
IDPAS	Iron Deficiency Project Advisory Service
IEC	information, education, and communication
IFA	iron and folic acid
IIH	iodine-induced hyperthyroidism
ILSI	International Life Sciences Institute
IMCI	Integrated Management of Childhood Illness
INACG	International Nutritional Anemia Consultative Group
IOM	Institute of Medicine
IQ	intelligence quotient

ITN	insecticide-treated bednets
IVACG	International Vitamin A Consultative Group
IZiNCG	International Zinc Nutrition Consultative Group
JHU	Johns Hopkins University
LHV	Lady Health Visitor (Pakistan)
MCH	maternal and child health
MDG	Millennium Development Goal
MI	Micronutrient Initiative
MOH	Ministry of Health
MOST	USAID Micronutrient Project
MT	metric ton
MTCT	mother-to-child transmission (of HIV)
NGO	nongovernmental organization
NID	national immunization day
NTD	neural tube defect
OMNI	USAID Micronutrient Project
ORS	oral rehydration solution
PEM	protein-energy malnutrition
RCT	randomized controlled trial
RDA	Recommended Daily Allowance
RDI	Reference Daily Intake
REC	Regional Economic Community
SCN	Standing Committee on Nutrition (UN)
TB	tuberculosis
TGR	total goiter rate
UI	urinary iodine
UNC	University of North Carolina
UNICEF	United Nations Children's Fund
USAID	U.S. Agency for International Development
USI	universal salt iodization
VAD	vitamin A deficiency
VITAL	USAID Global Vitamin A Project
VMD	vitamin and mineral deficiency
WFP	World Food Programme
WHO	World Health Organization

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Foreword

The need for a comprehensive strategy to reduce vitamin and mineral deficiencies grew out of a critical analysis of the current international response. On the positive side, those working in the field could see the potential to make a significant impact on a problem affecting 2 billion people, worldwide. Effective solutions, such as food fortification, had been demonstrated to improve health and cognitive function and if only these solutions could be applied on a wide scale basis, those most at risk, especially the poor in developing countries, could reap real benefits. On the negative side of the ledger, however, was the realization that the lack of funding for this neglected problem was a limiting factor. Further, while much good work was being done, the sheer number of players in the sector introduced risks of duplication or lack of coordination.

In 2005, a number of agencies agreed to collaborate on the development of a Ten Year Strategy for the Reduction of Vitamin and Mineral Deficiencies. GAIN—the Global Alliance for Improved Nutrition—was asked to coordinate the development of this work and a phased approach was proposed. The first stage, "Phase 1", focused on the need to develop a comprehensive understanding of the current situation. In September 2005 the Academy for Education and Development in Washington DC was commissioned to undertake an extensive review of the technical situation, including the science and economics of vitamin and mineral deficiencies and how to address them. This review is published here and it contains a wealth of knowledge not just about what is known, but also about the gaps in our knowledge. This work was complemented by a study of the expectations and suggestions of those working in the field of micronutrient deficiencies, from all sectors including private industry. To gather this information, GAIN commissioned Mestor Associates to design a survey and interview over 150 key informants. Their findings are published in the document "Stakeholder Perceptions Analysis".

Together, these two documents position us to move ahead to the next stage of the strategy development—the preparation of a framework including a range of targeted interventions where the nutrition community, in partnership with the private sector, can address vitamin and mineral deficiencies in a coordinated, rational and effective way.

This work has been undertaken with the guidance of the Ten Year Strategy Reference Group. Each member of this Group, leaders in their field from the public and private sectors, as well as civil society, has generously given their time and expertise to this process. On behalf of GAIN I am glad to take this opportunity to thank them for their efforts and commitment to this process. I am also grateful to those at AED and Mestor who have created these excellent analyses.

The challenge now is to put this information to good use. Too many people around the world suffer the adverse effects of vitamin and mineral deficiencies. For their sake, we cannot allow these documents to be academic works that sit on shelves gathering dust. I look forward to working with each and every one of you in the hope that, in a decade's time, we may look back and know that we really were able to make a difference.

Marc Van Ameringen
GAIN Executive Director
May 2006

Summary

Micronutrients are among the best buys in development, according to economists and public health leaders. At the United Nations General Assembly Special Session on Children in May 2002, UN Secretary-General Kofi Annan, 70 heads of state, and high-ranking government delegations from 187 countries committed to reducing or eliminating vitamin and mineral deficiencies among children. This level of global commitment was based partly on the substantial evidence of the negative impacts of vitamin and mineral deficiencies and partly on the availability of proven, cost-effective interventions. Unfortunately, currently available figures on the magnitude of deficiencies and program coverage levels indicate that only a small part of the vulnerable populations have been reached with effective interventions on a sufficiently large scale. A notable exception is iodized salt, the use of which has successfully prevented a large incidence of iodine deficiency worldwide.

This report summarizes the current technical information about vitamin and mineral deficiencies and identifies gaps in data and programs. It is intended to inform the development of a future comprehensive multi-donor strategy for accelerating the reduction of vitamin and mineral deficiencies in the next decade.

Why reducing vitamin and mineral deficiencies is critical for development

Micronutrients have proven to be essential for chemical processes that ensure the survival, growth, and functioning of vital human systems. Large field trials and observational studies have documented reductions in maternal and child mortality and morbidity. This includes the prevention of disabilities such as neural tube defects (NTDs) and child blindness, protection of learning abilities and progress in school, and improved adult capacity for physical labor.

At current prevalence levels, vitamin A deficiency accounts for 9 percent of child deaths and 13 percent of maternal deaths. Iron deficiency causes about half of all anemia, and anemia in pregnancy contributes to 18 percent of maternal deaths and 24 percent of perinatal deaths. Intellectual impairment occurs in babies born to iodine-deficient mothers. Zinc deficiency is a contributing cause of 5.5 percent of child deaths. Folic acid-preventable neural tube defects (NTDs) are estimated to number 240,000.

Studies that quantified productivity impacts have found that countries stand to lose at about 1 percent of their gross domestic product (GDP) if iron, iodine, and zinc deficiencies persist. The cost of reversing these deficiencies is a small fraction of that loss. According to the available evidence, inaction could delay the achievement of the Millennium Development Goals (MDGs) in countries with a high burden of vitamin and mineral deficiencies.

How widespread are the deficiencies and what are their causes?

Deficiencies of vitamin A, iron, iodine, zinc, and folate affect over 2 billion people. Countries of sub-Saharan Africa and South Asia have both the largest prevalence rates and the largest absolute numbers of micronutrient-deficient people. The global prevalence of vitamin A and iodine deficiencies, particularly in their severe forms, has declined significantly as a result of large-scale programs but remain high in some countries. Data on iron deficiency are virtually nonexistent; the existing information on a related indicator – anemia – suggests little improvement in that area.

Vitamin and mineral deficiencies are caused by diets that are poor in vitamins and minerals, and the deficiencies are made worse by losses or poor absorption related to illness. These conditions are found in every region of the world. Transitions in food consumption patterns with rising incomes have not taken care of all deficiencies. Moreover, the rise of new infections and the resurgence of old ones, such as malaria, have prevented reductions in deficiency diseases in some regions.

Available global databases report that, worldwide, an estimated 25 percent of pre-school children and 18 percent of women are vitamin A-deficient; 37 percent of the total population has anemia; 35 percent of the population is at risk for iodine deficiency; and 20 percent is estimated to be at risk for zinc deficiency. The figures for vitamin A and iodine deficiencies are likely to be overestimates, as programs have expanded since the last estimates were developed.

There are significant gaps in the data that are currently available. This reflects inadequate resources to update prevalence figures and track coverage trends. For example, household coverage with iodized salt is estimated to be substantially greater than currently reported in global databases, and the prevalence of iodine deficiency lower. Some indicators of vitamin and mineral deficiencies need to be better defined, and field methods streamlined for broader use. The deficiencies are often overlapping and the same person can experience more than one deficiency. But the magnitude and patterns of multiple micronutrient deficiencies is not well defined. Disaggregated food intake data are particularly lacking for critical age groups and income segments; and the precision of projected consumer trends associated with demographic transitions needs to be improved.

How well have programs performed in reducing vitamin and mineral deficiencies?

Dramatic reductions in national indicators of mortality and clinical signs of deficiency diseases associated with a rise in program coverage have proved the effectiveness of two intervention approaches: fortification and supplementation. Both are highly cost-effective compared with other health interventions, especially fortification. But fortification alone cannot solve the problem of vitamin and mineral deficiencies in any country. Supplementation is an essential component of successful strategies to address the needs to critical targets groups. The intake of foods naturally rich in micronutrients can reinforce the benefits of fortification and supplementation; breastfeeding for infants is particularly critical, as are the use of animal foods, and fruits and vegetables in diets of women and children

The evidence of program effectiveness includes sharp reductions in childhood mortality levels following vitamin A supplementation in countries as diverse as Nepal, Nicaragua and Tanzania;

lower incidence of severe disabilities among newborns following folic acid fortification; and the virtual elimination of severe clinical deficiencies of iodine and vitamin A in several countries.

Despite progress in some countries, serious gaps remain. And there are few safeguards to ensure that the gains already made are sustained. In emergencies, when food and health systems are disrupted, intervention strategies tailored to reach the most vulnerable need to be put into place rapidly. Most importantly, large populations in South Asia and sub-Saharan Africa even in stable situations do not have access to adequately fortified foods or supplements. For example,

- According to UNICEF's 2004 database (containing data from 1998-2003) for iodized salt, among 116 countries with household data, only 62 percent had coverage of 50 percent or more.
- In 2004, of 196 countries with data, 73 countries provided vitamin A supplements linked with routine immunizations or immunization campaigns, or both; over 60 countries did not link vitamin A with immunization; and 56 countries were not classified as deficient. Few countries provide vitamin A without linking with immunizations.
- On paper, prenatal iron supplementation is universally included in antenatal care policies, but only about 40 countries report data on coverage with prenatal iron supplements. The quality of these data are also questionable. Those with data show very low coverage, and compliance is a significant barrier. More than 22 countries have adopted public health policies for iron supplementation for infants and pre-school children, but few countries actually implement such programs.
- The value of zinc in reducing diarrhoeal disease morbidity was demonstrated several years ago, but few countries have established policies to introduce zinc within diarrhoeal disease control programs.
- Programs to improve folate nutrition have been introduced in about 40 countries; these countries account for less than 10 percent of NTDs that can be prevented with folic acid.

This slow progress could change rapidly. The roadblocks to achieving high coverage—such as policies, supplies, quality assurance, training, monitoring and supervision, and public education and communications—are well known and can be addressed with available tools and methods, adequate resources, leadership and political commitment. The interventions are affordable and highly cost-effective.

Program approaches and delivery strategies have undergone important transformations over the past two decades. New products, market channels, and health delivery approaches have opened up more options to meet country-specific needs. For example, a broader array of fortified staple foods and specially formulated foods and supplements are now available through a larger number of producers. Processes and frameworks for successful industry-led and government-mandated strategies for delivering micronutrients are being worked out. Better coverage has recently been documented among high-risk groups, even in remote areas, using intensified outreach from health facilities to deliver micronutrients. Several large countries in South Asia offer government-supported program platforms—such as Integrated Child Development Services (ICDS) in India, Lady Health Visitors (LHVs) in Pakistan, and Female Community Health Volunteers (FCHVs) in Nepal—that are capable of reaching a substantial segment of the vulnerable population. In all regions, employer health schemes can support micronutrient interventions with direct payoffs for worker productivity especially among women of reproductive age; schools can deliver vitamins and minerals with substantial payoffs in attendance and learning. These programs have produced promising results in some countries.

While activities to increase the provision of micronutrients expanded, consumer demand for micronutrient-rich foods has also accelerated. The livestock and dairy industries have grown rapidly in response to burgeoning demand from consumers in developed and developing countries. There is some evidence that fruit and vegetable consumption will rise with incomes in sub-Saharan Africa. It appears unlikely that this increase is a result of attempts to improve dietary diversity through traditional nutrition education efforts, as there is little evidence that these programs have achieved sufficient scale. Analysts believe that favorable costs for production and marketing, affordable prices, and the image of these foods as prestige foods may have fuelled the increase in demand. The recent trend in developing countries toward centrally managed food retailing for all foods through large supermarket chains offers a new opportunity for consumer education through these outlets and greater product choices with the goal of further raising micronutrient intakes.

There are additional options for improving micronutrient status beyond fortification, supplementation, and changing food choices. Research and field trials currently under way suggest that plant breeding to develop new varieties of foods high in vitamin and mineral content could substantially contribute to improved micronutrient status. Among health interventions that have proved effective in supporting the reduction of vitamin and mineral deficiencies are malaria control and de-worming for anemia, and measles immunization for vitamin A deficiency. Other important adjunct interventions include appropriate breastfeeding and complementary feeding practices, and reducing low birth weight.

What do micronutrient interventions cost?

Micronutrient fortification and supplementation are among the most cost-effective public health interventions, but there is enormous variation in the documented costs of programs. The costs vary dramatically by specific cost measure, program, type of intervention and delivery system, country, and a host of other factors.

Tremendous differences among program costs show that it is not useful to generalize cost estimates across different countries and different types of programs. For example, in the most studied intervention, vitamin A supplementation, the reported unit cost per beneficiary ranges from 14 cents to $5.56**.** The estimated cost per death averted for vitamin A supplementation programs varied by a factor of 50, ranging from $90 to $3,383. The single most important cost in vitamin A supplementation programs is personnel, which constitutes roughly 65 percent of total costs. The imputed value of the time of volunteers who participate in biannual vitamin A supplementation programs and play an important role in implementing the program is about one quarter of total costs. Combining the delivery of other health services with vitamin A supplementation reduces the costs attributable to vitamin A alone and increases health benefits, thereby improving cost-effectiveness.

The single most important cost for food processors in fortification programs, accounting for approximately 90 percent of total costs, is the cost of the added vitamins and minerals (fortificant). The composition of the premix is a major influence on total and unit costs. For example, wheat flour fortification varies from 40 cents per metric ton for iron and folic acid to $3.52 for iron, folic acid, riboflavin, thiamin, and vitamin A. Targeted fortification with products formulated to meet the needs of high-risk groups may cost more but could deliver larger impacts. The use of costing and cost-effectiveness analysis could measurably improve the use of resources to achieve accelerated reductions in vitamin and mineral deficiencies.

Data on food intakes by young children and women of reproductive age particularly in low income households, and their health services utilization suggest that additional resources will be required for achieving the full payoffs from micronutrient programs. This is because the cost per person reached with a combined supplementation and fortification strategy is likely to increase once the first 50-60% of the population has been covered. Existing food vehicles and health services may not be able to deliver the required nutrients to the groups who are most in need, making it necessary to find supplementary delivery channels.

What type of external assistance is available to countries?

International agencies fulfill a broad range of technical and financial gaps in country programs. They support activities to develop new approaches, build capacity, provide data and tools for advocacy and planning, supply materials and equipment, and document results. Some institutions place technical experts in country and regional offices to provide technical support and facilitate information exchange. At the global level, they support coordination activities, gather and disseminate information, and support basic and applied research.

Gaps in resources and coordination remain, however. Certain areas of technical support and operations overlap among donors, and there are a number of missing pieces. Few agencies provide flexible multi-year funding for comprehensive strategies, and details of how best to access and put together packages of donor support to meet country goals are not well understood.

The financial contribution to micronutrient programs in 2004, of the organizations successfully contacted for this review, is estimated conservatively at $124 million. Vitamin A received the bulk of these resources; folic acid and zinc received far less. The African region benefits from roughly half the resources available for micronutrient programs, with substantial investments also being made in Asia. This assessment suggests that country programs are under-funded and receive relatively low levels of external assistance compared with the calculated payoffs from the impacts and in comparison with donor investments in other health areas.

Implications for a coordinated global strategy

This review of the available information related to the impacts, prevalence, causes, interventions, costs, and external assistance for reducing vitamin and mineral deficiencies suggests that the following principles may be useful for strengthening the global approaches being currently followed by donors:

- Focus first on specific regions and countries that have the greatest number and highest prevalence of persons with vitamin and mineral deficiencies, starting with the countries in which the potential is high for rapid impact.
- Build intervention packages around the two proven core intervention approaches—supplementation and fortification—recognizing that people obtain micronutrients through multiple channels. Provide for adequate monitoring of safety issues.
- Aim to fulfill the needs of women of reproductive age, the very young, and the very poor first. Include health interventions that affect vitamin and mineral deficiencies in the package of services for these groups; and link with food security and other food interventions as needed.
- Expand coverage using district-wide approaches for supplementation and strategies such as intensified outreach and social mobilization to assure coverage of marginalized communities. Identify special delivery channels for the urban poor.
- Build country capacity for the long-term institutionalization of effective strategies; for example, within decentralized district health plans and as part of public-private partnerships.
- Support government entities in harnessing private sector expertise, market channels, and interest in contributing to social objectives.
- Strengthen the country databases and diagnostics for developing best intervention mixes to guide policy and program choices. Invest in mechanisms to maintain up-to-date prevalence and coverage figures across countries using consistent definitions, methods, and age groups. Track trends in consumer demand for micronutrient-rich foods and potential food vehicles for fortification; support the evolving structure of industries related to processing, production and marketing of relevant products; monitor transitions in food purchasing and consumption patterns; determine household food allocation and child feeding practices; and identify patterns of health services utilization and indicators of infections that predispose to poor micronutrient status.
- Explore in more detail the *modus operandi* of key institutions involved in international support for micronutrient programs. Specifically, clarify and define the regulatory and policy frameworks within which these institutions operate; their mandates and the parameters that limit or encourage what they can and cannot do; the source of their resources; and the guidance or regulations to which they are subject. Determine the opportunities and challenges for accessing resources from each agency, and the mechanisms through which they communicate with and provide support to recipient countries.
- Expand the scope of current donor coordination to cover the main micronutrients and intervention approaches in order to support comprehensive country strategies for reducing the five most damaging vitamin and mineral deficiencies. The basic elements of a global coordination framework for micronutrients are listed in the last section.

In conclusion, there is a basic foundation of evidence for public health and development impacts arising from micronutrient programs. The know-how appears to exist for successfully reaching high-risk populations in a range of country settings. There is growing documentation on the strengths and limitations of different delivery channels. Food fortification and supplementation have proved successful in diverse settings, and promising new approaches such as biofortification are emerging. There are several success stories, but huge gaps remain. A global strategy could help with more timely and complete tracking of prevalence and program indicators, improve complementarities in donor support, bring a critical mass of resources to focus on high burden countries, and help secure sustained benefits.

Introduction

When asked how $50 billion should be invested for development, the world's top economists ranked 'providing micronutrients' second only to combating HIV/AIDS. Micronutrients offer a better cost/benefit ratio than trade liberalization, reducing migration barriers, new agricultural technologies, climate change, water and sanitation and other topics (Copenhagen Consensus 2005[1]).

The analysis and conclusions of the Copenhagen Consensus (2005) reaffirmed why micronutrients receive attention as one of the most highly cost-effective public health interventions available. The returns on investing in nutrition overall and in particular for micronutrients are very high (World Development Report, 1993). Individuals, entire communities and nations pay a significant price for allowing vitamin and mineral deficiencies to persist. Leading economists estimate that the benefit-cost ratios are in the range of 1: 176-200 for fortification and 1: 4-43 for supplementation (Behrman et al 2005).

A wide range of development impacts are possible with effective programs. Investing in micronutrients is likely to contribute towards achieving the Millennium Development Goals (MDGs).

Contribution of Improved Micronutrient Status to Millennium Development Goals

Goal 1: Eradicate extreme poverty and hunger	Iron and iodine deficiencies are related to mental and physical incapacity and this has implications for learning and productivity; zinc deficiency is associated with stunting that is related to low earnings; vitamin and mineral deficiencies are interrelated to poverty and hunger
Goal 2: Achieve universal primary education	Iron and iodine nutrition are closely related to cognitive function; anemia is related to low school attendance independent of cognition
Goal 3: Promote gender equity and empower women	The demands of childbearing, menstruation, pregnancy and lactation create high demands on micronutrient stores of women which results in a higher level of deficiencies; reducing vitamin and mineral deficiencies improves maternal health and productivity and reduces disabilities such as night blindness
Goal 4: Reduce child mortality	Iodine supplements, vitamin A and zinc, are proven to reduce childhood deaths and/or severe illness; improving folate status around the time of conception reduces risk of mortality related to neural tube defects (NTD)
Goal 5: Improve maternal health	Anemia is an important cause of maternal deaths; several vitamin and mineral deficiencies (vitamin A, iron, iodine, folate and calcium) are associated with pregnancy complications
Goal 6: Combat HIV/AIDS, malaria and other diseases	Adequate micronutrient status may reduce progression of HIV/AIDS and improve the quality of life of survivors; the evidence that micronutrient deficiencies may interfere with HIV progression needs to be better researched and documented; vitamin and mineral deficiencies (e.g. zinc and vitamin A) increase morbidity and mortality from diarrhoea, pneumonia, measles and malaria

1 A panel of economists that included three Nobel Laureates was convened in Copenhagen to identify global development priorities, primarily using economic costs and benefits.

Goal 7: Ensure environmental sustainability	Fortification and supplementation support environmental sustainability compared with consumption of animal foods; micronutrient status in turn is dependent upon a safe environment, e.g. soils and IDD.
Goal 8: Develop a global partnership for development	The micronutrient sector has facilitated a broad range of partnerships that raise the awareness and functioning of public and private sector development initiatives.

Source: SCN, 2004.

Building on a decade of accelerated program achievements and a strengthened base of evidence, many experts believe that it is time to scale-up engagement and investments in reducing deficiencies. At the United Nations General Assembly Special Session on Children (2002), Secretary-General Kofi Annan, 70 Heads of State and high-ranking government delegations from 187 countries committed themselves to reduce or eliminate these deficiencies.

Transitions taking place on a large scale across the globe provide new opportunities to improve the micronutrient status of populations. For example, there are rapid shifts in lifestyles and food choices, better and faster ways to raise public awareness and most prominently, there is increasing capacity in business to become part of the solution for global challenges[2].

Technically, experts have the knowledge and tools to address vitamin and mineral deficiencies in diverse settings. There is sufficient evidence that the fortification of staple food and supplementation programs, in particular when built into existing public health programs, can reduce deficiencies effectively. Child survival, mental and physical health, blindness reduction, and labor productivity have all shown documented improvements following the expansion of micronutrient programs in different regions.

By providing access to currently available technical knowledge and relevant data, this report aims to help lay the foundation for a new global strategy to significantly reduce micronutrient malnutrition by 2015. The global strategy is expected to be implemented through a global alliance of governments, international and national organizations, and businesses. With increasing demands on limited resources this strategy will be challenged to focus on the most critical and high-payoff actions. Choices will need to be made. To inform these choices, country and regional information related to the five most widely recognized deficiencies—vitamin A, iron, iodine, folic acid and zinc—is summarized in this report. The information corresponds to the following questions:

- What is the importance of micronutrients in the current development context?
- Where are the deficiencies most widespread; who is most affected and why?
- How can we prevent/reduce/eliminate the deficiencies or mitigate their impact?
- How well are we reaching scale, what would it cost, and what are the unmet needs?
- What is the role of international agencies currently engaged in micronutrient programs?

2 GAIN is conducting a separate review of the contributions of the private sector to complement this report.

1 Why is Reducing Vitamin and Mineral Deficiencies Critical for Development?

The Links Between Vitamin and Mineral Deficiencies and Survival, Health, Education and Productivity

*"Called **micronutrients** because they are needed only in minuscule amounts, these substances are the "magic wands" that enable the body to produce enzymes, hormones and other substances essential for proper growth and development. As tiny as the amounts are, however, the consequences of their absence are severe." (WHO, 2006)*

Summary of Findings

- There is consistent evidence that micronutrients are essential for chemical processes that assure survival, growth and functioning of vital human systems. Research and surveys have shown their health and economic impacts on individuals, communities and at national level.
- Reducing vitamin and mineral deficiencies strengthens the innate immune capacity of individuals, helping ward off a broad range of existing and emerging infectious diseases. Also, recovery from illnesses is faster and with fewer adverse outcomes.
- All age groups benefit from micronutrients but the deficiencies are particularly damaging and difficult to reverse when experienced during fetal development and in early childhood.
- Education and learning abilities are importantly affected by micronutrients. Among school-age children, vitamin and mineral deficiencies have been shown to reduce the ability to pay attention and lower school attendance. Increased performance and attendance in school is likely to translate into greater productivity as adults.
- Reducing vitamin and mineral deficiencies has also been shown to directly increase adult physical aerobic capacity and productivity.
- The seriousness and broad range of impacts attributable to vitamin and mineral deficiencies suggest that their continuation will delay the achievement of Millennium Development Goals (MDGs) in high prevalence countries.

Review of the Evidence

How strong is the evidence and what types of impacts can be expected from reducing vitamin and mineral deficiencies?

There is good clinical and epidemiological evidence of the beneficial impacts of micronutrients[3]

Clinical research, intervention trials, and biochemical studies have confirmed the wide-ranging impact of vitamin and mineral deficiencies on the following: immune function, brain and nervous system development, psychomotor development and cognition, skeletal development and growth, integrity and functioning of the epithelial and endothelial (e.g. gastrointestinal tract) systems, health and functioning of the eyes, and muscular performance.

Population-wide impacts of micronutrients on outcomes related to these systems have been documented in intervention trials and observational studies. The evidence is particularly strong for vitamin A, iodine, zinc, folate and iron and anemia.

BOX 1.1

Micronutrients Protect Health and Survival In Several Ways

- *Strengthened innate immune capacity (e.g. vitamin A, and zinc in reducing diarrhoea, pneumonia and malaria morbidity)*
- *More effective immunization—potentiating effect of micronutrients on vaccine efficacy (e.g. zinc and oral cholera vaccine)*
- *Improved care-seeking and increased use of disease control services (e.g. sustained high coverage of polio national immunization days when linked with vitamin A distribution)*
- *Increased efficacy of treatment for illnesses (e.g. zinc in severe diarrhoea, vitamin A in measles, multiple micronutrients in HIV/AIDS)*
- *Improved recovery and disease outcomes—e.g. zinc, vitamin A, iron in preventing stunting (zinc in diarrhoea), blindness (vitamin A in measles), improved quality of life and well-being (all key micronutrients in adult infections)*

The impact of vitamin and mineral deficiencies varies according to the magnitude of the deficiency, other accompanying nutritional problems and health conditions, age of the subject and duration of the deficiency. All stages in the lifecycle are vulnerable to the ill effects of deficiencies. However, pregnant women and children at stages of rapid growth and development are particularly vulnerable. When accompanied by infections, the vitamin and mineral deficiencies are more severe, and the ensuing damage is substantially greater.

Vitamin and mineral deficiencies contribute to death, illness and disability

Deficiencies of vitamin A, iron, iodine, zinc and folate are important contributing factors to maternal, newborn, infant, and child mortality. They affect a range of immune factors, predispose to mortality and disability resulting from illnesses and can delay recovery from illnesses. See box 1.1.

The results of mortality trials indicated that preventive vitamin A supplements could produce a 23% reduction in

3 The following are the primary references for this section: Rebecca J. Stoltzfus, Luke Mullany, and Robert E. Black, Chapter 3. Iron deficiency anemia, in Comparative Quantification of Health Risks, Global and Regional Burden of Disease Attributable to Selected Major Risk Factors 2004, Volume 1; Amy L. Rice, Keith P. West Jr. and Robert E. Black. Chapter 4. Vitamin A deficiency in the same; and Laura E. Caulfield and Robert E. Black. Chapter 5. Zinc deficiency in the same. For folate deficiency, Karen Bell and Godfrey Oakley, summary of the literature, 2006. Stoltzfus RJ. 2001, Iron-deficiency anemia: reexamining the nature and magnitude of the public health problem. Journal of Nutrition, 131. For micronutrients and immune function R Semba (personal communication, 2005). Black, R. 2003. Micronutrient deficiency—an underlying cause of morbidity and mortality. Bulletin of the World Health Organization, 81(2): 79. Sommer A. 2005. Innocenti Micronutrient Research Report # 1. WHO 2004, Iodine Status Worldwide, who.int/whosis. DHS Surveys ORC/MACRO. Jere R. Behrman, Harold Alderman and John Hoddinott, 2004. Hunger and malnutrition. In: Copenhagen Consensus. 19 February 2004.

childhood mortality in vitamin A-deficient populations (Beaton et al 1993). Treatment of measles with vitamin A could reduce hospitalizations, blindness and deaths (Sommer and West, 1996). A major pathway for these and similar effects of other micronutrients is through strengthening the immune response; and the total burden of deaths and disability makes micronutrients one of the highest priorities for public health. See figures 1.1 and 1.2. Table 1.1 lists the type of impacts by nutrient.

The mortality effects of vitamin A supplementation were confirmed through national surveys. The rapid decline of under five mortality in Nepal is credited in large part to the vitamin A program. According to the 2001 Nepal DHS under-five mortality fell from 158 to 91 per 1,000 over a 10-year period (1987–1991 to 1997–2001), a decline of 42%. A similar decline in under-five mortality over a 10-year period was also documented in Bangladesh at 38% and recently in Tanzania over five years (DHS/MACRO, 2006). A common feature across these countries is that biannual vitamin A supplementation was launched and reached high nationwide coverage during the years of most rapid decline. Iodine supplementation has been shown to be associated with child survival in China and Indonesia. Box 1.2 summarizes the estimated levels of health impacts from vitamin and mineral deficiencies

Figure 1.1 *Several micronutrients strengthen the immune system and increase resistance to infections*

Micronutrients and host defense and resistance to infections in humans

	Antioxidant capacity	Immune system	Resistance to infections
A	↑	↑↑↑	↑↑↑ / ↓
B group	↑	↑	
C	↑↑↑	↑	
E	↑↑↑	↑↑	
Iron	↓	↑	↑ / ↓
Zinc	↑↑↑	↑↑↑	↑↑↑
Selenium	↑↑↑	↑	↑

↑ : increase

↓ : decrease

Number of arrows indicate relative importance; arrows in both directions indicate conflicting findings

Source: Friis H, WHO, 2005

BOX 1.2

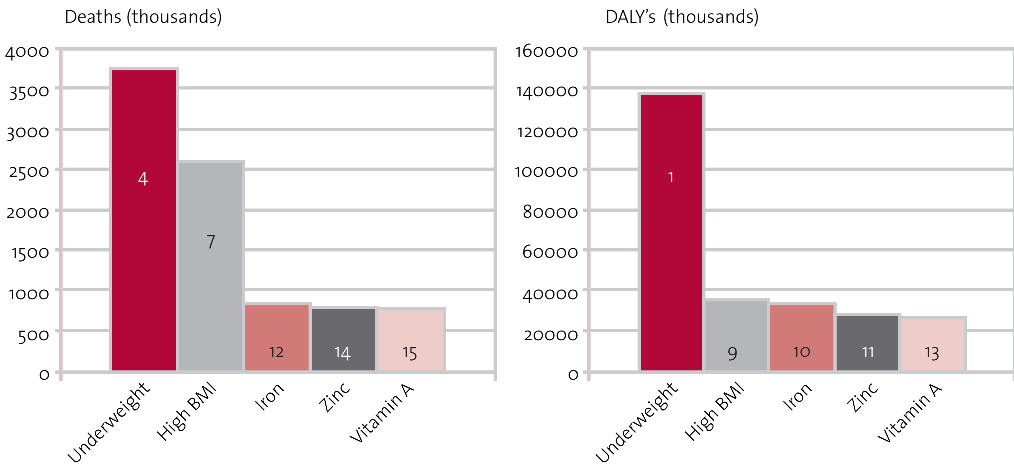
Health Impacts of Vitamin and Mineral Deficiencies

Current levels of vitamin and mineral deficiencies are estimated to have the following impacts.

- *Vitamin A deficiency: is a contributing cause of an estimated 9.0% of child deaths and possibly of 13.2% of maternal deaths.*
- *Iron deficiency: anemia in pregnancy contributes to an estimated 18.4% of maternal deaths and 23.5% of perinatal deaths; about half of anemia is associated with iron deficiency.*
- *Iodine deficiency: an estimated 19.7% of babies who are born to iodine-deficient mothers are likely to suffer from some form of intellectual impairment. WHO estimates (2004, based on data from 1998-2003) that nearly 50 million people were at risk of some degree of IDD-related brain damage.*
- *Zinc deficiency: is a contributing cause of 5.5% of child deaths according to our estimates.*
- *Folate deficiency: an estimated 240,000 neural tube defects could be prevented through supplementation with folic acid.*

Note: The methodology for calculating these effects involves using current WHO, IVACG and IZiNCG estimates of the prevalence of deficiencies provided in Annex A and a rapid PROFILES model that is described in Annex E. Folate deficiency estimates are from Bell and Oakley (personal communication, 2006)

Figure 1.2 *Global burdens of death and disability for nutrition risk factors*



Numbers indicate ranking amongst all risk factors considered

Source: Caulfield, 2002.

Table 1.1 *Health Impacts of Vitamin and Mineral Deficiencies*

DEFICIENCY	IMPACTS
Vitamin A Deficiency	Mortality: ▪ Meta-analyses demonstrate a link between vitamin A and cause-specific mortality for measles, and there is some evidence for diarrhoea and other infectious diseases. Single studies have shown a link between malaria mortality among children and all-cause maternal mortality (Rice et al 2004). ▪ Children 6-59 months old living in vitamin A-deficient areas who received vitamin A supplements were on average 20-30% less likely to die from any cause than children not receiving supplements according to meta-analysis of supplementation and fortification studies (Beaton et al. 1993; Fawzi et al. 1993; Glasziou and Mackerras 1993; Tonascia 1993)*. ▪ Pregnant women receiving a weekly supplement of 10,000 IU of vitamin A were 40% less likely to die than those receiving a placebo in one study in Nepal (West et al, 1999). ▪ Based on the current estimates of vitamin A deficiency (VAD) prevalence vitamin A contributes to an estimated 9% of the remaining childhood deaths and possibly more than 13% of maternal deaths.
	Morbidity: ▪ Vitamin A supplements reduce complications from measles such as blindness and the need for hospitalization (Sommer and West, 1996).
	Disability: ▪ Night blindness in pregnant women is a reversible consequence of VAD (Christian 2002). ▪ VAD is a significant preventable cause of childhood blindness in developing countries (Gilbert and Foster 2001).
Iron and Anemia	Mortality: ▪ Anemia as a risk factor for mortality is estimated to contribute 591,000 perinatal deaths and 115,000 maternal deaths globally. (Stoltzfus, 2004). When combined with the direct impacts of iron deficiency anemia the deaths total 841,000 annually (ibid). ▪ Using current data on prevalence 18.4% of maternal deaths and 23.5% of perinatal deaths are attributable to anemia**. ▪ A substantial body of observational data relates pregnancy anemia to pre-term birth and low birth weight both of which predispose to childhood mortality and morbidity (Stoltzfus et al, 2004) ▪ Two recent studies, one from Tanzania and one from Nepal, suggest that iron supplementation in areas with high malaria prevalence may increase adverse outcomes but no adverse impact was found in non-malarious areas***. Morbidity and disability: ▪ Iron deficiency predisposes to diseases through reduced immune function e.g. humoral, cell-mediated and nonspecific immunity and the activity of cytokines which have an important role in various steps of immunogenic mechanisms are influenced by iron deficiency anemia. ▪ Iron deficiency directly causes decreased oxygen delivery to muscles and the brain resulting in impaired aerobic capacity and altered child development (or intelligence) (Ekiz et al 2005).

Iodine Deficiency	Mortality: ▪ Maternal iodine deficiency is associated with increases in the risk of perinatal mortality, childhood mortality, stillbirths, miscarriages, thyroid disorders and brain damage Based on epidemiological data (Dillon and Milliez, 2000) Morbidity and disability: ▪ The effects of iodine deficiency disorders include cretinism, deaf mutism and mental retardation (WHO, 2004)
Zinc Deficiency	Mortality: ▪ Infants born small for gestational age who received supplements six days per week were 0.32 times as likely to die during infancy as compared to the placebo supplement (Sazawal et al., 2001). In another study, children who received supplements of 20 mg/d as adjunct to ORS during diarrhoea were half as likely to die as those receiving oral rehydration solution (ORS) alone (Baqui et al., 2002). ▪ Based on current estimates of zinc deficiency, it is a contributing cause of 5.5% of child deaths in developing countries. Morbidity: ▪ In placebo-controlled trials, children supplemented with zinc experienced fewer episodes of diarrhoea and pneumonia and lower clinic attendance for malaria (IZiNCG, 2004). The duration of diarrhoea and fluid losses were also lower.
Folate Deficiency	Mortality: ▪ Folate deficiency is associated with an increased risk of pre-term delivery and low birth weight (Scholl and Johnson, 2000); these conditions predispose to mortality. Morbidity: ▪ Folate deficiency is thought to contribute to anemia, especially in pregnant and lactating women in communities with a low intake of folate (Dugdale, 2001). Disability: ▪ Folic acid plays an important role in preventing congenital malformations (Fenech, 2001).

* Studies that provided vitamin A supplements to newborn infants immediately after birth have not demonstrated consistent effects on newborn mortality according to Rice et al (2004); the evidence for postpartum vitamin A supplementation remains weak. A recent study by Humphrey et al (2005) in HIV-positive pregnant women in Zimbabwe suggests that increased adverse outcomes may occur in some infants if postpartum mothers or they are given high doses of vitamin A at birth

** Data on anemia prevalence are in annex A, and methods for estimating mortality are in annex B.

*** WHO Statement on iron supplementation and child mortality. 2006 who.int website

Iron and iodine deficiencies affect brain development and cognition

Adequate iron intake is necessary for brain development, and its deficiency is implicated in impaired cognitive development (see table 1.2). Anemia in school-age children may also affect schooling whether or not there had been earlier impaired brain development.

Iodine deficiency concerns the irreversible impairment of mental capacities with resulting lower learning capacity. Although iodine is a required nutrient throughout life, most documented consequences of deficiencies are from prenatal and early childhood deficiencies (Dunn, 2003). This evidence comes from epidemiological studies, including the analysis showing a 13.5 point difference in IQ between deficient and normal individuals, and maternal supplementation studies (Grantham-McGregor, Fernald and Sethuraman,1999; and Black, 2003). The earlier iodine deficiency can be addressed the greater the impact.

The impact of vitamin A deficiency on childhood blindness and of folate deficiency on neural tube defects severely limits the quality of human resources in communities where the prevalence of these deficiencies is high.

Table 1.2 *Impacts of Vitamin and Mineral Deficiencies on Cognition and Education*

DEFICIENCY	IMPACTS
Vitamin A Deficiency	▪ Childhood blindness caused by VAD is a deterrent to education.
Iron Deficiency and Anemia	▪ Observational studies show infants with moderate iron deficiency anemia have test scores that are 0.5 to 1.5 standard deviations lower than those of infants with sufficient iron stores (Lozoff, 1988; and Pollitt, 1993). ▪ Iron supplementation corrects IQ deficits in anemic children (Pollitt et al, 1989; Seshadri and Gopaldas, 1989; Soewondo et al., 1989). A quantitative estimate of the size of this effect suggests a reversible IQ deficit in anemic 5- to 6-year-old Indian boys of 8 points or half a standard deviation. ▪ Two published placebo-controlled, randomized trials found significant benefits from longer-term (>2 months) iron supplementation on cognitive development of young anemic children in Indonesia and Zanzibar (Idrajdinata and Pollitt 1993; Stoltzfus et al., 2001. Levin et al. 1993). ▪ There appears to be a causal relationship between iron deficiency anemia in early childhood and intelligence in mid-childhood. Impairments may only be partially reversible later in life (Beard, 2001; Grantham-McGregor and Ani, 2001).
Iodine Deficiency	▪ Iodine deficiency during pregnancy affects the development of the fetus, results in cretinism, deaf mutism and other forms and degrees of mental and physical impairment. ▪ A review of reports from seven countries indicates that approximately 3.4% of births to iodine-deficient women are cretins and another 10.2% of their offspring are mentally impaired (Clugston et al., 1987). ▪ A meta-analysis shows the average IQ to be 13.5 points lower in iodine deficient communities when compared to iodine-sufficient communities (Bleichrodt and Born 1994).
Folate Deficiency	▪ The development of the newborn central nervous system is severely damaged in utero when mothers are folate-deficient around the time of conception; survival among infants born with spina bifida and encephalocele has improved since folic acid fortification (Bol et al 2006)

Vitamin and mineral deficiencies in children and adults translate into substantial productivity losses

There is good evidence that nutritional deficiencies severely erode productivity**.** Vitamin A deficiency causes blindness and the economic losses from childhood blindness accumulate throughout life. Night blindness caused by vitamin A deficiency in women of reproductive age severely limits the number of working hours. Similarly the deficiencies of folate and iodine result in mental and physical impairments and lifetime losses in productivity. Zinc deficiency contributes to child stunting, which is directly linked to productivity losses in adulthood.

Additionally, adult productivity unrelated to childhood morbidity, stunting or cognition is independently affected by micronutrient status. Anemia in adults is associated with reduced productivity and critical household tasks such as caregiving by mothers both in cross-sectional data and in randomized interventions. The magnitude of impacts appears to depend on the nature of the task. An overview of the effects of vitamin and mineral deficiencies on productivity is given in table 1.3.

Table 1.3 *Productivity Impacts of Vitamin and Mineral Deficiencies*

DEFICIENCY	IMPACTS
Iron Deficiency and Anemia	▪ Anemia is associated with reduced productivity both in cross-sectional data and in randomized interventions (Thomas, et al., 2004, Li, et al. 1994; Basta, Karyadi and Scrimshaw, 1979). About half of anemia is associated with iron deficiency. The magnitude of productivity impacts may depend on the nature of the task. Iron supplementation in anemic adults is estimated to result in a 5% increase in "blue collar" labor productivity and an additional 12% increase in heavy manual labor productivity (Horton and Ross, 2003). ▪ Workers with iron deficiency anemia were found to be less productive in physical tasks than non-anemic workers in Indonesia, producing 1.5% less output for every 1.0% that hemoglobin is below standard (Basta et al., 1979; reviewed by Levin et al., 1993.)
Iodine Deficiency	▪ Brain function is impaired by iodine deficiency during fetal development. The future productivity losses due to iodine deficiency is equal to about 0.23% of GDP. See Annex B.
Zinc Deficiency	▪ Stunting during childhood translates into equal height deficiencies in adulthood, and the elasticity of height on productivity—as measured by wage—is estimated to be up to 1.38. This implies that a difference of 1% in the height of adult workers is associated with a 1.38 difference in their wages (Pinstrup-Andersen et al, 1993).
Folate Deficiency	▪ Folate deficiency has been shown to be a factor in anemia – a debilitating condition in women in communities where diets are folate poor.

Data Sources, Limitations, and Issues

- Randomized controlled trials provide evidence for the health impact of several micronutrients, for example, for prevention and treatment of vitamin A deficiencies, and zinc supplementation. Documented improvements in national or area health indicators following the introduction of large-scale programs provide further evidence of impact. However the research and evaluations are not representative of all country settings, and study designs are limited by cost constraints, measurement difficulties and ethical considerations. For example, there are no experimental trials of iron deficiency and maternal mortality and researchers have estimated the risk relationship from observational data.

- The literature on efficacy and effectiveness of micronutrient interventions can be difficult to interpret and compare due to differences in definitions, age groups and methods. Despite these limitations, however, the collective evidence is strong. The results are in the same direction, the ranges of impact similar and there is growing understanding of the likely mechanisms of action.
- The extrapolation of efficacy and effectiveness results obtained in one setting to other contexts assumes that the local conditions and interventions are similar and this may not be universally accurate. In this report, estimates of mortality and productivity impacts presented in Annex B are based on the rapid PROFILES model. While the exact level of impact of each deficiency may be under- or over-estimated it provides a good approximation of orders of magnitude of effects.

Next Steps for Strategic Action and Research

- Research is needed on the impacts of multiple micronutrient deficiencies during early childhood and among women of reproductive age and the role of diet in controlling it.
- Research is needed on addressing co-morbidities of micronutrients and infectious diseases (e.g. malaria, HIV/AIDS, TB) safely and efficaciously.
- Research on the long- and short-term impact of improved iron intake among women and children will be useful, including impacts on fetal development, birth weight and neonatal mortality, as well as later growth and development.
- Documentation of the evidence linking country micronutrient strategies and changes in intake with indicators related to functional outcome e.g. mortality, morbidity, blindness, NTDs, productivity, schooling and education. While there is already evidence of the impacts of micronutrients, documenting additional examples from diverse country settings will help build momentum through advocacy, highlight ways in which the benefits can be enhanced, and help maintain a focus on reducing the deficiencies. This does not mean more mortality studies, but rather opportunistic data collection where programs are being scaled up and where ongoing routine health data can be used.
- Analysts and policy-makers should have a common understanding of the estimated magnitude of potential impacts based on recent evidence. An updated standardized approach is needed for characterizing and documenting the public health and productivity outcomes from investments to be made over the next decade. This information is necessary for advocacy and continuing analysis of the cost-effectiveness of programs using tools such as PROFILES.

Conclusions and Recommendations

- Vitamin and mineral deficiencies erode the fundamental capacities of individuals, households, communities, and nations; they are likely to impede the achievement of the Millennium Development Goals.
- Strategies to reduce poverty and narrow the equity gap should include targeted approaches for delivering adequate micronutrients. Low-income households are several times more likely to suffer from deficiencies than are better off households; this affects their children's education, adult productivity and earnings and widens the income gap.
- Health investments will have enhanced payoffs if micronutrient interventions are an integral component of health sector strategies—examples include: preventive vitamin A supplementation of preschool children; zinc supplements given to children with diarrhoea; promotion and testing for use of adequately iodized salt; iron supplements for pregnant women; and folic acid for women of reproductive age.
- Education-sector investments in school education will also benefit from investing in micronutrient and related programs, especially through increased coverage with iodized salt, reduction of iron deficiency and anemia in young infants and children, iron and folic acid fortification, and treatment of measles with vitamin A to prevent blindness.
- The following areas need further research: role of the diet, interactions among micronutrients, micronutrients and the environment, especially infection; range of safe levels of intake between minimum requirements and upper tolerance levels (especially in young children); and the public health significance of marginal deficiencies for iodine, iron and vitamin A; and channels to increase multiple micronutrient intakes.

2 What Is the Extent of Vitamin and Mineral Deficiencies?

Magnitude of the Problem

"One out of three people in developing countries are affected by vitamin and mineral deficiencies and therefore more subject to infection, birth defects and impaired physical and psycho-intellectual development." (WHO, 2006)

Summary of Findings

- Vitamin and mineral deficiencies—particularly of vitamin A, iron, iodine, zinc, and folate—pose a public health problem that affects over 2 billion people. An estimated 25 percent of preschool children and 18 percent of women are vitamin A-deficient; 37 percent of the total population has anemia; 35 percent of the world's population is at risk for iodine deficiency (data from 1998-2003); and 20 percent is estimated to be at risk for zinc deficiency. These prevalence figures may not reflect the current situation, as limited resources have prevented the gathering and maintenance of up-to-date information.
- Apart from iodine, vitamin A and anemia, we do not have data on the prevalence of other micronutrient deficiencies. Surveys are needed to fill these gaps. We need to develop, field test and apply field methods for other micronutrients.
- More evidence is needed on the relationship between interventions and different measures of micronutrient status. The present indicators have considerable limitations, e.g. biological indicators are more invasive and cumbersome but more likely to be specific, but functional indicators are less specific.
- The deficiencies are caused by diets poor in vitamins and minerals, and by losses or poor absorption related to illness—conditions found in every region of the world.
- Countries of sub-Saharan Africa and South Asia have the largest deficiency prevalence rates and the largest absolute numbers of micronutrient-deficient people; many countries in East Asia, Latin America, Central Asia, and Eastern Europe also have sizable populations with a high prevalence of specific vitamin and mineral deficiencies, notably of iron, iodine and folate.
- Economic prosperity per se does not protect communities or countries against deficiencies. However, the poorest segments of the population—both urban and rural—and women and children suffer the most severe forms of deficiencies.
- Deficiencies tend to cluster in individuals, households, and communities. The same populations tend to suffer from more than one micronutrient deficiency at a time, which provides an opportunity to address multiple deficiencies together.
- The global prevalence of vitamin A deficiency and iodine deficiency, particularly their severe forms, has declined significantly as a result of large-scale programs. However, these deficiencies remain high in several regions.
- The prevalence of iron deficiency and anemia has remained high over the past several decades despite prenatal iron supplementation programs due partly to the multiple causality of

anemia and partly to inadequate implementation of iron supplementation programs. Our understanding of various causes of anemia such as malaria, intestinal parasites, other infections and micronutrient deficiencies and hemoglobinopathies has increased, and more effective programs are expected to develop.

- The magnitude of zinc and folate deficiencies has not been directly measured in more than a few areas; however, indirect indications suggest that the factors that cause these deficiencies are widely prevalent. With little progress on interventions for reducing zinc and folate deficiencies, global prevalence figures have probably not changed recently.

Review of the Evidence

What are the global patterns of vitamin and mineral deficiencies?

Extensive evidence from surveys and extrapolations from the best available data indicate that vitamin A, iron, and iodine deficiencies remain widespread public health problems.[4] Other micronutrient deficiencies may also be widespread but few prevalence studies have been done. Only limited precise, up-to-date, global figures exist for the current prevalence of the major vitamin and mineral deficiencies; steps should be taken to fill these data gaps. In general, less is known about zinc and folate deficiencies. For zinc deficiency, prevalence figures are estimated from predictions of national risks of inadequate zinc intake based on national food supplies. For folate deficiency, experts differ in their assessment of adequate intake and few large-scale population-based surveys have been done to measure the deficiency. Despite the data limitations, regional estimates for the major micronutrients have been developed (often through extrapolations based on measured levels and their predictors), and regional trends have been documented.

Current estimates are that, throughout the world, 25 percent of pre-school children and 18 percent of women are vitamin A-deficient; 37 percent of the total population has anemia of which about half is due to iron deficiency; 35 percent do not consume adequate iodine (data from 1998-2003); and 20 percent is estimated to be at risk for zinc deficiency.

BOX 2.1

Five Questions Raised by Current Prevalence Data

- *Why do vitamin and mineral deficiencies remain at such high levels if many national programs have been successful?*
- *Do prevalence data reflect the actual situation since large-scale programs were introduced in the past five years and many data are from older surveys?*
- *If biochemical indicators of prevalence are too invasive and costly for regular tracking can intermediate steps be monitored e.g intakes, or can proxies be used?*
- *Who are the deficient populations, and do current approaches effectively reach them?*
- *Are the indicators used to measure prevalence the right ones?*

4 The following are the primary references for this section: SCN (2004). Standing Committee on Nutrition. 5th report on the world nutrition situation: nutrition for improved development outcomes. WHO: Geneva. WHO 2004, Iodine Status Worldwide, who.int/whosis. Mason J. et al 2005. Recent trends in malnutrition in developing regions: vitamin A deficiency, anemia, iodine deficiency and child underweight. J Nutrition 26 (1). West KP, 2002. Extent of vitamin A deficiency among preschool children and women of reproductive age. J Nutrition 132 (9S). WHO MDIS 2005. Global Database for Anemia. IZiNCG, 2004. Assessment of the Risk of Zinc Deficiency in Populations and Options for Its Control C. Hotz and K.H. Brown, guest editors. *Food and Nutrition Bulletin,* vol. 25, no. 1 2004, The United Nations University. K. Bell and G. Oakley for folate deficiency, personal communication 2006. RJ. Stoltzfus, L Mullany and RE Black. Chapter 3. Iron deficiency anemia. In: Comparative Quantification of Health Risks, Global and Regional Burden of Disease Attributable to Selected Major Risk Factors 2004, Volume 1. WHO, 2006

Vitamin A deficiency (VAD) is a public health problem in 118 countries, especially in Africa and Asia

Extrapolations from the available data suggest that about 125 million pre-school-age children and 20 million pregnant women suffer from VAD, and 4.4 million children and 6.2 million women suffer from xerophthalmia (West, IVACG 2002). See table 2.1. Nearly half of all VAD and xerophthalmia occurs in South and Southeast Asia. India, Indonesia, China, Ethiopia, Afghanistan, and Nigeria account for the largest concentrations of vitamin-A-deficient and xerophthalmic children. The World Health Organization (WHO, 2005) estimates that 250,000 to 500,000 children become blind every year as a result of VAD, and half of them die within 12 months of losing their sight. Map 2.1 shows the global distribution of VAD.

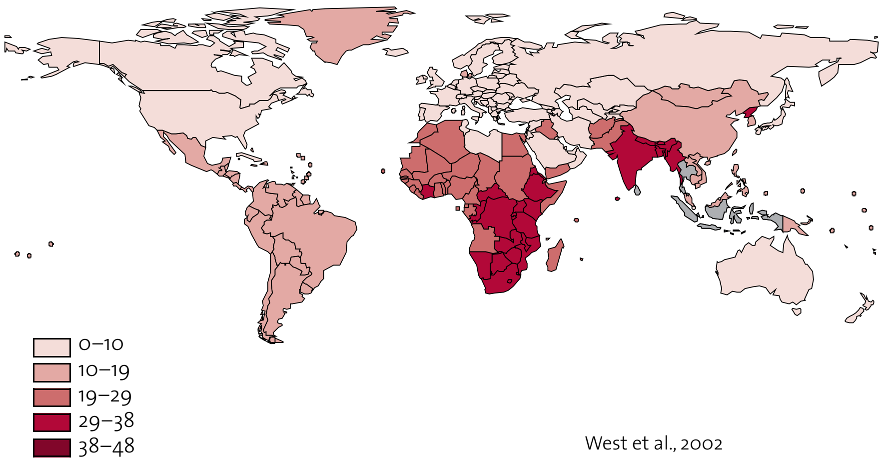
Table 2.1 *Global Prevalence of Vitamin A Deficiency in Young Children*

WHO REGION	% VITAMIN A-DEFICIENT* (NUMBER)	EYE CHANGES DUE TO VITAMIN A DEFICIENCY (XEROPHTHALMIA)	
		%	NUMBER
Africa	32.1 (33,406,000)	1.53	1,593,000
Eastern Mediterranean	21.2 (12,664,000)	0.85	510,000
South/Southeast Asia	33.0 (55,812,000)	1.20	2,026,000
Western Pacific	14.0 (17,128,000)	0.18	220,000
The Americas	17.3 (8,212,000)	0.16	75,000
GLOBAL	25.3 (127,273,000)	0.88	4,424,000

* *Serum retinol <0.70µmol/L or abnormal conjunctival cytology.*

Source: West in IVACG, 2002

Prevalence of vitamin A deficiency among children 0–4 years old by regions



Map 2.1 *Global Distribution of Vitamin A Deficiency*

Source: Black RE, 2003

Iron deficiency is the world's most prevalent form of undernutrition

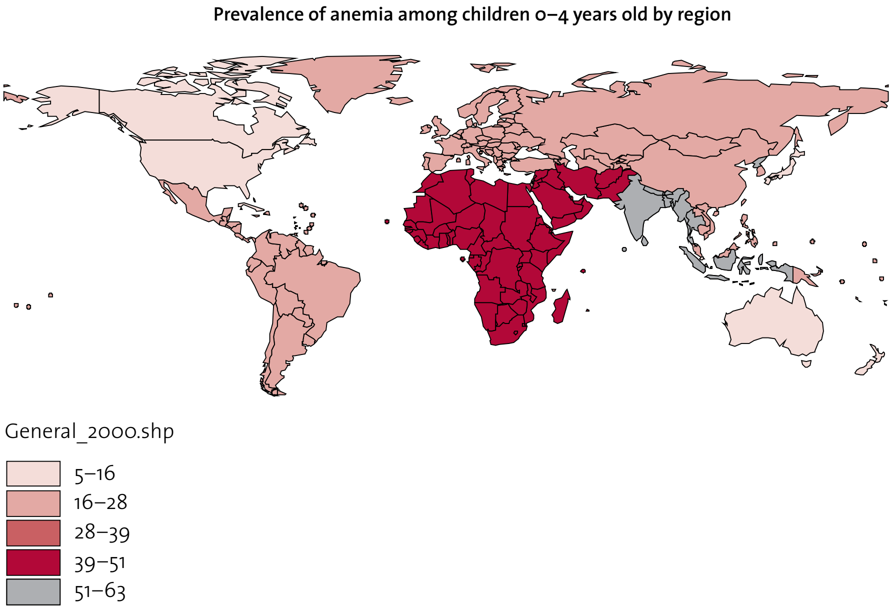
Iron deficiency is one of the most common causes of anemia. In developing countries, anemia is frequently exacerbated by malaria and worm infections. Most of the disease burden from anemia occurs in pregnancy and early childhood, and is borne by women and children in Asia and Africa. Substantial numbers of women and children in other regions also are affected. Map 2.2 shows the global distribution of anemia. Table 2.2 contains the best estimates of anemia in the population, however, these are not based on representative national samples from countries of the regions.

Table 2.2 *Geographic Distribution of Anemia in the Population*

WHO REGION	TOTAL AFFECTED POPULATION (%)	CHILDREN 0–59 MONTHS (MILLIONS)	WOMEN 15–59 YEARS (MILLIONS)
Africa	46	45	58
The Americas	19	14	54
South/Southeast Asia	57	111	215
Europe	10	12	27
Eastern Mediterranean	45	33	60
Western Pacific	38	30	159
GLOBAL	37	245	573

Source: Adapted from WHO/UNICEF/UNU (2001).

Map 2.2 *Global Distribution of Anemia*

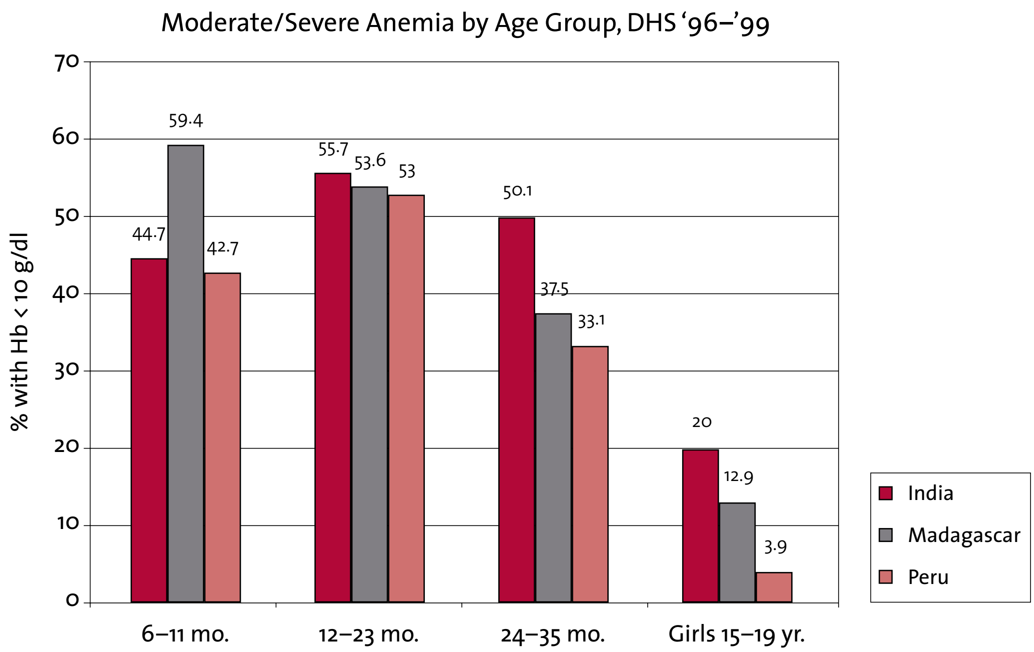


Source: Black RE, 2003

No current global figures exist for iron deficiency, but using anemia as an indirect indicator, WHO (2006) estimates that most pre-school-age children and pregnant women in nonindustrialized countries, and at least 30 percent to 40 percent in industrialized countries, are iron deficient. Nearly half the pregnant women in the world are estimated to be anemic: 52 percent in nonindustrialized countries and 23 percent in industrialized countries.

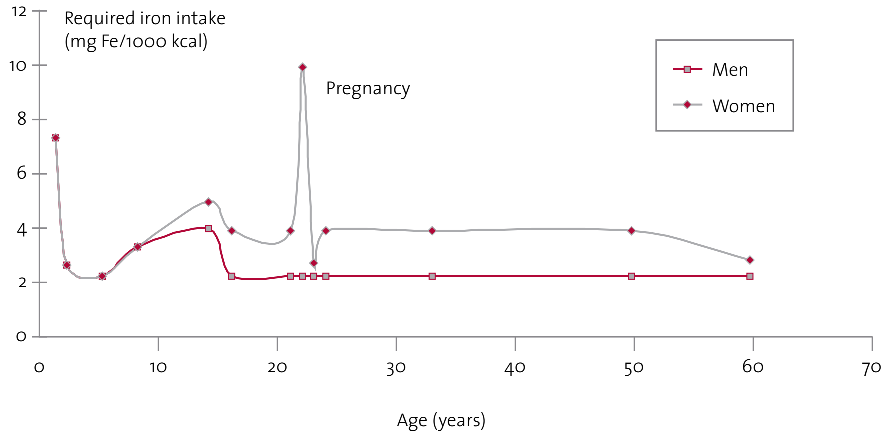
More young children and pregnant women suffer from moderate and severe forms of anemia than any other group, according to Demographic and Health Surveys (DHS). See figure 2.1. This is related to the very high requirements for iron during periods of rapid growth and pregnancy (see figure 2.2). Prevalence of anemia in children ages 6–35 months can exceed 50 percent in countries as diverse as India, Madagascar, and Peru (DHS, ORC/MACRO 1996–2000). This is particularly troubling, because iron deficiency and anemia can have lasting deleterious effects on mental and physical development.

Figure 2.1 *Moderate/Severe Anemia By Age Groups*



Source: Demographic and Health Surveys (1998–2005)

Figure 2.2 Requirements for Iron Are High During Periods of Rapid Growth



Stolt fus, 1997

The prevalence of anemia in children and non-pregnant women has declined in some countries; however, overall, prevalence levels have remained steady over the past 20 years. From 1977 to 1987, anemia levels increased in South Asia and sub-Saharan Africa. In 1990, the World Summit for Children set goals for reducing malnutrition that included a goal to reduce iron deficiency anemia by one-third by the year 2000. But by 1995, according to UNICEF (1995), very few countries had taken national action to reduce iron deficiency anemia.

"Substantial efforts have been made in the past several decades to implement programs to reduce iron deficiency. Yet, compared with other micronutrients such as vitamin A and iodine, overall progress in reducing iron deficiency has been limited. Such limited progress is not attributed to a lack of scientific knowledge about the prevalence, causes or consequences of iron deficiency, but to limited implementation of effective interventions… " (Yip, 2000)

An analysis conducted by Mason et al (2005) suggests that if current trends continue, anemia in non-pregnant women will decline only marginally from the current 40 percent to 38.5 percent by 2010; in pregnant women, it will decline from the current 45 percent only to 44.5 percent by 2010. The situation is even worse for young children, half of whom suffer from anemia across developing countries.

Reporting on iodine deficiency has greatly improved and program coverage has expanded in the past few years

The prevalence of iodine deficiency declined in the past two decades because of high coverage with iodized salt. Clinical signs declined sharply, and the available data on urinary iodine (although not up to date for many countries) show improving trends in iodine intake.

A total of 117 countries now report on the Universal Salt Iodization initiative (USI) coverage and/or deficiency of iodine, according to UNICEF. USI has progressed from 20% coverage in the 1990's to 68% in 2005. In 1993, 110 countries reported urinary iodine levels of <100μg/L and in 2003 this number was down to 54 countries. According to WHO (data reported from 1990's to 2003 in the report of 2004), iodine deficiency disorders (IDDs) affect over 740 million people, or 13 percent of the world's population. An additional 30 percent are at risk of IDDs.

The Americas have the lowest prevalence of iodine deficiency, consistent with the high household coverage of iodized salt. See table 2.3. Europe has the reverse situation, with a high prevalence of iodine deficiency and low coverage of iodized salt. More than half of the 2 billion people at risk of iodine deficiency live in Asia.

Table 2.3 *Proportion of Population with Insufficient Iodine Intake*

UN REGION	% GENERAL POPULATION UI <100 μg/L	TOTAL NUMBER (MILLIONS)
Africa	43.0	324.2
Asia	35.6	1,239.3
Europe	52.7	330.8
Latin America and Caribbean	10.0	47.4
North America	9.5	27.6
Oceania	64.5	19.2
GLOBAL	35.2	1988.7

Source: WHO Global Database on Iodine Deficiency (2004). Note that much of these UI data are from 1999 or before and do not fully reflect progress of USI.

Approximately 20 percent of the world's population is estimated to be at risk for inadequate zinc intake

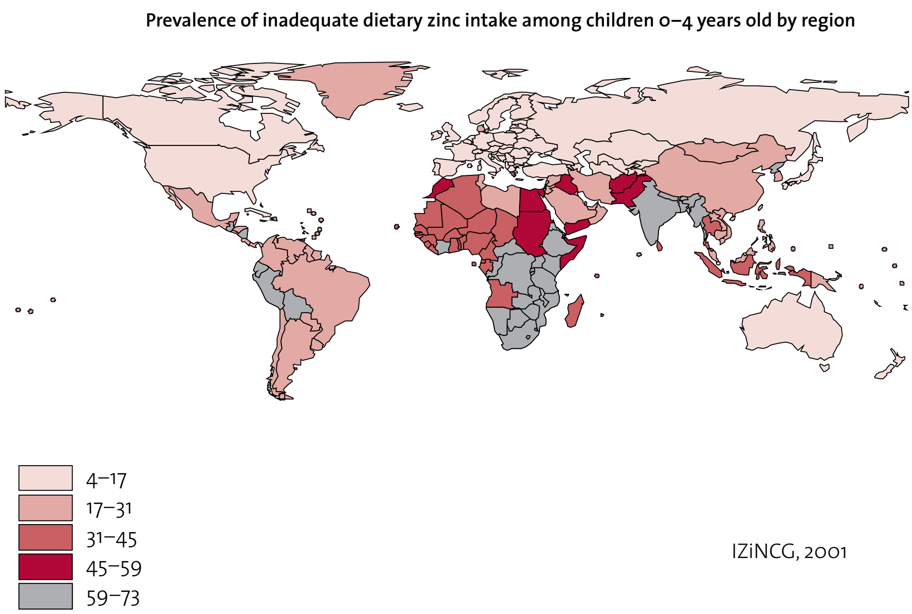
Zinc deficiency has not been measured in nationally representative surveys, and its prevalence is not known. The International Zinc Nutrition Consultative Group (IZiNCG, 2005) used indirect indicators to predict national risks of inadequate zinc intake based on such factors as national food supplies and stunting. In this analysis, the estimated percentage of individuals at risk for inadequate zinc intake ranged from 9.3–9.5 percent in North Africa, the Eastern Mediterranean, the United States, and Canada to 33.1 percent in Southeast Asia. See table 2.4 and map 2.3.

Table 2.4 Estimated Population at Risk for Inadequate Zinc Intake by Region

REGION	% OF POPULATION WITH INADEQUATE INTAKE
Western Europe	10.9
USA and Canada	9.5
Eastern Europe	16.2
North Africa and Eastern Mediterranean	9.3
China (and Hong Kong)	14.1
Western Pacific	22.1
Latin America and Caribbean	24.8
South Asia	26.7
Southeast Asia	33.1
Sub-Saharan Africa	28.2
GLOBAL	20.5

Source: IZiNCG, 2004

Map 2.3 Global Distribution of Zinc Deficiency



Source: Black RE, 2003

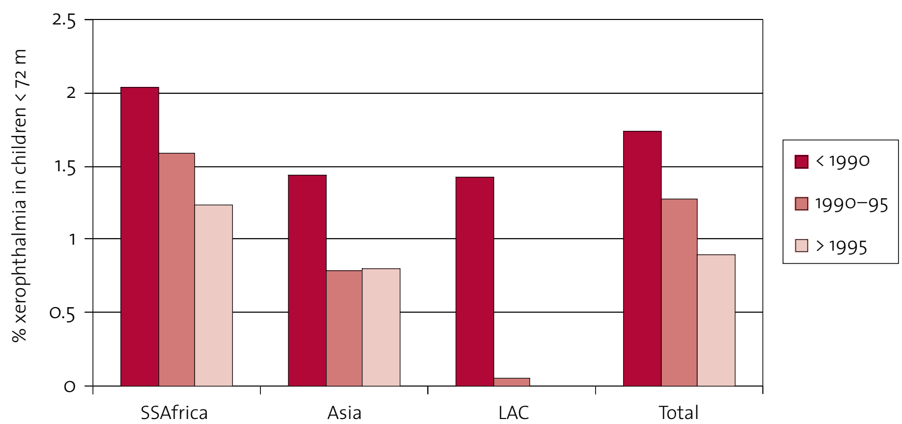
In industrialized countries folate deficiency may be one of the most prevalent micronutrient deficiencies

WHO recently completed a comprehensive review of data available on folate deficiency throughout the world and it appears the prevalence of folate deficiency is comparable in developed and developing countries (Bruno deBenoist, personal communication, 2006). Large-scale population-based surveys of folate deficiency are rare. Food fortification and supplementation trials in the United Kingdom, Australia, China, and other countries indicate that folate deficiency may be fairly widespread among all age groups. In a recent survey in Vargas state in Venezuela, the prevalence of folate deficiency was 81.8 percent in adolescents and 61.3 percent in pregnant women (Garcia-Casal et al, 2005). Pathak and others (2004) found a prevalence of 26.4 percent in pregnant women in a survey of rural villages in Haryana state, India. Earlier studies from India reported folate deficiency in the range of 21–63.5 percent. In Anqing, China, 23 percent of women textile workers of reproductive age were deficient in folate (Ronnenberg, 2000). These studies recorded multiple vitamin and mineral deficiencies— particularly B vitamin deficiency, iron deficiency, and anemia—in the same women. Folate deficiency may be the most prevalent micronutrient deficiency in industrialized countries, primarily because of a decline in consumption of folate rich foods such as leafy green vegetables and whole grains.

What is the evidence that vitamin and mineral deficiencies have declined?

WHO and other international authorities estimate that the global prevalence of vitamin A deficiency and iodine deficiency have declined significantly as a result of large-scale nutrition and health programs in most countries of the world. Figure 2.3 illustrates the decline in the prevalence of clinical vitamin A deficiency since 1990.

Figure 2.3 *Decline in prevalence of clinical VAD (1990–1995)*



Source: Based on actual surveys, cited in Mason et al, 2005.

Trend data also show that the mean prevalence of goiter declined from 26.7 percent before 1990 to 21 percent after 1990. The analysis by Mason and others (2005) suggests that in countries with high endemic goiter levels, these rates are halved when iodized salt reaches a coverage of 50 percent. Several countries have exceeded these minimum effective coverage levels. By 2000, universal salt iodization (USI) appears to have spared 800,000 people from iodine deficiencies (Mason 2005).

From the few repeated surveys conducted during 1990–2000, it appears that xerophthalmia, as indicated by night blindness and Bitot's spots, declined (figure 2.3). Mason and others (2005) developed comprehensive country and regional estimates that show that the declines took place in the Americas, in some countries in South Asia (e.g., Bangladesh and Nepal), and in the Middle East and Northern Africa.

West (2002) developed national estimates of clinical and subclinical forms of VAD. The available data show that the decline in clinical VAD is attributable to increasing measles immunization coverage as well as effective large-scale vitamin A supplementation programs.

The prevalence of iron deficiency and anemia has remained high in the past decade, even in countries where it declined. The magnitudes of zinc deficiency and folate deficiency have not been empirically determined in nationally representative household surveys (IZiNCG, 2004), and there have been few interventions to address these deficiencies. National flour fortification has led to reductions in folate deficiency in Chile, the United States, Canada, and Costa Rica (RCOG, 2003).

What are the trends in vitamin and mineral deficiencies for specific geographic regions?

Among regions, sub-Saharan Africa shows an unchanging or worsening trend in subclinical vitamin A and mineral deficiencies, except for intake of iodine, which improved with expanded coverage of iodized salt. It is anticipated that this favorable trend in IDDs can be sustained if sufficient resources are provided to maintain and enforce supportive policies. Anemia levels in Africa are particularly troublesome; they are among the highest in the world among women and, especially, children.

South Asia, particularly India, continues to register vitamin A deficiency and anemia. Xerophthalmia is above 1 percent and there is recent evidence of a high prevalence of VAD in children. The prevalence of anemia is also very high; it has been stagnant for several decades. Even among the highest income percentiles, the prevalence rate for anemia in women is over 60 percent. Documented success stories for reducing national levels of vitamin and mineral deficiencies through large-scale programs are found in Latin America, China, Thailand, and Vietnam for all major deficiencies; and in Nepal and Bangladesh for vitamin A.

How are vitamin and mineral deficiencies identified, and what causes them?

The principal vitamin and mineral deficiencies known to cause widespread public health problems are deficiencies of vitamin A, iron, and iodine. Recently, deficiencies in zinc and folate have also been identified as major problems. A micronutrient inadequacy is reflected in lower than recommended circulating levels of the nutrient in blood (e.g., vitamin A, folate, zinc, iron); low levels in urine (e.g., iodine); low liver stores (e.g., vitamin A, iron); or the presence of physical

BOX 2.2

Diet and diseases work together to cause vitamin and mineral deficiencies during various stages of the lifecycle and during emergencies

- *The vitamin and mineral content of the diet is the main determinant of the micronutrient status of a person or a group. Deficiencies can be caused by insufficient micronutrient intake compared with the physiological need for each nutrient or excessive losses of the nutrients due to illness, poor absorption, or bleeding. Often both factors—low intake and loss—are responsible. Failure to fully address these direct causes has led to the failure of some intervention programs.*
- *Some foods (e.g., animal foods) have a higher content of micronutrients than others. Breastfeeding is a good source of micronutrients in infants and protects against infections. A deficiency in the soil (e.g., an iodine-deficient soil) can cause foods to have low nutrient content. Inhibitory factors may be present in the diet that prevent absorption of the micronutrients in food, e.g. phytates prevent iron and zinc absorption. Processing can remove these inhibitors.*
- *An increased need for micronutrients in pregnancy and during periods of rapid growth in infancy and childhood makes people in these physiological states highly vulnerable to vitamin and mineral deficiencies. A mother's nutritional status before conception and her micronutrient status during pregnancy determine the adequacy of micronutrient stores at birth for the newborn. The mother's status continues to influence the infant's status through the levels of micronutrients in breast milk. Aging populations in developed and developing countries are also experiencing significant vitamin and mineral deficiencies because of poor dietary intake and low absorption.*
- *Rapid urbanization is one of the driving forces for transitions in dietary practices, resulting in greater access to a diversity of foods, particularly livestock and dairy products, among some segments of the population and thereby potentially improving micronutrient intake. But among the urban poor, the problems of affordability and access to foods have increased the risk of poor nutrition and poor health. According to WHO/FAO (2003), "[U]rbanization will distance more people from primary food production, and in turn have a negative impact on both the availability of a varied and nutritious diet ... and the access of the urban poor to a varied diet"(WHO/FAO, 2003)*
- *Natural and man-made emergencies can create situations that lead to vitamin and mineral deficiencies. In some settings, seasonal or cyclical peaks in vitamin and mineral deficiencies are manifestations of seasonal/cyclical food access, dietary changes, and/or disease incidence.*

symptoms related to the deficiency (e.g., pallor due to lack of iron, night blindness and other signs of xerophthalmia due to lack of vitamin A, and neural tube defects due to lack of folic acid).

Globally recommended intake levels have been established for each nutrient based on the amounts needed to maintain adequate stores and circulating levels for each nutrient in a healthy population. Sometimes dietary intake of nutrients below these recommended levels is used to establish that a deficiency is present, as in the case of folate and zinc. Box 2.2 summarizes the factors that cause vitamin and mineral deficiencies.

Data Sources, Limitations, and Issues

There are important gaps in data on the changing trends in vitamin and mineral deficiencies. However, sufficient information is available to develop strategies and target programs, even while efforts are under way to obtain more complete, up-to-date, and precise data. The analyses of Mason and others (2005) and West (2002), as well as a collection of survey results from DHS and WHO MDIS (see annex A), provide useful information on the prevalence of vitamin and mineral deficiencies for more than 150 countries, even though many of the figures are approximations and are now somewhat out of date. The authors have demonstrated the validity of their models, which allows us to examine regional trends.

The tables in annex A contain some of the available data on the prevalence of vitamin A deficiency, anemia and iodine intake (as measured by urinary iodine). These tables were prepared to guide the development of country priorities for the global strategy. The figures on deficiencies are drawn from the following sources:

- Direct measurements of the prevalence of vitamin A deficiency and xerophthalmia, anemia, and iodine deficiency. These include DHS and other national or subnational surveys carried out using more or less comparable indicators, cut-offs, and age groups.

- Country or national estimates derived from equations that incorporate predisposing or other factors found to be closely related to the deficiency (e.g., infant mortality, female literacy, stunting, meat in the diet, phytate in the diet, measles immunization, and regional tendencies). This is the approach used to estimate zinc deficiency levels (IZiNCG, 2005) and vitamin A and anemia levels (Mason et al., 2005). In Mason's estimates, the equations were developed from countries with measured prevalence.
- Figures extrapolated from countries with measured prevalence having a similar demographic profile and anticipated risk (West, 2002).
- Country estimates developed for iodine deficiency using information on soil mapping, characteristics of land, extent of household use of iodized salt, and iodine deficiency levels measured in other countries in the same region (Mason et al., 2005).

The difficulty of maintaining current estimates of deficiencies requires the development new streamlined methods for data collection and/or agreement on appropriate modeling methods to simulate trends and patterns of deficiencies in a consistent and comparable manner. There needs to be consensus on the appropriate uses of biochemical and dietary measures, data on outcomes and the role of modeling in defining the prevalence of deficiencies. For example, there is concern that UI in school children does not accurately reflect population-wide coverage of iodized salt. Serum retinol is confounded by the presence of infections. Also, the use of a single blood spot to assess several deficiencies was being considered some years ago but there has been little follow up.

A major gap is the absence of dietary data. Very little representative information is available on food consumption among high-risk groups; this is a limitation in planning food fortification programs and complementary or hybrid strategies (e.g., combining fortified staple foods with home-based powders containing vitamins and minerals such as Sprinkles or supplements for young children).

It is also worth noting that relatively few data are currently available for quantifying either the joint distribution of multiple deficiencies or the impact that multiple vitamin and mineral deficiencies have on specific health outcomes. In this report, each deficiency is treated independently, although some of these nutrients affect closely related biological systems.[5]

Next Steps for Strategic Action and Research

- A monitoring and surveillance component for the proposed global strategy will be essential to track global progress and identify bottlenecks. Designing this component will involve addressing issues related to indicators, methods, and definitions. There is need for consensus on indicators to be used and standardized data collection and reporting for countries.
- Technical reviews are needed to interpret the VAD trends observed in existing data; especially trends following large-scale supplementation programs in which mortality declines

5 For example, vitamin A and zinc play important roles in maintaining different aspects of immune function, and vitamin A, iron, B12 and folate affect hemoglobin metabolism. Epidemiological studies have demonstrated that the prevalences of these deficiencies are high in the same populations, indicating that many people suffer from multiple micronutrient deficiencies at the same time.

accompany rising coverage (as expected from field trials), but serum retinol distribution does not shift in parallel.

- Mechanisms should be established for gathering and reporting data from routine surveys and surveillance for iron deficiency, zinc deficiency, folate deficiency, anemia, and intestinal parasites. More detailed dietary data should be routinely collected, disaggregated by household income and focusing on young children and women of reproductive age.
- Current prevalence data based on nationally representative surveys are urgently needed, especially for the large contributing countries of Asia and Africa, where a reduction in deficiencies is likely to take place as part of the global strategy. Funds should be set aside for baseline studies. Ideally, program process indicators and information to guide capacity building and donor support should be tracked. Low cost methods should be developed, ideally for measuring more than one deficiency at a time.
- Support should be provided to document improved functional outcomes linked to improved micronutrient indicators in key countries (e.g., reduced mortality and improved productivity, test scores and school attendance). Opportunistic strategies based on routine rather than controlled trials would be cost-effective.
- Country and regional capacity must be built to track vitamin and mineral deficiencies and the related variables especially individual quantitative food intakes in key age groups, and to make optimum use of the data to guide country programs.

Conclusions and Recommendations

- Vitamin and mineral deficiencies remain at high prevalence levels, but important progress has been made in reducing IDDs and VAD, even in remote areas. Rapid improvements resulting from programs indicate the potential to make a major contribution to global public health by reducing vitamin and mineral deficiencies. A large number of countries with sizable populations have not yet scaled up programs, except for iodized salt.
- Countries of sub-Saharan Africa and South Asia have the largest prevalence rates and the largest absolute numbers of people with vitamin and mineral deficiencies. The success of a global strategy will be determined by the ability to scale up proven interventions in these two regions.
- Considering the distribution of vitamin and mineral deficiencies among various segments of the population and various age groups, a combination of universal and targeted intervention approaches is needed. Specific approaches are needed to reach women of reproductive age, the very young, and the very poor.
- It is important to continue tracking the prevalence of deficiency diseases even after substantial reductions are achieved in order to determine whether the improvements are being sustained.
- Resources are needed for adequate baseline studies in key countries to establish current levels of vitamin and mineral deficiencies for the global strategy.
- New non-invasive, low-cost and rapid techniques need to be developed for assessing the prevalence of deficiency diseases.

3 How Can Vitamin and Mineral Deficiencies Be Reduced?

Implementing Proven Interventions at Scale

Summary of Findings

- The main options for addressing vitamin and mineral deficiencies are food fortification and supplementation. Support of optimal breastfeeding and appropriate complementary feeding are key food-based approaches that support good micronutrient status during the high risk period of infancy. Broader dietary diversification has not produced significant results at scale, and plant breeding is relatively new. Public health interventions—especially malaria control, control of intestinal parasites, and measles immunization—have helped reduce deficiency diseases.
- Databases on national coverage of programs are inadequate to assess the relative success of interventions in reaching coverage and reducing deficiencies. The notable exceptions are iodized salt and vitamin A supplementation for which evidence of coverage and impact are available. There is some evidence of the success of folic acid supplementation and fortification but no global databases so far. In countries with a high burden of vitamin and mineral deficiencies, there is strong evidence that fortification and supplementation have been effective. Dramatic reductions in national indicators of childhood mortality and the virtual elimination of clinical deficiencies of iodine and vitamin A have proved the effectiveness of these interventions on a large scale in countries as diverse as Nepal, Nicaragua and Tanzania.
- The number of countries with iodine as a public health problem declined substantially from 1993 to 2003; although these countries may still have pockets of iodine deficiency requiring targeted attention. Most countries with scaled-up high-coverage vitamin A supplementation have linked supplementation with routine immunization or immunization campaigns, or both, at least initially. However, several large, high-burden countries have reached coverage of only 50 percent or less, a level that will probably not produce the expected declines in mortality.
- In high-burden countries, prenatal iron and folic acid supplementation is being attempted, but there is little evidence of impacts. Problems include irregular supplies and noncompliance. Folic acid fortification is likely to have been more cost-effective than supplementation in the few countries where it has been implemented and this needs to be evaluated. Iron and the B vitamins fortification of cereal flours and condiments has been implemented in several countries, but the coverage of fortified products is not well documented. Vitamin-A-fortified sugar has been successful in Central America; fortified vegetable oil is widely used in food distribution programs and is expanding commercially in Asia, Africa and Latin America. Zinc supplementation is being launched as part of the control of diarrhoeal disease (CDD) efforts; in several countries, the supplement is added to premixes for cereal fortification. Supplements and fortified foods have successfully prevented the emergence of vitamin and mineral deficiencies common in emergencies according to the World Food Programme.

- The available data on the progress of programs do not provide a complete picture. Many more countries than reflected in current databases have achieved good vitamin A supplementation and iodized salt coverage. It is necessary to define the various kinds of programs currently being implemented and to track their progress systematically, beginning with the high-burden regions of South Asia and sub-Saharan Africa.
- Mandatory public-sector-led food fortification and voluntary industry-led fortification have both demonstrated results. The success factors for fortification programs are availability of suitable food vehicles (i.e., centralized processing and widespread regular consumption); adequate food regulations and labeling; public awareness and demand; quality assurance and monitoring to ensure shelf life and adequate levels of micronutrients; compliance; and advocacy based on evidence of positive impact. Building strong public-private partnerships is a critical first step.
- The majority of supplementation efforts targeting high-risk groups are public health programs linked to antenatal care or immunizations. Success factors for supplementation programs are assured supplies; trained frontline providers; proactive outreach combined with social mobilization; consumer/target group awareness and compliance; listing/registration of eligible women and children; and regular monitoring of coverage.
- Iodized salt and vitamin A supplementation have both achieved scale. The common factors that appear to have helped in scaling up were strong evidence of impact; low-cost, affordable, and streamlined interventions that could be easily adapted to existing delivery channels; advocacy; documented progress in coverage; leadership in support of the intervention programs at the global and country levels; social mobilization and public awareness; and well-coordinated donor support sustained over several years.

Review of Evidence

The principal options for delivering micronutrients are food fortification and supplementation[6]

The feasibility and effectiveness of the available options vary in different settings, even within countries. Countries are combining and adapting various approaches to suit their local contexts. A growing proportion of the population in many countries fulfills its vitamin and mineral needs through diet, including various kinds of fortified foods complemented with supplements. Strategy development to accelerate progress should be based on a good understanding of age and income disaggregated data on deficiencies and dietary deficits as well as patterns of food consumption and supplement use.

6 The following are the primary references for this section:]Proceedings of the 20th IVACG Meeting, 2002; Per Pinstrup-Andersen and R. Pandya-Lorch 2001, The Unfinished Agenda; UNICEF/UNU/WHO/MI Preventing Iron Deficiency in Women and Children, 1998; Aguayo et al 2005; Dary et al, 2005; Lutter, 2006; Sanghvi T. and P. Harvey, 2006; HKI, MI, MOST, World Vision and CARE Reports; Mannar MG. and R. Sankar, 2004. Micronutrient fortification of foods--rationale, application and impact. Indian J Pediatr. 2004 Nov;71(11): 997-1002.; MI/UNICEF 21 Country Assessment, 2005; Houston/MOST, 2004; World Bank 2006; Thapa et al 2005; Mora and Bonilla, 2002; Zlotkin et al, 2005; Galloway R, 2003. Anemia Prevention and Control: What Works?; Deitchler M. et al 2004; Darnton-Hill I and R. Nalubola, 2002. Fortification strategies to meet micronutrient needs: successes and failures. Proc Nutr Soc. 2002 May;61(2): 231-41; and Gibson R 2004.

Fortification of foods can provide a substantial proportion of the required nutrients without changing food habits.

Table 3.1 provides an example of the range of products being fortified in countries of the Africa region. Proper choices of fortificant and processing methods are necessary to ensure the stability and bioavailability of nutrients. The level of fortification should take into account variations in food consumption to ensure safety for those at the higher end of the scale and impact for those at the lower end. Fortification must be supported by adequate food regulations and labeling, quality assurance and monitoring to ensure shelf life and adequate levels, public education, compliance and desired impact. In industrialized countries, food fortification has played a major role in the substantial reduction and elimination of a number of micronutrient deficiencies.

Table 3.1 *Overview of Fortified Products in the Africa Region, 2005*

COUNTRY/REGION	WHEAT FLOUR	MAIZE FLOUR	VEGETABLE OIL	SUGAR	PALM OIL
ECSA*	■	■	■	■	
Burkina Faso					■
Eritrea	■				
Ghana	■		■		
Kenya	■	■ (maize porridge)	■ (margarine)		
Malawi			■		
Morocco	■		■		
Namibia		■			
Nigeria	■	■	■ (margarine)	■	
S.Africa	■	■	■ (margarine)		
Uganda		■	■	■	
Zambia	■	■		■	
Zimbabwe		■	■ (margarine)		

** Eastern, Central and Southern Africa region.*

Source: Dary, 2006.

Starting in the early part of the 20th century, fortification was used to target specific health conditions: goiter with iodized salt; rickets with vitamin D-fortified milk; beriberi, pellagra, and anemia with B vitamins and iron-enriched cereals; and neural tube defects (NTDs) with folic-acid-fortified flour (Darnton-Hill and Nalubola, 2002). It has taken more than five decades to expand fortification in developing countries. Constraints have included the lack of appropriate centrally-processed food vehicles, less-developed commercial markets and technology, and relatively low consumer awareness and demand. The long-term sustainability of fortification programs is ensured when consumers are willing and able to bear the additional cost of fortified foods.

Lutter (2006) identified the importance of specially formulated fortified foods for infants and young children. She suggests that macro- and micronutrient composition and the cost of products marketed to urban populations will determine the success of this approach. In the high-burden countries of South Asia and sub-Saharan Africa, changes in complementary feeding practices will need to be encouraged, where delayed introduction of complementary feeding and the use of liquids/low-density products are common.

Vitamin and mineral mixes in powder form or "sprinkles" provide a well-tested vehicle to improve micronutrient status in children ages 6–24 months (Zlotkin et al., 2005) that could be expanded quickly. Pastes containing micronutrients in combination with protein and fats are likely to improve growth and micronutrient status, but they are more expensive and thus may not reach those in need through commercial channels (Huffman, 2006)[7].

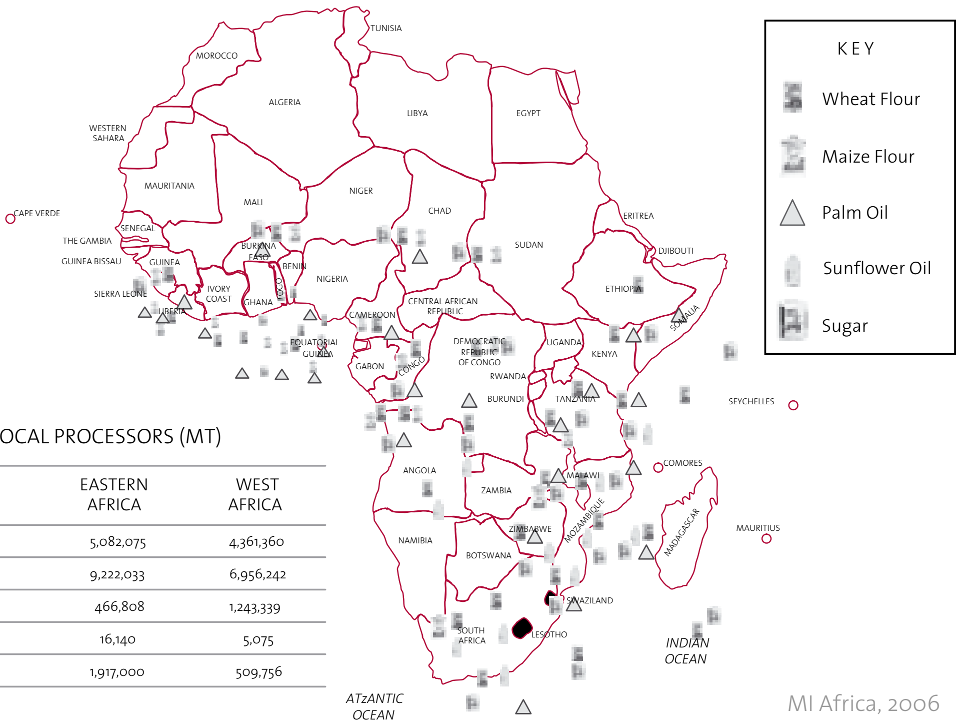
According to Mannar and Sankar (2004, p.997), "[A]lthough a growing number of large-scale fortification programs in different parts of the world are beginning to demonstrate impact at the biochemical level and are leading to the elimination of several nutrient deficiencies, food fortification remains an underutilized opportunity in many developing countries." But this is changing. The Micronutrient Initiative (MI) has systematically mapped the producer and importer countries and trade flows of key food vehicles in the Africa region (Marshall, 2006) (see map 3.1).

There is growing support in Asia for public-private partnerships (e.g., the Philippines, India, and others through GAIN, MI, ILSI, and MOST/A2Z) and regional organizations such as NEPAD and ECSA. MI and others have supported the expansion of new products for large public-sector social programs, such as Integrated Child Development Services (ICDS) in India, as well as commercial marketing of staples and targeted foods at a reasonable cost. Specific issues are beginning to be identified at the regional and country levels, and a number of workshops and meetings have been held in Latin America, Asia and Africa. Table 3.2 describes key fortification issues identified for Africa.

The recent developments bode well for the achievement of scale and impact, especially if adequate monitoring and evaluation guide the expansion and targeting of operational elements of strategies. Joint monitoring and evaluation plans should be developed and baselines established during the initial phases of launching a coordinated global strategy.

7 There are also other presentation options, such as dispersible tablets (see IRIS study, UNICEF). These new approaches are promising and are being documented for effectiveness. Spreads are currently used for the treatment of malnutrition. On-going studies are looking at their preventive uses. However the cost may be a limitation. Research is still needed to explore all possibilities of increasing micronutrient intake, especially during the complementary feeding period (Bruno deBenoist, personal communication, 2006).

Map 3.1 *Potential Food Vehicles for Fortification in Africa*



VOLUMES PRODUCED BY LOCAL PROCESSORS (MT)

	SOUTHERN AFRICA	EASTERN AFRICA	WEST AFRICA
WHEAT FLOUR	4,315,263	5,082,075	4,361,360
MAIZE FLOUR	12,336,690	9,222,033	6,956,242
PALM OIL	327,387	466,808	1,243,339
SUNFLOWER OIL	931,453	16,140	5,075
REFINED SUGAR	4,647,308	1,917,000	509,756

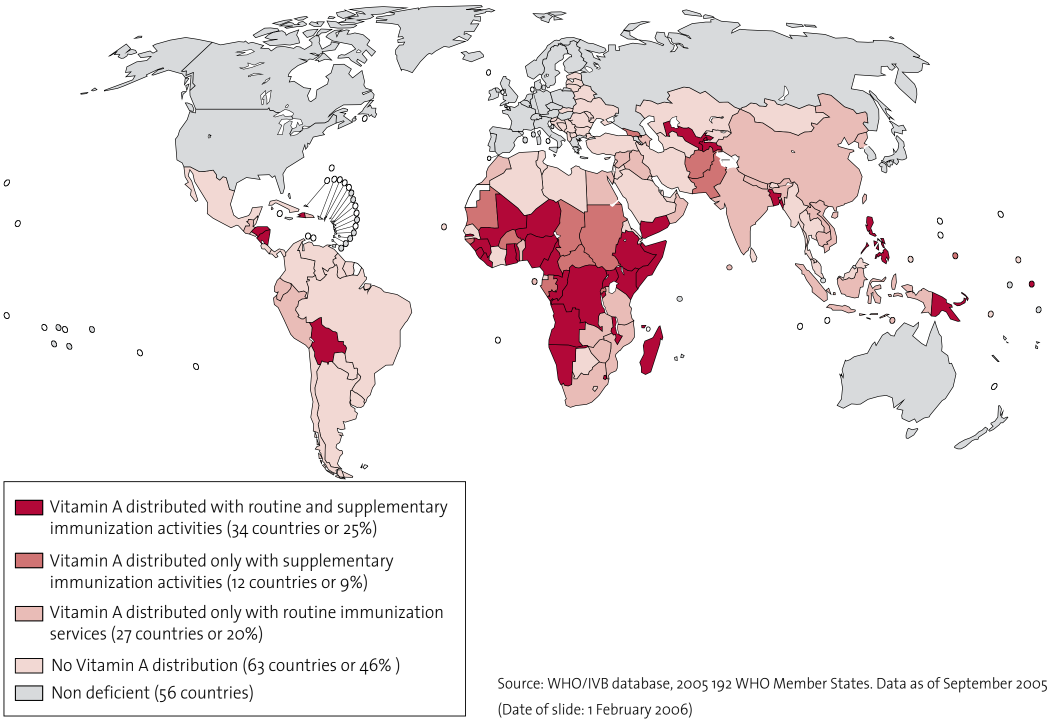
Table 3.2 *Examples of Key Issues in Fortification in Africa*

ISSUES	RECOMMENDED ACTIONS
Need for advocacy for resources and supportive policies for food fortification.	Develop food fortification policy and action plans at the African and Regional Economic Community (REC) levels. Document impact and cost-effectiveness of food fortification in the elimination of vitamin and mineral deficiencies.
Engagement of the private sector to play a significant role in food fortification.	Support harmonization of food fortification standards and develop enforcement capacity at REC level through strategic relationships with RECs. Develop regionwide markets for fortified food products by creating an investment climate. Actions would include supplying loans; removing tariff and non-tariff barriers; and building consumer demand, including regional logos and certification systems.
Need for building human resource capacity to advance the food fortification agenda.	Identify key capacity areas and competencies required for specific operations and positions. Develop an Africa-wide training program that includes both short-term and long-term training as well as mentoring. Lobby and support governments, development agencies, and the private sector in providing incentives for retention of specialized personnel.

Source: NEPAD/MI/GAIN, 2006.

Oral supplements can be provided through health services to prevent or treat specific deficiencies. Biannual vitamin A supplementation has been successfully scaled-up through outreach activities of peripheral health centers in combination with catch-up rounds for immunization with intensified community mobilization. Map 3.2 shows the global coverage of vitamin A supplementation linked to immunization.

Map 3.2 *Regional Patterns of Vitamin A Supplementation Linked to Immunization*



Source: WHO/IVB database, 2005 192 WHO Member States. Data as of September 2005 (Date of slide: 1 February 2006)

According to the WHO database (2004), of 196 countries with data, about 40 percent provided vitamin A supplements linked to routine immunization or immunization campaigns, or both. More than 60 countries did not link vitamin A to immunization; other countries were not classified as deficient. Prenatal iron supplementation is a universal part of antenatal care policies, but only about 40 countries report data on consumption of prenatal iron supplements (see annex A) using DHS and other surveys, and most have very low coverage. More than 22 countries have adopted public health policies for iron supplementation for infants and pre-school children, but few implement such programs (UNICEF et al., 1998). Programs for improving folate nutrition have been introduced in about 40 countries; these are estimated to account for less than 10 percent of NTDs caused by folate deficiency (Oakley et al., 2004).

Immunization campaigns are a major delivery channel for vitamin A. The available data indicate that immunization campaigns are an important delivery mechanism for vitamin A (table 3.3 and map 3.2), but they are likely to be phased out or redirected to new disease control initiatives. They are not a stable platform on which to build an ongoing strategy. A clear strategy and joint efforts by stakeholders to initiate new mechanisms would be timely.

Table 3.3 *Proportion of Vitamin A Doses Delivered via National and Sub-national Immunization Days*

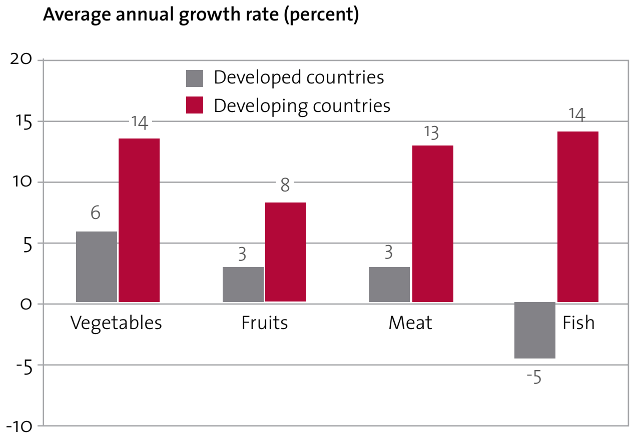
REGION	2004	2005	2006
Africa: Eastern, Central, and Southern	14%	18%	14%
Africa: West	86%	88%	91%
Asia: East and Southeast	0%	0%	0%
Asia: South	47%	33%	33%
Latin America and the Caribbean	0%	0%	0%
Total	39%	38%	37%
Exclusive of India	49%	48%	47%

Source: UNICEF 2005, as presented by MI 2005.

In theory, activities to enhance dietary diversification are an attractive option for improving micronutrient status, but these have proved difficult to evaluate. Data on the extent and forms of micronutrients in plant-based diets show that it is virtually impossible to correct vitamin and mineral deficiencies through dietary changes. Young children in particular, who have enhanced physiological needs and limited capacity, find it difficult to consume the required amounts of plant foods (IVACG, 2002). However, improving diets to raise micronutrient intake and increasing the use of foods that enhance absorption for the purpose of improving the efficacy of fortified products and supplements are valid objectives of public education and dietary counseling programs. People will be able to obtain sufficient micronutrients from a combination of food sources, fortified products, and supplements.

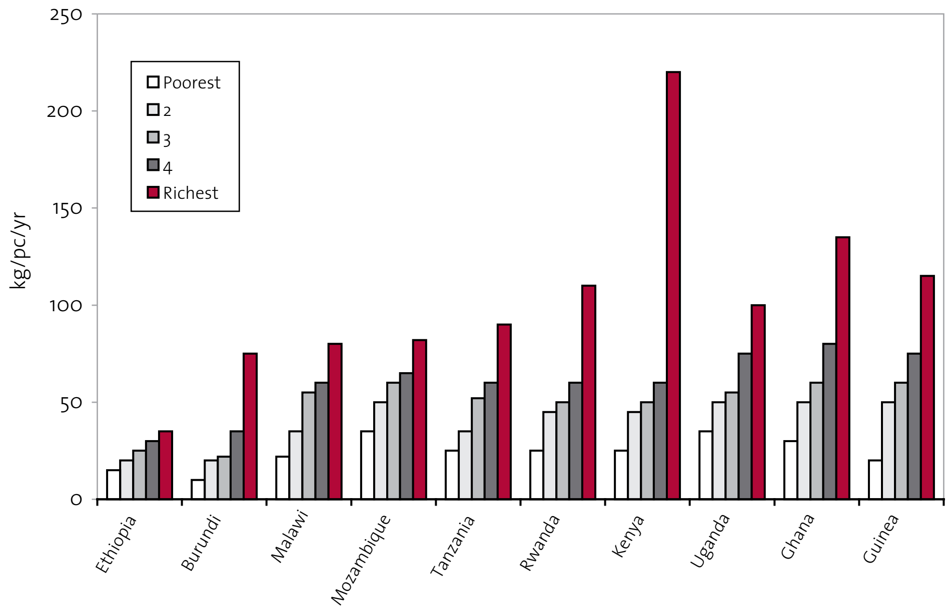
Recently, consumer demand for micronutrient-rich foods of animal origin has accelerated. The livestock and dairy industries have expanded in response to burgeoning demand from consumers in developed and developing countries. Annual production of fruits and vegetables, meat and fish has accelerated in developing countries (figure 3.1) There is some evidence that fruit and vegetable consumption is higher in upper income households in sub-Saharan Africa (figure 3.2); and the gap in micronutrient intakes between the rich and poor households may have increased. It appears unlikely that increased consumption is a result of attempts to improve dietary diversity through traditional nutrition education efforts, as there is little evidence that these programs have achieved sufficient scale. Analysts believe that the increased consumption is the result of low costs of production and marketing, affordable prices, and the image of these foods as prestige foods. The recent trend toward centrally managed purchasing in the food retailing sector (namely, through large supermarket chains in developing countries) offers a new opportunity for market-based improvements in micronutrient intake (see figure 3.3).

***Figure* 3.1** *Increased Production of Micronutrient Rich Foods*



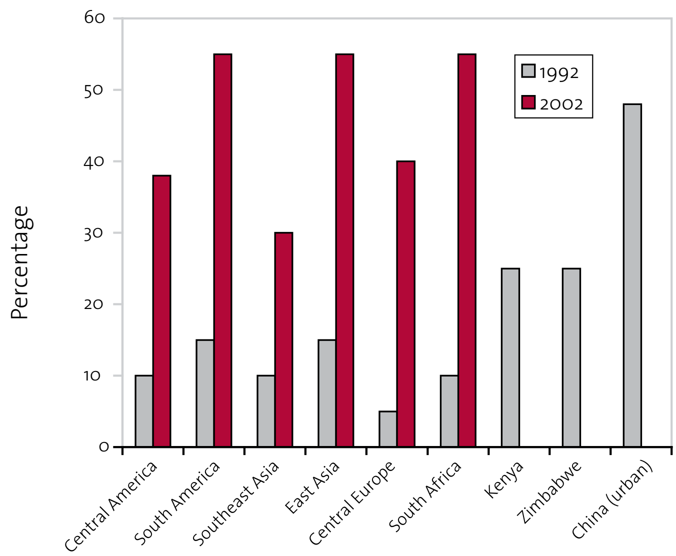
Source: FAOSTAT 2005

Figure 3.2 *Differential Intakes of Fruits and Vegetables by Household Income in Africa*



Source: Ruel et al 2005

Figure 3.3 *Growth of Retail Food Sales Through Supermarkets in Developing Countries*



Source: Reardon and Timmer et al, 2003.

The composition of foods can be modified through selective plant breeding and genetic modifications, or biofortification.[8] While traditional staples tend to be low in micronutrients, biofortification (the development of food crops rich in bioavailable micronutrients, through either conventional breeding and selection or transgenic techniques) is showing promise. Although the levels of micronutrients are unlikely to reach those that can be achieved through commercial fortification, once they are developed and integrated into agricultural systems, biofortified cultivars can be incorporated rapidly into the diets of vulnerable groups with important health benefits.

Some health interventions have been important adjuncts for reducing vitamin and mineral deficiencies. Health interventions—especially measles immunization for vitamin A deficiency, de-worming for anemia and vitamin A deficiency, and malaria treatment for severe anemia in Africa—have documented impacts on deficiency diseases such as anemia and vitamin A deficiency (VAD). In addition, there is strong evidence that infant feeding practices, especially optimal breastfeeding and appropriate complementary feeding, are closely related to micronutrient status. Epidemiological evidence of causality and program results suggest that country strategies for reducing vitamin and mineral deficiencies should explicitly link with these maternal and child health (MCH) and nutrition services, or vitamin and mineral deficiencies are likely to persist.

Strategies for delivering vitamins and minerals have adapted to new opportunities and evidence. Delivery strategies for interventions that address vitamin and mineral deficiencies have evolved considerably over the past 30 years (see table 3.5). New research in the 1970s and 1980s suggested that even where clinical forms of vitamin and mineral deficiencies were not widespread, they could cause functional damage in humans. This finding completely changed the perception of the problem. It suggested that a much larger proportion of the population needed to be reached and transformed the way intervention programs were designed and implemented. The emphasis shifted away from simply detecting xerophthalmia and treating it with vitamin A, for example, to universal biannual doses of vitamin A. A similar shift occurred with goiter and anemia, as intervention strategies sought to provide universal coverage.

Food fortification emerged as one of the most cost-effective interventions and one that could achieve scale rapidly if foods commonly consumed by a large proportion of the population were fortified. This led to a new appreciation for the role of the private sector in reducing vitamin and mineral deficiencies. There is growing emphasis on community mobilization and raising public awareness, not only to promote fortified products and motivate uptake and compliance with supplementation protocols, but also to generate ownership and commitment at the community, district, and national levels.

New products, market channels, and health delivery approaches have opened up more options to meet country-specific needs. For example, a broader array of fortified staple foods and specially formulated foods and supplements is now available through a larger number of producers. Processes and frameworks for successful industry-led and government-supported strategies are delivering micronutrients in various country settings. Better coverage has recently been documented among high-risk groups, even in remote areas, using intensified outreach from health

8 The obvious advantages and recognized potential of this approach to address vitamin and mineral deficiencies (Welch and Graham 2004) have recently attracted many advocates, donors, and commercial interests; it is considered a promising approach for the long term.

facilities to deliver micronutrients. Several large countries in South Asia offer government-supported program platforms—such as Integrated Child Development Services (ICDS) in India, Lady Health Visitors (LHVs) in Pakistan, and Female Community Health Volunteers (FCHVs) in Nepal—that are capable of reaching a substantial segment of the vulnerable population.

Safety concerns for micronutrients have surfaced periodically, and WHO has addressed them appropriately. Two recent studies have highlighted the importance of supporting the responsible use of supplements where infection rates are high (Zvitambo and Pemba studies). WHO has been at the forefront of interpreting safety concerns arising from research findings. However, there is currently no central authority or mechanism to help countries manage these issues programmatically in the field. Recognized safety issues are summarized in table 3.4.

Table 3.4 *Safety Issues*

MICRONUTRIENT	ISSUE	EVIDENCE
Vitamin A	Toxicity from excessive intake from high-dose capsules that can cause fetal abnormalities or bone fragility. Acceleration of HIV/AIDS infection in neonates of supplemented mothers.	No confirmed evidence of toxicity in currently implemented programs. New U.S. survey data (Briefel et al 2006) show dietary excess in young children above recommended levels. The Zvitambo (2006) study in Zimbabwe indicates adverse events in a small proportion of infants of HIV-positive mothers.
Iron	Iron toxicity in young children from accidental excessive intake of tablets or syrup. Increased morbidity in iron-replete young children where malaria is endemic.	The United States has few cases of overdosing; emergency medical services use simple methods to remove the excess iron to prevent serious effects. The Pemba study (2006) in Tanzania shows deleterious effects on malaria progression in children.
Iodine	Excessive iodine that causes hyperthyroidism, tremors, and nodules, especially in the elderly and where low iodine intake has been endemic for a long time.	Iodine-induced hyperthyroidism (IIH) is the most common complication of iodine prophylaxis; it has been reported in some iodine supplementation programs in their early phases. Excess iodine in salt can result from not adjusting added levels to account for greater stability of iodine in processed, refined salt.
Folic Acid	Excess can interfere with vitamin B12 metabolism and neurologic functions. The US Food and Drug Administration (FDA) has set a safe upper limit of consumption at 1 mg/d of folic acid.	Cases of pernicious anemia incorrectly treated with folic acid instead of B12 demonstrated adverse effects; needs further study
Zinc	Interactions with iron. Effects of excess zinc intakes on the immune system as indicated in the literature.	None; there are no large-scale programs in operation

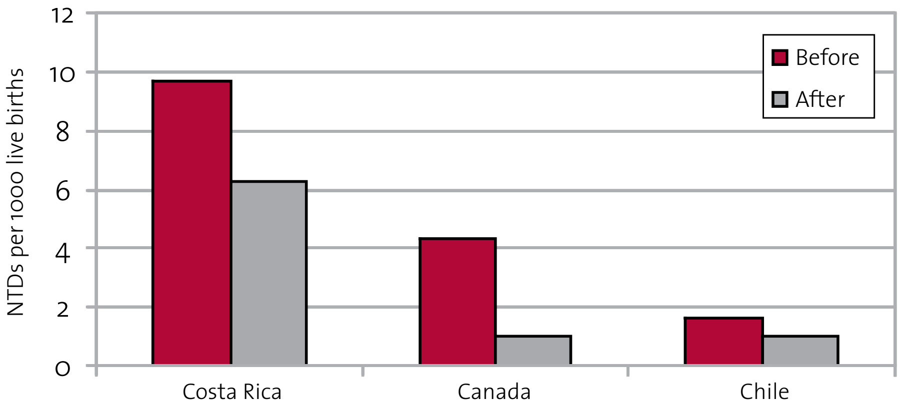
Source: WHO website and published documents.

What is the evidence of effectiveness in large-scale programs?

Fortification has reduced vitamin and mineral deficiencies in all geographic regions. Developed countries have benefited from fortification for more than 80 years, and food fortification has been in place in selected countries of Latin America for more than 30 years. In the early 20th century in Switzerland, school children had a high prevalence of goiter, and 0.5 percent of the population had cretinism. When salt iodization was introduced in 1922, the prevalence of goiter and deaf mutism in children dropped dramatically. Since then, salt iodization has been sustained and the population of Switzerland has achieved adequate iodine status. Recently, several countries have documented a reduction in NTDs following folic acid fortification of cereal flour (figure 3.4).

The addition of vitamin D to milk in Canada and the United States started in the 1930s, and virtually eliminated childhood rickets, although rickets is re-emerging as a public health problem. In the 1930s, beriberi, riboflavin deficiency, pellagra, and anemia were public health problems in the United States, leading to the decision to add thiamin, riboflavin, niacin, and iron to wheat flour. In the United States and Europe, a diverse diet containing animal foods plays a role in ensuring micronutrient status, but fortified cereal products still make an important contribution.

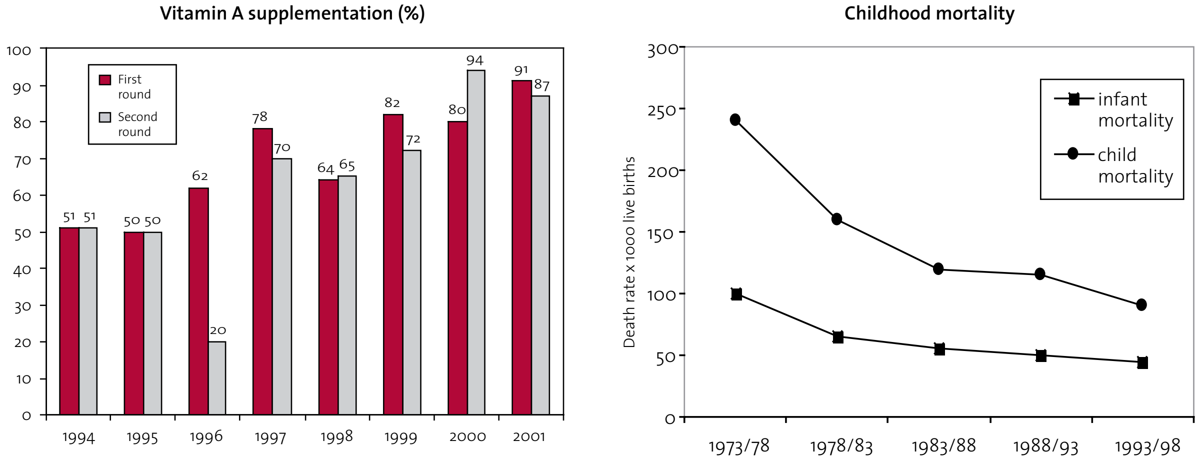
Figure 3.4 *Annual Rates of Neural Tube Defects Before and After Folic Acid Fortification*



Source: PAHO/CDC/MOD/UNICEF/INTA, 2003

Supplementation programs for vitamin A have been followed by mortality declines. The predicted reductions in under-five mortality from vitamin A supplementation (Beaton et al., 1993) have been validated through recent DHS surveys e.g. in Tanzania that document shifts in child mortality trends paralleling the scaling up of vitamin A supplementation in several countries. Figure 3.5 provides data from Nicaragua. Thapa and others (2005) showed a stepwise relationship between vitamin A coverage and mortality levels in Nepal based on data from DHS surveys.

Figure 3.5 *Rising Vitamin A Coverage and Childhood Mortality Decline in Nicaragua*



Source: Ministry of Health, Nicaragua; Mora and Bonilla, 2002; DHS/MACRO.

A substantial proportion of all vitamin A supplementation is carried out with immunization activities twice annually. Since 1987, WHO has advocated the routine administration of vitamin A with measles vaccine in countries where vitamin A deficiency is a problem. The first dose of vitamin A is given with measles vaccination at about 9 months of age; children ages 1–5 years receive vitamin A doses through intensified outreach every six months (Goodman et al., 2000).

Lessons learned about scaling up

Public education and social mobilization are critical but often neglected components of supplementation and fortification activities. Community mobilization for vitamin A and demand creation for fortified products are key components of effective strategies. National and district budgets seldom provide adequate resources for these activities. See box 3.1.

Monitoring and evaluation are important program components that can facilitate scaling up but require ongoing attention. Emphasis on surveillance in universal salt iodization (USI) programs helped maintain a focus on problem-solving as large-scale programs for iodized salt were rolled out. Where salt iodization has been in place for more than five years, improvement in iodine status has been clearcut. Over the past decade, the number of countries with salt iodization programs has doubled, rising from 46 to 93. As a result, 68 percent of the 5 billion people living in countries with iodine deficiency disorders (IDDs) have access to iodized salt, and the global rates of goiter, mental retardation, and cretinism have fallen.

Vitamin A supplementation was scaled up at the global level following the meta-analysis of Beaton and others (1993). In early-implementation countries, evaluation data were used to initiate action. For example, nationwide vitamin A supplementation was initiated as a result of two key studies on child mortality in Nepal. A unique characteristic of this program was the use of monitoring data for program advocacy; use of data in this way helped obtain resources and motivated staff to maintain high coverage (BASICS II/MOST, 2004).

Progress has been substantial in identifying and improving the use of common indicators among stakeholders. However, technical issues related to methods, interpretation, and comparability must be addressed on an ongoing basis. For example, the complex etiology of anemia requires the use of locally appropriate indicators and methods, and these may not be comparable across programs and countries. The precision of iodized salt testing kits and standard approaches to using different-colored vitamin A capsules to help recall vitamin A supplementation in DHS and similar surveys have created problems of consistency in the field. Greater attention needs to be given to the quality of data.

An issue that has concerned public health leaders in countries such as the Philippines and Zambia is related to the evaluation of vitamin A supplementation using serum retinol as the indicator of VAD. Technical discussion at the global level is needed to clarify how best to capture the success of vitamin A supplementation in reducing VAD at a time when clinical signs are no longer common. Box 3.2 summarizes an example from the Philippines that reflects current thinking.

BOX 3.1

Mobilizing Communities: The Vitamin A Project in Nepal

The ongoing success of vitamin A supplementation at national scale over several years is partly due to an innovative communication approach.

- *The management body developed a unique and respectful relationship with the primary outreach workers, the Female Community Health Volunteers (FCHVs). The program staff were treated as they were expected to treat mothers.*
- *Training for field workers was highly participatory, involving extensive role-plays designed to build confidence, support, and a sense of ownership of the program. The approach was entertaining and empowering. These attitudes and approaches led to high levels of motivation among the FCHVs, who then motivated and organized others.*
- *The program featured creative media and communication approaches combined with carefully field-tested materials and messages to popularize desired behaviors.*
- *At the community level, special outreach efforts were held in hard-to-reach communities often neglected by local programs. The program achieved and maintained high levels of coverage and produced epidemiologically significant outcomes.*
- *The periodic reporting of evidence-based results formed the underpinnings of advocacy at the district and national levels.*

Source: BASICS II/MOST, 2004. Nepal Child Survival Case Study.

Vitamin A supplementation was accelerated with the help of free or subsidized capsules. Global expansion took off when donors pledged free supplies of vitamin A if countries linked polio national immunization days (NIDs) and routine immunization with vitamin A supplementation. Within a two- to three-year period, a large number of countries reached millions of children through polio campaigns. However, the trends documented by WHO (Goodman, 2006) reflect instability and frequent transitions between any supplementation, routine immunization-linked supplementation, and supplementation with biannual events or immunization campaigns. Immunization campaigns have been unpredictable and the addition of vitamin A to these campaigns is idiosyncratic.

Partnerships have been crucial to success. In both salt iodization and vitamin A supplementation, progress has been dramatic since global partnerships were formed. To control IDDs, universal salt iodization (USI) was adopted in 1993. Alliances among UN agencies (WHO, UNICEF, and the World Bank); Network for Sustained Elimination of IDD; the International Council for Control of Iodine Deficiency Disorders (ICCIDD); international and bilateral agencies (e.g., USAID and the U.S. Congress); and the salt industry have helped countries put permanent national salt iodization programs firmly in place. Global standards, guidelines, tools, and resources have been provided by international agencies. These agencies have helped public health authorities in various countries successfully partner with the salt industry and have provided critical technology and technical inputs.

Clear evidence of the mental and physical damage done by IDDs, along with mandatory fortification, fueled the momentum for scaling up iodized salt programs worldwide. Salt iodization has proved to be highly cost-effective and feasible for producers, consumers, and governments. Led by a strong global partnership (USI) and with the support of WHO, UNICEF, bilaterals, and private donors (e.g., Kiwanis International and the Gates Foundation), countries began to mandate iodization of salt. Coverage with iodized salt increased substantially after 1990. Forty-three of 126 countries with national data documented adequate levels of intake (WHO Iodine Database, 2004). Iodized salt coverage exceeded 75 percent in 26 countries in 2004. The number of countries with iodine as a public health problem decreased from 110 to 54 during 1993 to 2003; although these countries may still have pockets of iodine deficiency that require targeted support. Constraints to reaching all target groups with iodized salt include the difficulty of equipping, staffing, and monitoring small-scale production; the lack of consumer awareness and demand; no or weak legislation, or legislation not implemented; and inadequate technical support and accountability.

BOX 3.2

Evaluating Successful Vitamin A Supplementation Programs

The prevalence of vitamin A deficiency as measured by serum retinol in children ages one to five years in the Philippines rose from 35.8 percent to 38 percent between 1993 and 1998, despite a twice-yearly universal vitamin A capsule distribution program. In-depth analysis showed that there was a detectable impact in groups with the highest prevalence of vitamin A deficiency and that it lasted up to four months after dose administration. In highly urban cities in Visayas, where very high prevalences were found, the prevalence was reduced from 27 percent to 9 percent one to two months after distribution of vitamin A capsules, and to 16 percent at three to four months. Two concerns have been raised following this analysis: (1) the uneven level of magnitude of the effect of high-dose vitamin A capsules, and (2) the fact that the effect did not persist for six months, which is the interval between doses. The authors note that with more frequent dosing, especially for those most deficient, a progressive reduction in vitamin A deficiency may occur. The policy implication arising from these results is that a shift in resources is warranted. In areas of low prevalence of vitamin A deficiency, distribution of vitamin A capsules should be targeted to deficient children only. In areas of high prevalence, vitamin A capsules should be distributed to children ages one to five years at least three times a year.

Source : Pedro et al, 2006.

Sustainable programs are important; micronutrient interventions must be maintained in perpetuity, or the deficiencies will reappear. These interventions are unlike disease eradication strategies, such as the eradication of smallpox and polio, and the subsequent elimination of the need for smallpox and polio vaccines. The human body cannot manufacture these vitamins and minerals to meet critical life functions; they must be consumed through food or by supplementation. Because of the need to build permanence in this sector and the vulnerabilities of public-sector delivery systems, interest is increasing in strengthening both public- and private-sector delivery systems.

Where fortification programs have been in place, continued advocacy on behalf of fortification is important. In India, salt iodization was once mandatory; later, the ban on uniodized salt was lifted, leading to increases in iodine deficiency.

To facilitate sustainability, policies must be continuously monitored. Public education and the awareness, motivation and capacity of health providers play important roles. Data and results from monitoring systems can be effectively used in advocacy for ongoing support.

In programs of iron supplementation for women, ensuring supplies, providing appropriate counseling on compliance, and mobilizing communities are key to impact. Iron supplementation programs for pregnant women are among the oldest micronutrient interventions still being implemented worldwide. In recent years, countries have embarked on iron supplementation programs for adolescents and young children as well, and there is evidence of impact. Experience has provided useful lessons. For decades, prenatal iron supplementation was a neglected program; it was embedded in routine antenatal care but was poorly implemented. Supplies of iron supplements were unreliable and of poor quality, and the program was not considered a high priority. This may be changing now.

For example, in Nicaragua, during 2000–2003, several indicators related to iron deficiency anemia improved nationwide. Coverage with prenatal iron rose from 70 percent to 88 percent, and the prevalence of anemia in pregnant women fell by one-third (MOH, 2003; Mora et al., 2004). Coverage of children ages 6–59 months with iron supplements improved from 37 percent to 62 percent, and anemia fell from 29 percent to 23 percent. During this period, breastfeeding duration and vitamin A coverage through fortified sugar and supplements also increased, which may explain some of the reduction in anemia.

In India, UNICEF assisted national efforts to intensify programs for adolescent girls ages 10–19 years in seven states. All programs provided weekly iron and folic acid (IFA) supplements, and one state provided daily IFA tablets, as well as albendazole to treat worm infestation (UNICEF, 2004). All assessments showed a decrease in anemia prevalence. The decrease varied from 5 percent in Jharkhand state to 40 percent in Andhra Pradesh state after one year. Andhra Pradesh also conducted an assessment two years later and reported a total reduction of about 70 percent in anemia. Programs conducted through schools showed greater impact than non-school-based programs, achieving a more than 20 percent decrease in prevalence of anemia. Moderate and severe anemia decreased in all but one program.

Thailand has addressed nutrition in national development policies and plans since the mid-1970s. Anemia is still widespread and observed in almost all vulnerable groups, but there is an improving trend in all regions of the country. Data from national nutrition surveys and routine Ministry of Health (MOH) data show a consistent decline in anemia prevalence among pregnant Thai women during 1986–1996 (MI, 2004). The program initially consisted of surveillance and iron supplementation; fortification has been added.

The effectiveness of weekly iron supplementation in women of reproductive age in three Asian countries has recently been documented by Cavalli-Sforza and others (2005). Social marketing and community mobilization were strong elements of the programs.

For preventive vitamin A supplements for children, community mobilization and well-planned outreach sessions at least twice yearly are important. Once polio campaigns began to be phased out, countries developed plans to continue high coverage strategies for vitamin A supplementation. Child health days/weeks/months were seen as a twice-yearly outreach session during which immunization, vitamin A, de-worming, and other services and information could be provided, especially to hard-to-reach communities.

The Nepal vitamin A supplementation program was introduced in the poorest districts in 1993 (even before polio NIDs) and was phased in to reach almost national coverage by 2001. Coverage has remained high, attributed to a system of resident female community health volunteers trained to administer vitamin A with supervision from health authorities on two fixed days each year. The volunteers know the eligible children in their communities and monitor their need for supplementation. Analysis of child mortality trends based on consecutive DHS surveys shows a reduction in child mortality of 50 percent among children who receive two doses of vitamin A in the period from ages 6 to 59 months (Thapa et al., 2005).

In Vietnam, biannual vitamin A supplementation rounds were implemented through NIDs and micronutrient distribution days from 1993 to 1997 (Ching et al., 2000). National protein-energy malnutrition (PEM) and VAD surveys carried out in 1985, 1988, and after vitamin A supplementation in 1993–94 found that night blindness, Bitot spots, and corneal scars had declined by 87–90 percent following supplementation.

In Nicaragua, strong partnerships helped achieve and maintain high coverage of the vitamin A supplementation program.

Lessons learned from a large number of countries that followed this model of twice-yearly supplementation have found the following components to be key aspects of success: bringing services closer to communities through a variety of extended outreach mechanisms at fixed times during the year; monitoring and frequent review of coverage; communication and community mobilization; logistics and financing; and training and supervision (Houston/MOST, 2003). Leadership and partnerships across sectors have helped several countries sustain these programs over several years.

How have micronutrients been delivered during emergencies?

Fortification of donated food resources is key to preventing deficiencies. For many years, donated commodities did not contain vitamin and mineral premix. As evidence was reported of deficiencies in vitamins A, B, and C, international donors and NGOs took steps to ensure fortification or supplementation as integral elements of relief efforts. The World Food Programme (WFP) has implemented local processing and fortification in Angola, Bangladesh, India, Nepal, and Zambia, and in the southern Africa regional drought emergency.[9] The experience shows that local fortification is possible but challenging. Specifically, the challenges involve technical and managerial capacity constraints, lack of compliance with procurement specifications and quality control, unclear policies on micronutrient content labeling, and inadequate cash resources to support many aspects of local processing and fortification activities. Blended and fortified foods typically given during an emergency now contain added vitamin A, thiamine, riboflavin, niacin, vitamin C, folic acid, iron, iodine and zinc.

9 Partly adapted from WFP WFP/EB.A/2004/5-A/2 Micronutrient Fortification:WFP Experiences and Ways Forward. April 2004. Also see WHO/UNICEF/WFP Joint Statement on Multiple Vitamin and Mineral Supplements for Pregnant and lactating Women, and for Children aged 6 to 59 Months, 2005.

Blended foods may not fully meet the needs of pregnant and lactating women or young children in emergencies. This is primarily because the micronutrients may not be absorbed very well and because other critical micronutrients, such as vitamin B6, vitamin B12, and zinc, are lacking in emergency situations where food and health systems are dysfunctional. UNICEF, WHO and WFP recommend daily multiple micronutrient supplements that can meet the recommended nutrient intake for these vulnerable groups during a humanitarian crisis. Helen Keller International (HKI), UNICEF, and WFP are also providing "sprinkles" (a mix of vitamins and minerals that can be added to individual portions or a group feeding) for use in tsunami rehabilitation and through the commercial markets in Asia (Saskia dePee, personal communication, 2006).

Data Sources, Limitations, and Issues

A lack of objective reviews and evaluations of program implementation and coverage seriously limited this stock-taking exercise. The data used in this review, from web searches and available global datasets, have significant gaps. Taking IDD as an example, among 185 countries, only 123 report urinary iodine (UI). Of the 123 countries that report a UI value, only 20 percent have data more recent than 1999. Among the 24 countries that have more recent UI data, only 54 percent of the data are from a national survey and only 6 countries report low UI. The WHO database does not include household iodized salt coverage, but salt coverage is reported in the 2004 UNICEF database. Of the 188 countries in that dataset, 117 reported salt coverage. Among the 116 countries with a date associated with the salt coverage data, only 86 (74%) had data more recent than 1999. Among the countries with recent data, 62 percent had coverage of 50 percent or more.

Household iodized salt coverage is presented in global datasets as using "adequately" iodized salt. Adequacy is almost always based on the subjective interpretation of the salt test kit, which may underestimate the use of salt with some iodine—perhaps enough to reduce deficiency. Thus, the assumptions made using these global data may be outdated or limited by the accuracy of the data and may not reflect the true situation in the country.

The situation is similar for vitamin A. For many countries, there is a lag between prevalence data and supplement coverage data, so the prevalence data may be misleading if supplement coverage has increased dramatically. Data on prevalence should be used with caution, as improved coverage is likely to have changed the prevalence.

Improved data will allow for a more comprehensive planning and monitoring framework for a global strategy. Various groups maintain valuable databases that can be further built upon: WHO MDIS, IDPAS, and MI/UNICEF/CIDA (vitamin A documents); WHO/EPI (vitamin A and immunization spreadsheets and maps); Flour Fortification Initiative; Iodine Network; and others.

Data on food intake and the use of supplements by high-risk age and income groups would be valuable for comprehensive planning. Key information is also missing on types of programs, community platforms, and innovative ways of generating ongoing community demand for micronutrient products and services.

Next Steps for Strategic Action and Research

- There is an overriding need to develop different types of intervention mixes and program strategies to meet the diverse and changing needs of countries as demographics and disease patterns change; no single intervention e.g. food fortification can address the needs of all target groups, even iodine supplements are essential in some situations.
- Support for optimal breastfeeding should be a part of micronutrient programs. Operational models for improving micronutrient intake for children ages 6–24 months are needed to complement strategies intended for the general population; in South Asia and sub-Saharan Africa, the problem of macronutrients in young children should be addressed at the same time. Solutions for low birth weight are urgently needed in S. Asia.
- Programs should aim to reach at least 80% of the target population with adequate levels of each micronutrient. Coverage data on programs for the five main micronutrients should be updated frequently using surveys, tally sheets or routine health services data.
- Ongoing global level monitoring of country progress is critical. Systematic program reviews such as the analytic review conducted under the Integrated Management of Childhood Illness (IMCI) are useful every 2-3 years to respond to changing needs and adapt new research findings. More frequent e.g. annual reviews of country operations and policy issues should be conducted in each region to maintain momentum and target technical assistance as needs arise. An example of such a mechanism is the regional Expanded Programme on Immunization (EPI) managers meetings organized by WHO.
- Agreement on program coverage and process indicators, and ongoing support for data collection, analysis, and use would help countries target hard-to-reach groups and refocus program efforts.
- Operational programs are needed to expand the use of zinc in diarrhoeal disease control programs in different contexts; food-based options are needed to enhance coverage with preventive zinc and folic acid.
- A summary of evaluations and studies on adolescent anemia reduction programs would help spearhead this approach to anemia reduction.
- A review is needed of evidence of effectiveness from large-scale iron fortification programs of cereal flours.
- Fortification and supplementation approaches must be developed for addressing multiple vitamin and mineral deficiencies while promoting consumption of micronutrient rich foods.

Conclusions and Recommendations

- Food fortification and supplementation are effective strategies for reducing vitamin and mineral deficiencies on a large scale in many different settings, but coverage and scale remain limited. Both are highly cost-effective compared with other health interventions, especially fortification. But fortification alone cannot solve the problem of vitamin and mineral deficiencies in any country. Supplementation is an essential component of successful strategies to address the needs to critical targets groups. The intake of foods naturally rich in micronutrients can reinforce the benefits of fortification and supplementation; breastfeeding for infants is particularly critical, as are the use of animal foods, and fruits and vegetables.

- Current data limitations and planning mechanisms need to be improved to encourage the development of combined strategies and best intervention mixes for different populations and contexts.
- A global effort should focus on a group of jointly selected high-need and 'potential for high-impact' countries. It is important not to overlook small countries where progress has been made and countries that have good programs that could achieve high universal coverage with limited additional input. Focusing only on high-population countries with large micronutrient problems may result in a loss of momentum in countries that are moving quickly in the right direction.
- Public-private partnerships are key for effective national strategies; fortification efforts led by private industry have worked well in several countries. Public education and consumer groups are key. The track record on mandatory fortification is impressive where enforcement capacity exists.
- Micronutrient supplementation can be effectively integrated with routine services and special outreach efforts; supplementation has been successfully combined with other primary health care interventions such as antenatal care and immunizations. These efforts should be institutionalized through routine monitoring, planning, training and supervision within district health services.
- Both food and health systems should be strengthened to deliver micronutrients to critical target groups in a sustainable manner; lack of leadership is a major constraint and ongoing advocacy is key. Substantially more must be done to clarify, develop, and implement follow-up, monitoring, and evaluation efforts; and use of data.
- Much more can be accomplished even with current levels of external support. Global and regional coordination mechanisms have served other health initiatives well and should be adapted. Additional resources are needed for implementation and global coordination.

Table 3.5 *Milestones in Evolving Micronutrient Strategies*

	I. Micronutrients gain a discrete place on national public health agendas	II. Importance of subclinical forms of deficiencies and need for universalization	III. Alternative delivery strategies tailored for local contexts; universal salt iodization; vitamin A and iron integrated within IMCI	IV. Successful mass distribution of vitamin A; sustainability issues arise; no breakthroughs yet in iron interventions	V. Lancet series reestablishes importance of new "super-nutrients," zinc and folic acid; need for coordinated global strategy for acceleration.*
Supplementation	Recognition of life-saving and functional importance of micronutrients. Vitamins and minerals provided to individuals diagnosed with deficiency diseases	Establishment of mortality impacts of vitamin A even where clinical signs in the population are not highly significant. Need established for mass supplementation as preventive measure for mortality reduction. Low measles immunization coverage and analysis on vitamin A supplementation during measles puts disease-linked vitamin A supplementation high on priorities for pediatric care. Connection of iodine deficiency to brain development receives attention.	Policies in many countries call for expanded vitamin A supplementation and universal iron/folic acid supplementation in prenatal care. Iodized oil supplements used where iodized salt is not produced or accessed. Clinical detection and treatment of severe anemia integrated within the IMCI; also, vitamin A for measles and severe underweight.	Nepal demonstrates the use of community-based volunteers to administer vitamin A at almost national scale. Vitamin A supplements are linked to national immunization days (NIDs) for polio and reach unprecedented numbers of children in large numbers of countries. Iron coverage still lagging behind. Iodine supplements found not cost-effective and use severely limited.	Phasing out of NIDS, although a number of countries in Africa still depend on NIDs for vitamin A delivery. Donor-dependent vitamin A supplies raise concerns. Alternatives such as child health weeks are found to be feasible and cost-effective when services are combined. Six-month outreach begins rise to top of public health strategies for packaging basic services. Malaria and de-worming are recognized as key adjuncts for anemia reduction. Supplies, formulations for young children. and compliance are identified as key constraints for iron. Zinc to lead the revitalization of control of diarrhoeal disease/oral rehydration therapy programs.
Food Fortification	Enrichment to replace nutrients lost during processing. Fortified margarine and dairy products.	Need for universal strategies is emphasized as subclinical indicators are found to be associated with important outcomes (e.g., vitamin A, iron deficiency, iodine deficiency). Potential of fortification gains momentum.	Salt iodization universalized. Sugar fortification in Guatemala and other Central American countries demonstrates feasibility for reaching scale; introduced in Africa (Zambia). Emergence of previously eliminated deficiency diseases in refugee camps raises concerns for providing fortified products and supplements. Fortified foods come under scrutiny in food aid programs.	Intensified efforts in USI, but issues of sustainability, quality, and surveillance arise. Fortification of cereal flours with iron and B vitamins begins to take off, but public health impact is yet to be established at scale. A wide array of products emerge as fortification vehicles, including powders for home fortification for children. Lack of Government capacity in enabling industry and enforcement are identified as key barrier.	Capacity building in fortification intensified; recognition of regional nature of production and trade flows in Africa; greater efforts to build public-private partnerships as a bridge. Growing understanding of regulatory frameworks, laboratory needs, public demand creation, and other hitherto underemphasized elements. Need for more realistic cost projections and time lags. Need to define how to target better for public health impacts (e.g., trends in consumption patterns of high-risk groups).

* The Bellagio Study Group on Child Survival. Knowledge Into Action for Child Survival. Lancet 2003. 362: 323-327.

I. Micronutrients gain a discrete place on national public health agendas	II. Importance of subclinical forms of deficiencies and need for universalization	III. Alternative delivery strategies tailored for local contexts; universal salt iodization; vitamin A and iron integrated within IMCI	IV. Successful mass distribution of vitamin A; sustainability issues arise; no breakthroughs yet in iron interventions	V. Lancet series reestablishes importance of new "super-nutrients," zinc and folic acid; need for coordinated global strategy for acceleration
Dietary Diversification Food composition studies help identify good food sources, and these are promoted through nutrition education	Studies on iron inhibitors, vitamin A absorption, and conversion of beta carotene define the limitations of dietary approaches. Studies on food behavior modification find positive results, but intensity of interventions raises concerns about feasibility.	Cost-effectiveness studies put fortification at the top of intervention priorities. Severe lack of "problem nutrients" in complementary foods identified, reemphasizing the need for fortified special foods and supplements.	Lack of evidence that large-scale reductions in deficiencies can be accomplished through dietary diversification strategies minimalizes the role of this approach. Rise of biofortification through plant breeding. Orange sweet potato successfully introduced in East Africa. Biofortification gains momentum with other crops.	Reemergence of dietary diversification as a key component of micronutrient strategies, especially with regard to time lags in take-off of programs at scale, and interactions among micronutrients and between micronutrients and infectious agents (e.g., malaria and HIV/AIDs). Role of phytochemicals (quasi-micronutrients) in disease prevention highlights need for continued work to expand public education and investment in the horticulture/nutricrops sector.

4 What Are the Costs of Interventions?

Program Costs Vary by Type of Intervention, Country Setting, and Methodology

Summary of Findings

- Micronutrient interventions are among the most cost-effective public health interventions; combining delivery approaches such as fortification and supplements to assure coverage of over 60-70% of key target groups will increase costs but also assure high impacts.
- There is enormous variation in the estimated costs of micronutrient interventions. The costs vary dramatically by specific cost measure, program, type of intervention, delivery system, country, and a host of other factors.
- In the most studied intervention, vitamin A supplementation, the unit cost per beneficiary reported in 27 studies ranges from 14 cents to $5.56.
- The cost per death averted for vitamin A supplementation programs averaged $711 and varied by a factor of 50, ranging from $90 to $3,383.
- The estimated costs of vitamin A supplementation interventions vary more than those of any other supplementation or fortification interventions.
- The single most important cost in vitamin A supplementation programs is personnel, which constitutes roughly 65 percent of total costs.
- The single most important cost in fortification programs, accounting for approximately 90 percent of total costs, is the cost of the vitamins and minerals (fortificant) mixed into the product. Vitamin A is the most costly nutrient in fortification programs. The higher the price of the food vehicle, the easier it is to pass along the cost of fortification to consumers as the natural rise in prices due to inflation can hide the small incremental costs of fortification.
- The imputed value of the time of volunteers who participate in campaign-style vitamin A supplementation programs and play an important role in implementing the programs accounts for about one quarter of total costs.[10]
- Tremendous differences in program costs show that it is not useful to generalize cost estimates across different types of programs or different countries.
- More needs to be learned about government regulatory and enforcement costs and public education costs of food fortification and of large scale sustainable biofortification programs.
- Lack of data on food and supplement consumption patterns among critical target groups makes it difficult to project the coverage and cost-effectiveness of food fortification and supplementation activities. Consumer perceptions of costs and factors influencing consumer choices are important factors determining cost-effectiveness but little information is available.

10 Valuing their time at the minimum legal wage.

Review of Evidence

Why Do Cost Analysis?

In addition to its use in macro health policy and resource allocation discussions, cost analysis of micronutrient programs has proved useful for understanding and assessing the performance of the programs, and for planning and budgeting. Specifically, cost studies have provided information that has been used in the following ways:

- To provide information for developing budgets or monitoring budget execution.
- In the analyses of existing programs in Guatemala and hypothetical programs in South Africa, the Philippines, and Peru to inform policy discussions about the cost-effectiveness of alternative program interventions.
- In an analysis of Nepal and the Philippines, to determine the types and quantities of specific inputs used to produce a service or output.
- In Nepal, to identify the quantities and types of inputs and the financing required to complete the scaling up of a subnational program.
- In Zambia and Ghana, to explore the costs and coverage differences of alternative program implementation schemes.
- In Jamaica, to identify supply constraints as bottlenecks to improving coverage.
- In studies of Tanzania, Ghana, Zambia, Nepal, and the Philippines, to assess the relative degree of vulnerability or dependency on foreign funding.
- In Nepal, to provide information to assess progress toward sustainability.
- In Jamaica, to demonstrate that the cost to households of participating in the program is substantial and constitutes an impediment to high coverage rates.

In five Asian country studies, public-private teams conducted cost analyses; this cooperation provided a process for cultivating partnerships and breaking down walls of isolation between the private and public sectors, and facilitated the development of fortification programs.

What Do Interventions Cost?

Micronutrient interventions are among the most cost-effective public health interventions. There have been no new studies since the 1990s that suggest that this fact has changed. The most common cost measure reported in the literature is the average (or unit) cost per beneficiary. Several other measures are also frequently used, including average cost per deficient person (sometimes referred to as the average cost per "useful" coverage); average cost per disability-adjusted life years (DALY)[11]; and average cost per death averted. Additional cost measures are reported for specific types of program interventions: Vitamin A supplementation studies, for example, frequently report the cost per dose (e.g., vitamin A capsule). In the case of fortification

11 Disability-adjusted life year (DALY) is a composite index of health that takes into account loss of life, morbidity, and disability, and their combined effect on productivity.

programs, three cost measures are commonly reported: (1) incremental fortification cost per metric ton (MT) of the food vehicle; (2) proportion of increase in the retail price of a food due to fortification; and (3) cost per person per year.

In the most studied intervention, vitamin A supplementation, various studies have used different measures to determine costs.

- ***Unit cost per beneficiary.*** Reported in 27 studies, the unit cost per beneficiary ranges from 14 cents in the Philippines in 1993 (Loevinsohn et al., 1997) and Bangladesh in 1997–98 (Berti et al., 2002) to $5.56 in Uganda in 1998 (Berti et al., 2002). The Bangladesh and Uganda estimates are based on subnational programs. The large variation in the cost estimates (they vary by a factor of 40), the different years in which they were determined, and the differences in country setting are contraindications for combining them to develop a general measure.
- ***Unit cost per vitamin-A-deficient beneficiary.*** Eighteen studies estimated the unit cost per vitamin-A-deficient beneficiary (i.e., person-year of useful coverage) of a vitamin A supplementation program. Here the range of estimates is even larger than in the unit cost per beneficiary method, ranging from 42 cents to $23.76 (varying by a factor of 56). The mean and median ($6.95 and $2.71, respectively) vary by a factor of more than 2.
- ***Cost per death averted.*** Nineteen studies estimated the cost per death averted for vitamin A supplementation programs. The cost averaged $711 and varied by a factor of 50, ranging from $90 to $3,383.

Programs implemented exclusively by nongovernmental organizations (NGOs) appear to be one-quarter to one-third more expensive per beneficiary than programs implemented primarily or predominantly by a public-sector entity. There is even greater variability between NGO and public-dominated systems when the cost per person-year of useful coverage is analyzed.

How Different Are Program Structures and Their Related Costs?

Interventions to address vitamin and mineral deficiencies have different program structures and different cost structures. Supplementation programs have a greater diversity of costs than fortification programs. Personnel costs constitute the most important input expense of supplementation programs. In contrast, fortification programs have more concentrated cost structures that are dominated by the cost of the micronutrients themselves. Personnel costs are one of the least important costs of fortification interventions. Still, studies of fortification interventions have used different methodological approaches, and the estimates of costs vary substantially across programs. The component of fortification programs that was most precisely and uniformly estimated was private industry costs; within that subset, the most precisely estimated costs were the costs of fortificants.

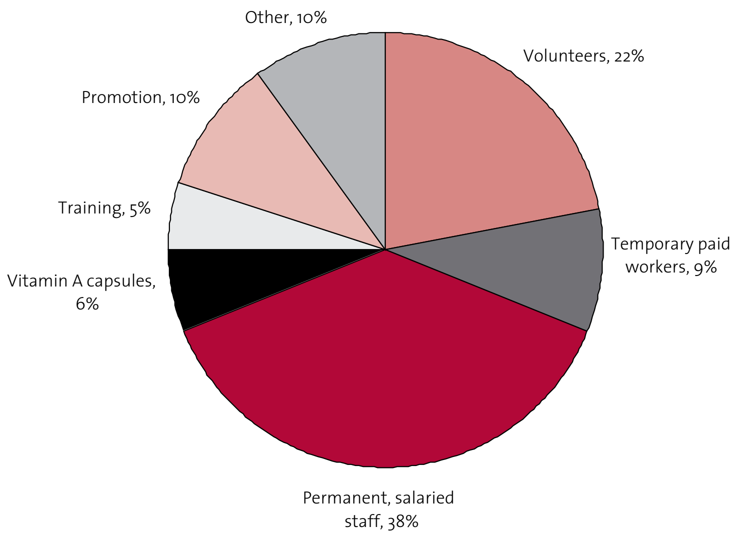
Cost Structures of Supplementation Programs

Programs have different implementation mechanisms and vary in other important ways that contribute to large variations in cost, but their cost structures have some commonalities. Cost structures of the seven vitamin A supplementation programs for which data are available were analyzed in three categories: (1) personnel; (2) program-specific costs (i.e., additional direct costs, which include outlays essential to the program); and (3) capital costs.

1. ***Personnel costs*** are the single most important cost in four of the programs. The one exception is the Nepal analysis, which did not estimate all personnel costs.[12] All programs rely significantly on volunteers, and those that estimated the personnel costs valued the time of volunteers. The volunteers' share of costs averaged 20 percent of total program costs (10–30%) and roughly one-third of total personnel costs.
2. ***Program-specific costs*** generally accounted for about 30 percent of total costs.
3. ***Capital costs*** were estimated in only three of the seven studies. They were uniformly the least important category of costs, although their importance varied substantially across the three countries.

For iron supplementation programs, few empirical data exist on the cost of interventions. They are likely to have cost structures that are quite similar to those of vitamin A programs; however, iron programs are likely to be somewhat more expensive because more frequent doses are necessary for useful coverage. Figure 4.1 shows vitamin A capsule costs as a percentage of annual operating costs in eight supplementation programs. Note that the capsules constitute a small proportion of total program costs—ranging from 2 percent to 14 percent in the eight country studies. The major cost is not the vitamin A supplement itself but rather the cost of the system to deliver it. In the delivery system, by far the most important cost is for personnel.

Figure 4.1 *Common Cost Structure of Vitamin A Supplementation Programs*



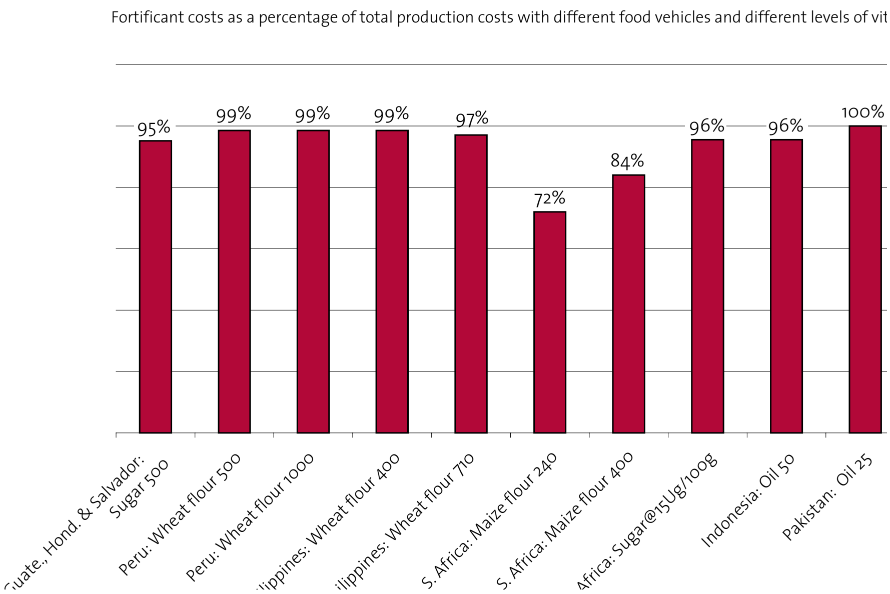
12 The Nepal analysis considered the personnel costs of the NGO in charge of implementing the program but included the time of MOH personnel only when they were in initial or annual refresher training or on the campaign distribution day.

Cost Structures of Fortification Programs

Data on the structure of costs of 15 fortification interventions were reviewed for this report. The data for 10 of the 15 studies are drawn from the ADB/Keystone RETA 2 studies, which were proposed projects or hypothetical programs. *Recurrent costs* constitute the single most important of the four cost components, accounting for roughly 80 percent of total public and private fortification program costs. *One-time start-up costs and capital* generally represent 5 percent to 10 percent of total costs, as do *marketing and education*. The smallest of the four cost components, *government regulatory responsibilities*, is estimated to account for roughly 5 percent of total program costs.

Costs for the fortificant constitute the vast majority of annual operating costs and average total annual costs. They account for a mean of 77 percent and a median of 83 percent of total costs, and a mean of 93 percent and a median of 96 percent of operating costs. Figure 4.2 shows the percentage of annual production costs accounted for by the fortificant for different levels of vitamin A fortification using different food vehicles.

Figure 4.2 *Vitamin A Fortification Program Cost*



Why Do Cost Estimates Vary?

There is enormous variation in the estimated costs of micronutrient interventions. The types of delivery systems used, country characteristics, program characteristics, and costing methodologies all contribute to the variability among cost estimates found in the literature. These differences show that it is not useful to generalize cost estimates across countries or across different types of programs; in fact, this common practice is misleading and disturbing. To provide greater comparability and understanding, and to enhance the usefulness of cost studies, estimation techniques must be more transparent and the discussion of results more specific.

The estimated costs of vitamin A supplementation interventions vary more than the costs of any other supplementation or fortification intervention. Estimated costs of vitamin A supplementation programs vary five-fold; for vitamin A fortification programs, estimates of cost per person per year and cost per death averted vary 15- and 24-fold, respectively. Tables 4.1 and 4.2 outline variations in the costs of supplementation interventions and fortification interventions in terms of cost structures, country characteristics, program characteristics, implementation mechanisms, and costing methodology. Details about these variations are provided in the following sections.

Table 4.1 Supplementation Interventions—Sources of Variation in Estimated Cost

Cost Structures	Country Characteristics	Program Characteristics and Implementation	Costing Methodology
Vitamin A Program Costs ▪ Major cost is the delivery system. ▪ Personnel costs are the single most important cost in 4 out of 5 programs. ▪ Programs rely heavily on volunteers, whose time is valued; volunteers' share of costs ranges from 10% to 30% of total program costs, averaging 20%. Volunteers constitute about 1/3 of total personnel costs. ▪ Program-specific costs account for 30% of total costs in 4 out of 5 programs. ▪ Vitamin A capsules constitute a small proportion of total program costs, ranging from 2% to 14% in 8 country studies. ▪ Capital costs estimated in 3 of 7 studies were the least important category, although this varies. Iron Program Costs ▪ Little data on costs, but likely similar to vitamin A cost structures. ▪ Costs may be higher than those for vitamin A because of more frequent doses, implementation mechanisms, need for consistently maintained supplies, and greater compliance-promotion efforts.	Costs Vary with Country Factors ▪ Nature of micronutrient deficiency. ▪ Size, composition, rural-urban distribution of population. ▪ Variations in geography and climate. ▪ Ministry of Health treatment protocols. Costs Vary with Health Care Delivery System Characteristics ▪ Composition, size, distribution of infrastructure. Costs Vary with Knowledge and Culture ▪ Knowledge about micronutrient deficiency. ▪ Knowledge about specific program. ▪ Distance and transportation to participate. ▪ Cultural differences toward health care and the specific program. Study of Vitamin A Supplementation Costs in 50 Countries (Ching et al 2003) ▪ Differences in cost per death averted depended on country-specific variables, including program coverage, whether 1 or 2 doses were delivered, and underlying level of mortality. ▪ Estimates of cost per death averted and cost per DALY averted are sensitive to assumptions about the estimated mortality impact of programs.	Costs Vary by Program Approach ▪ Less standardized than fortification programs. ▪ Personnel costs are important. ▪ Many more country-specific program variables that may affect costs. Costs Vary by Delivery Channels ▪ Important to specify costs of program delivery channels. ▪ Distinguish among routine service-based programs, campaign-based interventions, in-facility, outreach-based.	Optimal Costing is Comprehensive ▪ Look at the sum of private, government, donor, and consumer costs. ▪ Most supplementation programs focus on government costs. ▪ Donors often play an important role in financing supplementation programs. ▪ Look at household costs to determine ease of participation, effect on rate of participation, coverage, and average cost per beneficiary. Adjust Comparators ▪ It is realistic to assume that some portion of those who receive the first vitamin A supplement receive the second dose. Allow for Price Adjustments and Price Indices ▪ Comparability is difficult as data are not always adjusted for changes in the value of currency.

Table 4.2 Fortification Interventions—Sources of Variation in Estimated Cost

Cost Structures	Country Characteristics	Program Characteristics and Implementation	Costing Methodology
Fortificant Costs ▪ Constitute most important costs, commonly 85% of total fortification cost to industry. Costs of Changes in the Fortificant ▪ Incremental additions of micronutrients may significantly affect the total cost of a fortification intervention. ▪ Producers will be concerned about the impact of the fortificant on pricing, competition, and the bottom line.	Costs Vary with Country Factors ▪ Food consumption patterns. ▪ Industrial structure of the food fortification vehicle. ▪ Amount of product produced, and where and how it is marketed. ▪ Concentration of food fortification vehicles. ▪ Taxation and tariff rates, interest rates, and price competition. Costs Vary for Governments ▪ Costs of monitoring industry production of fortified products depend on government capacity to monitor quality and control for safety.	Costs Vary with Different Types of Activities ▪ Fortification programs include both private-sector and public-sector costs, but certain types of activities are often not included in cost estimates. ▪ Costs vary depending on factors such as the vehicle for fortification (sugar, flour, oil, sauce); the nature of the industrial structure of the vehicle; and the amount of fortificant to be added to the product. ▪ Costs vary depending on the composition of the fortificant; specificity about the composition is essential to understand costs. ▪ Costs vary for ongoing government monitoring and enforcement to ensure compliance. Iron Fortification Costs ▪ The cost of the most expensive iron compound may reach 27% of the total cost of the product because of lower costs of other components.	Optimal Costing is Comprehensive ▪ Look at the sum of private, government, donor, and consumer costs. ▪ Donor assistance in fortification is far less common than in supplementation; such assistance is usually earmarked for fortification start-up costs. ▪ Include household costs to determine ease of participating. Allow for Price Adjustments and Price Indices ▪ Comparability is difficult as data are not always adjusted for changes in the value of currency.

How Are Cost Estimates Affected by Country Characteristics?

Supplementation Programs

The cost of a given type of micronutrient supplementation program is likely to reflect a number of country-specific factors:

- ***The specific nature of the micronutrient deficiency problem in a particular country***—the prevalence, composition, rural-urban distribution, and degree of geographic clustering of the deficiency.
- ***Other important factors***—key population characteristics and how difficult or easy it is to reach target groups; geographic and climatic conditions that impose certain requirements (and, thus, affect costs) for logistics systems, packaging, and storage; and the Ministry of Health's treatment protocols, including its definition and target populations
- ***The health care delivery system***—including the composition, size, and distribution of its infrastructure; demand-related factors that determine the rate of health care utilization; and the general level of wages in the health care sector.

In their econometric study of 50 countries, Ching et al (2000) found that differences in vitamin A supplementation costs per death averted depended on several country-specific variables, including program coverage, whether one or two doses of vitamin A were delivered, and the underlying level of mortality. Obviously, estimates of cost per death averted and cost per disability-adjusted life year (DALY) averted are sensitive to assumptions about the estimated mortality impact of programs. The magnitude of that impact is subject to debate.

Knowledge about vitamin and mineral deficiencies, along with cultural factors, affects the demand for programs. Since they affect the denominator of the cost measure (the cost per beneficiary), country-specific, demand-side factors are also likely to play an important role in cost variations across countries. Relevant country-specific, demand-side factors include knowledge about micronutrient deficiency, awareness of the existence of the micronutrient program, and travel distances and transportation requirements that would-be participants face. Cultural differences might affect a person's predisposition to use health care and participate in a program.

Only three supplementation program studies have investigated any of these demand-side factors (Gonzalez et al., 2000; Sanghvi et al., 1996; Popkin et al., 1980). Two of the three studies found that household costs accounted for a high proportion of total program costs, 79 percent and 65 percent of an iron and vitamin A program, respectively. The third study, which analyzed household costs incurred in a program designed to prevent both malaria and anemia, found that these costs constituted 18 percent of a health-facility-based intervention strategy. These findings suggest that demand is constrained by household costs. This consideration has been largely ignored in the literature, which is overwhelmingly dominated by supply-side considerations.

Fortification Programs

The primary country-specific factors influencing fortification costs are food consumption patterns and the industrial structure of the food fortification vehicle (amount of product produced, where and how it is marketed, and concentration in the industry).

- ***The size, distribution, and extent of industrial concentration of potential food fortification vehicles*** must be analyzed early on to assess the feasibility of a fortification intervention. If the number of firms is judged to be "unmanageable" (in terms of the costs of monitoring and enforcement), or plants are not located in a relatively concentrated area or are not accessible, fortification is generally deemed too expensive.
- ***Other aspects of the economic environment, including taxation and tariff levels, interest rates, and levels of price competition,*** constitute potential sources of significant variation in the costs of a fortification program by country and may have a significant impact on costs. For example, the import duties on fortificants in some Asian countries vary from 1 percent in Thailand (ADB/Keystone, 2004) to 47 percent in Bangladesh (Dary and Rassas, 2004).
- ***The costs that government incurs in monitoring fortification efforts*** are another factor that can add variation to the costs of fortification. In many studies, these costs are ignored. The magnitude of these costs can vary substantially, depending on whether the government already has this type of capability (e.g., monitoring food safety, as was the case in the Philippines and South Africa) or must develop this capability (as in Zambia).

How Do Costs Vary by Program Characteristics?

The heterogeneous nature of micronutrient interventions is an important reason for variation in costs. It is necessary to distinguish the cost of supplementation from the cost of fortification and the cost of dietary change, or some combination of these very different types of interventions.[13]

Supplementation Programs

There is inadequate discussion of and appreciation for the many distinguishing characteristics of interventions that have important cost implications. The major cost reviews, for instance, refer to the cost of "supplementation programs" without distinguishing between supplementation programs that are routine service-based programs and campaign-based interventions, and those that are in-facility or outreach-based. Supplementation program approaches are not standardized; personnel play an important role in program implementation, and many country-specific variables affect costs.[14]

- ***Cost per person reached varied substantially*** in countries where cost-effectiveness analyses of alternative intervention configurations were investigated.

13 This is the case, for example, with some of the most visible discussions in the literature of the cost of micronutrient interventions (World Bank, 1993; 1994, Horton 1999).

14 The difference between how a program is designed and how it is implemented is a complex issue. It is at the heart of the important impact evaluation concept of "intention to treat." For further discussion, see Habicht et al., 1999.

- I*ntegrated approaches may be considerably cheaper than stand-alone approaches.* When vitamin A supplementation was integrated with routine immunization services in Peru, it cost $1.62 per person (1998 dollars), 55 percent of the $2.97 per person cost of a stand-alone, campaign-based approach (Baiochi et al., 1998). In the Philippines, a vitamin A capsule distributed through a stand-alone micronutrient campaign was estimated to cost nearly twice as much as a capsule distributed as part of a national immunization day (NID) program (Fiedler, 2000). A Zambian study that estimated the cost per child of two mechanisms onto which vitamin A capsule distribution was piggybacked found that the average cost per child in an NID round was more than six times the distribution cost during a child health week (Rassas et al., 2004).[15]

Fortification Programs

Inadequate specificity is another problem that plagues discussions of fortification program costs.

- ***Fortification intervention costs are commonly grouped together*** with little regard for whether the fortification vehicle is sugar, wheat flour, maize flour, cooking oil, soy sauce, or fish sauce, and with little or no discussion about the nature of the industrial structure of the food fortification vehicle in conditioning the cost of the fortification intervention, or the composition or level of the fortificant.
- ***Changing the fortificant mix affects the rate at which the fortificant is mixed, which also affects costs.*** For example, depending on the composition of the fortificant, wheat flour fortification costs can vary by a factor of nearly nine.
- ***Variation in the fortificant mix is a potential source of significant variation in the cost of fortification,*** given that fortificant costs are commonly 85 percent of the total cost to industry of fortification.
- ***The structure of the food industry has a bearing on costs, both costs to industry and the cost of government monitoring and enforcement.*** More needs to be learned about government regulatory and enforcement costs.
- ***More information is needed on the costs of public education in strategies that have major food fortification components.*** The same will apply to large scale sustainable biofortification programs once they are implemented.
- ***Marketing, distribution, and customer use patterns can influence costs.*** Lack of data on food and supplement consumption patterns among critical target groups makes it difficult to project the coverage and cost-effectiveness of food fortification and supplementation activities. Consumer perceptions of costs and factors influencing consumer choices are important factors determining cost-effectiveness but little information is available.

15 The NID covered only 35 of Zambia's districts, whereas the CHW covered all 72 and, in addition to vitamin A and immunizations, provided de-worming, health education, family planning, prenatal care, and growth monitoring.

Table 4.3 shows four different mixes of fortificants: Their costs vary by a factor of four. Changing the forticant mix and the rate at which it is mixed with the wheat can cause fortification costs to vary by a factor of nearly nine.

Table 4.3 *Variations in Wheat Flour Fortificant and Fortification Costs*

	FORTIFICANT COST			FORTIFICATION COST	
Fortificant level (parts per million)	Cost/kg	Relative Cost/kg	Feed rate (g/MT)	Cost/MT	Relative Cost /MT
Iron 60, folic acid 2	$4.00	100%	100	$0.40	100%
Iron 60, folic acid 2, riboflavin 4, thiamin 2.5	$10.00	250%	160	$1.60	400%
Iron 60, folic acid 2, riboflavin 4, thiamin 2.5, zinc 30	$12.00	300%	200	$2.40	600%
Iron 60, folic acid 2, riboflavin 4, thiamin 2.5, vitamin A 25 IU	$16.00	400%	220	$3.52	880%

Source: O. Dary, 2005.

NOTE: MT = metric ton. Iron costs are for electrolytic iron.

Variations Due to Differences in Costing Methodologies

There are a number of ways in which variations in costing methodology might result in variations in the estimated cost of a micronutrient program. Often, studies consider only government costs if it is a supplementation program or, in the case of a fortification program, only private-sector costs. Studies rarely take a comprehensive approach and including private, government, donor, and household costs. Other factors that contribute to non-comparability of studies are different assumptions about adjusting comparators and prices, and the use and types of price indices.

Data Sources, Limitations, and Issues

The literature is highly disparate in its definitions, perspectives, scope, and methodologies, and in what is included in "costs." Limited documentation is available, which in turn limits the ability to draw conclusions about costs and to determine how to improve the efficiency and cost-effectiveness of programs.

Next Steps for Strategic Action and Research

To construct a costing benchmark or gold standard, more thorough discussion is needed of the methodological issues involved in designing and implementing a cost study, as well as decision points concerning potential "shortcuts" and the implications of those shortcuts. Such a benchmark could serve as the reference point to facilitate better understanding of the generalizability of the results of studies, encourage greater transparency, and promote discussion of the specific cost-impacting characteristics of programs.

Conclusions and Recommendations

- Supplementation and fortification programs have markedly different cost structures.
- In supplementation and fortification interventions, country characteristics are important factors in cost variations and must be clearly identified for costing.
- Supplementation programs are less standardized than fortification programs, making cross-country comparisons relatively more difficult for supplementation programs. Greater specificity about program characteristics is needed to better understand how the costs of supplementation programs vary by implementing mechanism.
- The study of household costs is a relatively neglected topic that holds promise as a tool for identifying and reducing one set of obstacles to improving coverage rates.
- Optimal costing methodology should be more comprehensive than the narrowly defined approach that has characterized many studies to date. In particular, government regulatory system and enforcement costs associated with fortification should be incorporated into cost studies of these programs.
- More needs to be learned about government regulatory and enforcement costs and public education costs of food fortification and of large scale sustainable biofortification programs.
- Lack of data on food and supplement consumption patterns among critical target groups makes it difficult to project the coverage and cost-effectiveness of food fortification and supplementation activities. Consumer perceptions of costs and factors influencing consumer choices are important factors determining cost-effectiveness but little information is available.

5 What Is the Role of International Agencies in the Micronutrient Sector?

A Broad Range of Agencies Provides Technical and Financial Support in All Regions But There Are Major Funding Gaps

This section provides a preliminary look at the global financial picture for international support of vitamin and mineral deficiency programs. We directly approached organizations known to be involved, asking for information on the resources they expended in 2004 on micronutrient activities and whatever information they could provide on the nature of those activities, such as geographical location, type of micronutrient involved, and whether the project involved research or service provision. Annex E provides more information on the sources of data and the methodological issues encountered. We also obtained background information on the principal organizations from a survey of organization websites and recent reviews. Two examples of these reviews (World Bank, 2006; IDPAS, 2005) are summarized in annex D.

Summary of Findings

- Information on more than 40 institutions—including bilateral donors, multilateral agencies, nongovernmental organizations (NGOs), foundations, and universities—was collected for this review. Hundreds of additional organizations at the regional, national, and subnational levels play an important part.
- International agencies fulfill a broad range of technical and operational needs to build capacity, improve and document micronutrient program results, and develop new approaches at the country level; globally, they support coordination activities, gather and disseminate information, and support basic and applied research.
- Certain areas of technical support and operations overlap among donors, and there are a number of gaps in the countries receiving assistance, types of interventions, range of micronutrients, and types of assistance provided.
- The financial contribution to vitamin and mineral deficiency (VMD) activities in 2004 of the organizations successfully contacted for this review is estimated conservatively to be in the order of $124 million.
- Funding for reducing vitamin and mineral disorders amounts to only a small fraction of the funding for infectious diseases and immunization, although vitamin and mineral disorders contribute substantially more to the global burden of death, disease and disability.
- Vitamin A receives the bulk of resources, while folic acid and zinc are low priorities.
- Research on plant breeding appears likely to receive more emphasis in the future.
- The African region benefits from roughly half the resources available for micronutrient programs, and substantial investments are being made in Asia.
- Important gaps exist in the available financing data, and most organizations have difficulty readily accessing disaggregated financial data. The complex flow of resources among various

organizations adds to the difficulty of getting an accurate picture of overall support for reducing VMDs.

- Developing a more transparent, accessible, and consistent way of tracking micronutrient funding, at least for major supporters, would help with future efforts to document the nature of global support for reducing VMDs
- For the development of any global strategy, it is essential to explore in more detail the current *modus operandi* of key institutions involved in international support of VMD reduction, including the regulatory and policy frameworks within which they operate, the mechanisms through which they communicate with and support developing country work, and the mechanisms through which they coordinate their micronutrient efforts with others.

Review of the Evidence

Micronutrient programs in the developing world receive support from many different sources. Developing country governments and the private sector are the main sources of financing for country-level activities in the micronutrient sector. A third broad category is external international support through bilateral and multilateral donors, private foundations, universities, and NGOs.

More than 40 institutions are significantly involved in international support for the micronutrient sector. Some are multilateral bodies or official bilateral donor agencies, others are foundations or universities. Some are implementing agencies with health programs in the field, while others focus on research or are active in providing technical advice, disseminating information, teaching, or coordination.

Donors and implementing agencies have complex interrelationships. Figure 5.1 (at the end of this chapter) illustrates some of the principal financial interactions among organizations providing international support for reducing VMDs and shows the complexity of these relationships. This complex situation argues for the formation of a coordination mechanism among donors at the global, regional, and country levels.

As the programs have gathered momentum, so has the urgency of the need for coordination and more systematic information sharing. While the evidence in favor of increased support for micronutrient programs has grown stronger and more complex, pressures on resources have increased. A number of attempts have been made to form coordinating mechanisms and working groups; examples include IVACG, INACG, IZiNCG, ICCIDD, Flour Fortification Initiative, Iodine Network, Business Alliance for Food Fortification, Global Vitamin A Alliance, Wakefield Coalition, and others at various levels.

Two bilateral donors are the dominant external financiers of worldwide micronutrient activities. For many years, the Canadian International Development Agency (CIDA) and the U.S. Agency for International Development (USAID) have been the major donors in this sector. Both are active in food fortification and are key supporters of national vitamin A supplementation programs. CIDA leads a global effort to coordinate procurement of vitamin A supplements and itself finances a large proportion of the supplements. Both USAID and CIDA have established large field-based micronutrient projects or initiatives for which they are the sole or primary donor. These include A2Z (previously VITAL, OMNI, and MOST), which are projects of USAID, and the Micronutrient Initiative (MI), which is largely financed by CIDA.

Other primary sources of funding include foundations such as the Bill and Melinda Gates Foundation and charitable fundraising organizations such as Kiwanis, which has been a significant source of support for iodine initiatives. The international banks—the World Bank and the Asian Development Bank (ADB)—are both active in funding micronutrient activities as components in their often large-scale health and nutrition projects. Nonprofit voluntary organizations such as Helen Keller International (HKI) and World Vision (WV) are key players that raise private funds from the commercial sector and individual donors.

The primary funding sources channel their funds and in-kind resources through a variety of other institutions, including multilateral agencies. UNICEF and WHO—two key organizations involved in supporting micronutrient activities worldwide—receive funds from bilateral agencies and a range of other sources. UNICEF primarily supports national programs and, in its global leadership capacity, gathers and disseminates critical data for planning and monitoring. WHO provides technical guidance at the global, regional, and country levels; helps translate research findings into policy guidelines; funds applied research; and maintains global databases on vitamin and mineral deficiencies.

UNICEF plays a crucial role in the provision of vitamin A supplements and salt iodization. Especially significant in financial terms is UNICEF, whose micronutrient activities attract funds from many bilateral organizations, particularly USAID and CIDA (through MI and independently), as well as the Gates Foundation. Their focus in supporting large scale implementation has been salt iodization and vitamin A. Sixty-five percent of MI project funds are "managed" by UNICEF, and 11 percent of Gates Foundation support for micronutrients in 2004 was directed through UNICEF. The World Bank has also purchased vitamin A capsules through UNICEF (e.g., for the Bangladesh National Nutrition project). In fact, UNICEF appears to be responsible for providing, or managing the procurement of, 95 percent of vitamin A supplements for developing countries.

The private sector contributes to the development of technologies, new products, and formulations, and provides micronutrient supplies as gifts in kind. Private firms carry out advocacy and support newsletters and other information dissemination activities. Some, such as World Vision and the International Life Sciences Institute (ILSI), provide funds and facilities for NGOs to support communication and advocacy activities at the global and country levels. The food processing and pharmaceutical sectors are deeply engaged in policies and programs at the country level. Programs such as Harvest Plus work with the agricultural sector.

The private sector contributes through its core business operations, through public-private partnerships, and on a philanthropic basis. Currently, the private sector supports the micronutrient effort primarily by developing and producing the products (namely, fortified foods and supplements) and contributing to specific programs mostly through donated commodities.

Some of the agencies covered in this section operate public-private partnerships in an effort to engage companies in micronutrient projects. The projects range from R&D on new formulas and applications to joint advocacy, technical capacity building along the value chain (e.g., premix companies for staple food producers), and program delivery (e.g., school feeding projects). In addition, some organizations—such as the Global Alliance for Improved Nutrition (GAIN) Business Alliance for Food Fortification (BAFF)—have standing platforms aimed at catalyzing project activities.

Companies also engage on a purely philanthropic basis, through product donations and in-kind support, as was seen with the tsunami and other emergencies. The emerging area of corporate social responsibility often unites philanthropic and commercial goals, such as volunteer opportunities or the preferential pricing that appears in the pharmaceutical sector (although not necessarily in the context of vitamin and mineral deficiencies).

The potential of business to contribute to reducing vitamin and mineral deficiencies is enormous, and largely untapped so far. This potential includes all relevant sectors but especially the pharmaceutical sector with regard to supplements and the food sector with regard to fortification and retail. In principle, populations of high need also represent a huge number of potential customers with a demand for vitamin and mineral products; in practice, the challenge is to develop a business model that can deliver to customers with limited and fragmented purchasing power at scale and on a sustainable basis. A global strategy geared toward significantly reducing micronutrient deficiencies will need to explore this opportunity in depth.

An urgent need for better coordination and information sharing has led to the formation of formal and informal alliances and groups. Some of these groups address issues of research and applications to policy development; others are more programmatic in their orientation. The following are some examples:

- The International Vitamin A Consultative Group (IVACG) provides guidance to international activities aimed at controlling vitamin A deficiency worldwide; it is funded by USAID.
- The Iron Deficiency Project Advisory Service (IDPAS) is supported principally by MI but also by UNICEF, WHO, and the Centers for Disease Control (CDC).
- The International Council for Control of Iodine Deficiency Disorders (ICCIDD) is an international nonprofit NGO promoting the elimination of IDDs though technical assistance and training; it is supported by UNICEF and WHO.
- The Global Alliance for Improved Nutrition (GAIN) was established in 2002 as an alliance of potential donors, UN agencies, industry, NGOs, civil society, and academia to implement national food fortification programs; it receives funding mainly from entities such as the Gates Foundation and USAID.
- Harvest Plus is an alliance of international research organizations tackling the micronutrient problem (with a focus on iron, vitamin A, and zinc) by breeding nutrient-dense staple foods such as cassava, wheat, maize, beans, and sweet potatoes; it is funded by the World Bank, the ADB, the Gates Foundation, USAID, and CIDA.
- SCN and IUNS have played key roles in synthesizing program and policy relevant information and coordination.

- The Iodine Network engages the private sector, implementing agencies, and civil society in coordination and advocacy activities.

Universities and sometimes nutrition institutes play a key role in building capacity and in establishing the importance of vitamins and minerals through training, education, research, and analysis. Universities have also helped identify the risks and benefits of dosing with vitamins and minerals, and they maintain information exchanges. The best-known examples of these universities are Mahidol University (Thailand), Wageningen University (Netherlands), Auckland University (New Zealand), University of Toronto (Canada), Emory University, Johns Hopkins University, University of California at Davis, and Cornell University. More assistance to field-based institutions is needed to build leadership and broaden the base of stakeholders for micronutrient programs and policies. Examples of field-based nutrition institutes include INCAP (Guatemala), FNRI and NCP (the Philippines), TFNC (Tanzania), NIN and CFTRI (India), INTA (Chile), CFNI (Caribbean) and NFNC (Zambia).

An initial analysis of the financing picture shows that about $124 million is allocated annually by the main external donors for reducing vitamin and mineral deficiencies. Table 5.1 (at the end of this chapter) summarizes the data obtained on expenditures for micronutrient programs in 2004.[16] The figures may not accurately reflect the global level of international financial support for micronutrient activities for two reasons: (1) they fail to capture important contributions from some donors, and (2) they include some double-counting, a problem described in detail below. After making some adjustments,[17] we conservatively estimate the total international contribution to vitamin and micronutrient deficiency activities in 2004 at $124 million. The World Bank notes that "initial estimates suggest that the costs of addressing the micronutrient agenda in Africa are approximately $235 million per year." Clearly, resource needs for micronutrient programs must be assessed and ways found to raise new funds and link with other resources. Countries need the support of a cohesive donor community to accelerate their programs.

Funding relationships, combined with existing approaches to budgeting and financial accounting, do not allow the calculation of fully accurate figures. The Harvest Plus program provides an example of the kind of problem faced in teasing out figures to include in the estimate of total financial support. In the period 2003–2007, Harvest Plus received funding from two of the primary donors for which we have data: Gates (43% of Harvest Plus funding) and USAID (17%). It is not clear whether the USAID data include the agency's contribution to Harvest Plus[18]; we have assumed they do not. For the Gates funding, we decided that it was more appropriate to use the Harvest Plus figures (which represent actual expenditures on research in the period) rather than the amount of the grant Gates made to Harvest Plus. The contributions of other

16 See annex E for notes on the sources and methods used to derive the information in this table.

17 Including Gates (minus its allocation to Harvest Plus of $6.25 million) ($21.87 million), USAID ($32.44 million), DFID ($2.39 million), MI $23.40 million), Harvest Plus ($5.45 million), CDC (4.99 million), World Vision ($4.17 million),the regular resources of UNICEF ($3.74 million, see text), CIDA (excluding its contribution to MI ($9.18 million), DANIDA, Spain, SIDA and AusAid ($ 0.97 million collectively), and assuming that the World Bank contribution is very roughly of the order of $15 million (see annex E for explanations). FFI is primarily funded by CDC and is therefore excluded from our final estimate. GAIN's contribution is not included, as we assume that it is largely captured through the data we have from Gates, USAID, and CIDA.

18 USAID data relate to "expenditures occurring via two channels: centrally managed activities procured and managed in Washington, D.C., by GH (USAID's Global Health Office) and bilateral activities managed by USAID Missions." It does not include "field support" expenditures or agreements managed by USAID's regional bureaus, nor some multilateral contributions.

Harvest Plus supporters—World Bank (20%), Department for International Development (DFID) (5%), and CIDA (12%)—are not included elsewhere, so the entire sum for Harvest Plus is used in the estimate. UNICEF attributions are also complex; the agency separately records its allocations for micronutrient programs from regular program funds and specific donor resources that are earmarked for micronutrients. The latter comprise four-fifths of the total amount allocated to micronutrient programs.[19]

An important undercounted input supporting global micronutrient activities is the manpower involved in managing international efforts by these organizations. For example, MI, USAID, World Vision/Canada, and CDC together have an estimated 50 full-time equivalent (FTE) staff devoted to managing micronutrient work at their respective headquarters. More than half of these people are at MI, which has an additional 19 FTE staff at the regional level.

Funding is concentrated in South Asia and sub-Saharan Africa, even though the number of project activities may be higher in other regions. Africa is a major recipient of support from USAID (41% of funding), UNICEF (63% of countries with UNICEF-supported vitamin A supplementation programs are in the region), and MI (45% of total funding). The World Bank directs only 14 percent of its resources for nutrition projects with a micronutrient component to the region, although about half the countries it supports are in Africa. Asia is important also, with MI and USAID directing, respectively, 40 percent and 54 percent of their micronutrient funding there. The World Bank sends 60 percent of its total financial commitment to projects with a micronutrient component to Asia; the funding goes to a relatively small number of projects and countries (primarily to Bangladesh, India, and China).

International organizations vary in the extent of the geographic coverage of their micronutrient-related activities and their regional emphasis.[20] Some organizations do not target particular countries. For example, the Gates Foundation provides funding to other international organizations rather than to individual countries, and the work of Harvest Plus, CDC, and Emory/FFI is global in nature. Of the bigger players with field-based projects, some are involved in large numbers of programs scattered throughout the world: In 2004, MI supported 166 micronutrient projects in 92 countries. Others are more focused: In 2004, the World Bank supported 42 programs with micronutrient components in 29 countries.

Vitamin A programs are consistently supported by all donors reviewed and receive more support than any other micronutrient programs. At least half of USAID's support and 63 percent of MI's projects are dedicated to vitamin A. Both iron and vitamin A are found in nearly two-thirds of World Bank projects that have a micronutrient component, and iodine is found in about one-third. USAID reports an obligation of $3.49 million to UNICEF for universal salt iodization and iodine deficiency disorders (IDDs).

19 UNICEF separately records its "regular" and "other" resources. The latter comprise 81 percent of the total amount allocated to micronutrient programs and are "often earmarked effectively by the donor (e.g. vitamin A and CIDA)" (I. Darnton-Hill, personal communication, December, 2005). As this is a potential source of double-counting, we have included only UNICEF's regular resources ($3.74 million). This may be an underestimation.

20 It is difficult to interpret differences between organizations because of the different ways regional emphasis is measured. Where possible, we used the percentage of micronutrient funding by region. Otherwise, a proxy was employed. In the case of UNICEF, the proxy was the distribution of projects by country (and only for vitamin A programs). For the World Bank, the only information available was a list by country of nutrition projects with a micronutrient component and the total cost (not just the cost of the micronutrient component) of those projects. We have assumed that the distribution of resources to each project as a whole reflects the distribution to the micronutrient component within it.

Zinc receives very little support. One percent of MI projects and 10 percent of USAID projects support zinc-related activities, and there is no indication that any of the 42 World Bank projects in 2004 supported activities to address zinc deficiency. Folic acid is rarely mentioned. Projects that involve more than one micronutrient are quite common; for example, more than half of Gates Foundation investments in micronutrients and the majority of World Bank micronutrient projects are for such projects.

Most funding is directed toward project implementation, almost equally for supplementation and fortification. However, in addition to project implementation, some significant basic research efforts (e.g., Harvest Plus) as well as advocacy, training, and coordination activities (Emory, CDC) are important components of strategies. The data are insufficient to draw any conclusions about overall levels of support for supplementation versus fortification programs. Several big players (e.g., USAID, CIDA, and UNICEF) focus heavily on supplementation. GAIN's country programs are for fortification. The World Bank has more supplementation than fortification activity; among the two-thirds of projects in which project type is indicated, most mention supplementation and only 20 percent mention fortification. Home gardening and the promotion of micronutrient-rich foods are strategies supported by many NGOs, by some bilaterals (such as GTZ), and, less commonly, by the World Bank.

Supplementation consumes more of MI's resources (60%) than fortification (28%), with shared activities such as program design and monitoring accounting for the rest. The emphasis for MI programming differs for different regions and micronutrients. Supplementation is more important in Africa, where it accounts for 81 percent of resources, than in Asia (51%). In 2004, most of the projects for iron, folic acid, iodine, and zinc involved fortification (78%, 67%, 100%, and 100%, respectively). In the case of vitamin A, 88 percent of the projects were for supplementation.

The Gates Foundation provided important levels of support for research on plant breeding, directed to the Harvest Plus program. In 2005, Gates awarded seven grants, worth $9.6 million per annum, to plant-breeding projects.[21]

Data Sources, Limitations, and Issues

- Data on financial inputs is not normally in the public domain and is not available in a useful format. Websites and annual reports may present some information, but rarely is it specific with regard to micronutrient activities.
- Not all organizations report in a standardized or comparable way, and not all types of activities or geographic areas are consistently reported. Analyses may include only information that is readily available, rather than presenting the complete picture.
- Financing data, especially data related to the World Bank and the World Food Program, contain important gaps (see below).
- Most organizations have some problem in readily accessing disaggregated data on their financial contributions to VMD programs.

21 Data extracted from the list of grants awarded in the "priority diseases" and "breakthrough science" categories, www.gatesfoundation.org

The World Bank is a significant player—many of its nutrition projects include a micronutrient component, and nutrition lending was estimated at $700 to $750 million in 2004 (Heaver, 2005). However, we have no micronutrient-specific financing data to verify this estimate. HKI is another important organization for which we do not have first-hand data. HKI has been combating vitamin A deficiency for decades through vitamin A supplementation, nutrition education, promoting the production and consumption of vitamin-A-rich foods, and encouraging food fortification with micronutrients. The organization's total expenditures in 2004, according to its annual report, were about $35 million, but it is not clear how much of that can be attributed to micronutrient programs as opposed to, for example, general nutrition or blindness prevention programs. Some of the HKI contribution is captured in information from other donors (e.g., CIDA's contribution to HKI of $4 million). There are also smaller international NGOs active in this field whose contributions we have not been able to include. Some of these contributions may be quite significant.

The World Food Programme (WFP) uses voluntary contributions to support humanitarian and development projects. Donations are made in cash; food such as flour, beans, oil, salt, and sugar; or basic items necessary to grow, store, and cook food (e.g., kitchen utensils, agricultural tools, warehouses). An estimated 20 percent of the total volume of food programmed by WFP was fortified with vitamins and minerals in 2002 (WFP, 2004). Cereal flours made up 50 percent of the processed fortified foods. The WFP is the leading purchaser of fortified, blended foods worldwide. However, none of this information is captured in our calculations.

These observations suggest that our estimate of total commitment from international sources to reducing VMDs is conservative. The way organizations routinely collect and record financial and programmatic data makes it easier for some organizations than for others to identify specific micronutrient activities. For example, the coding system used at UNICEF appears to allow the organization to identify micronutrient activities relatively easily. Even so, these data were not easily retrievable, and coding has been interpreted differently over the years. It is unclear whether UNICEF's recently implemented system of thematic funding will improve or weaken the ability to disaggregate expenditure data to the level of detail needed to track funding for VMD activities.[22]

The trend in some organizations (e.g., the World Bank) is toward integration (subsuming nutrition components into larger health programs), making it more difficult to identify and code not only nutrition activities but the smaller subset of micronutrient activities. DFID also does not treat nutrition, let alone micronutrient programs, in isolation.

Perhaps not surprisingly, MI, whose sole purpose is micronutrients, provided an impressively rapid and comprehensive response. Nevertheless, even MI had some data problems.

22 "Thematic contributions are based on existing programs ...or the thematic priority areas described in the [medium-term strategic plan (MTSP)], and no specific proposals are requested by the donor. The pooled funds are allocated to achieve the goals in the respective priority areas. The donors do not request any specific financial statements tracking their contribution, but rather a holistic report on results achieved in the thematic area they are supporting and the expenditures from all sources (regular resources, other resources and thematic funds) in the same thematic area, at the global, regional or country level." United Nations Children's Fund Executive Board. November 14, 2005. Thematic funding in the context of the medium-term strategic plan. E/ICEF/2006/9. http://www.unicef.org/spanish/about/execboard/files/06-9-thematic_funding_final.pdf (accessed December 19, 2005)

Expenditures by program, country, activity, and input are not separately held or attributed (although vitamin A supplies are easily attributable by country).

The Gates Foundation has an information system that made accessing essential information about its support for VMDs straightforward. From its website, we were able to access a database that provided a complete list of projects funded by year, with a short description of the project (from which it was possible to identify micronutrient projects), the organization receiving the grant, the level of the grant, and the grant period.

It is difficult to analyze expenditures on micronutrients at the international level because of the complex financing relationships among organizations. Donors that fund micronutrient work are not always able to provide sufficiently detailed or appropriately coded data necessary for estimating funding for micronutrient activities, let alone for specific types of micronutrients, or for regions, countries, and so on. Implementing agencies are usually in a better position to do this, but relying solely on them is also problematic, in part because there are many more of them than there are donors, which makes it likely that important work will be overlooked.

Though it increases the risk of double-counting, a pragmatic combination of approaching donors and implementers is best. The task is made more difficult by the dual role many key agencies play. Some organizations are clearly donors, receiving funding directly from government (e.g., bilateral donors such as CIDA, DFID, USAID, and CDC) or from private funding sources (e.g., the Gates Foundation). Some are clearly recipients, funded to carry out micronutrient-related work (e.g., Harvest Plus). However, many play a dual role as donor/implementers, functioning as a conduit through which money passes. MI, for example, is funded by CIDA and in turn funds organizations such as UNICEF and HKI to implement some of its projects.

Agencies group and categorize their data differently. Variables that typically are not treated consistently include the period covered by the financial year, the definition of geographic regions, and the scope of activities included. In reporting expenditures and program information, some of the institutions we surveyed excluded shared functions such as management and administration, while others included them. Furthermore, some of the reported data refer to obligated funds, while others use actual expenditures.

International agencies have demonstrated that it is possible to work collaboratively at country level to scale up programs. These experiences should be highlighted and shared.

Next Steps for Strategic Action and Research

To gain an accurate picture of overall support for VMD reduction, we need to clearly document and understand the flows of international finance. Developing standard funding definitions and categories would help in piecing together the puzzle.

More complete and accurate information on the scope and nature of donor activities and financial commitments would be desirable not only as a snapshot of a single year, as we have presented here, but for several years, so that trends in support for VMD reduction can be illuminated.

There are a number of aspects of international support that we have not been able to address in this report. These aspects should be explored if an effective global strategy is to be developed.

- The legal and regulatory framework and the broad policy framework within which agencies operate.
- Organizations' procedures for dealing with developing countries.
- Mechanisms that currently exist to facilitate coordination of micronutrient efforts among different supporters.
- Agency structures and how they affect the management of micronutrient programs and the decisions made about those programs.
- The extent to which micronutrient activities are integrated within broader programs.

Considering the number of organizations involved, albeit with limited funding from each, effective coordination can help accelerate country programs. At least a consistent set of objectives, technical approaches and protocols, and commitment to working harmoniously are essential. At best, a common strategy with stated milestones and results and a monitoring framework would be developed and actively used. Coordination mechanisms at the global and country levels would need to be strengthened. Coordination among donors and international implementing agencies appears to be most urgently needed on the following topics that are of common concern among stakeholders:

- Databases on Prevalence, Food Consumption, Consumer Behavior and Forecasting
- Public Education and Communications (including advocacy)
- Strengthening Food Delivery Systems (including fortification and biofortification)
- Strengthening Health Delivery Systems (including supplementation and linking with other health interventions e.g. de-worming, malaria, EPI, antenatal care)
- Addressing special Needs: Emergencies, Children 6-24 months
- Research Agenda for Securing Rapid Global Impact (including micronutrients and infectious diseases)
- Capacity Building and Leadership Development
- Monitoring Global and Country Results and Cost/Cost-effectiveness

The experience of other results-oriented global initiatives that have functioned well in the past, suggest that a more sharply focused and prioritized global strategy would require the functioning of the following types of mechanisms:

- a broad, participatory *global forum* where all stakeholders at various administrative levels and regions and from the private and public sectors could meet to renew their commitments, and share experiences and concerns, perhaps every 2 years (e.g. adapted IVACG/INACG conferences);
- a *'board of directors'* working on policies related to the rolling out, implementation and monitoring of the global initiative. There might be regional boards with the support of regional development banks;
- a small secretariat or *working committee* for day to day tasks;

- a technical advisory or reference group or panel of experts meeting annually to help interpret new research findings and concerns from the field, possibly with subgroups for each key micronutrient;
- working groups or task forces with annual funding and defined results/products related to the topics listed above to solve operational problems getting in the way of achieving global results. They could develop guidelines and tools, carry out lessons learned reviews, monitor progress or conduct program and 'analytic' reviews, help build country or regional capacity, identify success stories etc.

Conclusions and Recommendations

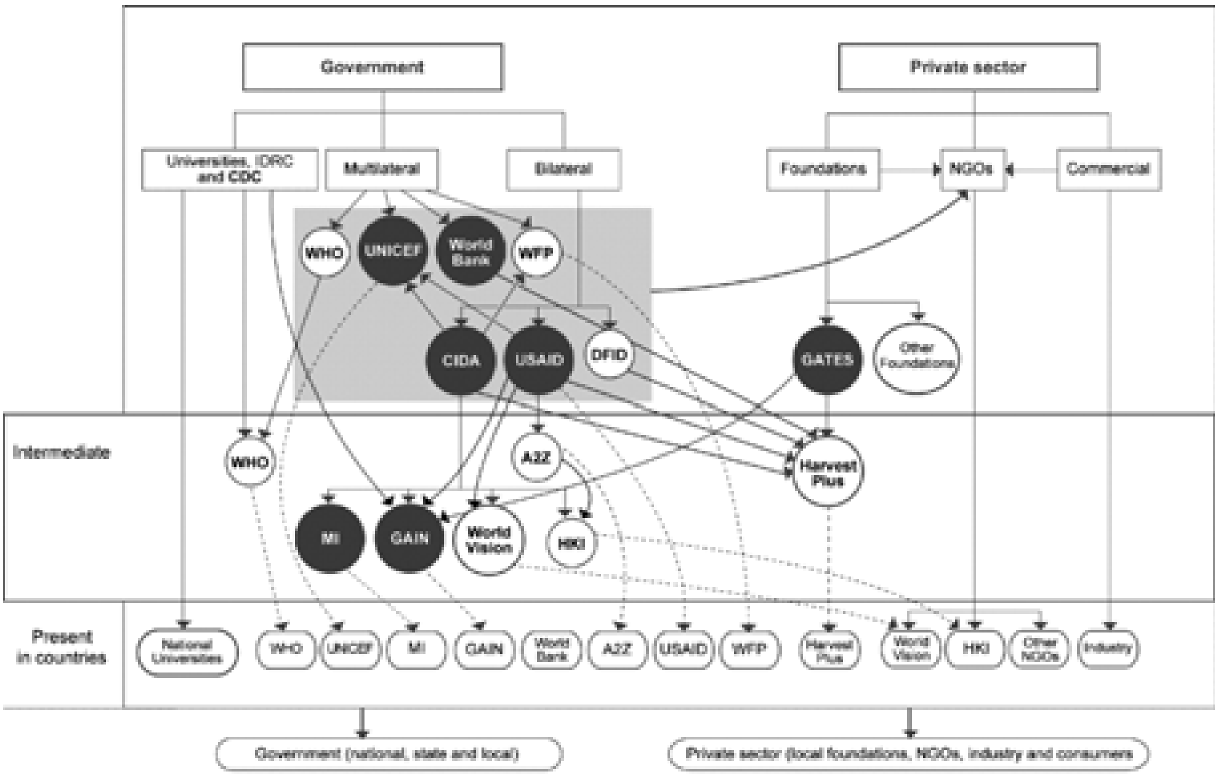
- There is a significant level of international support for various vitamin and mineral deficiency reduction activities, but funding levels are much less than for other health initiatives with less favorable cost-benefit ratios and less impact on objectives such as health, education, productivity, and, ultimately, the Millennium Development Goals.
- Many international agencies are engaged in vitamin A programs, and many are working in the Africa region. Both fortification and supplementation needs of countries are supported. Currently, there is no effective way to ensure that donors are speaking with one voice. The potential for overlap and gaps is high because of the lack of comprehensive and inclusive coordination mechanisms.
- Information on relative strengths, the niche areas of various organizations, and organizational funding is not well documented. Lessons learned include the following:
  - Direct contact with the organization is usually essential, but it can be difficult to identify the persons who have access to data and the authority to make it available.
  - The data requested are not always easily assembled, even by the organization itself, because of the way organizations categorize and summarize their financial information.
  - Identifying all the components related to VMDs can be problematic. It is easy to overlook some elements when an organization is funding health service support programs from one pool of financial resources, research conducted by multilateral organizations from another, and training provided by universities from a third. Many programs and projects may be related to VMDs, but the micronutrient elements may be so deeply embedded that it is difficult to tease out the finances related to them.
  - Even when reliable, complete, specific data are collected from individual organizations, it can be difficult to build an accurate global picture. The data may not be directly comparable (e.g., definitions of financial years vary, and some organizations have data on financial allocations but not on expenditures). Also, the complex financial interactions that exist among organizations can be difficult to untangle, especially as these organizations are a mix of primary donors, intermediate financial managers, and implementing agencies.
- Currently available financial data are not sufficiently comprehensive to provide an accurate picture of the overall levels of international funding for VMD reduction activities. They do,

nevertheless, provide some indication of the general level of support and the emphasis given to particular micronutrients, activities, and regions.

- Annual international support for micronutrient activities in developing countries is probably on the order of at least $124 million.
- Vitamin A consistently receives the bulk of the resources, while folic acid and zinc appear to be low priorities.
- The Africa region appears to benefit from about half the resources available for micronutrient programs, and substantial investments are also being made in Asia.
- Research on plant breeding appears likely to receive more emphasis in the future.
- Improved estimates of the extent and nature of donor support for VMD reduction activities would help planning and coordination and might encourage new donors to invest.
- The creation of a coordinated global strategy and mechanisms for donors and implementers to discuss and resolve emerging issues would help countries and donors alike.
- Developing a more transparent, accessible, and consistent way of tracking micronutrient funding, at least for major supporters, might encourage greater accountability on the part of donors for the commitments they make to micronutrient programs.[23] The first steps in developing such a system would be to gain agreement on what is needed and how it is to be used, and to understand how donors currently collect, code, and analyze their financial and project data.
- A jointly agreed upon framework for coordination is needed. It should be operationalized in a manner that builds on existing coordination mechanisms. It would facilitate more efficient planning and use of donor and country resources; include mechanisms for timely, ongoing alignment of programs and policies based on the latest evidence; make better use of resources for higher quality documentation and tracking of process and outcome indicators, including the cost-effectiveness of programs; monitor emerging threats to public health impacts from micronutrient programs; and guide investments in country-level leadership and evidence-based strategies. There are several functioning models that can be explored and adapted for the micronutrients sector.

23 The Gates Foundation website is a good example of clear presentation of funding information. www.gatesfoundation.org

Figure 5.1 *Illustrative Relationships Among Donors and Intermediaries Supporting Micronutrient Programs*



Note: Though not represented here, regional organizations also play an important role.

Table 5.1 Levels of Financial Support

DONOR	Total Contribution to VMD Activities in 2004 (US$ 1,000s)	Regional Allocations			Breakdown by Type of Micronutrient (% / yes)					
		Africa	Asia			Iron	Folic Acid		Zinc	
MI	23,400	45%	40%	15%	63%	19%	9%	7%	1%	
USAID	32,442	41%	54%	5%	50%	15%		10%	10%	15%
UNICEF	19,401	63%	21%	16%	yes	yes	yes	yes	no?	
World Bank	No data	14%	61%	25%	62%	66%	7%	34%	0%	21%
Harvest Plus	5,448	Nr	Nr	Nr	yes	yes			yes	
DFID	2,389				yes					
FFI	100	Yes	Yes	Yes						
CDC	4,986	10%	30%	60%	yes	yes	yes	yes	no	Yes
GAIN	17,270	40%	17%	43%	yes	yes	yes	no	no	Yes
CIDA	27,637				yes	yes		yes		
GATES	28,122	50%	14%	36%	14%	1%		11%	8%	65%
WV/ Canada	4,166	yes	yes	yes	yes	yes	yes	yes	no	yes
HKI	No data	yes	yes		yes	yes			yes	Yes
DANIDA	296									
SIDA	177									
Spain	17									
AusAid	480									
Preliminary Total	166,331									
Adjustment	-42,000									
Adjusted TOTAL	$124,000 approximate									

Sources: See annex E for a detailed description of sources and methods.

6 Conclusions and the Way Forward

"The unequivocal choice now is between continuing to fail, as the global community did with HIV/AIDS for more than a decade, or to finally put nutrition at the center of development so that a wide range of economic and social improvements that depend on nutrition can be realized." (Sarbib in World Bank News Release No: 2006/283/HD accessed March 20 2006)

This review shows that a substantial amount of information is available to guide the use of resources for accelerating progress in reducing vitamin and mineral deficiencies. A Global Ten Year Strategy could serve as a powerful planning and advocacy tool, outlining regional and global scenarios for impacts and costs of planned activities. Following the pattern of other successful initiatives, strategic plans could be developed for key operational components of the strategy, and mechanisms for coordination, information exchange, and technical support could be established. The thematic focus of actions would be the virtual elimination of vitamin and mineral deficiencies as a basis for campaign development.

The following are the main inferences that can be drawn from the review of current literature.

Rationale for Investing in Reducing Vitamin and Mineral Deficiencies

- Poverty alleviation and equity strategies should give priority to nutrition. Micronutrient interventions are highly cost-effective and produce rapid favorable impacts on the poor, women, and young children. Reducing vitamin A, iron, iodine, folic acid and zinc deficiencies in particular have high payoffs.
- Proven interventions can reduce maternal and child mortality and prevent crippling disabilities (such as childhood blindness, neural tube defects in newborns, and mental impairment/cretinism) that erode educability, physical capacity, and well-being.
- The threat of large-scale infectious disease outbreaks leading to death and disability can be partly reduced by strengthening the innate immune function by ensuring adequate micronutrient status.
- Nutritional deficiencies (e.g., of iron and iodine) can impair mental development and affect schooling. Interventions to prevent such deficiencies should be given priority in education strategies.

Magnitude of the Problem

- Despite the availability of effective interventions, the global prevalence of vitamin and mineral deficiencies (VMDs) remains high. Some countries have experienced declines in the deficiencies, but these declines have not substantially affected global levels, except for the reduction in clinical and subclinical signs of iodine deficiency disorders (IDD) and clinical signs of vitamin A deficiency (VAD).

- The global prevalence of VMDs will not decrease unless large-scale intervention programs improve micronutrient intake in South Asia and sub-Saharan Africa, particularly among hard-to-reach groups in large countries.
- Improving national prevalence data and establishing surveillance and monitoring mechanisms are worthwhile investments. Factors closely related to trends in prevalence, particularly food intake at the individual level, should be a part of the monitoring function of an accelerated global strategy. Indicators for some of the deficiencies should be reviewed and reassessed. Modeling provides useful insights when measured prevalences are unavailable; it could be used judiciously to complement data. Representative surveys such as DHS and MICS help to validate data from routine monitoring systems.

Implementing Programs at Scale

- Transitions in food procurement and consumption patterns that are accompanying global transformations in urbanization, food production, incomes, family structures and lifestyles have major repercussions for nutrition, particularly micronutrients.
- Immunization and antenatal health care contacts, and the use of processed foods in the food sector, provide good opportunities for effectively delivering vitamins and minerals. The rise of retail food sales through large supermarket chains provides another opportunity to engage the private sector in the delivery of a large variety of micronutrient rich products at reasonable cost along with appropriate consumer information.
- Food fortification is highly cost-effective but for most micronutrients does not reach the most critical target populations with levels of nutrients needed to prevent or reduce dietary deficiencies; supplementation and/or special products are needed to complement fortification. In many countries, food fortification can form the core of a comprehensive strategy that also includes other interventions selected on the basis of careful analysis on which target populations require supplemental interventions. Fortification is also a safe and cost-effective way to addressing multiple deficiencies not only of the five main vitamins and minerals but others e.g. vitamin B group and C as well.
- Economic growth will not necessarily reduce VMDs unless it is accompanied by micronutrient interventions. Much of the industrialized world depends on fortified foods to meet micronutrient needs; high-need groups such as infants and pregnant women also consume supplements.
- There needs to be an explicit strategy for the very high risk groups, e.g. refugees and populations experiencing emergencies, and young children 6-24 months of age.
- Delivery strategies for iron and iodine will need to reach a broad range of populations, since a wide spectrum of ages and groups are affected. Young children will need specially targeted interventions for vitamin A, iron, and zinc; pregnant women will require targeted supplementation; and all women of reproductive age need folic acid.
- Owing to the role of infections in determining micronutrient status, programs aimed at reducing VMDs should establish close links with health interventions, especially malaria control, de-worming, and measles immunization.

- Global partnerships for universal salt iodization (USI) and vitamin A supplementation have addressed critical planning, supply, and monitoring needs at the country level. Current partnerships provide a good starting point for building a more comprehensive micronutrient alliance. Several working models exist for global public health initiatives (e.g., Stop TB Partnership and the Global Alliance for Improved Nutrition); certain elements of these models can be adapted to the micronutrient sector.

Costs of Interventions

- The micronutrient literature includes studies that, although frequently cited, are very old and lack specificity and precision in their treatment of program costs.
- Great caution should be used in generalizing the unit costs of micronutrient programs, especially vitamin A supplementation.
- The cost-effectiveness of vitamin A supplementation programs can be further improved by bundling programs with other services (such as national immunization days or child health weeks/days) and using volunteers.
- The noncomparability of methods precludes making a more definitive statement, but it appears that programs implemented exclusively by nongovernmental organizations (NGOs) are roughly 25 percent more expensive per beneficiary than programs implemented primarily or predominantly by a public-sector entity.

External Assistance in the Micronutrient Sector

- The urgency of the problem of VMDs, combined with potential high payoffs and current inadequate program levels, points toward development of a carefully planned strategy for fundraising and better coordination among donors in their financing and implementation approaches. Many donors may not be aware of the comparative high return on investment in the VMD sector with regard to health, education, and productivity relative to other development options.
- To ensure consistency and transparency, resources should be invested to establish a mechanism for completing and updating the key information on international efforts that is needed for program planning.
- The current mechanisms used for information gathering, retrieval, and use are limited in scope, representation, and function, but they could be excellent building blocks and should form the foundation for a joint global planning effort.
- Urgent next steps are to make a short list of the most critical information essential for joint strategy analysis and planning, and explore the best methods of obtaining this information. A commitment is needed for ongoing maintenance of the tracking mechanism for such information.
- The feasibility of developing an ongoing, harmonized mechanism for capturing donor investments should be carefully explored. The use of a common framework for application within each organization's coding system or the use of periodic surveys of key informants are two options. Good examples of formats are discussed in the report. A common set of indicators and definitions should guide this activity.

Strong evidence exists for public health and development impacts arising from micronutrient programs that have successfully reached high-risk populations. We know a lot about the strengths and limitations of delivering the appropriate micronutrients to the most vulnerable groups in the fastest, safest, and most cost-effective way. But gaps in coverage, lack of clarity about current investments, and uncertainties about future funding remain. A mechanism for donors and implementers to share information and agree on emerging issues would help countries and donors alike. This review has identified some elements of a globalized approach for the micronutrient sector.

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ANNEX

A

Tables on Country Indicators for Micronutrients

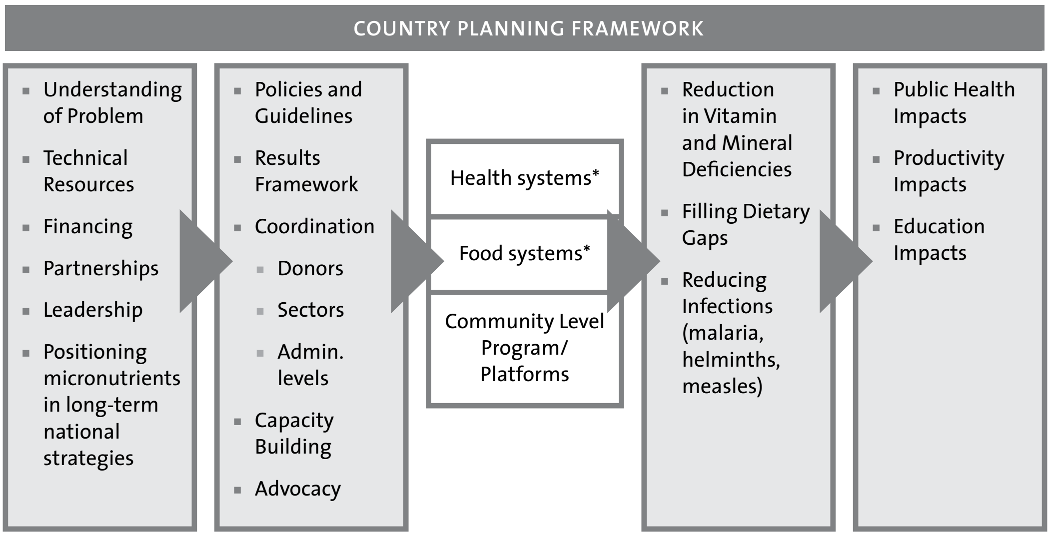
Introduction

The purpose of this Annex is to provide ready access to the type of country data required for global strategy development.

The following categories of variables were considered based on typical considerations that go into country program planning. It contains several gaps particularly for current policies, food sector related variables, e.g. patterns of food consumption, amounts of daily intakes by age groups and rural/urban, mapping of food industries by size of operation and coverage, import/export patterns and tariffs, current products being fortified, levels used in premixes etc. Also missing are: a complete listing of stakeholders involved in country programs and the nature and level of support, and country contextual factors.

- **Key outcomes:** public health indicators, vitamin and mineral deficiencies
- **Objectives of programs:** fill dietary gaps and reduce health conditions that increase the risk of deficiencies
- **Processes in the key development sectors that affect program delivery and results:** food sector, health sector, community platforms
- **Inputs and enabling or constraining factors:** related to food and health systems strengthening and community mobilization, coordination, resources
- **Contextual factors:** Country stability, governance, leadership, financial situation, regulatory frameworks etc.

It is hoped that this database can be built upon and maintained for use by teams engaged in country and regional/global planning.



* A number of factors influence the ability of these systems to facilitate or limit delivery of adequate amounts of key vitamins and minerals to high risk groups and address confounding factors.

Tables A.1: Prevalence

Table A.1.1 Prevalence: Vitamin A Deficiency Among Young Children (Pre-school Age Children)

Vitamin A deficiency (Serum/plasma retinol < 0.70 umol/L)

Country	Last Measured Prevalence			Recent Prevalence (Derived)	
	Survey year	Prevalence %	Source	Tulane/MI/ UNICEF[1] 2000 %	JHU[2] 2001 %
AFRICA					
Algeria	ND			28.9	28.0
Angola	1998	64.3[r]	Aguayo, 2003	64.3	28.0
Benin	1999	70.2[p]	Aguayo, 2003	43.3	23.8
Botswana	1994	32.5[a]	MI, 2001	29.8	32.5
Burkina Faso	NS	70.5[a]	WHO MDIS, 1995; MI 1998	46.4	36.0
Burundi	ND			44.2	28.0
Cameroon	2000	19.7[p]	Aguayo, 2003; MI, 1998	36.0	11.8
Cape Verde	1996	2.0	Global Micronutrient Survey, 2002	ND	2.2
Central African Republic	1999	68.2[b]	Mulder-Sibanda et al. 2001	46.8*	68.2
Chad	ND			45.1	28.0
Comoros	ND			ND	28.0
Congo	1988	26.0[a]	WHO MDIS, 1995	32.2	17.6
Cote d'Ivoire	1996	33.2	Global Micronutrient Survey, 2002	34.0	28.0
Democratic Republic of Congo	1998	61.1[c]	Aguayo, 2003	42.1	23.3
Equatorial Guinea	ND			ND	28.0
Eritrea	1995	13.4	Araya, 1997	29.7*	17.9
Ethiopia	1999	68.0	Haidar and Demissie, 1999	38.9	61.2
Gabon	ND			42.8	28.0
Gambia	1999	64.0[q]	Aguayo, 2003	46.6*	64.0
Ghana	1991	72.0	D. Ross unpublished in Sommer and West KP, 1996	45.8	24.5
Guinea	ND			51.0	23.8
Guinée Bissau	ND			31.1	28.0

Country	Last Measured Prevalence			Recent Prevalence (Derived)	
	Survey year	Prevalence %	Source	Tulane/MI/UNICEF[1] 2000 %	JHU[2] 2001 %
Kenya	1994	40.6	WHO MDIS, 2001	31.7	40.6
Lesotho	1993	78.0	WHO MDIS, 1995; WHO MDIS, 2001	54.1	78.0
Liberia	1999	52.9[b]	Craft 2001 (DBS Method), Mulder-Sibanda, Ortiz, Andele, and Baker, 2001	37.7	52.9
Madagascar	2000	41.8[d]	MOST, 2001	44.0	32.0
Malawi	1991	22.0[a,e]	Escoute et al., 199[1]	51.4	16.5
Mali	NS	73.0[f]	WHO MDIS, 1995; MI 1998	47.3	46.5
Mauritania	1987	41.6[g]	WHO MDIS, 1995; MI 1998	17.4	21.2
Mauritius	1995	9.3[h]	WHO MDIS, 1995; MI 1998	48.7	9.3
Mozambique	ND			25.8	28.0
Namibia	1992	20.4[e]	FAO, 2001; WHO MDIS, 1995; MI 1998	58.8	17.3
Niger	ND			41.1	23.8
Nigeria	1998	28.0	Stoltfus and Klemm, 1998	38.2	28.1
Rwanda	1996	6.4	WHO MDIS, 2001	38.8	5.4
Sao Tome & Principe	ND			ND	28.0
Senegal	1991	46.0[i]	Carlier et al., 1991 using ICT	61.1	34.5
Seychelles	ND			ND	28.0
Sierra Leone	ND			46.9	28.0
South Africa	1994	33.3[j]	SAVACG, 1995	33.1	33.3
Swaziland	1997	54.0	ACCSCN, 1998	38.2	54.0
Tanzania	1997	24.2[s]	Ballart, A. et al., 1998	36.6	23.1
Togo	ND			34.7	28.0
Uganda	2001	27.9[s]	Aguayo, 2003	36.6*	28.0
Zambia	1997	65.7[r]	Aguayo, 2003	52.6*	55.8
Zimbabwe	1999	35.8	WHO MDIS, 2001	35.8	35.8

Country	Last Measured Prevalence			Recent Prevalence (Derived)	
	Survey year	Prevalence %	Source	Tulane/MI/UNICEF[1] 2000 %	JHU[2] 2001 %
EASTERN MEDITERRANEAN					
Afghanistan	ND			53.3	28.0
Bahrain	ND			ND	ND
Djibouti	1988	15.8	WHO MDIS, 2001	ND	15.8
Egypt	1995	11.9[k]	WHO MDIS, 2001; Moussa et al., 1997	27.1	11.9
Iran	1980's	9.0	Kimiagar WHO 1995	23.1	5.4
Iraq	ND			41.7	28.0
Jordan	1997	4.04[a]	Deitchler et al., 2004	19.3	ND
Kuwait	ND			15.8	ND
Lebanon	ND			19.9	ND
Libyan Arab Jamahiriya	ND			19.3	ND
Morocco	1997	40.0	ACC/SCN, 1997	29.2	25.5
Oman	1994-1995	20.8	WHO MDIS, 1995	ND	17.7
Pakistan	1998	50.0[a]	WHO MDIS, 1995	35.0	24.0
Qatar	ND			ND	ND
Saudi Arabia	ND			20.9	ND
Somalia	ND			25.1	23.8
Sudan	ND			35.8	23.8
Syrian Arab Republic	ND			22.0	ND
Tunisia	ND			21.5	ND
United Arab Emirates	ND			13.7	ND
Yemen	1992	63.0[a]	Rosen et al., 1996	40.3	32.1
SOUTH/SOUTH EAST ASIA					
Bangladesh	1997	22.0	Deitchler et al., 2004	28.2	30.8
Bhutan	1985	28.0[l]	WHO MDIS, 1995	32.4	23.8
Democratic Republic of Korea	ND			ND	12.3
India	ND			56.8	30.8
▪ Rajasthan	ND			ND	ND

Country	Last Measured Prevalence			Recent Prevalence (Derived)	
	Survey year	Prevalence %	Source	Tulane/MI/UNICEF[1] 2000 %	JHU[2] 2001 %
▪ Madhya Pradesh	ND			ND	ND
▪ Uttar Pradesh	ND			ND	ND
▪ Bihar	ND			ND	ND
▪ Orissa	2001	63.8[a]	Global Micronutrient Survey, 2002	ND	ND
▪ West Bengal	ND			ND	ND
▪ Gujarat	ND			ND	ND
▪ Maharashtra	ND			ND	ND
▪ Andhra Pradesh	2001	52.3[a]	Global Micronutrient Survey, 2002	ND	ND
Indonesia	1995	50.0	Deitchler et al., 2004	25.8	57.5
▪ Lampung	ND			ND	ND
▪ Banten	ND			ND	ND
▪ West Java	ND			ND	ND
▪ Central Java	ND			ND	ND
▪ East Java	ND			ND	ND
▪ NTB/Lombok	ND			ND	ND
▪ South Sulawesi	ND			ND	ND
Maldives	ND			ND	0.0
Myanmar	1987	32.4[a]	WHO MDIS, 1995	35.2	16.0
Nepal	1998	32.3	MOH et al., 1998	32.8	34.9
Sri Lanka	1996	35.3	WHO MDIS, 2001	23.5*	35.3
Thailand	1990	20.0[a]	WHO MDIS, 1995	21.9	6.7
Timor-Leste	ND			ND	ND
WESTERN PACIFIC					
Australia	ND			ND	ND
Brunei Darussalam	ND			ND	ND
Cambodia	1992	19.7[a]	Dietchler et al., 2004	42.3	23.6
China	1999-2000	11.7[a]	Y. Shi-an, 2004	11.7	11.7
Cook Islands	ND			ND	12.3
Fiji	ND			ND	ND

Country	Last Measured Prevalence			Recent Prevalence (Derived)	
	Survey year	Prevalence %	Source	Tulane/MI/ UNICEF[1] 2000 %	JHU[2] 2001 %
Japan	ND			ND	ND
Kiribati	ND			ND	49.0
Korea, Republic of	ND			ND	ND
Lao PDR	2000	44.9	MOH (LPDR), 2001	44.7	23.6
Malaysia	1984	12.0[a]	WHO MDIS, 1995	19.7	7.2
Marshall Islands	NS	63.0	Peterson, 1996	ND	63.0
Micronesia, Federated States of	NS	49.0[m]	Lloyd -Puryear et al., 1991; CDC, 2001	ND	49.0
Mongolia	1999	19.8	Global Micronutrient Survey, 2002	29.1	ND
Nauru	ND			ND	ND
New Zealand	ND			ND	ND
Niue	ND			ND	ND
Palau	ND			ND	19.6
Papua New Guinea	1993	58.1[a]	MI, 2001	37.4	22.8
Philippines	2003	40.1	Perlas et al., 2003	22.8	38.0
Samoa	ND			ND	ND
Singapore	ND			ND	ND
Solomon Islands	ND			ND	12.3
Tonga	ND			ND	12.3
Tuvalu	ND			ND	12.3
Vanuatu	ND			ND	12.3
Vietnam	2000	10.2	NFNS	17.9*	11.8
EUROPE					
Albania	ND			ND	ND
Andorra	ND			ND	ND
Armenia	ND			11.6	ND
Austria	ND			ND	ND
Azerbaijan	ND			22.7	ND
Belarus	ND			ND	ND
Belgium	ND			ND	ND

Country	Last Measured Prevalence			Recent Prevalence (Derived)	
	Survey year	Prevalence %	Source	Tulane/MI/ UNICEF[1] 2000 %	JHU[2] 2001 %
Bosnia & Herzegovina	ND			ND	ND
Bulgaria	ND			ND	ND
Croatia	ND			ND	ND
Cyprus	ND			ND	ND
Czech Republic	ND			ND	ND
Denmark	ND			ND	ND
Estonia	ND			ND	ND
Finland	ND			ND	ND
France	ND			ND	ND
Georgia	ND			11.4	ND
Germany	ND			ND	ND
Greece	ND			ND	ND
Hungary	ND			ND	ND
Iceland	ND			ND	ND
Ireland	ND			ND	ND
Israel	ND			ND	ND
Italy	ND			ND	ND
Kazakhstan	ND			19.3	ND
Kyrgyzstan	ND			18.3	ND
Latvia	ND			ND	ND
Lithuania	ND			ND	ND
Luxembourg	ND			ND	ND
Macedonia, The Former Yugoslav Republic of	1998	29.5[n]	WHO MDIS, 2001	ND	29.5
Malta	ND			ND	ND
Moldova, Republic of	ND			ND	ND
Monaco	ND			ND	ND
Netherlands	ND			ND	ND
Norway	ND			ND	ND
Poland	ND			ND	ND
Portugal	ND			ND	ND

Country	Last Measured Prevalence			Recent Prevalence (Derived)	
	Survey year	Prevalence %	Source	Tulane/MI/UNICEF[1] 2000 %	JHU[2] 2001 %
Romania	ND			ND	ND
Russian Federation	ND			ND	ND
San Marino	ND			ND	ND
Serbia-Montenegro	ND			ND	ND
Slovakia	ND			7.8	ND
Slovenia	ND			ND	ND
Spain	ND			ND	ND
Sweden	ND			ND	ND
Switzerland	ND			ND	ND
Tajikistan	ND			17.9	ND
Turkey	ND			17.7	ND
Turkmenistan	ND			17.9	ND
Ukraine	ND			ND	ND
UK	ND			ND	ND
Uzbekistan	1993	48.9[a]	MI, 2001	39.7	ND
Yugoslavia	ND			ND	ND
REGION OF THE AMERICAS					
Antigua & Barbuda	1996	11.7	Mora et al., 1998	ND	ND
Argentina	1999	6.3[a]	Global Micronutrient Survey, 2002	ND	ND
Bahamas	ND			ND	ND
Barbados	ND			ND	ND
Belize	1990	10.0	WHO MDIS, 1995; ACC/SCN, 1997	16.4	10.0
Bolivia	1991	11.3	ACC/SCN, 1997	22.6	11.3
Brazil	1998	32.10[a]	Global Micronutrient Survey, 2002	15.2	13.7
▪ Paraiba	ND			ND	ND
▪ Pernambuco	ND			ND	ND
▪ Piaui	ND			ND	ND
▪ Sao Paulo	ND			ND	ND

Country	Last Measured Prevalence			Recent Prevalence (Derived)	
	Survey year	Prevalence %	Source	Tulane/MI/ UNICEF[1] 2000 %	JHU[2] 2001 %
▪ Sergipe	ND			ND	ND
Canada	ND			ND	ND
Chile	ND			8.8	ND
Colombia	1995	13.0	ACC/SCN, 1997	12.7	11.1
Costa Rica	1996	8.7	ACC/SCN, 1997	8.8	8.7
Cuba	ND			8.2	ND
Dominica	1996	9.0	ACC/SCN, 1997	ND	9.0
Dominican Republic	1991	19.6[a,o]	WHO MDIS, 1995; ACC/ SCN, 1997; MI, 1998	17.5	19.6
Ecuador	1993	17.9[p]	Jervis et al., 1994	13.0	10.7
El Salvador	1988	36.0	WHO MDIS, 1995; MI, 1998	17.0	18.4
Grenada	ND			ND	ND
Guatemala	1995	15.8	ACC/SCN, 1997; MI, 1998	21.3	13.4
Guyana	1997	10.6	Global Micronutrient Survey, 2002	18.3	ND
Haiti	ND			31.5	19.6
Honduras	1996	13.0	Pineda, 1998	15.2	13.0
Jamaica	ND			11.1	ND
Mexico	1990	32.0	ACC/SCN, 1997; MI, 1998	13.1	32
Nicaragua	2000	8.6	Mora & Bonilla, 2002	14.1*	9
Panama	1999	9.4	Global Micronutrient Survey, 2002	11.7	5.1
Paraguay	ND			12.9	ND
Peru	1999	10.9	Global Micronutrient Survey, 2002	16.9	13.0
Saint Kitts & Nevis	ND			ND	ND
Saint Lucia	ND			ND	ND
Saint Vincent & the Grenadines	1997	6.2	Global Micronutrient Survey, 2002	ND	ND
Suriname	ND			ND	ND
Trinidad & Tobago	ND			10.1	ND
USA	ND			ND	ND
Uruguay	ND			9.6	ND

Country	Last Measured Prevalence			Recent Prevalence (Derived)	
	Survey year	Prevalence %	Source	Tulane/MI/ UNICEF[1] 2000 %	JHU[2] 2001 %
Venezuela	1994	7.0	ACCSCN 97, 1998	11.4	7.0

* Predicted and recent survey values averaged
a Subnational data
b National survey for children 6 to 35 months
c For children 6-36 months
d Near-national survey; For children 6-59 months
e For children 2 to 6 years
f Assessment of previous surveys performed in 1986 and other years
g Average of two surveys conducted in 1987 among 1 to 15 year olds
h For children 36-72 months
i Using ICT
j For children 6-71 months
k Children 6 to 76 months
l Use of "doubling rule"
m Results from these two studies combined estimate a composite prevalence of .49
n For children 0 to 4 years
o Survey of preschool children in southwestern region of the country
p For children 12 to 59 months
q For children 12-71 months
r For children 0-59 months
s For children 6-59 months

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Table A.1.2 Prevalence: Vitamin A Deficiency Among Young Children (Pre-school Age Children)

Xerophthalmia

Country	Last Measured Prevalence			Recent Prevalence (Derived)	
	Survey year	Prevalence %	Source	Tulane/MI/UNICEF[1] 2000 %	JHU[2] 2001 %
AFRICA					
Algeria	ND			1.0	1.2
Angola	1973	3.0[a]	WHO MDIS, 1995	1.6	1.8
Benin	1989	8.3	WHO MDIS, 1995	1.5	2.0
Botswana	1986	0.7	MI, 1998	0.5	0.2
Burkina Faso	1986	3.9[a]	MI, 1998	2.1	0.9
Burundi	ND			1.3	1.2
Cameroon	1992	0.7[b]	WHO MDIS, 1995; Sibetcheu and Kollo, 1999	1.1	0.5
Cape Verde	1982-83	3.2	WHO MDIS, 1995	ND	3.2
Central African Republic	ND			2.0	1.2
Chad	1986	3.6[a]	MI, 1998	2.0	2.7
Comoros	ND			ND	1.2
Congo	ND			1.7	0.1
Cote d'Ivoire	ND			1.5	0.7
Democratic Republic of Congo	ND			2.1	1.2
Equatorial Guinea	ND			ND	1.2
Eritrea	ND			0.9	1.9
Ethiopia	NS	4.8	Haider and Demissie, 1999	2.3	4.8
Gabon	ND			1.3	1.2
Gambia	ND			1.2	1.2
Ghana	ND			1.0	0.5
Guinea	1995	0.4[a,c]	Schemann, 1996	1.9	0.1
Guinée Bissau	ND			1.7	0.4
Kenya	1994	2.0	WHO MDIS, 1995; MI, 1998	0.7	2.0
Lesotho	ND			0.4	1.2
Liberia	ND			1.6	1.2
Madagascar	2000	2.2	Global Micronutrient Survey, 2002	2.2	0.5

Country	Last Measured Prevalence			Recent Prevalence (Derived)	
	Survey year	Prevalence %	Source	Tulane/MI/UNICEF[1] 2000 %	JHU[2] 2001 %
Malawi	1983-89	2.0[d]	WHO MDIS, 1995	1.0	1.2
Mali	1986-90	6.5[d]	WHO MDIS, 1995	1.7	2.0
Mauritania	1983	2.6	USAID reported by WHO MDIS, 1995	1.7	0.6
Mauritius	NS	0.0	WHO, 1995	0.6	0.0
Mozambique	1990	0.7	WHO MDIS, 1995; Fidalgo, 1999	1.8	0.4
Namibia	ND			0.8	0.5
Niger	1992	3.7	MI, 1998	2.5	0.9
Nigeria	1993	1.0	WHO MDIS, 1995	1.6	1.0
Rwanda	1987	2.6[a]	MI, 1998	0.7	0.6
Sao Tome & Principe	ND			ND	1.2
Senegal	1994	0.6	MI, 1998	1.7	0.4
Seychelles	ND			ND	1.2
Sierra Leone	ND			1.8	1.2
South Africa	1994	1.6[e]	SAVACG, 1995	0.5	1.6
Swaziland	ND			0.6	1.2
Tanzania	1984	1.5	WHO MDIS, 1995	0.9	0.4
Togo	1992	10.0	WHO MDIS, 1995	1.8	6.0
Uganda	1991	3.5[a]	WHO MDIS, 1995	1.4	2.1
Zambia	1998	6.2	Luo et al., 1999	0.5	2.5
Zimbabwe	1999	0.2	Global Micronutrient Survey, 2002	0.2*	0.2
EASTERN MEDITERRANEAN					
Afghanistan	NS	5.5	NS	2.2	4.1
Bahrain	ND			ND	ND
Djibouti	1988	1.0	WHO MDIS, 1995	ND	0.4
Egypt	1995	0.2	Mason et al., 2001	0.9	0.3
Iran	NS	1.0[f]	Kimiagar, 1994	0.4	0.6
Iraq	1994	1.6	WHO MDIS, 1995	1.4	0.4
Jordan	ND			0.3	ND

Country	Last Measured Prevalence			Recent Prevalence (Derived)	
	Survey year	Prevalence %	Source	Tulane/MI/UNICEF[1] 2000 %	JHU[2] 2001 %
Kuwait	ND			0.3	ND
Lebanon	ND			0.4	ND
Libyan Arab Jamahiriya	ND			0.5	ND
Morocco	ND			1.1	0.5
Oman	ND			ND	1.2
Pakistan	1997	0.6	Paracha and Jameel, 2000	1.8	0.2
Qatar	ND			ND	ND
Saudi Arabia	ND			0.5	ND
Somalia	NS	3.1	Feldon, 1997	2.0	3.1
Sudan	NS	2.9	Nestel et al., 1993	1.6	1.7
Syrian Arab Republic	ND			0.6	ND
Tunisia	ND			0.8	ND
United Arab Emirates	ND			0.1	ND
Yemen	1992	2.2[a]	Rosen et al., 1996	1.5	1.3
SOUTH/SOUTH EAST ASIA					
Bangladesh	1999	0.5	HKI and Institute of Public Health Nutrition, 1999	[0.5]	0.6
Bhutan	1999	0.0	Global Micronutrient Survey, 2002	0.0*	0.1
Democratic Republic of Korea	ND			ND	ND
India	2001	1.7	Deitchler et al., 2004	1.7	1.6
▪ Rajasthan	ND			ND	ND
▪ Madhya Pradesh	ND			ND	ND
▪ Uttar Pradesh	ND			ND	ND
▪ Bihar	ND			ND	ND
▪ Orissa	ND			ND	ND
▪ West Bengal	ND			ND	ND
▪ Gujarat	ND			ND	ND
▪ Maharashtra	ND			ND	ND

Country	Last Measured Prevalence			Recent Prevalence (Derived)	
	Survey year	Prevalence %	Source	Tulane/MI/UNICEF[1] 2000 %	JHU[2] 2001 %
▪ Andhra Pradesh	ND			ND	ND
Indonesia	1995	0.3	Deitchler et al., 2004	0.7	0.3
▪ Lampung	ND			ND	ND
▪ Banten	ND			ND	ND
▪ West Java	ND			ND	ND
▪ Central Java	ND			ND	ND
▪ East Java	ND			ND	ND
▪ NTB/Lombok	ND			ND	ND
▪ South Sulawesi	ND			ND	ND
Maldives	ND			ND	0.0
Myanmar	1994	1.8	MI, 1998	0.5	0.4
Nepal	1998	0.6	MOH et al., 1998	[0.3]	0.6
Sri Lanka	1995	1.6	Deitchler et al., 2004	0.2	1.6
Thailand	NS	0.1g	Udomkesmalee, 1992	0.1	0.0
Timor-Leste	ND			ND	ND
WESTERN PACIFIC					
Australia	ND			ND	ND
Brunei Darussalam	ND			ND	ND
Cambodia	NS	1.0	HKI, 2000	1.4	0.4
China	2000	0.2[h]	Dietchler et al., 2004	[0.2]	0.2
Cook Islands	NS	0.6	Schaumberg et al., 1995	ND	0.6
Fiji	ND			ND	ND
Japan	ND			ND	ND
Kiribati	NS	14.8	Schaumberg et al., 1995; Darnton-Hill, 1994	ND	14.8
Korea, Republic of	ND			ND	ND
Lao PDR	2000	0.7	MOH (LPDR), 2001	[1.1]	0.7
Malaysia	ND			0.4	0.3
Marshall Islands	1991	4.0	WHO MDIS, 1995	ND	4.0
Micronesia, Federated States of	NS	16.0	Lloyd -Puryear et al., 1991; CDC, 2001	ND	16.0

Country	Last Measured Prevalence			Recent Prevalence (Derived)	
	Survey year	Prevalence %	Source	Tulane/MI/ UNICEF[1] 2000 %	JHU[2] 2001 %
Mongolia	1999	0.8	Global Micronutrient Survey, 2002	[0.5]	ND
Nauru	ND			ND	ND
New Zealand	ND			ND	ND
Niue	ND			ND	ND
Palau	ND			ND	6.4
Papua New Guinea	1991	0.6[i]	WHO MDIS, 1995	1.2	0.2
Philippines	1993	0.1 or 0.7[j]	WHO MDIS, 1995	0.4	0.1
Samoa	ND			ND	ND
Singapore	ND			ND	ND
Solomon Islands	NS	1.6 or .59[j]	Schaumberg et al., 1995; WHO MDIS, 1995	ND	1.6
Tonga	ND			ND	ND
Tuvalu	NS	0.3	Schaumberg et al., 1995	ND	0.3
Vanuatu	NS	0.1	Schaumberg et al., 1995	ND	0.1
Vietnam	1998	0.2	Khan, 2001	0.2	0.2
EUROPE					
Albania	ND			ND	ND
Andorra	ND			ND	ND
Armenia	ND			0.1	ND
Austria	ND			ND	ND
Azerbaijan	ND			0.0	ND
Belarus	ND			ND	ND
Belgium	ND			ND	ND
Bosnia & Herzegovina	ND			ND	ND
Bulgaria	ND			ND	ND
Croatia	ND			ND	ND
Cyprus	ND			ND	ND
Czech Republic	ND			ND	ND
Denmark	ND			ND	ND

Country	Last Measured Prevalence			Recent Prevalence (Derived)	
	Survey year	Prevalence %	Source	Tulane/MI/UNICEF[1] 2000 %	JHU[2] 2001 %
Estonia	ND			ND	ND
Finland	ND			ND	ND
France	ND			ND	ND
Georgia	ND			0.3	ND
Germany	ND			ND	ND
Greece	ND			ND	ND
Hungary	ND			ND	ND
Iceland	ND			ND	ND
Ireland	ND			ND	ND
Israel	ND			ND	ND
Italy	ND			ND	ND
Kazakhstan	ND			0.0	ND
Kyrgyzstan	ND			0.0	ND
Latvia	ND			ND	ND
Lithuania	ND			ND	ND
Luxembourg	ND			ND	ND
Macedonia, The Former Yugoslav Republic of	ND			ND	ND
Malta	ND			ND	ND
Moldova, Republic of	ND			ND	ND
Monaco	ND			ND	ND
Netherlands	ND			ND	ND
Norway	ND			ND	ND
Poland	ND			ND	ND
Portugal	ND			ND	ND
Romania	ND			ND	ND
Russian Federation	ND			ND	ND
San Marino	ND			ND	ND
Serbia-Montenegro	ND			ND	ND
Slovakia	ND			0.0	ND
Slovenia	ND			ND	ND

Country	Last Measured Prevalence			Recent Prevalence (Derived)	
	Survey year	Prevalence %	Source	Tulane/MI/UNICEF[1] 2000 %	JHU[2] 2001 %
Spain	ND			ND	ND
Sweden	ND			ND	ND
Switzerland	ND			ND	ND
Tajikistan	ND			0.3	ND
Turkey	ND			0.6	ND
Turkmenistan	ND			0.0	ND
Ukraine	ND			ND	ND
UK	ND			ND	ND
Uzbekistan	ND			0.0	ND
Yugoslavia	ND			ND	ND
REGIONS OF THE AMERICAS					
Antigua & Barbuda	ND			ND	ND
Argentina	ND			ND	ND
Bahamas	ND			ND	ND
Barbados	ND			ND	ND
Belize	ND			0.5	ND
Bolivia	1981	1.7	Mora et al., 1998	0.6	ND
Brazil	1983	0.5	WHO MDIS, 1995	0.2	0.1
▪ Paraiba	ND			ND	ND
▪ Pernambuco	ND			ND	ND
▪ Piaui	ND			ND	ND
▪ Sao Paulo	ND			ND	ND
▪ Sergipe	ND			ND	ND
Canada	ND			ND	ND
Chile	ND			0.1	ND
Colombia	ND			0.5	ND
Costa Rica	ND			0.2	ND
Cuba	ND			0.1	ND
Dominica	ND			ND	ND
Dominican Republic	ND			0.2	ND

Country	Last Measured Prevalence			Recent Prevalence (Derived)	
	Survey year	Prevalence %	Source	Tulane/MI/UNICEF[1] 2000 %	JHU[2] 2001 %
Ecuador	ND			0.1	ND
El Salvador	ND			0.3	ND
Grenada	ND			ND	ND
Guatemala	ND			0.8	ND
Guyana	ND			0.2	ND
Haiti	1975	8.0	WHO MDIS, 1995	1.6	4.8
Honduras	ND			0.2	ND
Jamaica	ND			0.1	ND
Mexico	ND			0.2	ND
Nicaragua	ND			0.5	ND
Panama	ND			0.2	ND
Paraguay	ND			0.2	ND
Peru	ND			0.3	ND
Saint Kitts & Nevis	ND			ND	ND
Saint Lucia	ND			ND	ND
Saint Vincent & the Grenadines	ND			ND	ND
Suriname	ND			ND	ND
Trinidad & Tobago	ND			0.1	ND
USA	ND			ND	ND
Uruguay	ND			0.1	ND
Venezuela	ND			0.3	ND

* Predicted and recent survey values averaged
[ ] Values in square brackets - more uncertain
a Subnational data
b Near-national survey
c Prevalences added for groups X1B and XN
d Estimate from several surveys
e For children 6-71 months
f In poorer regions
g Average of two estimates plus consideration of seasonal variation of estimates; likely an underestimate
h Survey of 14 provinces, treated as national
i Hospital survey
j Conflicting value listed in comments section and table; therefore, both numbers have been provided

1 Mason, J. Rivers, J. and Hetwig C. Recent trends in malnutrition in developing regions: Vitamin A deficiency, anemia, iodine deficiency, and child development. Food and Nutrition Bulletin. Vol. 26, No. 1, 2005; pages 160-162. (Reported in children 0-72 months).
2 West KPJr, Rice A, Sugimoto, J. Tables on the Global Burden of vitamin A deficiency among preschool children and Low Vitamin A Status, Vitamin A Deficiency and Maternal Night Blindness among Pregnant Women by WHO Region. http://www.jhsph.edu/chn/images/GlobalVADtables.pdf

Table A.1.3 Prevalence: Vitamin A Deficiency Among Pregnant Women

Vitamin A Deficiency (Serum/plasma retinol < 0.70 umol/L)

Country	Last Measured Prevalence			Recent Prevalence (Derived)
	Survey year	Prevalence %	Source	JHU[1] 2001 %
AFRICA				
Algeria	ND			9.4
Angola	ND			9.4
Benin	ND			9.4
Botswana	ND			9.4
Burkina Faso	1978	57.6	WHO MDIS, 1995	23.0
Burundi	ND			9.4
Cameroon	ND			9.4
Cape Verde	ND			9.4
Central African Republic	1999	16.8	Mulder-Sibanda et al., 2001	16.8
Chad	ND			9.4
Comoros	ND			9.4
Congo	ND			9.4
Cote d'Ivoire	ND			9.4
Democratic Republic of Congo	ND			9.4
Equatorial Guinea	ND			9.4
Eritrea	ND			9.4
Ethiopia	ND			9.4
Gabon	ND			9.4
Gambia	NS	4.8[a,b]	Villard and Bates, 1987	3.6
Ghana	ND			9.4
Guinea	ND			9.4
Guinée Bissau	ND			9.4
Kenya	NS	15.1[c]	Mostad et al., 1997	9.1
Lesotho	ND			9.4
Liberia	1999	12.0	Mulder-Sibanda et al., 2001	12.0
Madagascar	ND			9.4
Malawi	1994 & 1998	23.5[d]	Young et al., 2000 and Semba et al., 1994	14.1
Mali	1978 & 1979	36.1[d]	Le Francoies et al., 1980	21.7
Mauritania	ND			9.4

Country	Last Measured Prevalence			Recent Prevalence (Derived)
	Survey year	Prevalence %	Source	JHU[1] 2001 %
Mauritius	ND			9.4
Mozambique	ND			9.4
Namibia	ND			9.4
Niger	1975	65.3[e]	WHO MDIS, 1995	16.3
Nigeria	ND			4.7
Rwanda	NS	22.4[f]	Dushiminana, 1992	13.4
Sao Tome & Principe	ND			9.4
Senegal	1979	9.7[a]	WHO MDIS, 1995	5.8
Seychelles	ND			9.4
Sierra Leone	ND			9.4
South Africa	NS	23.9[a]	Fariney et al., 1987	9.6
Swaziland	NS	28[g]	Cairo IVACG meeting 1997	25.2
Tanzania	NS	33.4[h]	Fawzi et al., 1998	20.0
Togo	ND			9.4
Uganda	ND			5.6
Zambia	1998	21.5	WHO MDIS, 2001	21.5
Zimbabwe	NS	16.0[i]	Personal Communication by Mzengeza and Humphrey of ZVITAMBO study (Mzengeza and Humphrey, 2001)	9.6
EASTERN MEDITERRANEAN				
Afghanistan	ND			9.4
Bahrain	ND			ND
Djibouti	ND			9.4
Egypt	1995	10.2[j]	Moussa et al., 1997	10.2
Iran	ND			ND
Iraq	ND			9.4
Jordan	ND			ND
Kuwait	ND			ND
Lebanon	ND			ND
Libyan Arab Jamahiriya	ND			ND

Country	Last Measured Prevalence			Recent Prevalence (Derived)
	Survey year	Prevalence %	Source	JHU[1] 2001 %
Morocco	NS	12.5[a]	NS	12.5
Oman	ND			ND
Pakistan	1976-77	10.7	WHO MDIS, 1995	6.4
Qatar	ND			ND
Saudi Arabia	ND			ND
Somalia	ND			9.4
Sudan	NS	2.4	El Bushara and El Tom, 1987	2.4
Syrian Arab Republic	ND			ND
Tunisia	ND			ND
United Arab Emirates	ND			ND
Yemen	ND			9.4
SOUTH/SOUTH EAST ASIA				
Bangladesh	NS	8.0[k]	Ahmed et al., 1996 and Ahmed et al.,1997	6.0
Bhutan	1985	26.0[l]	WHO, 1995	2.6
Democratic Republic of Korea	ND			3.2
India	NS	8.0[m]	NS	4.8
▪ Rajasthan	ND			ND
▪ Madhya Pradesh	ND			ND
▪ Uttar Pradesh	ND			ND
▪ Bihar	ND			ND
▪ Orissa	ND			ND
▪ West Bengal	ND			ND
▪ Gujarat	ND			ND
▪ Maharashtra	ND			ND
▪ Andhra Pradesh	ND			ND
Indonesia	NS	17.0[n]	NS	10.2
▪ Lampung	ND			ND
▪ Banten	ND			ND
▪ West Java	ND			ND

Country	Last Measured Prevalence			Recent Prevalence (Derived)
	Survey year	Prevalence %	Source	JHU[1] 2001 %
▪ Central Java	ND			ND
▪ East Java	ND			ND
▪ NTB/Lombok	ND			ND
▪ South Sulawesi	ND			ND
Maldives	ND			2.0
Myanmar	ND			4.8
Nepal	1998	31.5	MOH et al., 1998	31.5
Sri Lanka	1991	15.4[a]	Jayasekara et al., 1991	11.6
Thailand	ND			3.0
Timor-Leste	ND			ND
WESTERN PACIFIC				
Australia	ND			ND
Brunei Darussalam	ND			ND
Cambodia	ND			16.7
China	NS	2.0[o]	NS	2.0
Cook Islands	ND			5.6
Fiji	ND			ND
Japan	ND			ND
Kiribati	ND			16.7
Korea, Republic of	ND			ND
Lao PDR	ND[p]			16.7
Malaysia	1960's - 1980's	12.0[q]	WHO MDIS, 1995	4.8
Marshall Islands	ND			16.7
Micronesia, Federated States of	ND			16.7
Mongolia	ND			ND
Nauru	ND			ND
New Zealand	ND			ND
Niue	ND			ND
Palau	ND			8.9
Papua New Guinea	ND			8.9

Country	Last Measured Prevalence			Recent Prevalence (Derived)
	Survey year	Prevalence %	Source	JHU[1] 2001 %
Philippines	2003	17.5	Perlas et al., 2003	22.2
Samoa	ND			ND
Singapore	ND			ND
Solomon Islands	ND			16.7
Tonga	ND			5.6
Tuvalu	ND			5.6
Vanuatu	ND			5.6
Vietnam	NS	20.0[r]	NS	15.0
EUROPE				
Albania	ND			ND
Andorra	ND			ND
Armenia	ND			ND
Austria	ND			ND
Azerbaijan	ND			ND
Belarus	ND			ND
Belgium	ND			ND
Bosnia & Herzegovina	ND			ND
Bulgaria	ND			ND
Croatia	ND			ND
Cyprus	ND			ND
Czech Republic	ND			ND
Denmark	ND			ND
Estonia	ND			ND
Finland	ND			ND
France	ND			ND
Georgia	ND			ND
Germany	ND			ND
Greece	ND			ND
Hungary	ND			ND
Iceland	ND			ND

Country	Last Measured Prevalence			Recent Prevalence (Derived)
	Survey year	Prevalence %	Source	JHU[1] 2001 %
Ireland	ND			ND
Israel	ND			ND
Italy	ND			ND
Kazakhstan	ND			ND
Kyrgyzstan	ND			ND
Latvia	ND			ND
Lithuania	ND			ND
Luxembourg	ND			ND
Macedonia, The Former Yugoslav Republic of	ND			ND
Malta	ND			ND
Monaco	ND			ND
Netherlands	ND			ND
Norway	ND			ND
Poland	ND			ND
Portugal	ND			ND
Moldova, Republic of	ND			ND
Romania	ND			ND
Russian Federation	ND			ND
San Marino	ND			ND
Serbia-Montenegro	ND			ND
Slovakia	ND			ND
Slovenia	ND			ND
Spain	ND			ND
Sweden	ND			ND
Switzerland	ND			ND
Tajikistan	ND			ND
Turkey	ND			ND
Turkmenistan	ND			ND
Ukraine	ND			ND
UK	ND			ND
Uzbekistan	ND			ND

Country	Last Measured Prevalence			Recent Prevalence (Derived)
	Survey year	Prevalence %	Source	JHU[1] 2001 %
Yugoslavia	ND			ND
REGION OF THE AMERICAS				
Antigua & Barbuda	ND			ND
Argentina	ND			ND
Bahamas	ND			ND
Barbados	ND			ND
Belize	ND			4.2
Bolivia	ND			5.3
Brazil	1973	2.5[S]	WHO MDIS, 1995	2.5
▪ Paraiba	ND			ND
▪ Pernambuco	ND			ND
▪ Piaui	ND			ND
▪ Sao Paulo	ND			ND
▪ Sergipe	ND			ND
Canada	ND			ND
Chile	ND			ND
Colombia	ND			4.2
Costa Rica	ND			5.3
Cuba	ND			ND
Dominica	ND			4.2
Dominican Republic	ND			4.2
Ecuador	ND			4.2
El Salvador	ND			4.9
Grenada	ND			ND
Guatemala	NS	7.0	Arroyave et al., 1979	5.3
Guyana	ND			ND
Haiti	ND			4.2
Honduras	ND			5.3
Jamaica	ND			ND
Mexico	ND			4.2

Country	Last Measured Prevalence			Recent Prevalence (Derived)
	Survey year	Prevalence %	Source	JHU[1] 2001 %
Nicaragua	ND			5.3
Panama	ND			4.2
Paraguay	ND			ND
Peru	ND			4.2
Saint Kitts & Nevis	ND			ND
Saint Lucia	ND			ND
Saint Vincent & the Grenadines	ND			ND
Suriname	ND			ND
Trinidad & Tobago	ND			ND
USA	ND			ND
Uruguay	ND			ND
Venezuela	ND			4.2

[a] Subnational data
[b] 0 to 18 months postpartum
[c] Clinic based survey of HIV-positive women of reproductive age
[d] Average of two surveys
[e] Refugee survey of 199 pregnant or lactating women
[f] Mixed HIV-positive and HIV-negative population in Butare
[g] 57 reported among breast-feeding mothers, estimate arbitrarily halved
[h] 1075 pregnant women in Dar es Salaam, who were 12-27 weeks gestation
[i] Average of two groups
[j] Mothers of preschool children
[k] Mean of two urban estimates
[l] Use of "doubling rule"
[m] Based on old and disparate data, this value assigned by cutoff
[n] Mean of 6 study estimates was .57, so .17 used for < 20ug/dl
[o] Estimated by assuming that it would be 2-times the national prevalence of maternal xerophthalmia, conservatively estimated at 0.1
[p] The 2000 National Health Survey collected serum retinol data on 695 women 12-49 years; prevalence = 21.32 (average calculated from MOH report); however, data not presented separately for pregnant women.
[q] Very poor and old data. Small study/survey data collected amongst women of reproductive age and a few pregnant women in the 1960's through the 1980's
[r] Khan 2001 reported 58% lactating women low breast milk vitamin A levels, and arbitrarily imputed one-third of that prevalence to be equivalent to <20 ug/dl
[s] A 1973 study involved 165 pregnant women who had a < 20ug/dl prevalence of 0.025, and an assumed <30ug/dl prevalence of 0.05, using the doubling rule

[1] West KPJr, Rice A, Sugimoto, J. Tables on the Global Burden of vitamin A deficiency among preschool children and Low Vitamin A Status, Vitamin A Deficiency and Maternal Night Blindness among Pregnant Women by WHO Region. http://www.jhsph.edu/chn/images/GlobalVADtables.pdf

Table A.1.4 Prevalence: Vitamin A Deficiency Among Pregnant Women

Night Blindness

Country	Last Measured Prevalence			Recent Prevalence (Derived)
	Survey year	Prevalence %	Source	JHU[1] 2001 %
AFRICA				
Algeria	ND			2.2
Angola	ND			2.2
Benin	2001	9.9/1.8[2]	ORC MACRO, 2005. DHS STAT COMPILER	2.2
Botswana	ND			2.2
Burkina Faso	2003	13.0/7.2[2]	ORC MACRO, 2005. DHS STAT COMPILER	2.2
Burundi	ND			2.2
Cameroon	2004	6.0/0.9[2]	ORC MACRO, 2005. DHS STAT COMPILER	2.2
Cape Verde	ND			2.2
Central African Republic	ND			2.2
Chad	ND			2.2
Comoros	ND			2.2
Congo	ND			2.2
Cote d'Ivoire	ND			2.2
Democratic Republic of Congo	ND			2.2
Equatorial Guinea	ND			2.2
Eritrea	2002	11.6/3.9[2]	ORC MACRO, 2005. DHS STAT COMPILER	1.2
Ethiopia	2000	17.5/4.8[2]	ORC MACRO, 2005. DHS STAT COMPILER	16.0
Gabon	ND			2.2
Gambia	ND			2.2
Ghana	2003	7.7/1.9[2]	ORC MACRO, 2005. DHS STAT COMPILER	2.2
Guinea	ND			2.2
Guinée Bissau	ND			2.2
Kenya	ND			2.2
Lesotho	ND			2.2

Country	Last Measured Prevalence			Recent Prevalence (Derived)
	Survey year	Prevalence %	Source	JHU[1] 2001 %
Liberia	ND			2.2
Madagascar	2003-2004	7.5/1.0[2]	ORC MACRO, 2005. DHS STAT COMPILER	7.4
Malawi	2000	4.3/1.4[2]	ORC MACRO, 2005. DHS STAT COMPILER	4.1
Mali	2001	19.1/5.8[2]	ORC MACRO, 2005. DHS STAT COMPILER	2.2
Mauritania	ND			2.2
Mauritius	ND			2.2
Mozambique	2003	5.3/1.4[2]	ORC MACRO, 2005. DHS STAT COMPILER	2.2
Namibia	ND			2.2
Niger	ND			2.2
Nigeria	2003	7.7/2.2[2]	ORC MACRO, 2005. DHS STAT COMPILER	2.4
Rwanda	2000	7.2/3.9[2]	ORC MACRO, 2005. DHS STAT COMPILER	6.9
Sao Tome & Principe	ND			2.2
Senegal	ND			2.2
Seychelles	ND			2.2
Sierra Leone	ND			2.2
South Africa	ND			2.2
Swaziland	ND			2.2
Tanzania	ND			2.2
Togo	ND			2.2
Uganda	2000-2001	8.3/1.0[2]	ORC MACRO, 2005. DHS STAT COMPILER	7.0
Zambia	1998	11.6	MDIS, 2001	11.6
Zimbabwe	1999	4.6/1.1[2]	ORC MACRO, 2005. DHS STAT COMPILER	4.4
EASTERN MEDITERRANEAN				
Afghanistan	ND			2.2
Bahrain	ND			ND
Djibouti	ND			2.2

Country	Last Measured Prevalence			Recent Prevalence (Derived)
	Survey year	Prevalence %	Source	JHU[1] 2001 %
Egypt	1995	9.4	Moussa et al., Cairo IVACG 1997	9.4
Iran	ND			ND
Iraq	ND			2.2
Jordan	ND			ND
Kuwait	ND			ND
Lebanon	ND			ND
Libyan Arab Jamahiriya	ND			ND
Morocco	2003-2004	2.2/0.9[2]	ORC MACRO, 2005. DHS STAT COMPILER	2.2
Oman	ND			ND
Pakistan	ND			2.2
Qatar	ND			ND
Saudi Arabia	ND			ND
Somalia	ND			2.2
Sudan	ND			2.2
Syrian Arab Republic	ND			ND
Tunisia	ND			ND
United Arab Emirates	ND			ND
Yemen	ND			2.2
SOUTH/SOUTH EAST ASIA				
Bangladesh	2004	6.5/3.1[2]	ORC MACRO, 2005. DHS STAT COMPILER	12.8
Bhutan	ND			7.7
Democratic Republic of Korea	2004	5.7	Central Bureau of Statistics, 2005	ND
India	2000	12.1[a]	NS	12.1
▪ Rajasthan	ND			ND
▪ Madhya Pradesh	ND			ND
▪ Uttar Pradesh	ND			ND
▪ Bihar	ND			ND
▪ Orissa	ND			ND

Country	Last Measured Prevalence			Recent Prevalence (Derived)
	Survey year	Prevalence %	Source	JHU[1] 2001 %
▪ West Bengal	ND			ND
▪ Gujarat	ND			ND
▪ Maharashtra	ND			ND
▪ Andhra Pradesh	ND			ND
Indonesia	2002-2003	1.7/0.4[2]	ORC MACRO, 2005. DHS STAT COMPILER	6.5
▪ Lampung	ND			ND
▪ Banten	ND			ND
▪ West Java	ND			ND
▪ Central Java	ND			ND
▪ East Java	ND			ND
▪ NTB/Lombok	ND			ND
▪ South Sulawesi	ND			ND
Maldives	ND			7.7
Myanmar	ND			5.6
Nepal	2001	19.6/7.5[2]	ORC MACRO, 2005. DHS STAT COMPILER	16.7
Sri Lanka	ND			3.7
Thailand	NS	7.5	Wasantwisut 2001, Christian IVACG Paper	1.9
Timor-Leste	ND			ND
WESTERN PACIFIC				
Australia	ND			ND
Brunei Darussalam	ND			ND
Cambodia	2000	8.4/1.6[2]	ORC MACRO, 2005. DHS STAT COMPILER	8.6
China	1999-2000	1.0[b]	Lin et al., SL 2/2001	1.0
Cook Islands	ND			6.5
Fiji	ND			ND
Japan	ND			ND
Kiribati	ND			8.6
Korea, Republic of	ND			ND

Country	Last Measured Prevalence			Recent Prevalence (Derived)
	Survey year	Prevalence %	Source	JHU[1] 2001 %
Lao PDR	2000	11.9[c]	MOH (LPDR), 2001	11.5
Malaysia	ND			3.4
Marshall Islands	ND			8.6
Micronesia, Federated States of	ND			8.6
Mongolia	ND			ND
Nauru	ND			ND
New Zealand	ND			ND
Niue	ND			ND
Palau	ND			6.5
Papua New Guinea	ND			3.4
Philippines	2003	7.9/2.2[2]	ORC MACRO, 2005. DHS STAT COMPILER	8.6
Samoa	ND			ND
Singapore	ND			ND
Solomon Islands	ND			6.5
Tonga	ND			6.5
Tuvalu	ND			6.5
Vanuatu	ND			6.5
Vietnam	1998	0.9	Khan, 2001	0.7
EUROPE				
Albania	ND			ND
Andorra	ND			ND
Armenia	2000	1.3/0.9[2]	ORC MACRO, 2005. DHS STAT COMPILER	ND
Austria	ND			ND
Azerbaijan	ND			ND
Belarus	ND			ND
Belgium	ND			ND
Bosnia & Herzegovina	ND			ND
Bulgaria	ND			ND

Country	Last Measured Prevalence			Recent Prevalence (Derived)
	Survey year	Prevalence %	Source	JHU[1] 2001 %
Croatia	ND			ND
Cyprus	ND			ND
Czech Republic	ND			ND
Denmark	ND			ND
Estonia	ND			ND
Finland	ND			ND
France	ND			ND
Georgia	ND			ND
Germany	ND			ND
Greece	ND			ND
Hungary	ND			ND
Iceland	ND			ND
Ireland	ND			ND
Israel	ND			ND
Italy	ND			ND
Kazakhstan	ND			ND
Kyrgyzstan	ND			ND
Latvia	ND			ND
Lithuania	ND			ND
Luxembourg	ND			ND
Macedonia, The Former Yugoslav Republic of	ND			ND
Malta	ND			ND
Moldova, Republic of	ND			ND
Monaco	ND			ND
Netherlands	ND			ND
Norway	ND			ND
Poland	ND			ND
Portugal	ND			ND
Romania	ND			ND
Russian Federation	ND			ND
San Marino	ND			ND

Country	Last Measured Prevalence			Recent Prevalence (Derived)
	Survey year	Prevalence %	Source	JHU[1] 2001 %
Serbia-Montenegro	ND			ND
Slovakia	ND			ND
Slovenia	ND			ND
Spain	ND			ND
Sweden	ND			ND
Switzerland	ND			ND
Tajikistan	ND			ND
Turkey	ND			ND
Turkmenistan	ND			ND
Ukraine	ND			ND
UK	ND			ND
Uzbekistan	ND			ND
Yugoslavia	ND			ND
REGION OF THE AMERICAS				
Antigua & Barbuda	ND			ND
Argentina	ND			ND
Bahamas	ND			ND
Barbados	ND			ND
Belize	ND			3.7
Bolivia	2003	14.1/3.0[2]	ORC MACRO, 2005. DHS STAT COMPILER	1.9
Brazil	ND			3.7
▪ Paraiba	ND			ND
▪ Pernambuco	ND			ND
▪ Piaui	ND			ND
▪ Sao Paulo	ND			ND
▪ Sergipe	ND			ND
Canada	ND			ND
Chile	ND			ND
Colombia	ND			3.7
Costa Rica	ND			1.9

Country	Last Measured Prevalence			Recent Prevalence (Derived)
	Survey year	Prevalence %	Source	JHU[1] 2001 %
Cuba	ND			ND
Dominica	ND			3.7
Dominican Republic	2002	4.5/2.9[2]	ORC MACRO, 2005. DHS STAT COMPILER	3.7
Ecuador	ND			3.7
El Salvador	NS	9.0[d]	Shankar, unpublished data	4.5
Grenada	ND			ND
Guatemala	ND			1.9
Guyana	ND			ND
Haiti	2000	9.4/0.9[2]	ORC MACRO, 2005. DHS STAT COMPILER	3.7
Honduras	ND			1.9
Jamaica	ND			ND
Mexico	ND			3.7
Nicaragua	2001	5.1/1.1[2]	ORC MACRO, 2005. DHS STAT COMPILER	1.9
Panama	ND			3.7
Paraguay	ND			ND
Peru	2000	8.2/1.9[2]	ORC MACRO, 2005. DHS STAT COMPILER	7.6
Saint Kitts & Nevis	ND			ND
Saint Lucia	ND			ND
Saint Vincent & the Grenadines	ND			ND
Suriname	ND			ND
Trinidad & Tobago	ND			ND
USA	ND			ND
Uruguay	ND			ND
Venezuela	ND			3.7

[a] Near-national survey
[b] No description of method used to assess xerophthalmia prevalence in China is available; further relevant data needed
[c] Reported as women (15-49 yrs.) of childbearing age, who had given birth in the last 12 months prior to the interview, who had a visual problem after sunset.
[d] Small rural, community-based study

[1] West KPJr, Rice A, Sugimoto, J. Tables on the Global Burden of vitamin A deficiency among preschool children and Low Vitamin A Status, Vitamin A Deficiency and Maternal Night Blindness among Pregnant Women by WHO Region. http://www.jhsph.edu/chn/images/GlobalVADtables.pdf
[2] DHS reports prevalence of both reported and adjusted night blindness (Women who reported night blindness, but did not report difficulty with vision during the day). The first figure provided is the reported and the second is adjusted prevalence.

Table A.1.5 Prevalence: Anemia in Young Children (6–59 months unless otherwise noted)

Country	Last Measured Prevalence (%)					
	Survey year	Any Hb<11 g/dl	Mild Hb 10.0-10.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
AFRICA						
Algeria	ND					
Angola	1998-1999	29.7[1]				WHO MDIS, 2005
Benin	2001	82.2	21.7	51.6	8.8	ORC MACRO, 2005. DHS STAT COMPILER
Botswana	1994	38.0			0.0	WHO MDIS, 2005
Burkina Faso	2003	91.6	18.4	60.0	13.2	ORC MACRO, 2005. DHS STAT COMPILER
Burundi	ND					
Cameroon	2004	69.4	22.7	41.9	4.9	ORC MACRO, 2005. DHS STAT COMPILER
Cape Verde	1996	70.4				Global Micronutrient Survey, 2002
Central African Republic	1999	84.2[2]				WHO MDIS, 2005
Chad	1993	96.5[3,a]				WHO MDIS, 2005
Comoros	ND					
Congo	ND					
Cote d'Ivoire	1996	50.0[4,a]				WHO MDIS, 2005
Democratic Republic of Congo	2002	67.3[5,a]				WHO MDIS, 2005
Equatorial Guinea	ND					
Eritrea	ND					
Ethiopia	ND					
Gabon	ND					
Gambia	1999	79.4[6]			16.2[6]	WHO MDIS, 2005
Ghana	2003	76.7	22.6	48.2	5.9	ORC MACRO, 2005. DHS STAT COMPILER
Guinea	2000	79.0			9.3	WHO MDIS, 2005
Guinée Bissau	ND					
Kenya	1999	72.8[7]			11.3[7]	WHO MDIS, 2005
Lesotho	1993[8]	ND				
Liberia	1999	86.7[2]				WHO MDIS, 2005

Country	Last Measured Prevalence (%)					
	Survey year	Any Hb<11 g/dl	Mild Hb 10.0-10.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
Madagascar	2003-2004	70.2	35.1	31.7	3.4	ORC MACRO, 2005. DHS STAT COMPILER
Malawi	2004-2005	68.1				WHO MDIS, 2005
Mali	2001	82.7	18.2	53.0	11.5	ORC MACRO, 2005. DHS STAT COMPILER
Mauritania	ND					
Mauritius	1995	5.3[9]			0.0[9]	WHO MDIS, 2005
Mozambique	2001-2002	74.7			7.2	WHO MDIS, 2005
Namibia	1993	1.0–55.7[10,a]				FAO, 2001
Niger	ND					
Nigeria	1993	75.6[11]				WHO MDIS, 2005
Rwanda	1996	35.5[12]			2.8[12]	ORC MACRO, 2005. DHS STAT COMPILER
Sao Tome & Principe	ND					
Senegal	ND					
Seychelles	1961[P]	3.4[13,c]				WHO MDIS, 2005
Sierra Leone	1989-1990	99.3[14,a]			38.5[14,a]	WHO MDIS, 2005
South Africa	1994	21.4[11]	14.4[11]	6.8[11]	0.2[11]	SAVACG, 1995
Swaziland	ND					
Tanzania	2004-2005	65.2			3.4	WHO MDIS, 2005
Togo	1999-2000	88.1[15, a]			17.5[15, a]	WHO MDIS, 2005
Uganda	2000-2001	65.2	20.3	38.0	6.8	ORC MACRO, 2005. DHS STAT COMPILER
Zambia	2003	53.0				WHO MDIS, 2005
Zimbabwe	1999	19.3[6]				WHO MDIS, 2005
EASTERN MEDITERRANEAN						
Afghanistan	2004	37.9				WHO MDIS, 2005
Bahrain	1979	34.6[1,a]				WHO MDIS, 2005

Country	Last Measured Prevalence (%)					
	Survey year	Any Hb<11 g/dl	Mild Hb 10.0-10.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
Djibouti	ND					
Egypt	2000	30.5	18.9	11.4	0.2	ORC MACRO, 2005. DHS STAT COMPILER
Iran	2002	18.7[2,a]				WHO MDIS, 2005
Iraq	ND					
Jordan	2002	34.2	20.8	13.2	0.2	ORC MACRO, 2005. DHS STAT COMPILER
Kuwait	2000[P]	25.5[3]				WHO MDIS, 2005
Lebanon	1997-1998	24.8[4]				WHO MDIS, 2005
Libyan Arab Jamahiriya	ND					
Morocco	2000	31.5				WHO MDIS, 2005
Oman	1995	50.5[5]			0.2[5]	WHO MDIS, 2005
Pakistan	2001	50.9			3.6	WHO MDIS, 2005
Qatar	1995	26.2[c]				WHO MDIS, 2005
Saudi Arabia	1988-1989	37.2[6,a]				WHO MDIS, 2005
Somalia	2001	58.9[7,a]			8.0[7,a]	WHO MDIS, 2005
Sudan	1995	87.2[8,a]				WHO MDIS, 2005
Syrian Arab Republic	ND					
Tunisia	1996-1997	21.7[9]				WHO MDIS, 2005
United Arab Emirates	ND					
Yemen	ND					
SOUTH/SOUTH EAST ASIA						
Bangladesh	2004	67.8[1,a]	28.0[1,a]	36.7[1,a]	3.0[1,a]	HKI & IPHN, 2006
Bhutan	2002	80.6[2,a]			6.8[2,a]	WHO MDIS, 2005
Democratic Republic of Korea	1998	31.7[3]				WHO MDIS, 2005
India	1998-1999	74.3[4]	22.9[4]	45.9[4]	5.4[4]	ORC MACRO, 2005. DHS STAT COMPILER
▪ Rajasthan		82.3	20.1	52.7	9.5	

Country	Last Measured Prevalence (%)					
	Survey year	Any Hb<11 g/dl	Mild Hb 10.0-10.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
▪ Madhya Pradesh		75.0	22.0	48.1	4.9	
▪ Uttar Pradesh		73.9	19.4	47.8	6.7	
▪ Bihar		81.3	26.9	50.3	4.1	
▪ Orissa		72.3	26.2	43.2	2.9	
▪ West Bengal		78.3	26.9	46.3	5.2	
▪ Gujarat		74.5	24.2	43.7	6.7	
▪ Maharashtra		76.0	24.1	47.4	4.4	
▪ Andhra Pradesh		72.3	23.0	44.9	4.4	
Indonesia	2003	52.8[5,a]	28.6[5,a]	23.7[5,a]	0.4[5,a]	HKI (NSS), 2003
▪ Lampung		52.6	25.3	26.8	0.5	
▪ Banten		62.4	32.2	29.8	0.4	
▪ West Java		56.6	27.6	28.5	0.6	
▪ Central Java		51.1	30.8	20.0	0.3	
▪ East Java		46.9	27.5	19.0	0.4	
▪ NTB/Lombok		70.4	35.3	34.2	0.8	
▪ South Sulawesi		51.6	28.0	23.1	0.5	
Maldives	1994	81.5[6]				WHO MDIS, 2005
Myanmar	ND					
Nepal	1998	78.0		74.9[7]	3.1	MOH et al., 1998
Sri Lanka	2001	29.9			0.3	WHO MDIS, 2005
Thailand	1995	25.2[8]				WHO MDIS, 2005
Timor-Leste	2003	31.5[9]			1.0[9]	WHO MDIS, 2005
WESTERN PACIFIC						
Australia	1997	6.3[1]				WHO MDIS, 2005
Brunei Darussalam	ND					
Cambodia	2000	63.5	30.2	31.3	2.0	ORC MACRO, 2005. DHS STAT COMPILER
China	2000	21.7[2]				ADB, 2005

Country	Last Measured Prevalence (%)					
	Survey year	Any Hb<11 g/dl	Mild Hb 10.0-10.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
Cook Islands	ND					
Fiji	1993	39.1				WHO MDIS, 2005
Japan	ND					
Kiribati	1976-1978	18.6[3,a]				WHO MDIS, 2005
Korea, Republic of	1995	18.3[9]				WHO MDIS, 2005
Lao PDR	2000			46.2[4]	2.0[4]	MOH, 2001
Malaysia	ND					
Marshall Islands	1990-1991	43.0[5]				WHO MDIS, 2005
Micronesia, Federated States of	2000	12.3[6,a]				WHO MDIS, 2005
Mongolia	2002	48.5[7]				MOH et al, 2002
Nauru	ND					
New Zealand	ND					
Niue	ND					
Palau	ND					
Papua New Guinea	1998	35.0 91.0[8,a]				FAO, 2003
Philippines	2003	32.4				Perlas et al, 2003
Samoa	1999	35.6[10]				WHO MDIS, 2005
Singapore	ND					
Solomon Islands	ND					
Tonga	ND					
Tuvalu	ND					
Vanuatu	ND					
Vietnam	2000-2001	34.1[11]	34.5[11]			WHO MDIS, 2005
EUROPE						
Albania	2000	68.8[1,a]				WHO MDIS, 2005
Andorra	ND					
Armenia	2000	23.9	14	9.6	0.4	ORC MACRO, 2006. DHS STAT COMPILER

Country	Last Measured Prevalence (%)					
	Survey year	Any Hb<11 g/dl	Mild Hb 10.0-10.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
Austria	ND					
Azerbaijan	2001	31.8				WHO MDIS, 2005
Belarus	1991-1993	21.5[2,a]				WHO MDIS, 2005
Belgium	1995[P]	46.5[3,a]				WHO MDIS, 2005
Bosnia & Herzegovina	ND					
Bulgaria	1999	32.3[4]				WHO MDIS, 2005
Croatia	ND					
Cyprus	ND					
Czech Republic	ND					
Denmark	ND					
Estonia	ND					
Finland	1979[P]	28.4[5]				WHO MDIS, 2005
France	1985-1986			10.6[6,a]		WHO MDIS, 2005
Georgia	ND					
Germany	ND					
Greece	1997-2001	2.4[7,a]				WHO MDIS, 2005
Hungary	ND					
Iceland	1996-1998		8.8[8]			WHO MDIS, 2005
Ireland	ND					
Israel	1995	30.6[9,a]				WHO MDIS, 2005
Italy	1984[P]	2.1[10,a]				WHO MDIS, 2005
Kazakhstan	1999	37.6	18	18.1	1.4	ORC MACRO, 2006. DHS STAT COMPILER
Kyrgyzstan	1997	52.2	24.8	25.8	1.6	ORC MACRO, 2006. DHS STAT COMPILER
Latvia	ND					
Lithuania	ND					
Luxembourg	ND					
Macedonia, The Former Yugoslav Republic of	1999	25.8			1	WHO MDIS, 2005
Malta	ND					

Country	Last Measured Prevalence (%)					
	Survey year	Any Hb<11 g/dl	Mild Hb 10.0-10.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
Moldova, Republic of	ND					
Monaco	ND					
Netherlands	ND					
Norway	ND					
Poland	ND					
Portugal	ND					
Romania	1999	45[11]				WHO MDIS, 2005
Russian Federation	2001	33.8[12,a]			0.8[13,a]	WHO MDIS, 2005
San Marino	ND					
Serbia-Montenegro	2000	29.5				WHO MDIS, 2005
Slovakia	ND					
Slovenia	ND					
Spain	ND					
Sweden	ND					
Switzerland	ND					
Tajikistan	2003	37.7			0.9	WHO MDIS, 2005
Turkey	2002[P]		34.5[13,a]		1.2[13,a]	WHO MDIS, 2005
Turkmenistan	2000	35.9	19.6	15.7	0.6	ORC MACRO 2006. DHS STAT COMPILER
Ukraine	2002	22.2[14]				WHO MDIS, 2005
UK	1992-1993	8[15]				WHO MDIS, 2005
Uzbekistan	2002	49.2[16]			1.0[16]	WHO MDIS, 2005
Yugoslavia	ND					
REGIONS OF AMERICAS						
Antigua & Barbuda	1996-1997	49.4[1,a]				WHO MDIS, 2005
Argentina	1998	66.4[2,a]				WHO MDIS, 2005
Bahamas	ND					
Barbados	1981	31.3[3]				WHO MDIS, 2005

Country	Last Measured Prevalence (%)					
	Survey year	Any Hb<11 g/dl	Mild Hb 10.0-10.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
Belize	ND					
Bolivia	2003	51.6	25.1	24.8	1.8	ORC MACRO, 2005. DHS STAT COMPILER
Brazil	ND					
▪ Paraiba	1994	36.4				WHO MDIS, 2005
▪ Pernambuco	1997	40.9				WHO MDIS, 2005
▪ Piaui	1991	33.8[4]				WHO MDIS, 2005
▪ Sao Paulo	1993	59.1[5]				WHO MDIS, 2005
▪ Sergipe	1998	31.4				WHO MDIS, 2005
Canada	1970-1972	5.7[6]				WHO MDIS, 2005
Chile	2002[P]	1.0[7,a]				WHO MDIS, 2005
Colombia	1995	23.3				Global Micronutrient Survey 2002
Costa Rica	1996	26.3[8]				WHO MDIS, 2005
Cuba	2002	15.5[9,a]				WHO MDIS, 2005
Dominica	1996-1997	34.4[10]				WHO MDIS, 2005
Dominican Republic	ND					
Ecuador	1993	37.8[11,a]				WHO MDIS, 2005
El Salvador	2002-2003	19.8[10]				WHO MDIS, 2005
Grenada	1985	43.7[12]				WHO MDIS, 2005
Guatemala	2002	39.7[13]				WHO MDIS, 2005
Guyana	1996-1997	47.9[14]				WHO MDIS, 2005
Haiti	2000	65.8	29.6	34.5	1.7	ORC MACRO, 2005. DHS STAT COMPILER
Honduras	2001	29.9[10]				WHO MDIS, 2005
Jamaica	1978	69.1[15]				WHO MDIS, 2005
Mexico	1998-1999	27.2[16]				WHO MDIS, 2005
Nicaragua	2002-2003	25.6			0.2	WHO MDIS, 2005
Panama	1999	36.0[10]			0.5[10]	WHO MDIS, 2005
Paraguay	ND					

Country	Last Measured Prevalence (%)					
	Survey year	Any Hb<11 g/dl	Mild Hb 10.0-10.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
Peru	2000	49.6	23.4	24.9	1.3	ORC MACRO, 2005. DHS STAT COMPILER
Saint Kitts & Nevis	ND					
Saint Lucia	ND					
Saint Vincent & the Grenadines	ND					
Suriname	ND					
Trinidad & Tobago	ND					
USA	2003	12.1[17,a]				WHO MDIS, 2005
Uruguay	ND					
Venezuela	2000-2001	38.1[18,a]				WHO MDIS, 2005

P When survey date is not specified the year of publication is used.
a Sub-national data
c Age range not specified

Africa Region

1 Reported for children 0-59 months
2 Reported for children 6-35 months.
3 Reported for infants 3-11 months; facility-based study (vaccination center) in Moundou; National survey (2000) on SAC children only.
4 Reported for children 24-71 months; Regional study of 4 zones; n=312
5 Prevalence figure reported is an average of the three medical centers reported in WHO MDIS 2005; Hb<12g/dl; Reported for children 12-35 months; Facility-based study in Lubumbashi; n=570
6 Reported for children 12-71 months.
7 Reported for children 2-71 months. Prevalence figure provided is an average of two age groups reported in WHO MDIS, 2005.
8 1993 national survey; prevalence reported in MDIS 2005 is 10.7% for children and women together (3-NS years) (Hb<11 g/dl both sexes 2-10 yrs, PW; Hb<11.5 g/dl girls 11-15 yrs, Hb,<12 g/dl boys 11-15 yrs, women)
9 Reported for children 36-83 months.
10 Data range from 1.0 in the South and Central and to 55.7 in the Northwest. Total=1,437 cases.
11 Reported for children 6-71 months.
12 Reported for children 0-83 months.
13 Reported for children not attending school; Hb<8g/dl.
14 Prevalence figure provided is an average of the 2 figures from the 2 phases reported in WHO MDIS 2005; Reported for children 0-59 months in Moyamba district; n=1164
15 Prevalence figure provided is the average of the three groups reported for children 6-35 months in WHO MDIS, 2005; study of three regions; n=3282.

Eastern Mediterranean Region

1 Facility-based study; pre-SAC location and ages not specified; n=295
2 Reported for children 6-71 months; Facility-based study (Health Care Centers) in Kharameh, an urban area in Fars Province; n=541.
3 Reported for children 24-83 months; Calculated prevalence reported in MDIS (Hb<11 g/dl 2.4 yrs, Hb<11.5g/dl for 5-6 yrs)
4 Reported for children 12-71 months.
5 Reported for children 0-59 months.
6 Reported for children 6-23 months; Facility-based study (University hospital) among children attending for immunization in Riyadh; n=366

[7] Regional study in 14 urban and rural locations in Somaliland; n=784
[8] Prevalence figure provided is an average of the six groups reported in WHO MDIS 2005; Survey in six states; n=1,800; Hb determination only for sub-sample, every 5th child.
[9] Reported for children 0-71 months.

South/South East Asia Region

[1] Unpublished data (February – March 2004) of the Nutritional Surveillance Project, HKI & Institute of Public Health Nutrition; nationally representative of rural Bangladesh (n=1,227).
[2] Reported for children 6-60 months in four zones (East, Central, West, South) and one urban area; sample size not specified.
[3] Reported for children 6-71 months; survey in 130 of 212 counties, covering 71% of the population.
[4] Reported for children 6-35 months
[5] HKI Nutrition and Health Surveillance System for 8 of the largest provinces (accounting for 70% of Indonesia's population). National figure is a weighted average for 70% of the population.
[6] Reported for children NS-59 months.
[7] Hb 7.0-10.9 g/dl (combining mild-moderate)
[8] Reported for children 0-71 months.
[9] Reported for children 0-59 months.

Western Pacific Region

[1] Reported for children 12-39 months; Facility based survey (5 Sydney hospitals); (Hb <11 g/dl+serum ferritin <10 µg/L+mean corpuscular volume <70 fL 12-23 months or <73 fL 24-38 months+mean corpuscular haemoglobin <22 pg); 95% CI: 4%, 9%.
[2] ADB report does not provide original source/reference. The 1992 national survey reports a prevalence 14.9 (WHO MDIS, 2005) for children under 6 years: 0-71 months
[3] Reported for children 0-59 months. Hb level is below 10g/dl; n=830.
[4] Reported for children 0-59 months; Hb 7-10.9 g/dl (combining mild and moderate anemia)
[5] Reported for children 0-83 months.
[6] Reported for children 24-59 months; survey in 2 (Yap, Kosrae) of 4 states; n=486.
[7] Reported for children aged 0-59 months; prevalence figure reported is adjusted; (Second National Nutrition Survey conducted by MOH, UNICEF and National Nutrition Center); National Nutrition Survey data from 2004 is being analyzed and will be released shortly
[8] Range reported for three provinces
[9] Reported for children 0-71 months; Hb<11.1g/dl; National surveys in 1995 and 1998 only report mean Hb levels
[10] Prevalence figure provided is an average of 2 age groups reported in WHO MDIS 2005.
[11] Reported for children 0-59 months.

Europe Region

[1] Cross sectional facility based study of children 6-60 months in the Lezha District of Northern Albania.
[2] Prevalence figure is an average of data for five villages reported in WHO MDIS 2005; Cohort study of healthy infants age 0-18 months selected from 75 villages in radiation-exposed and unexposed oblasts; n=757.
[3] Facility based study (12 kindergartens) of infants 4-11 months; n=142
[4] Reported for children 0-48 months
[5] Data represents prevalence of iron deficiency measured as transferring saturation <16% or serum ferritin <10ug/L; Prevalence data is an average of infants and children ages 0.5-.57, 0.75-.82, 1-1.07, 2-2.99 and 4-4.99; survey location is not specified; n=874
[6] Facility based study (Parisian Children Health Examination Center) ; Prevalence data is an average of four groups representing two age groups and two ethnic groups reported in WHO MDIS 2005; Hb<10g/dl; n=2300
[7] Prevalence data for iron deficiency anemia measured by Hb<11g/dl+serum ferritin<20ug/L ; reported for children 12-60 months;
[8] Reported for children 12-14 months; Hb<10.5g/dl
[9] Reported for children 12-36 months; Facility based study (68 "Mother and Child" Clinics); n=5589
[10] Prevalence data for iron deficiency anemia measured by Hb<11g/dl+serum ferritin <10ug/L+free erythrocyte protoporphyrin: Hb>3ug/g; Reported for children 9-38 months; Faciity based study (kindergarten) in Bologna-Nord; n=674.
[11] Reported for children 12-14 months.
[12] Prevalence value weighted; State level survey in Republic of Ingushetia; n=932.
[13] Reported for children 24-72 months; Study in all nine districts in the Province of Kahramanmaras; n=84.
[14] Reported for children 6-38 months.
[15] Reported for children 18-50 months.
[16] Hb <11g/dl for children under 36 months and Hb<12g/dl for children 36-60 months.

Region of the Americas

[1] Reported for children 12-59 months; Facility-based study (child health clinics); n=81
[2] Reported for children 6-24 months in Provincia de Chaco; 44 census centres; n=399
[3] Pre-SAC; ages not specified.
[4] Reported for children 24-71 months.
[5] Reported for infants 6-23 months.
[6] Reported for children 12-59 months; National survey n=87; Hb cut off less than 12g/dl
[7] Reported for children 24-71months; Facility-baed study (day care centers) in La Pintana; n=96
[8] Reported for children 12-83 months
[9] Reported for childrne 14-57 months; Facility-based survey (day care centers) in Havana; n=239.
[10] Reported for children 12-59 months
[11] Reported for children 12-59 months; survey in 5 poorest provinces in Ecuador; n=1486
[12] Reported for children 6-71 months.
[13] Hb <110 g/L for 6-23 months, Hb<11.1 g/dl 24-59 months.
[14] Reported for children 0-59 months.
[15] Reported for children 3-59 months.
[16] Hb<9.5g/dl,0.5-0.99 yrs, Hb<11g/dl 1-4 yrs
[17] Analysis of records from the Centers for Disease Control and Prevention (CDC) Pediatric Nutrition Surveillance System from 36 States; Hb<11g/dl 0.5 – 1 year and Hb<11.1g/dl 2 – 4 years; n=3,118,041
[18] Reported for children 24-84 months; Facility-based study (4 preschool institutions) in low socioeconomic areas in Maracaibo; n=202; Hb<11g/dl, Hb<11.5 6-7 yrs.

Table A.1.6 Prevalence: Anemia in Older Children

Country	Last Measured Prevalence (%)				
	Survey Year	Population group and age	Geographic Scope	Any Anemia Hb <12g/dl	Source
AFRICA					
Algeria	ND				
Angola	1992[P]	Children (4 m – 14y)	Local[1]	38.9[2]	WHO MDIS, 2005
Benin	1984-1985	SAC (6-14)	District[3]	54	WHO MDIS, 2005
Botswana	1994	SAC (5-9)	National	53[4]	WHO MDIS, 2005
Burkina Faso	2001	SAC (5-17)	State[5]	50.5[6]	WHO MDIS, 2005
Burundi	ND				
Cameroon	1991	Children (5-12)	Local[7]	47	WHO MDIS, 2005
Cape Verde	1977	SAC (6-15)	National	53.7[8]	WHO MDIS, 2005
Central African Republic	ND				
Chad	2000	SAC (6-16)	National	25.1[9]	WHO MDIS, 2005
Comoros	ND				
Congo	ND				
Côte d'Ivoire	1996	SAC (6-17)	Regional[10]	46[11]	WHO MDIS, 2005
Democratic Republic of Congo	ND				
Equatorial Guinea	ND				
Eritrea	ND				
Ethiopia	ND				
Gabon	ND				
Gambia	ND				
Ghana	1998[P]	SAC (6-11)	National	71.3[12]	WHO MDIS, 2005
Guinea	2000	SAC (5-10)	National	51.6[13]	WHO MDIS, 2005
Guinée Bissau	ND				
Kenya	2003[P]	SAC (9-19)	Local[14]	41.4[15]	WHO MDIS, 2005
Lesotho	ND				
Liberia	ND				
Madagascar	2000	SAC (6-15)	National	38[16]	WHO MDIS, 2005
Malawi	ND[17]				WHO MDIS, 2005
Mali	2000	SAC (6-20)	District[18]	55.8[19]	WHO MDIS, 2005

Country	Last Measured Prevalence (%)				
	Survey Year	Population group and age	Geographic Scope	Any Anemia Hb <12g/dl	Source
Mauritania	1994-1995	Children (5-13)	Local[20]	50.4[21]	WHO MDIS, 2005
Mauritius	1995	Children (3-7)	National	5.3[22]	WHO MDIS, 2005
Mozambique	2001	Adolescent Girls (10-15)	Local[23]	44.7[24]	WHO MDIS, 2005
Namibia	ND				
Niger	1992[P]	SAC (NS)	Local[25]	59.7	WHO MDIS, 2005
Nigeria	ND				
Rwanda	ND				
Sao Tome & Principe	ND				
Senegal	1968	Children (5-NS)	Local[26]	7[27]	WHO MDIS, 2005
Seychelles	1961[P]	SAC (NS)	National	0.5[28]	WHO MDIS, 2005
Sierra Leone	ND				
South Africa	1999[P]	SAC (NS)	Local[29]	22	WHO MDIS, 2005
Swaziland	ND				
Tanzania	2000[P]	SAC (7-19)	District[30]	62.6[31]	WHO MDIS, 2005
Togo	ND				
Uganda	ND				
Zambia	2001	SAC (7-16)	Local[32]	12.1[33]	WHO MDIS, 2005
Zimbabwe	1999	Children (6-15)	National	21[34]	WHO MDIS, 2005
EASTERN MEDITERRANEAN					
Afghanistan	ND				
Bahrain	1979	SAC (NS-12)	Local[1]	29.7	WHO MDIS, 2005
Djibouti	ND				
Egypt	2000	SAC (11-15)	National	28.5[2]	WHO MDIS, 2005
Iran	ND				
Iraq	1996-1997	Adolescents (11-20)	Local[3]	16.4[4]	WHO MDIS, 2005
Jordan	ND[5]				WHO MDIS, 2005
Kuwait	2000[P]	SAC (6-10)	National	21.1[6]	WHO MDIS, 2005
Lebanon	ND				

Country	Last Measured Prevalence (%)				
	Survey Year	Population group and age	Geographic Scope	Any Anemia Hb <12g/dl	Source
Libyan Arab Jamahiriya	1983[P]	SAC (6-20)	Local[7]	1.9[8]	WHO MDIS, 2005
Morocco	2003-2004	SAC (6-16)	Local Rural[9]	57.6[10]	WHO MDIS, 2005
Oman	1995	SAC (5.83-11.5)	National	51.5	WHO MDIS, 2005
Pakistan	ND				
Qatar	1993-1994	SAC (6-11)	National	11.9[11]	WHO MDIS, 2005
Saudi Arabia	2000	SAC (9-15)	Local[12]	17.3[13]	WHO MDIS, 2005
Somalia	ND				
Sudan	ND				
Syrian Arab Republic	ND				
Tunisia	1996-1997	SAC (6-10)	National	7.4[14]	WHO MDIS, 2005
United Arab Emirates	1994	SAC (6-7)	National	31	WHO MDIS, 2005
Yemen	2001[P]	SAC and Adolescents (5-19)	State[15]	18.3[16]	WHO MDIS, 2005
SOUTH/SOUTH EAST ASIA					
Bangladesh	2001	SAC (5-15)	National Rural	34.2[1]	WHO MDIS, 2005
Bhutan	ND				
Dem Rep of Korea	ND				
India	1998[P]	SAC (5-16)	Local[2]	51.5[3]	WHO MDIS, 2005
Indonesia	1995	SAC (8-11)	Local[4]	13[5]	WHO MDIS, 2005
Maldives	ND				
Myanmar	1972[P]	SAC (5-15)	Local[6]	8[7]	WHO MDIS, 2005
Nepal	1986[P]	Children (1-15)	Local[8]	78.4[9]	WHO MDIS, 2005
Sri Lanka	2003	SAC (9-16)	National	12.1[10]	WHO MDIS, 2005
Thailand	1995	SAC (6-15)	National	20.5	WHO MDIS, 2005
Timor-Leste	ND				
WESTERN PACIFIC					
Australia	ND				
Brunei Darussalam	1996-1997	Girls (6-10)	National	2.9[1]	WHO MDIS, 2005

Country	Last Measured Prevalence (%)				
	Survey Year	Population group and age	Geographic Scope	Any Anemia Hb <12g/dl	Source
Cambodia	ND				
China	1992	SAC (6-15)	National	16.9	WHO MDIS, 2005
Cook Islands	ND				
Fiji	1993	SAC (5-15)	National	29.4[2]	WHO MDIS, 2005
Japan	2000	Adolescents (12-19)	Local[3]	5.9[4]	WHO MDIS, 2005
Kiribati	2002	SAC (5-14)	Local[5]	25.7[6]	WHO MDIS, 2005
Korea, Republic of	1995	SAC (7-15)	National	30[7]	WHO MDIS, 2005
Lao PDR	2000	Children (6-12)	National	27.3[8]	WHO MDIS, 2005
Malaysia	1992-1995	Children (7-13)	Local[9]	21.9	WHO MDIS, 2005
Marshall Islands	1990-1991	SAC (7-13)	National	16[10]	WHO MDIS, 2005
Micronesia, Federated States of	1988-1989	Children (3-7)	State[11]	83.2[12]	WHO MDIS, 2005
Mongolia	ND				
Nauru	ND				
New Zealand	2002	SAC (5-15)	National Urban[13]	5.6[14]	WHO MDIS, 2005
Niue	ND				
Palau	ND				
Papua New Guinea	1973[P]	Children (2-16)	District[15]	56[16]	WHO MDIS, 2005
Philippines	2003	SAC (5-13)	National	34.5[17]	WHO MDIS, 2005
Samoa	1999	SAC (5-13)	National	10[18]	WHO MDIS, 2005
Singapore	1996[P]	SAC (11-14)	Local[19]	10.3[20]	WHO MDIS, 2005
Solomon Islands	ND				
Tonga	ND				
Tuvalu	ND				
Vanuatu	ND				
Vietnam	1999	SAC (7-10)	District[21]	2.9[22]	WHO MDIS, 2005

Country	Last Measured Prevalence (%)				
	Survey Year	Population group and age	Geographic Scope	Any Anemia Hb <12g/dl	Source
EUROPE					
Albania	ND				
Andorra	ND				
Armenia	ND				
Austria	ND				
Azerbaijan	ND				
Belarus	ND				
Belgium	ND				
Bosnia & Herzegovina	ND				
Bulgaria	ND				
Croatia	2001	SAC (7-8 and 13-14)	National	17.8[1]	WHO MDIS, 2005
Cyprus	ND				
Czech Republic	ND[2]				WHO MDIS, 2005
Denmark	1977	Children (4-14)	District[3]	0.3[4]	WHO MDIS, 2005
Estonia	ND				
Finland	1967[P]	School-age girls (12-21)	Local[5]	23	WHO MDIS, 2005
France	ND				
Georgia	ND				
Germany	ND				
Greece	1982[P]	SAC (6-18)	Regional[6]	20.1[7]	WHO MDIS, 2005
Hungary	ND				
Iceland	ND				
Ireland	ND				
Israel	ND				
Italy	ND[8]				WHO MDIS, 2005
Kazakhstan	2000	SAC (6-16)	State[9]	49.8[10]	WHO MDIS, 2005
Kyrgyzstan	ND				
Latvia	ND				
Lithuania	ND				

Country	Last Measured Prevalence (%)				
	Survey Year	Population group and age	Geographic Scope	Any Anemia Hb <12g/dl	Source
Luxembourg	ND				
Macedonia, The Former Yugoslav Republic of	ND				
Malta	ND				
Moldova, Republic of	ND				
Monaco	ND				
Netherlands	ND[11]				WHO MDIS, 2005
Norway	ND[12]				WHO MDIS, 2005
Poland	1997	SAC (10-13)	Local[13]	2.3[14]	WHO MDIS, 2005
Portugal	ND				
Romania	ND				
Russian Federation	1996-1997	Children (2-8)	Local[15]	1.7[16]	WHO MDIS, 2005
San Marino	ND				
Serbia-Montenegro	ND				
Slovakia	ND				
Slovenia	ND				
Spain	1994[P]	SAC (6-16)	Local[17]	4.1[18]	WHO MDIS, 2005
Sweden	ND				
Switzerland	ND				
Tajikistan	ND				
Turkey	2002	SAC (6-13)	State[19]	24.7[20]	WHO MDIS, 2005
Turkmenistan	ND				
Ukraine	ND				
UK	1997	SAC (4-15)	National	7.2[21]	WHO MDIS, 2005
Uzbekistan	ND				
Yugoslavia	ND				

Country	Last Measured Prevalence (%)				
	Survey Year	Population group and age	Geographic Scope	Any Anemia Hb <12g/dl	Source
REGION OF THE AMERICAS					
Antigua & Barbuda	ND				
Argentina	1993-1994	Children (6-12)	Local[1]	10.2[2]	WHO MDIS, 2005
Bahamas	ND				
Barbados	1981	SAC (NS)	National	41.8-52.5[3]	WHO MDIS, 2005
Belize	ND				
Bolivia	ND[4]				WHO MDIS, 2005
Brazil	2003[P]	Adolescents (10-15)	Local[5]	7.7	WHO MDIS, 2005
Canada	1970-1972	Children (5-10)	National	5.9[6]	WHO MDIS, 2005
Chile	ND[7]				WHO MDIS, 2005
Colombia	1999-2000	SAC (12-19)	Local[8]	5.9[9]	WHO MDIS, 2005
Costa Rica	1996	SAC (5-7)	National	34.9[10]	WHO MDIS, 2005
Cuba	ND				
Dominica	1996-1997	SAC (5-17)	National	30.7[11]	WHO MDIS, 2005
Dominican Republic	ND				
Ecuador	2000	SAC (5-15)	District[12]	16.6[13]	WHO MDIS, 2005
El Salvador	1997	SAC (6-15)	National	13.1[14]	WHO MDIS, 2005
Grenada	1985	SAC (6-15)	National	37.4	WHO MDIS, 2005
Guatemala	ND				
Guyana	1996-1997	SAC (5-15)	National	56.7[15]	WHO MDIS, 2005
Haiti	ND				
Honduras	ND				
Jamaica	1997-1998	SAC (5-17)	National	23.7	WHO MDIS, 2005
Mexico	1998-1999	SAC (5-12)	National	19.5[16]	WHO MDIS, 2005
Nicaragua	ND				
Panama	1999	SAC (6-13)	National	46.9	WHO MDIS, 2005
Paraguay	ND				
Peru	1968[P]	SAC (7-14)	Local[17]	23.8[18]	WHO MDIS, 2005
Puerto Rico	ND				
Saint Kitts & Nevis	ND				

Country	Last Measured Prevalence (%)				
	Survey Year	Population group and age	Geographic Scope	Any Anemia Hb <12g/dl	Source
Saint Lucia	ND				
Saint Vincent & the Grenadines	ND				
Suriname	ND				
Trinidad & Tobago	1968[P]	SAC (5-14)	District[19]	11.8[20]	WHO MDIS, 2005
USA	199-2002	Children (1-15)	National	2.1[21]	WHO MDIS, 2005
Uruguay	ND				
Venezuela	1992	SAC (7-16)	National	12.9[22]	WHO MDIS, 2005

P When survey date is not specified the year of publication is used.

Africa Region

1 Partly facility based study (92 children from day care center in Luanda) and older children from Cacuaco and Luanda; n=606
2 Hb <11g/dl
3 Study in two Cotonou urban districts and three rural districts in South Benin; n=508; Also Reported: Hemoglobin levels for SAC (6-14) in two 1986 rural studies.
4 Hb <11.5g/dl
5 Facility based study of schools in 5 states (Boulkiemdé, Uodalan, Sanguié, Sanmatenga and Zoundwéogo); n=1368
6 Hb <11.5g/dl both sexes 5-11 years, Hb <120 both sexes 12-14 and female 15-16, Hb <130 boys 5-16
7 Locality not specified; n=294
8 Study in 9 main islands
9 Hb <11g/dl
10 Study of four villages in each of four zones: Abidjan, Bouaké, Kolia, and Guitry; n=531
11 Hb <10g/dl;
12 Hb <11.5g/dl; Also reported: Hb <7g/dl = 0.8
13 Hb <11g/dl; Also reported: Hb <7g/dl = 1.1
14 Facility based study of 19 primary schools on the shores of Lake Victoria and Bondo District; n=746
15 Hb <11.5g/dl girls 9-11 years, Hb <12g/dl girls 12-18 years and boys 12-13 years, Hb <13g/dl boys 14-18 years.
16 Also reported: Hb <7g/dl = 1
17 Data reported for children 2.5-7.57 years in 1996 Local Intervention Study (62% in the dietary intervention and 59% in control).
18 Facility based study (60 schools) in Kolondieba Distrcit, Sikasso Region; n=1113
19 Hb <11.5g/dl both sexes 5-11, Hb <12g/dl both sexes 12-14 and girls over 14, Hb <13g/dl boys over 14
20 Senegal River Valley; n=238
21 Hb <11g/dl
22 Hb <11g/dl
23 Facility based study of 12 schools in two rural districts Guro and Macossa in Manica Province; n=688
24 Hb <12g/dl; Prevalence figure is an average of two age groups reported in WHO MDIS, 2005.
25 Primary school in Daekena; n=174
26 3 villages in Sine; n=75
27 Hb <9g/dl
28 Prevalence figure is an average of boys and girls reported in WHO MDIS, 2005; Hb <8g/dl.
29 Ndunakazi (Rural community in KwaZulu); n=123
30 Facility based study (59 schools); n=3400
31 Also reported: Hb <11g/dl =31.2 for this study and other SAC hemoglobin levels in 1994 Regional Study
32 2 Primary schools in Chawama, a peri-urban area in Lusaka; n=406
33 Hb <11.5g/dl both sexes 5-11, Hb <12g/dl girls 12-15 and boys 12-13, Hb <13g/dl boys 14-15
34 Hb <11.5g/dl 6-12 years and Hb <12g/dl 12-15 years

Eastern Mediterranean Region

[1] One school in location not specified; n=212
[2] Prevalence figure is an average of four age groups reported in WHO MDIS, 2005. Hb <12g/dl females, boys 11-13 yrs, Hb <13g/dl males 14-19 yrs
[3] Baghdad; n=1051
[4] Hb <12g/dl girls 11-19, boys 11-14 and Hb <13g/dl boys 15-19 years.
[5] No data measuring hemoglobin levels. Prevalence of iron deficiency anemia is 5.3% for children 6-16 (mean corpuscular volume <80.4 fL).
[6] Hb <11g/dl
[7] Facility based study (15 schools); n=2002
[8] Prevalence figure is an average of two groups reported in WHO MDIS, 2005. Also reported: hemoglobin levels 1.4 for girls and 0.3 for boys measured at Hb <11g/dl (average = 0.8)
[9] Brikcha Rural Commune; n=158
[10] Hb <11.5g/dl both sexes 6-11 yrs, Hb <12g/dl both sexes 12-14 and girls 15 yrs, Hb <13g/dl boys 15 yrs. Notes also indicate prevalence of *iron deficiency anemia* 32.3%, measured by: Hb <11.5g/dl both sexes 6-11 yrs, Hb <12g/dl both sexes 12-14 yrs, females 15 yrs, Hb <13g/dl males 15 yrs+zinc protoporphyrin >40 µmol/mol heme+serum ferritin <15 µg/L or serum transferrin receptor >8.5 mg/L
[11] Prevalence figure is an average of boys and girls reported in WHO MDIS, 2005.
[12] Jeddah City; n=455
[13] Prevalence figure is an average of two age groups reported in WHO MDIS, 2005. Prevalence measured: Hb <11.5g/dl for 9-12 years and Hb <12g/dl for 12-15 years.
[14] Hb <11.5g/dl
[15] Urban and rural schools in Al-Mahweet governorate; n=876
[16] Hb <11g/dl both sexes 5 years, Hb <12g/dl both sexes 6-14 years, Hb <12g/dl girls 15-18 and Hb <13g/dl boys 15-18.

South / South-East Asia Region

[1] Hb <11.5g/dl 5-11 years and Hb <12g/dl 12-14 years
[2] Facility based study (schools) in Punjab State, n=2000. Also reported by WHO MDIS, 2005: Hemoglobin levels for SAC in 1982, 1996-1999, 1996-1998 Local Studies and 1987, 1998-1992, 1989-1992 District studies.
[3] Hb< 11g/dl 5-6, Hb <12g/dl 7-15
[4] Facility based study (10 schools in 6 villages) in Sukaraja District, West Java; n=365
[5] Hg<11g/dl; Also reported: Hemoglobin levels for adolescent girls (11.8-16.5) in 2005 Local study.
[6] Rangoon, n=182
[7] Hb <11g/dl
[8] Kathmandu; n=213
[9] Hb < 12.5g/dl under 6 years and Hb <13.5g/dl over 6 years.
[10] Hb <11.5g/dl; Also reported: hemoglobin level 20.9 for SAC (5-11) in 2001 National Study, Hb <11.5g/dl.

Western Pacific Region

[1] Also reported: Girls 6-10 (2.9), Boys 6-10 (6.3), Girls 10-15 (3.8), Boys 10-15 (5.8); Hb <11g/dl
[2] Hb <11g/dl 5 years and Hb <12g/dl 6-14 years
[3] Facility Based study (high schools and yearly medical examination) in Tokyo, n=34,506
[4] Prevalence figure is an average of two groups reported in WHO MDIS, 2005. Hb <12g/dl for girls and Hb <12.5g/dl boys 12-14, Hb <13g/dl boys over 14
[5] Facility based study of 2 primary schoolsl in Bonriki and Nabeina villages on Tarawa atoll.
[6] Hb <11.5g/dl
[7] Hb <12.1g/dl
[8] Hb <11g/dl; Also reported: Children 6-12, Hb <7g/dl = 1.1%; Children 12-15 Hb <11g/dl = 16.8% and Hb <7g/dl = 0.6%. Two groups could not be averaged because sample size is unspecified.
[9] Study in 69 villages and 7 estates in 9 states in Paninsular Malaysia; n=1778
[10] Hb <11g/dl
[11] Survey in 16 villages
[12] Also reported: Hb<11g/dl = 46.3% in same group
[13] Facility based study (172 schools); n=1927
[14] Hb <11.5 g/dl both sexes 5-7 yrs, Hb <11.8 g/dl girls 12-14 yrs, Hb <11.9 g/dl both sexes 8-11 yrs, Hb <12.5 g/dl boys 12-14 yrs. Notes also indicate prevalence of *iron deficiency anemia* 0.3%, measured by: Hb <11.5 g/dl both sexes 5-7 yrs, Hb <11.8g/dl girls 12-14 yrs, Hb <11.9g/dl both sexes 8-11 yrs, Hb <12.5g/dl boys 12-14 yrs+>=2 of the indicators: serum ferritin <10 µg/L 5 yrs or <12 µg/L 6-14 yrs, red cell distribution width >14%, transferrin saturation <12% 5 yrs or <14% 6-14 yrs
[15] Morobe district; n=461

[16] Hb <11.5g/dl
[17] Hb <11.5g/dl 5-11 years and Hb <12g/dl for 12 year olds
[18] Hb <11.5g/dl 5-11 and Hb <12g/dl 12 years; Sample included 26 villages in 3 health regions; n=370
[19] Facility based study of schools, only low-income students, location not specified; n=222
[20] Prevalence figure is an average of two age groups reported in WHO MDIS, 2005.
[21] Facility based study of primary schools in Binh Chah (rural) and First (urban) Districts; n=284 (sum of two groups)
[22] Prevalence figure is an average of two age groups reported in WHO MDIS, 2005. Hb <7.13mmol/L

Europe Region

[1] Prevalence figure is an average of two age groups reported in WHO MDIS, 2005.
[2] Mean Hemoglobin levels only reported in 1966 Regional Study.
[3] Northern District of Faroe Islands; n=270
[4] Hb <11g/dl 4 years, Hb <11.5g/dl 8 years, Hb <12g/dl 13 years
[5] Helsinki; n=178
[6] Facility based study (schools) in siz areas: Euboea, Chalkis, Trikalla, Rhodes, Arta and Orchomenos; n=2198
[7] Hb <11g/dl both sexes 6 years, Hb <12g/dl both sexes 7-13 years, Hb <13g/dl boys 14-16, Hb <14g/dl boys 17 years
[8] Mean Hemoglobin levels only reported for school-age boys in 1981 Local Study.
[9] Kzyl-Orda Region; n=809
[10] Hb <12g/dl girls 6-15, boys 6-14 and Hb <13g/dl boys 15 years.
[11] Mean Hemoglobin levels only reported for school-age boys in 1981 Local Study.
[12] Mean Hemoglobin levels only reported for odler school age children in 1994 District Study. Notes indicate *iron deficiency anemia* for SAC 14-16 is 1.7% (serum ferritin <15ug/L+Hb<11.6g/dl girls or Hb <13.2g/dl boys.
[13] Cracow; n=188
[14] Hb <12g/dl for girls and Hb<12.2g/dl for boys
[15] Facility based study (kindergartens) in three cities: Ekarterinsburg, Krasnouralsk and Volgograd; n=1101
[16] Hb <11g/dl
[17] Velez-Malaga; n=196
[18] Hb <12g/dl girls 6-15 and boys 6-14, Hb <13g/dl boys 15 years
[19] Kahramanmaras; n=295
[20] Hb <11.5g/dl; notes in table indicate prevalence of *iron deficiency anemia* is 12.5%, measured by Hb <11.5g/dl +serum ferritin <=16ug/L
[21] Prevalence figure is an average of six groups reported in WHO MDIS, 2005. Hb <11g/dl 4-7 years and Hb <12g/dl 7+years

Region of the Americas

[1] Ushuaia; n=169
[2] Hb <11.5g/dl 6-9 and Hb <12g/dl 10-11
[3] Two sets of data available for SAC in this study (ages NS). Represented here as a range.
[4] Data available for 3.3-8.3 year old children only in 1995 Local Study.
[5] Facility based study (youth center); n=130; Also reported in WHO MDIS, 2005: Hemoglobin levels for SAC in other previous Local studies.
[6] Hb <11g/dl for 5 years and Hb <11.5g/dl for 6-9 years
[7] Data available for 2-6 year old children only in 2002P Local Study.
[8] Medellin; n=502
[9] Hb <12g/dl girls 12-18, boys 12-14 and Hb <13g/dl boys over 15
[10] Prevalence figure is an average of two age groups reported in WHO MDIS, 2005
[11] Hb <11g/dl 5 years and Hb <12g/dl 6-16 years
[12] Francisco de Orella and Sachas; n=592
[13] Hb <11g/dl
[14] Prevalence figure is an average of two age groups reported in WHO MDIS, 2005. Hb <12g/dl
[15] Hb <11g/dl for 5 years and Hb <12g/dl for 6-14 years
[16] Hb <11g/dl 5 years and Hb <12g/dl 6-11 years
[17] Amazon Basin Facility based study (school); n=130
[18] Hb <10g/dl
[19] Districts not specified; n=246 (sum of two groups)
[20] Prevalence figure is an average of two age groups reported in WHO MDIS, 2005. Hb <10g/dl 5-10 years and Hb <12g/dl 10-14 years.
[21] Hb <11g/dl 1-4 years, Hb <11.5g/dl 5-11 years and Hb <12g/dl 12-14 years. Also reported: SAC hemoglobin levels for various State and Local Studies
[22] Hb <11.5 g/dl both sexes 7 yrs, Hb <12g/dl girls 11 -15, Hb <12.5g/dl boys 11yrs and Hb <13g/dl boys 15 years; notes in table indicate prevalence of *iron deficiency anemia* is 5.5%, measured by Hb cut off levels+serum ferritin <12ug/L; Only labor and low-income children analyzed (schools and health centers); n=653

Table A.1.7 Prevalence: Anemia in Pregnant Women 15–49 years (unless otherwise noted)

Country	Last Measured Prevalence (%)					
	Survey year	Any Hb<11 g/dl	Mild Hb 10.0-10.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
AFRICA						
Algeria	ND					
Angola	ND					
Benin	2001	72.7	24.7	43.3	4.7	ORC MACRO, 2005. DHS STAT COMPILER
Botswana	ND					
Burkina Faso	2003	68.3	30.6	35.4	2.3	ORC MACRO, 2005. DHS STAT COMPILER
Burundi	ND					
Cameroon	2004	50.9	18.8	31.4	0.7	ORC MACRO, 2005. DHS STAT COMPILER
Cape Verde	1977	38.8/56.9[1]				WHO MDIS, 2005
Central African Republic	1999	54.8				WHO MDIS, 2005
Chad	ND					
Comoros	ND					
Congo	ND					
Cote d'Ivoire	ND					
Democratic Republic of Congo	2002	78.6[2,a,c]				WHO MDIS, 2005
Equatorial Guinea	ND					
Eritrea	ND					
Ethiopia	1990-1994	24.4[3,a]				WHO MDIS, 2005
Gabon	1995-1996	71.2[4,a,c]			1.6	WHO MDIS, 2005
Gambia	1999	75.1		6.7		WHO MDIS, 2005
Ghana	2003	61.1	33.2	26.7	1.2	ORC MACRO, 2005. DHS STAT COMPILER
Guinea	2000	63.2[5]			1.7[5]	WHO MDIS, 2005
Guinée Bissau	ND					
Kenya	1999	55.1[6]			4.4[6]	WHO MDIS, 2005
Lesotho	1993[7]	ND				
Liberia	1999	62.1[8]				WHO MDIS, 2005
Madagascar	2003-2004	50.1	20.9	27.7	1.5	ORC MACRO, 2005. DHS STAT COMPILER

Country	Last Measured Prevalence (%)					
	Survey year	Any Hb<11 g/dl	Mild Hb 10.0-10.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
Malawi	1997-1999	61.9[9,a,c]			3.7[9,a,c]	WHO MDIS, 2005
Mali	2001	73.4	24.5	43.6	5.2	ORC MACRO, 2005. DHS STAT COMPILER
Mauritania	ND					
Mauritius	1995	39.2[c]			0.2[c]	WHO MDIS, 2005
Mozambique	1998	58.1[10]			3.7[10]	WHO MDIS, 2005
Namibia	1995	41.5[11,a,c]				WHO MDIS, 2005
Niger	1997[P]	67.5[12,a]				WHO MDIS, 2005
Nigeria	1993	66.7[13]				WHO MDIS, 2005
Rwanda	1996	10.6[c]			0.0[c]	WHO MDIS, 2005
Sao Tome & Principe	ND					
Senegal	1985	60.0[a]				MI IDASTAT
Seychelles	ND					
Sierra Leone	1990	45.5				Global Micronutrient Survey, 2002
South Africa	1997[P]	10.5[14,a,c]				WHO MDIS, 2005
Swaziland	ND					
Tanzania	ND					
Togo	1999-2000	46.3[15,a]				WHO MDIS, 2005
Uganda	2000-2001	41.2	22.1	17.1	2.0	ORC MACRO, 2005. DHS STAT COMPILER
Zambia	1998	46.9[c]				WHO MDIS, 2005
Zimbabwe	1999	18.8				WHO MDIS, 2005
EASTERN MEDITERRANEAN						
Afghanistan	2000	71.4[1,a]				MICS2, 2001
Bahrain	ND					
Djibouti	ND					
Egypt	2000	23.6	13.3	9.7	0.6	ORC MACRO, 2005. DHS STAT COMPILER
Iran	1994-1995	40.5				WHO MDIS, 2005
Iraq	1987[P]	36.5[2,a]				WHO MDIS, 2005

Country	Last Measured Prevalence (%)					
	Survey year	Any Hb<11 g/dl	Mild Hb 10.0-10.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
Jordan	2002	37.0	23.4	13.5	0.1	ORC MACRO, 2005. DHS STAT COMPILER
Kuwait	ND					
Lebanon	1997-1998	20.0				WHO MDIS, 2005
Libyan Arab Jamahiriya	ND					
Morocco	2000	37.2[3]				WHO MDIS, 2005
Oman	2000	42.7			0.5	WHO MDIS, 2005
Pakistan	2001	39.1[c]			2.2[c]	WHO MDIS, 2005
Qatar	ND					
Saudi Arabia	1992	31.9[4,c]				WHO MDIS, 2005
Somalia	ND					
Sudan	ND					
Syrian Arab Republic	ND					
Tunisia	1996-1997	32.3[5]				WHO MDIS, 2005
United Arab Emirates	1992-1993	38.0[6,a,c]				WHO MDIS, 2005
Yemen	ND					
SOUTH/SOUTH EAST ASIA						
Bangladesh	2004	38.8[1,a]	24.7[1,a]	14.1[1,a]	0.0[1,a]	HKI & IPHN, 2005
Bhutan	1985	60.0[2,a,c]				WHO MDIS, 2005
Democratic Republic of Korea	1998	34.7[3,c]				WHO MDIS, 2005
India	1998-1999	49.7	21.8	25.4	2.5	ORC MACRO, 2005. DHS STAT COMPILER
▪ Rajasthan	ND					
▪ Madhya Pradesh	ND					
▪ Uttar Pradesh	ND					
▪ Bihar	ND					
▪ Orissa	ND					
▪ West Bengal	ND					
▪ Gujarat	ND					
▪ Maharashtra	ND					

Country	Last Measured Prevalence (%)					
	Survey year	Any Hb<11 g/dl	Mild Hb 10.0-10.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
Andhra Pradesh	ND					
Indonesia	2003	38.9[4,a]	22.1[4,a]	16.8[4,a]	0.0[4,a]	HKI (NSS), 2003
▪ Lampung		46.7	22.7	24.0	0.0	
▪ Banten		56.0	32.0	24.0	0.0	
▪ West Java		39.5	24.7	14.8	0.0	
▪ Central Java		38.0	23.1	14.8	0.0	
▪ East Java		27.5	13.7	13.7	0.0	
▪ NTB/Lombok		34.7	22.4	12.2	0.0	
▪ South Sulawesi		45.8	22.9	22.9	0.0	
Maldives	2001	55.4			1.4	WHO MDIS, 2005
Myanmar	1976[P]	71.6[5,a,c]			1.0[5,a,c]	WHO MDIS, 2005
Nepal	1998	74.6[c]		68.9[6,c]	5.7[c]	MOH et al., 1998
Sri Lanka	2001	29.3[c]				WHO MDIS, 2005
Thailand	1995	22.3[c]				WHO MDIS, 2005
Timor-Leste	2003	48.7				WHO MDIS, 2005
WESTERN PACIFIC						
Australia	1974	14.5[1,a]				WHO MDIS, 2005
Brunei Darussalam	1995	38.9			0.9	WHO MDIS, 2005
Cambodia	2000	65.1	27.2	33.8	4.1	ORC MACRO, 2005. DHS STAT COMPILER
China	ND					
Cook Islands	ND					
Fiji	1993	55.6[2]				WHO MDIS, 2005
Japan	2002	18.7[3]				WHO MDIS, 2005
Kiribati	ND					
Korea, Republic of	ND					
Lao PDR	ND					
Malaysia	1992-1993	39.5[4,a,c]				WHO MDIS, 2005
Marshall Islands	1990-1991	17.0[5]				WHO MDIS, 2005
Micronesia, Federated States of	ND					

Country	Last Measured Prevalence (%)					
	Survey year	Any Hb<11 g/dl	Mild Hb 10.0-10.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
Mongolia	ND					
Nauru	ND					
New Zealand	ND					
Niue	ND					
Palau	ND					
Papua New Guinea	1995-1996	58.5[6,a,c]				WHO MDIS, 2005
Philippines	2003	43.9				Perlas et al., 2003
Samoa	1999	44.0[c]				WHO MDIS, 2005
Singapore	1993	15.3[7,a,c]				WHO MDIS, 2005
Solomon Islands	ND					
Tonga	1986	38.1				WHO MDIS, 2005
Tuvalu	ND					
Vanuatu	1996	57.3				WHO MDIS, 2005
Vietnam	2000-2001	32.2[c]				WHO MDIS, 2005
EUROPE						
Albania	ND					
Andorra	ND					
Armenia	2000	12	7.4	4.6	0.0	ORC MACRO, 2006. DHS STAT COMPILER
Austria	ND					
Azerbaijan	2001	38.4[1]				WHO MDIS, 2005
Belarus	ND					
Belgium	1997-1999	20.2[2,a]				WHO MDIS, 2005
Bosnia & Herzegovina	ND					
Bulgaria	1973[P]		84.4[3,a]			WHO MDIS, 2005
Croatia	ND					
Cyprus	ND					
Czech Republic	ND					
Denmark	1985	5.3[4,a]				
Estonia	ND					

Country	Last Measured Prevalence (%)					
	Survey year	Any Hb<11 g/dl	Mild Hb 10.0-10.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
Finland	1992	19[5,a,c]				WHO MDIS, 2005
France	1988-1994			2.3[6,a]		WHO MDIS, 2005
Georgia	ND					
Germany	1999	13.6[7,a]				WHO MDIS, 2005
Greece	ND					
Hungary	ND					
Iceland	ND					
Ireland	ND					
Israel	ND					
Italy	ND					
Kazakhstan	1999	32.9	20.1	12.8	0.0	ORC MACRO 2006. DHS STAT COMPILER
Kyrgyzstan	1997	38.3	19.5	17.4	1.4	ORC MACRO 2006. DHS STAT COMPILER
Latvia	ND					
Lithuania	ND					
Luxembourg	ND					
Macedonia, The Former Yugoslav Republic of	ND					
Malta	ND					
Moldova, Republic of	ND					
Monaco	ND					
Netherlands	ND					
Norway	ND					
Poland	ND					
Portugal	ND					
Romania	ND					
Russian Federation	ND					
San Marino	ND					
Serbia-Montenegro	ND					
Slovakia	ND					
Slovenia	ND					

Country	Last Measured Prevalence (%)					
	Survey year	Any Hb<11 g/dl	Mild Hb 10.0-10.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
Spain	ND					
Sweden	1994-1996		7.1[8,a]			WHO MDIS, 2005
Switzerland	1999		5.5[9]			WHO MDIS, 2005
Tajikistan	ND					
Turkey	ND					
Turkmenistan	2000	41.6	23.9	16.4	1.3	ORC MACRO 2006. DHS STAT COMPILER
Ukraine	ND					
UK	1975-1977			8.7[10,a]		WHO MDIS, 2005
Uzbekistan	1996	50.8	23.2	26.9	0.6	ORC MACRO 2006. DHS STAT COMPILER
Yugoslavia	ND					
REGIONS OF THE AMERICAS						
Antigua & Barbuda	ND					
Argentina	2000	16.1[1,a]				
Bahamas	ND					
Barbados	ND					
Belize	1994-1995	51.7				WHO MDIS, 2005
Bolivia	2003	37.0	17.7	18.8	0.5	ORC MACRO, 2005. DHS STAT COMPILER
Brazil	ND					
▪ Paraiba	ND					
▪ Pernambuco	ND					
▪ Piaui	ND					
▪ Sao Paulo	ND					
▪ Sergipe	ND					
Canada	1970-1972	2.2[2]				WHO MDIS, 2005
Chile	2001	11.6[3,a]				WHO MDIS, 2005
Colombia	ND					
Costa Rica	1996	27.9[c]				WHO MDIS, 2005
Cuba	1998	64.6[4,a,c]				

Country	Last Measured Prevalence (%)					
	Survey year	Any Hb<11 g/dl	Mild Hb 10.0-10.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
Dominica	1996-1997	35.1[c]				WHO MDIS, 2005
Dominican Republic	1990-1991	67.0[5,a]				WHO MDIS, 2005
Ecuador	ND					
El Salvador	1998	9.6[6]				WHO MDIS, 2005
Grenada	1985	62.9[c]				WHO MDIS, 2005
Guatemala	2002	22.1[7]				WHO MDIS, 2005
Guyana	1996-1997	52.0[c]				WHO MDIS, 2005
Haiti	2000	63.4	30.1	29.7	3.6	ORC MACRO, 2005. DHS STAT COMPILER
Honduras	1996	32.4			0.0	WHO MDIS, 2005
Jamaica	1999	40.7[8]				WHO MDIS, 2005
Mexico	1998-1999	26.2[9]				WHO MDIS, 2005
Nicaragua	2000	32.9[10]				WHO MDIS, 2005
Panama	1999	36.4[c]			1.4[c]	WHO MDIS, 2005
Paraguay	ND					
Peru	2000	38.7	19.2	17.7	1.9	ORC MACRO, 2005. DHS STAT COMPILER
Saint Kitts & Nevis	ND					
Saint Lucia	ND					
Saint Vincent & the Grenadines	ND					
Suriname	ND					
Trinidad & Tobago	ND					
USA	2002	12.9[11,a,c]				WHO MDIS, 2005
Uruguay	ND					
Venezuela	1996	34.4[12,a]				WHO MDIS, 2005

[p] When survey date is not specified the year of publication is used.
[a] Sub-national data
[c] Age range not specified

Africa Region

1. Reported for women of childbearing age (25-34 years); for pregnant women data represents percentage of women with serum ferritin < 40ug/l
2. Prevalence figure reported is an average of the three medical centers reported in WHO MDIS 2005; Facility-based study in Lubumbashi; n=132
3. Regional study; n=685

[4] Facility-based study in Libreville (first visit at mother and child health center); n=309
[5] Reported for women NS-48 years.
[6] Reported for women NS-50 years.
[7] 1993 national survey; prevalence reported in MDIS 2005 is 10.7% for children and women together (3-NS years) (Hb<11 g/dl both sexes 2-10 yrs, PW; Hb<11.5 g/dl girls 11-15 yrs, Hb,<12 g/dl boys 11-15 yrs, women)
[8] Reported for women 14-49 years.
[9] Prevalence figures provided are averages of the two regional figures reported in WHO MDIS 2005; Regional facility based study of 2 regions Blantyre and Namitambo (hospital and health center); n=6939
[10] Study done in 4 out of 10 provinces of Mozambique; n=185.
[11] Local study in eastern Caprivi; n=171
[12] Reported for women 17-40 years; Facility-based study (MCH Center) in Niamey;n=197.
[13] Reported for women 15-45 years.
[14] Local study in Hlabisa; n=449; Hb<10g/dl
[15] Prevalence figure provided is the average of the three groups reported in WHO MDIS 2005; Study of three regions; n=376.

Eastern Mediterranean Region

[1] Women 12-49 years; Used Tallquist scale: Women having <75.3% Hb considered anemic.
[2] Reported for women 15-45 years; study in 2 villages in Abu-Al-Khasib District; n=96
[3] Reported for women 15-45 years.
[4] Regional facility-based study (69 health care centers) in Asir region; n=653.
[5] Reported for women 19-41.
[6] Facility based study (immunization center) in Al Ain city; n=29.

South/South-East Asia Region

[1] Unpublished data (February – March 2004) of the Nutritional Surveillance Project, HKI & Institute of Public Health Nutrition; nationally representative of rural Bangladesh (n=102).
[2] Facility-based survey in three zones; n=561
[3] Survey in 130 of 212 counties covering 71% of the population.
[4] HKI Nutrition and Health Surveillance System for 8 of the largest provinces (accounting for 70% of Indonesia's population). National figure is a weighted average for 70% of the population.
[5] Facility-based study (antenatal clinic) in Rangoon.; n=310
[6] Hb 7.0-10.9 g/dl (combining mild-moderate)

Western Pacific Region

[1] Facility-based study in Perth; n=331
[2] Reported for women 15-not specified
[3] Reported for women 20-NS years.
[4] Sub-national facility-based study (102 rural health clinics) in rural Kelantan (state); prevalence at last antenatal visit reported; n=9860
[5] Reported for pregnant and lactating women.
[6] Facility-based study (hospital) in Port Moresby; Hb values of first antenatal visit of all PW; n=997.
[7] Facility-based study (hospital) in Singapore; n=3728

Europe Region

[1] Hb<11g/dl pregnant women gestation 1-3, 7 months, Hb<10.6g/dl gestation 4 months, Hb<10.5 g/dl gestation 5 months, Hb<107g/dl 6 months, Hb<11.4 g/dl gestation 8 months, Hb11.9 g/dl gestation 9 months
[2] Prevalence figure is an average of women in each trimester reported in WHO MDIS, 2005; Facility based study (prenatal clinics); n=2500
[3] Facility based study (hospital) for the Region Burgas, Aytos, Karnobat and Grudovo in southeast Bulgaria; Hb<10.3g/dl; n=1339
[4] Facility based study (birth clinic) ; n=207
[5] Facility based study (Helsinki University Central Hospital); Hb <12g/dl; n=199
[6] Facility based study (Service de Gynecologie Obstetrique du Centre Hospitalo-Universitaire); Hb <10g/dl; n=3169
[7] Local study in Berlin; Ages not specified; n=242
[8] Reported for women 36 weeks pregnant ages 20-45.99 years; Facility based study (3 Antenatal Care Units); n=157
[9] Reported for women 16-43 years; Hb<10.5g/dl 2nd trimester and Hb<11g/dl 3rd trimester
[10] Reported for Pregnant Women age NS-24.99; F Facility based study (Duke Street Hospital) in Glasgow; n=1179

Region of the Americas

[1] Facility-based study in Buenos Aires; n=1218

[2] Reported for women 18-42 years; Hb <10.5 g/dl)

[3] Reported for women 18 & above; Facility-based study (first visit to public antenatal consultation in 4 centers) in Puente Alta in Santiago; n=1683

[4] Facility-based study (hospital) in Havana; n=209.

[5] Reported for women 15 and above; Facility-based study (hospital) in Santo Domingo; n=600; sampling: design not explained

[6] Reported prevalence figure is an average of the three figures reported for each trimester reported in WHO MDIS, 2005; Hb<11g/dl first trimester, Hb<10.6g/dl 4 months gestation, Hb<10.5 5g/dl months, Hb<10.7g/dl 6 months, Hb<11g/dl 7 months, Hb<11.4g/dl 8 months, Hb<11.9 g/dl 9 months.

[7] Hb <11 g/l for 1-4 months gestational age, Hb<10.6,10.5,10.7,11,11.4,11.9 g/dl for 4-9 months gestational age respectively.

[8] Reported for women 13-47 years.

[9] Reported for women 12-49 years.

[10] Reported for women 15-NS.

[11] Prevalence data is an average of three groups reported in WHO MDIS 2005; Study included an analysis of records from the Centers for Disease Control and Prevention (CDC) Pregnancy Nutrition Surveillance System (PNSS) from 25 States; Hb<11g/dl for first and third trimester and Hb<10.5g/dl for second trimester; n=482,433

[12] Reported for women 14-48 years; Facility-based study (hospital); 630 consecutive PW (low or very low income) in 3rd trimester at labor examined.

Table A.1.8 Prevalence: Anemia in Women 15–49 years (unless otherwise noted)

Country	Last Measured Prevalence (%)					
	Survey year	Any*	Mild Hb 10.0-11.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
AFRICA						
Algeria	1998-1999		49.0[1]		15.0[1]	FAO, 2005
Angola	ND					
Benin	2001	64.3	40.7	21.8	1.8	ORC MACRO, 2005. DHS STAT COMPILER
Botswana	1994	32.7[b]			1.3[b]	WHO MDIS, 2005
Burkina Faso	2003	53.7	37.8	14.7	1.1	ORC MACRO, 2005. DHS STAT COMPILER
Burundi	ND					
Cameroon	2004	44.9	32.5	11.6	0.9	ORC MACRO, 2005. DHS STAT COMPILER
Cape Verde	ND					
Central African Republic	1999	49.8[b]				WHO MDIS, 2005
Chad	1993	51.0[a,c]				WHO MDIS, 2005
Comoros	ND					
Congo	ND					
Cote d'Ivoire	2000	42.0[2,b]				WHO MDIS, 2005
Democratic Republic of Congo	ND					
Equatorial Guinea	ND					
Eritrea	ND					
Ethiopia	1990-1994	18.4[3,a]				WHO MDIS, 2005
Gabon	ND					
Gambia	ND					
Ghana	2003	44.6	34.8	9.0	0.8	ORC MACRO, 2005. DHS STAT COMPILER
Guinea	2000	50.4[4,b]			1.3[4,b]	WHO MDIS, 2005
Guinée Bissau	ND					
Kenya	1999	47.9[5,b]			2.1[5,b]	WHO MDIS, 2005
Lesotho	1993[6]	ND				
Liberia	1999	58.5[7]				WHO MDIS, 2005
Madagascar	2003-2004	46.0	34.6	8.5	2.9	ORC MACRO, 2005. DHS STAT COMPILER

Country	Last Measured Prevalence (%)					
	Survey year	Any*	Mild Hb 10.0-11.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
Malawi	2004-2005	45.0				WHO MDIS, 2005
Mali	2001	62.7	39.1	20.8	2.8	ORC MACRO, 2005. DHS STAT COMPILER
Mauritania	2000	68.6[8]/ 48.1[9,a]				WHO MDIS, 2005
Mauritius	1995	14.0[b]			0.0[b]	WHO MDIS, 2005
Mozambique	2001-2002	48.2[c]			0.7[c]	WHO MDIS, 2005
Namibia	ND					
Niger	1981-1982	35.0[12,a,b]				WHO MDIS, 2005
Nigeria	1993	62.7[13]				WHO MDIS, 2005
Rwanda	ND					
Sao Tome & Principe	ND					
Senegal	1985	58.0[2,a,b]				MI IDASTAT
Seychelles	1961[P]	3.1[14,c]				WHO MDIS, 2005
Sierra Leone	ND					
South Africa	2001[P]	44.0[15,a,c]				WHO MDIS, 2005
Swaziland	ND					
Tanzania	2004-2005	42.8[17]				WHO MDIS, 2005
Togo	1999-2000	42.3[16,a,b]				WHO MDIS, 2005
Uganda	2000-2001	30.4	22.1	7.5	0.7	ORC MACRO, 2005. DHS STAT COMPILER
Zambia	2003	29.1[b]				WHO MDIS, 2005
Zimbabwe	1999	31.0				WHO MDIS, 2005
EASTERN MEDITERRANEAN						
Afghanistan	2004	24.7[b]				WHO MDIS, 2005
Bahrain	1998-1999	37.3[1]				WHO MDIS, 2005
Djibouti	ND					
Egypt	2000	22.7	22.7	4.6	0.3	ORC MACRO, 2005. DHS STAT COMPILER
Iran	1994-1995	33.4				WHO MDIS, 2005
Iraq	1987[P]	25.5[2,b]				

Country	Last Measured Prevalence (%)					
	Survey year	Any*	Mild Hb 10.0-11.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
Jordan	2002	26.4	20.3	5.9	0.3	ORC MACRO, 2005. DHS STAT COMPILER
Kuwait	2000[P]	39.0[3]				WHO MDIS, 2005
Lebanon	1997-1998	23.1				WHO MDIS, 2005
Libyan Arab Jamahiriya	ND					
Morocco	2000	32.6[b]				WHO MDIS, 2005
Oman	2000	30.0[4]			0.3[4]	WHO MDIS, 2005
Pakistan	2000-2001	29.4[c]			1.1[c]	WHO MDIS, 2005
Qatar	ND					
Saudi Arabia	ND					
Somalia	ND					
Sudan	1995	47.7[5,a,c]				WHO MDIS, 2005
Syrian Arab Republic	ND					
Tunisia	1996-1997	25.9[6]				WHO MDIS, 2005
United Arab Emirates	1992-1993	22.0[7,a,b,c]				WHO MDIS, 2005
Yemen	ND					
SOUTH/SOUTH EAST ASIA						
Bangladesh	2004	45.5[1,a]	38.4[1,a]	9.1[1,a]	0.2[1,a]	HKI & IHPN, 2006
Bhutan	2002	54.8[2,a]			1.2[2,a]	WHO MDIS, 2005
Democratic Republic of Korea	2004	34.7		0.5[3]	0.1	Central Bureau of Statistics, 2005
India	1998-1999	51.8	35.1	14.8	1.9	ORC MACRO, 2005. DHS STAT COMPILER
▪ Rajasthan		48.5	32.3	14.1	2.2	
▪ Madhya Pradesh		54.3	37.6	15.6	1.0	
▪ Uttar Pradesh		48.7	33.5	13.7	1.5	
▪ Bihar		63.4	42.9	19.0	1.5	
▪ Orissa		63.0	45.1	16.4	1.6	
▪ West Bengal		62.7	45.3	15.9	1.5	
▪ Gujarat		46.3	29.5	14.4	2.5	

Country	Last Measured Prevalence (%)					
	Survey year	Any*	Mild Hb 10.0-11.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
▪ Maharashtra		48.5	31.5	14.1	2.9	
▪ Andhra Pradesh		49.8	32.5	14.9	2.4	
Indonesia	2003	24.8[4,b]	21.5[4,b]	3.2[4,b]	0.1[4,b]	HKI (NSS), 2003
▪ Lampung		29.8	23.5	5.9	0.3	
▪ Banten		29.9	25.9	4.0	0.0	
▪ West Java		25.9	21.5	4.2	0.1	
▪ Central Java		24.0	21.3	2.6	0.1	
▪ East Java		21.7	19.2	2.4	0.1	
▪ NTB/Lombok		30.0	28.0	2.0	0.0	
▪ South Sulawesi		27.2	23.7	3.4	0.1	
Maldives	2001	51.3		0.9		WHO MDIS, 2005
Myanmar	ND					
Nepal	1998	67.7[c]		65.5[5,c]	2.2[c]	MOH et al., 1998
Sri Lanka	2001	31.0[c]				WHO MDIS, 2005
Thailand	1995	17.6[6]				WHO MDIS, 2005
Timor-Leste	2003	31.5[b]			1.0[b]	WHO MDIS, 2005
WESTERN PACIFIC						
Australia	1974	3.2[1,a,b]				WHO MDIS, 2005
Brunei Darussalam	1996-1997	5.9[2]				WHO MDIS, 2005
Cambodia	2000	58.8	44.8	12.7	1.3	
China	1992	22.7				WHO MDIS, 2005
Cook Islands	ND					
Fiji	1993	32.7[3]				WHO MDIS, 2005
Japan	2002	18.7[4]				WHO MDIS, 2005
Kiribati	ND					
Korea, Republic of	1993	29.0[12]				WHO MDIS, 2005
Lao PDR	ND					
Malaysia	1994	17.2[5,a]				WHO MDIS, 2005
Marshall Islands	1990-1991	26[6]				WHO MDIS, 2005
Micronesia, Federated States of	2000	14.1[7,a]				WHO MDIS, 2005

Country	Last Measured Prevalence (%)					
	Survey year	Any*	Mild Hb 10.0-11.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
Mongolia	2000	58.52 [8]				MOH et al., 2002
Nauru	ND					
New Zealand	1996-1997	2.0[9]				WHO MDIS, 2005
Niue	ND					
Palau	ND					
Papua New Guinea	1987-1988	98.1[10,a,c]				WHO MDIS, 2005
Philippines	1998	34.3[11,b]				WHO MDIS, 2005
Samoa	1999	21.7[13]				WHO MDIS, 2005
Singapore	1998	18.4[14]				
Solomon Islands	ND					
Tonga	1986	36.2				WHO MDIS, 2005
Tuvalu	ND					
Vanuatu	1996	53.1				WHO MDIS, 2005
Vietnam	2000-2001	24.3[b]				WHO MDIS, 2005
EUROPE						
Albania	ND					
Andorra	ND					
Armenia	2000	12.4[1]	10.2[1]	2[1]	0.3[1]	WHO MDIS, 2005
Austria	ND[2]					
Azerbaijan	2001	40.2[b]				WHO MDIS, 2005
Belarus	ND					
Belgium	ND					
Bosnia & Herzegovina	ND					
Bulgaria	ND					
Croatia	ND					
Cyprus	ND					
Czech Republic	ND					
Denmark	1992-1993	18.3[3,a]				WHO MDIS, 2005
Estonia	ND					
Finland	1967-1972	5.8[4,b]				WHO MDIS, 2005

Country	Last Measured Prevalence (%)					
	Survey year	Any*	Mild Hb 10.0-11.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
France	1985[P]	1.3[5,a]				WHO MDIS, 2005
Georgia	ND					
Germany	ND					
Greece	ND					
Hungary	1976[P]	3.6[6,a]				WHO MDIS, 2005
Iceland	1984-1985	10.5[7,a]				WHO MDIS, 2005
Ireland	ND					
Israel	ND					
Italy	ND					
Kazakhstan	1999	35.5[8]	26.6[8]	7.7[8]	1.2[8]	ORC MACRO, 2006. DHS STAT COMPILER
Kyrgyzstan	1997	38.1[9]	27.7[9]	9[9]	1.5[9]	ORC MACRO, 2006. DHS STAT COMPILER
Latvia	ND					
Lithuania	ND					
Luxembourg	ND					
Macedonia, The Former Yugoslav Republic of	1999	12[12,a,b]			0.0[12,a,b]	WHO MDIS, 2005
Malta	ND					
Moldova, Republic of	ND					
Monaco	ND					
Netherlands	ND					
Norway	1976[P]	5.8[10,a]				WHO MDIS, 2005
Poland	ND					
Portugal	ND					
Romania	ND					
Russian Federation	2001	51.9[11,a,b]			1.1[11,a,b]	WHO MDIS, 2005
San Marino	ND					
Serbia-Montenegro	2000	26.7				WHO MDIS, 2005
Slovakia	ND					
Slovenia	ND					
Spain	ND					

Country	Last Measured Prevalence (%)					
	Survey year	Any*	Mild Hb 10.0-11.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
Sweden	ND					
Switzerland	ND					
Tajikistan	2003	41.2[b]			1.2[b]	WHO MDIS, 2005
Turkey	2002[P]	40.1[13,a]			3.2[13,a]	WHO MDIS, 2005
Turkmenistan	2000	47.3[14]	37.8[14]	8.4[14]	1.1[14]	ORC MACRO 2006. DHS STAT COMPILER
Ukraine	2002	9.2				WHO MDIS, 2005
UK	2000-2001	8				WHO MDIS, 2005
Uzbekistan	1996	60.4[15]	45.3[15]	14.2[15]	0.9[15]	ORC MACRO 2006. DHS STAT COMPILER
Yugoslavia	ND					
REGIONS OF THE AMERICAS						
Antigua & Barbuda	ND					
Argentina	ND					
Bahamas	ND					
Barbados	1981	27.5[b]				WHO MDIS, 2005
Belize	ND					
Bolivia	2003	33.1	26.3	6.5	0.4	ORC MACRO, 2005. DHS STAT COMPILER
Brazil						
▪ Paraiba	ND					
▪ Pernambuco	1997	24.5[1,b]				WHO MDIS, 2005
▪ Piaui	1991	26.2[c]				WHO MDIS, 2005
▪ Sao Paulo	ND					
▪ Sergipe	ND					
Canada	1970-1972	6.4[2]				WHO MDIS, 2005
Chile	ND					
Colombia	ND					
Costa Rica	1996	18.6[3]			0.1[3]	WHO MDIS, 2005
Cuba	ND					
Dominica	ND					

Country	Last Measured Prevalence (%)					
	Survey year	Any*	Mild Hb 10.0-11.9 g/dl	Moderate Hb 7.0-9.9 g/dl	Severe Hb Below 7.0 g/dl	Source
Dominican Republic	ND					
Ecuador	ND					
El Salvador	2002-2003	8.8				WHO MDIS, 2005
Grenada	1985	47.0[b]				WHO MDIS, 2005
Guatemala	2002	20.2[b]				WHO MDIS, 2005
Guyana	1996-1997	53.9[4]				WHO MDIS, 2005
Haiti	2000	55.1	36.3	15.8	3.0	ORC MACRO, 2005. DHS STAT COMPILER
Honduras	2001	14.7[b]				WHO MDIS, 2005
Jamaica	ND					
Mexico	1998-1999	20.2[5]				WHO MDIS, 2005
Nicaragua	2002-2003	16.0[b,c]			0.7[b,c]	WHO MDIS, 2005
Panama	1999	40.0[c]			0.3[c]	WHO MDIS, 2005
Paraguay	ND					
Peru	2000	31.6	25.4	5.9	0.3	ORC MACRO, 2005. DHS STAT COMPILER
Saint Kitts & Nevis	ND					
Saint Lucia	ND					
Saint Vincent & the Grenadines	ND					
Suriname	ND					
Trinidad & Tobago	ND					
USA	2002	35.1[6,a,b,c]				WHO MDIS, 2005
Uruguay	ND					
Venezuela	ND					

[P] When survey date is not specified the year of publication is used.
[a] Sub-national data
[b] Non-pregnant women
[c] Age range not specified
* Unless otherwise noted (Hb<11g/dl PW, Hb<12 g/dl NPW)

Africa Region

1 Hb cut-offs unclear.
2 Reported for women 16-50 years; regional study of 4 zones; n=406.
3 Reported for pregnant and lactating women; regional study; n=1449.
4 Reported for women NS-49 years.
5 Reported for women NS-50 years; Hb<11g/dl.

[6] 1993 national survey; prevalence reported in MDIS 2005 is 10.7% for children and women together (3-NS years) (Hb<11 g/dl both sexes 2-10 yrs, PW; Hb<11.5 g/dl girls 11-15 yrs, Hb,<12 g/dl boys 11-15 yrs, women)
[7] Reported for women 14-49 years.
[8] Local study in 3 regions in Gorgol; n=312; Hb<12 g/dl;
[9] Local study in 3 regions in Gorgol; n=312; Hb<10.9g/dl.
[10] Reported for women 25-50 years.
[11] Hb<12g/dl
[12] Reported for women 18-20 years; Facility-based study (antenatal clinic) in Dosso; n=40
[13] Reported for women 15-45 years.
[14] Hb < 8g/dl.
[15] Local study in Ndunakazi; n=126; Hb<12g/dl.
[16] Prevalence figure provided is the average of the three figures WHO MDIS 2005; Study of three regions; n=2878.
[17] Reported for females 5-49.

Eastern Mediterranean Region

[1] Reported for women 19 and above.
[2] Reported for women 15-45 years; study in 2 villages in Abu-Al-Khasib District;n=514
[3] Reported for women 19-45 years.
[4] Reported for women 20-49 years; Hb<12g/dl.
[5] Prevalence figure provided is an average of the six groups WHO MDIS 2005; Survey in six states; n=900; Hb determination only for sub-sample
[6] Reported for women 20-59 years; Hb<12g/dl.
[7] Facility based study (immunization center) in Al Ain city; n=279.

South/South-East Asia Region

[1] Unpublished data (February – March 2004) of the Nutritional Surveillance Project, HKI & Institute of Public Health Nutrition; nationally representative of rural Bangladesh (n=1499).
[2] Reported for women 16 years and above. Survey done in 4 zones and one urban area; sample size not specified
[3] Among women with a child less than 24 months; Reported as moderate to severe anemia (Hb<9.0g/dl); not weighted by province
[4] HKI Nutrition and Health Surveillance System for 8 of the largest provinces (accounting for 70% of Indonesia's population). National figure is a weighted average for 70% of the population.
[5] Hb 7.0-10.9 g/dl (combining mild-moderate)
[6] Reported for women 15-59 years; Hb less than 12g/dl.

Western Pacific Region

[1] Facility-based study in Perth; n=95
[2] Reported for women 20 and above; Hb cut-off used 10g/dl.
[3] Reported for women 15-Not specified
4 Reported for women 20-Not specified
[5] Reported for women 13-69 years. Cross-sectional study in five remote interior communities in Sarawak; n=176
[6] Reported for Non-pregnant/non-lactating women.
[7] Survey in 2 (Yap, Kosrae) of 4 states; n=363, unsure if pregnant women are included; Hb<12g/dl
8 Reported for mothers of children aged 0-5; prevalence figure reported is adjusted; Unclear if sample includes pregnant women, but Hb cut-off used was 12g/dl; n=593 (Second National Nutrition Survey conducted by MOH, UNICEF and National Nutrition Center); National Nutrition Survey data from 2004 is being analyzed and will be released shortly.
[9] Reported for women 16-NS.
[10] Local study done in West Sepik, Sanduan Province; n=259
[11] Reported for women 13-NS.
[12] Reported for women 18-NS.
[13] Reported for women 20-29 years.
[14] Reported for women 18-69 years.

Europe Region

[1] Hb <11g/dl for PW and Hb<12g/dl for NPW; Data also available for non-pregnant/non-lactating women (12.4% any anemia, 10.3% mild anemia, 1.9% moderate anemia and 0.2% severe anemia).
[2] Hemoglobin levels reported for Women 25-26 (10%), 40-41 (13%) and 60-61 (11%), in 1979 Vienna Study. Averaging the three was not possible because specific sample sizes were not specified. Hb <12g/dl.
[3] Local Study of young people who, as children, had participated in blood pressure survey between 1979-1980 and 1984-1985; n= 284

[4] Reported for women 15-100 years; Results of this national 1967-1972 survey are the same as results for more recent 1997 Local Urban study of Women in Helsinki and Vantaa (5.8%).
[5] Facility based study (Students Health Examination Center); Reported for female students ages 17-42.99; n=476
[6] Random samples of women ages 20-40 years in small industrial village in West-Hungary, location not specified; n=121
[7] Reported for women 30-46 years in local study in Reykjavik; n=333
[8] Hb<11 g/dl for PW and Hb<12 g/dl for NPW; Data also available for non-pregnant/non-lactating women (35.3% any anemia, 26.3% mild anemia, 7.6% moderate anemia and 1.3% severe anemia).
[9] Hb<11 g/dl for PW and Hb<12 g/dl for NPW; Data also available for non-pregnant/non-lactating women (36.8% any anemia, 27.1% mild anemia, 8.2% moderate anemia and 1.5% severe anemia).
[10] Reported for women 17-65 years; Local study in two sparsely populated areas in eastern and western Norway; n=208
[11] Prevalence value weighted; State level survey in the Republic of Ingushetia; n=1035
[12] Prevalence value weighted; Reported for women 15-46 years.
[12] Reported for women 19-41 years; Study in all nine districts in the Province of Kahramanmaras; n=439
[13] Hb<11 g/dl for PW and Hb<12 g/dl for NPW; Data also available for non-pregnant/non-lactating women (45.8% any anemia, 37.1% mild anemia, 7.6% moderate anemia and 1.1% severe anemia).
[14] Hb<11 g/dl for PW and Hb<12 g/dl for NPW; Data also available for non-pregnant/non-lactating women (59.8% any anemia, 45.8% mild anemia, 12.9% moderate anemia and 1.1% severe anemia).

Region of the Americas

[1] Reported for women 10-49 years
[2] Prevalence figure is an average of the three age groups reported in WHO MDIS 2005; Reported for women 20-87 years
[3] Reported for women 15-44 years
[4] Prevalence figure is an average of two age groups reported in WHO MDIS 2005; Reported for women 15-51 years
[5] Reported for women 12-49 years
[6] Analysis of records from the Centers for Disease Control and Prevention (CDC) Pregnancy Nutrition Surveillance System (PNSS) from 25 States; n=518,731

Table A.1.9 Prevalence: Anemia in Men

Country	Last Measured Prevalence				
	Survey year	Population group and age	Geographic scope	Any Anemia Hb<13 g/dl	Source
AFRICA					
Algeria	ND				
Angola	ND				
Benin	1984-1985	Men (NS)	District[1]	16	WHO MDIS, 2005
Botswana	ND				
Burkina Faso	2003	Men (15-60)	National	31.7	WHO MDIS, 2005
Burundi	ND				
Cameroon	2000	Men (18-NS)	National	19.2	WHO MDIS, 2005
Cape Verde	ND				
Central African Republic	ND				
Chad	ND				
Comoros	ND				
Congo	ND				
Côte d'Ivoire	1996	Men (16-51)	Regional[2]	18[3]	WHO MDIS, 2005
Democratic Republic of Congo	ND				
Equatorial Guinea	ND				
Eritrea	ND				
Ethiopia	ND				
Gabon	ND				
Gambia	ND				
Ghana	ND				
Guinea	2000	Men (18-50)	National	23.4	WHO MDIS, 2005
Guinée Bissau	ND				
Kenya	1999	Men (15-51)	National	31.4[4]	WHO MDIS, 2005
Lesotho	ND				
Liberia	ND				
Madagascar	2003-2004	Men (15-60)	National	18.5[5]	WHO MDIS, 2005
Malawi	ND				
Mali	2001	Men (15-60)	National	18.1	WHO MDIS, 2005
Mauritania	ND				

Country	Last Measured Prevalence				
	Survey year	Population group and age	Geographic scope	Any Anemia Hb<13 g/dl	Source
Mauritius	1995	Men (25-51)	National	3.3	WHO MDIS, 2005
Mozambique	1998	Men (15-NS)	State[6]	32[7]	WHO MDIS, 2005
Namibia	ND				
Niger	ND				
Nigeria	ND				
Rwanda	ND				
Sao Tome & Principe	ND				
Senegal	ND				
Seychelles	1961[P]	Men (NS)	National	0.9[8]	WHO MDIS, 2005
Sierra Leone	ND				
South Africa	1989[P]	Indian Men (19-NS)	Local[9]	3.6	WHO MDIS, 2005
Swaziland	ND				
Tanzania	1992	Men (16-NS)	District[10]	41.4	WHO MDIS, 2005
Togo	1999-2000	Men (16-66)	Regional[11]	14.6	WHO MDIS, 2005
Uganda	2000-2001	Men (15-55)	National	18.3	WHO MDIS, 2005
Zambia	ND				
Zimbabwe	1997	Men (NS)	State[12]	16.5	WHO MDIS, 2005
EASTERN MEDITERRANEAN					
Afghanistan	2004	Men (18-61)	National	7.1	WHO MDIS, 2005
Bahrain	ND				
Djibouti	ND				
Egypt	ND				
Iran	ND				
Iraq	ND				
Jordan	ND				
Kuwait	2000[P]	Men (19-46)	National	8.8	WHO MDIS, 2005
Lebanon	ND				
Libyan Arab Jamahiriya	ND				
Morocco	2000	Men (18-60)	National	18	WHO MDIS, 2005

Country	Last Measured Prevalence				
	Survey year	Population group and age	Geographic scope	Any Anemia Hb<13 g/dl	Source
Oman	ND				
Pakistan	ND				
Qatar	ND				
Saudi Arabia	ND				
Somalia	ND				
Sudan	ND				
Syrian Arab Republic	ND				
Tunisia	1996-1997	Men (20-60)	National	6.2	WHO MDIS, 2005
United Arab Emirates	ND				
Yemen	ND				
SOUTH/SOUTH EAST ASIA					
Bangladesh	1975-1976	Men (15-NS)	National Rural	62[1]	WHO MDIS, 2005
Bhutan	2002	Men (NS)	National	27.6[2]	WHO MDIS, 2005
Dem Rep of Korea	ND				
India	1997-2000	Men (20-46)	Local[3]	27.9	WHO MDIS, 2005
Indonesia	ND				
Maldives	ND				
Myanmar	1972[P]	Men (16-NS)	Local[4]	52[5]	WHO MDIS, 2005
Nepal	ND				
Sri Lanka	ND				
Thailand	1995	Men (15-60)	National	15.6	WHO MDIS, 2005
Timor-Leste	ND				
WESTERN PACIFIC					
Australia	1992	Aboriginal Men (15-NS)	Local[1]	18.2	WHO MDIS, 2005
Brunei Darussalam	1996-1997	Men (20-NS)	National	1.4[2]	WHO MDIS, 2005
Cambodia	ND				
China	1992	Men (15-NS)	National	14.6	WHO MDIS, 2005
Cook Islands	ND				

Country	Last Measured Prevalence				
	Survey year	Population group and age	Geographic scope	Any Anemia Hb<13 g/dl	Source
Fiji	ND				
Japan	2002	Men (20-NS)	National	9.2	WHO MDIS, 2005
Kiribati	ND				
Korea, Republic of	1993	Men (18-NS)	National	25	WHO MDIS, 2005
Lao PDR	2000	Men (15-50)	National	22.8[3]	WHO MDIS, 2005
Malaysia	1992-1995	Men (18-60)	Local[4]	14.2	WHO MDIS, 2005
Marshall Islands	ND				
Micronesia, Federated States of	ND				
Mongolia	2001	Men (18-60)	Regional[5]	2.1	WHO MDIS, 2005
Nauru	ND				
New Zealand	1996-1997	Men (16-NS)	National	0	WHO MDIS, 2005
Niue	ND				
Palau	ND				
Papua New Guinea	1986	Men (16-NS)	Local[6]	8.6	WHO MDIS, 2005
Philippines	1998	Men (13-NS)	National	29.4[7]	WHO MDIS, 2005
Samoa	1999	Men (20-50)	National	3.8	WHO MDIS, 2005
Singapore	1998	Men (18-70)	National	2.4	WHO MDIS, 2005
Solomon Islands	ND				
Tonga	ND				
Tuvalu	ND				
Vanuatu	1985	Men (21-NS)	Regional[8]	5.3	WHO MDIS, 2005
Vietnam	2000-2001	Men (NS)	National	9.4	WHO MDIS, 2005
EUROPE					
Albania	ND				
Andorra	ND				
Armenia	ND				
Austria	ND[1]				WHO MDIS, 2005
Azerbaijan	1996	Men (NS)	National	26[2]	WHO MDIS, 2005
Belarus	ND				
Belgium	ND				

Country	Last Measured Prevalence				
	Survey year	Population group and age	Geographic scope	Any Anemia Hb<13 g/dl	Source
Bosnia & Herzegovina	ND				
Bulgaria	ND				
Croatia	ND				
Cyprus	ND				
Czech Republic	ND[3]				WHO MDIS, 2005
Denmark	1992-1993	Men (16-32)	Local[4]	2.3[5]	WHO MDIS, 2005
Estonia	ND				
Finland	1967-1972	Men (15-100)	National	2.1	WHO MDIS, 2005
France	ND[6]				WHO MDIS, 2005
Georgia	ND				
Germany	ND				
Greece	1974[P]	Men (20-26)	National	10.5[7]	WHO MDIS, 2005
Hungary	ND				
Iceland	1984-1985	Men (30-46)	Local[8]	1.4	WHO MDIS, 2005
Ireland	ND				
Israel	ND				
Italy	ND				
Kazakhstan	ND				
Kyrgyzstan	ND				
Latvia	ND				
Lithuania	ND				
Luxembourg	ND				
Macedonia, The Former Yugoslav Republic of	ND				
Malta	ND				
Moldova, Republic of	ND				
Monaco	ND				
Netherlands	ND				
Norway	1976[P]	Men (17-65)	Local[9]	3.1	WHO MDIS, 2005
Poland	ND				
Portugal	ND				

Country	Last Measured Prevalence				
	Survey year	Population group and age	Geographic scope	Any Anemia Hb<13 g/dl	Source
Romania	ND				
Russian Federation	ND				
San Marino	ND				
Serbia-Montenegro	ND				
Slovakia	ND				
Slovenia	ND				
Spain	ND				
Sweden	ND				
Switzerland	ND				
Tajikistan	ND				
Turkey	2002[P]	Men (19-41)	State[10]	0[11]	WHO MDIS, 2005
Turkmenistan	ND				
Ukraine	ND				
UK	2000-2001	Men (19-65)	National	3	WHO MDIS, 2005
Uzbekistan	ND				
Yugoslavia	ND				
REGION OF THE AMERICAS					
Antigua & Barbuda	ND				
Argentina	1993-1994	Men (NS)	Local[1]	15.8[2]	WHO MDIS, 2005
Bahamas	ND				
Barbados	1981	Men (15-NS)	National	19.1	WHO MDIS, 2005
Belize	ND				
Bolivia	ND				
Brazil	ND				
Canada	1970-1972	Men (20-65)	National	6.1[3]	WHO MDIS, 2005
Chile	ND				
Colombia	ND				
Costa Rica	ND				
Cuba	ND				
Dominica	ND				
Dominican Republic	ND				

Country	Last Measured Prevalence				
	Survey year	Population group and age	Geographic scope	Any Anemia Hb<13 g/dl	Source
Ecuador	ND				
El Salvador	ND				
Grenada	1985	Men (15-NS)	National	20.4	WHO MDIS, 2005
Guatemala	ND				
Guyana	1996-1997	Men (15-51)	National	23[4]	WHO MDIS, 2005
Haiti	ND				
Honduras	ND				
Jamaica	1965-1966	Men (35-65)	Local Urban[5]	3.9[6]	WHO MDIS, 2005
Mexico	ND				
Nicaragua	ND				
Panama	ND				
Paraguay	ND				
Peru	ND				
Puerto Rico	ND				
Saint Kitts & Nevis	ND				
Saint Lucia	ND				
Saint Vincent & the Grenadines	ND				
Suriname	ND				
Trinidad & Tobago	1968	Men (18-NS)	District[7]	4.3[8]	WHO MDIS, 2005
USA	1999-2002	Men (15-NS)	National	2.8	WHO MDIS, 2005
Uruguay	ND				
Venezuela	ND				

[P] When survey date is not specified, the year of publication is used

Africa Region

[1] Study in two Cotonou urban districts and three rural districts in South Benin; n=519; Also reported: Hemoglobin levels for Men in two 1986 rural studies.
[2] Study of four zones: Abidjan, Bouaké, Kolia, Guitry; n=324
[3] Hb < 12g/dl
[4] Hb <11g/dl; Also reported: Hb <7g/dl = 1.4
[5] Hb <13g/dl; Also reported: Hb <7g/dl = 1.1
[6] Study done in 4 out of 10 provinces of Mozmbique; n=509
[7] Also reported: Hb <7g/dl = 1.6
[8] Hb <8g/dl; Study of 3 largest islands
[9] Chatsworth; n=251
[10] Lindi district; n=649; Also reported: Hemoglobin levels for men in 1987-1989 Regional study
[11] Lomé Region, n=398
[12] Four provinces, n=811

Eastern Mediterranean Region

(no footnotes)

South/South East Asia Region

[1] Also reported: Hemoglobin levels for adolescent boys (15-20) in 2001National Rural Study (29%)
[2] Also reported: Hb<7g/dl = 0.3
[3] Mumbai and Pune city; n=290; Also reported in WHO MDIS, 2005: Hemoglobin levels for men in 1982 Local Calcutta Study.
[4] Study of 5 villages in different regions of Myanmar; n=1220
[5] Hb <14g/dl

Western Pacific Region

[1] Community in far north of Western Australia, n=55
[2] Hb <11g/dl
[3] Hb <11g/dl; Also reported: Hb <7g/dl = 1.1%
[4] Study in 69 villages and 7 estates in 9 states in Peninsular Malaysia; n=1230
[5] Two separate survey samples selected; 1 from areas exceptionally affected by severe weather & a comparison group, n=175
[6] Study in 4 of 13 Gidra-speaking villages in Western Province
[7] Hb <12g/dl 13-14 years and Hb <13g/dl for men over 15.
[8] From noncommunicable diseases survey in 3 regions: Port Vila civil servants (urban), Island of Ngua (semirural) and villages of Middle Bush Tanna (rural), n= 720.

Europe Region

[1] Hemoglobin levels reported for Men 25-26 (0%), 40-41 (3%) and 60-61 (3%), in 1979 Vienna Study. Averaging the three was not possible because specific sample sizes were not specified. Hb <12g/dl
[2] Hb <13.6g/dl
[3] Mean Hemoglobin levels only reported for 1966 Regional Study.
[4] Copenhagen; n=264
[5] Hb <12.9g/dl
[6] Mean Hemoglobin levels only reported for 1994 National Study.
[7] Hb <14g/dl
[8] Reykjavik; n=372
[9] Two areas, location not specified; n=161
[10] Kahramanmaras, n=180
[11] Hb <7g/dl

Region of the Americas

[1] Ushuaia; n=60
[2] Hb <14g/dl
[3] Prevalence data is an average of two groups reported by WHO MDIS, 2005. Hb<14g/dl
[4] Prevalence data is an average of two groups reported by WHO MDIS, 2005. Hb<12g/dl
[5] n=206
[6] Hb <12g/dl
[7] Sample from different areas; n=140
[8] Hb <12g/dl

Table A.1.10 Prevalence: Iodine Deficiency in the Population

Country	Survey year	Population group & age SAC=School Age Children (years)	Geographic scope	Median Urinary Iodine (UI) ug/l	Proportion of population with UI<100ug/l %	95% CI %
AFRICA						
Algeria	1994[P]	SAC (6-11)	Local	27	77.7	71.4-84.0
Angola	ND					
Benin	1999	SAC (6-12)	Local	289	8.3	5.7-10.9
Botswana	1994	SAC (8-10)	National	219	15.3	11.1-19.5
Burkina Faso	1999	SAC (6-12)	Local	114	47.5	42.6-52.4
Burundi	ND					
Cameroon	1993	SAC (6-18)	National	52	91.7	89.7-93.7
Cape Verde	1996	SAC (6-12)	National	52	77.4	72.7-82.1
Central African Republic	1993-1994	General Population	Province	21	79.5	75.1-83.9
Chad	1993-1994	SAC (10-20)	National	29	99.6	99.2-100.0
Comoros	ND					
Congo	ND					
Cote d'Ivoire	1999-2000	SAC (4-16)	Local	162	33.8	29.2-38.4
Democratic Republic of Congo	1995	SAC (6-14)	Local	267	0.0	0.0-0.0
Equatorial Guinea	ND					
Eritrea	1998	SAC (6-12)	National	168	25.3	23.4-27.2
Ethiopia	2000[P]	SAC	District	58	68.4	64.4-72.4
Gabon	2001	SAC (6-12)	National	190	38.3	ND
Gambia	1999	SAC (8-12)	National	42	72.8	69.2-76.4
Ghana	1994	ND	District	54	71.3	66.1-76.5
Guinea	1999	SAC (8-19)	Region	91	63.6	60.9-66.3
Guinée Bissau	ND					
Kenya	1994	SAC (8-10)	National	115	36.7	35.0-38.4
Lesotho	1999	SAC (8-12)	National	26	100.0	ND
Liberia	1999	SAC (6-11)	National	321	3.5	2.7-4.3
Madagascar	ND					
Malawi	ND					
Mali	1999	SAC (6-12)	Local	203	34.1	29.2-39.1
Mauritania	1995	SAC (6-14)	National	55	69.8	64.0-75.6

Country	Survey year	Population group & age SAC=School Age Children (years)	Geographic scope	Median Urinary Iodine (UI) ug/l	Proportion of popula-tion with UI<100ug/l %	95% CI %
Mauritius	1995	Adults	National	154	4.4	1.7-7.1
Mozambique	1998	SAC	Province	69	65.4	61.5-69.3
Namibia	ND					
Niger	1998	SAC	Region	270	0.0	0.0-0.0
Nigeria	1998	SAC (8-12)	State	147	38.8	34.7-42.9
Rwanda	1996	SAC (5-19)	National	298	0.0	0.0-0.0
Sao Tome & Principe	ND					
Senegal	1996-1997	SAC (10-14)	Region	45	75.7	73.1-78.3
Seychelles	ND					
Sierra Leone	ND					
South Africa	1998	SAC (7-11)	National	177	29.0	28.0-30.0
Swaziland	1998	SAC (6-18)	Local	170	34.5	27.4-41.7
Tanzania	1996	SAC (8-9)	State	127	37.7	33.8-41.6
Togo	1999	SAC (6-12)	Local	116	42.8	37.8-47.8
Uganda	1999	SAC (6-12)	National	310	11.9	8.2-15.6
Zambia	1993	SAC	National	60	72.0	70.2-73.8
Zimbabwe	1999	SAC (6-14)	National	245	14.8	12.4-17.2
EASTERN MEDITERRANEAN						
Afghanistan	ND					
Bahrain	1999	SAC (8-12)	National	204	16.2	13.6-18.8
Djibouti	ND					
Egypt	1998	SAC (6-10)	State	148	31.2	27.8-34.6
Iran	1996	SAC (8-10)	National	205	14.9	13.6-16.2
Iraq	ND					
Jordan	2000	SAC (8-10)	National	154	24.4	22.8-26.1
Kuwait	1997	SAC (6-9)	National	147	31.4	26.5-36.3
Lebanon	1997	SAC (7-15)	National	95	55.5	51.5-59.5
Libyan Arab Jamahiriya	ND					
Morocco	1993	SAC (6-12)	National	75	63.0	57.4-68.7
Oman	1993-1994	SAC (8-11)	National	91	49.8	46.6-53.0

Country	Survey year	Population group & age SAC=School Age Children (years)	Geographic scope	Median Urinary Iodine (UI) ug/l	Proportion of population with UI<100ug/l %	95% CI %
Pakistan	1993-1994	SAC (8-10)	Region	16	90.4	88.9-91.9
Qatar	1996	SAC (6-15)	Local	203	30.0	26.3-33.7
Saudi Arabia	1994-1995	SAC (8-10)	National	180	23.0	21.8-24.2
Somalia	ND					
Sudan	1997	SAC	National	75	62.0	60.4-63.6
Syrian Arab Republic	ND					
Tunisia	1996-1997	SAC (6-9)	National	164	26.4	17.5-35.3
United Arab Emirates	1994	SAC (9-13)	Region	91	56.6	50.6-62.7
Yemen	1998	SAC (6-12)	National	173	30.2	27.3-33.1
SOUTH/SOUTH EAST ASIA						
Bangladesh	1993	SAC (5-11)	National	54	70.7	68.7-72.7
Bhutan	1996	SAC (6-11)	National	230	24.0	19.4-28.6
Democratic Republic of Korea	ND					
India	1993-1993, 1995, 1996 1996[P], 1997 1997[P], 1998 1998[P], 1999 2000[P], 2001[P], 2001, 2002	SAC	Local State, district	133	31.3	30.6-32.0
▪ Rajasthan	ND					
▪ Madhya Pradesh	ND					
▪ Uttar Pradesh	ND					
▪ Bihar	ND					
▪ Orissa	ND					
▪ West Bengal	ND					
▪ Gujarat	ND					
▪ Maharashtra	ND					
▪ Andhra Pradesh	ND					
Indonesia	1996[P]	SAC (8-10)	District	65	63.7	59.7-67.7
▪ Lampung	ND					

Country	Survey year	Population group & age SAC=School Age Children (years)	Geographic scope	Median Urinary Iodine (UI) ug/l	Proportion of population with UI<100ug/l %	95% CI %
▪ Banten	ND					
▪ West Java	ND					
▪ Central Java	ND					
▪ East Java	ND					
▪ NTB/Lombok	ND					
▪ South Sulawesi	ND					
Maldives	1995	SAC (6-12)	National	67	65.5	60.3-70.7
Myanmar	2001	SAC (6-11)	National	136	38.2	36.6-39.9
Nepal	1997-1998	SAC (6-11)	National	144	35.1	32.6-37.6
Sri Lanka	2000-2001	SAC (8-10)	National	145	30.6	28.8-32.4
Thailand	2000	Pregnant Women	National	150	34.9	33.3-36.5
Timor-Leste	ND					
WESTERN PACIFIC						
Australia	2000, 2001	SAC (4-18)	State, local	77	71.5	68.4-74.6
Brunei Darussalam	ND					
Cambodia	ND					
China	2002	SAC (8-10)	National	241	16.2	15.5-16.9
Cook Islands	ND					
Fiji	1994	SAC	District	34	75.4	71.5-79.3
Japan	ND					
Kiribati	ND					
Korea, Republic of	ND					
Lao PDR	2000	SAC (8-12)	National	162	26.9	24.0-29.8
Malaysia	1995	SAC (8-10)	National	91	57.0	56.1-57.9
Marshall Islands	ND					
Micronesia, Federated States of	ND					
Mongolia	2001	SAC (4-16)	National	102	48.9	47.0-50.8
Nauru	ND					
New Zealand	1996-1999	SAC (8-10)	Local	66	79.7	75.0-84.4

Country	Survey year	Population group & age SAC=School Age Children (years)	Geographic scope	Median Urinary Iodine (UI) ug/l	Proportion of population with UI<100ug/l %	95% CI %
Niue	ND					
Palau	ND					
Papua New Guinea	1996	SAC (8-10)	Local	181	27.7	24.2-31.2
Philippines	1998	SAC (6-12)	National	71	65.3	64.4-66.2
Samoa	ND					
Singapore	ND					
Solomon Islands	ND					
Tonga	ND					
Tuvalu	ND					
Vanuatu	ND					
Vietnam	1993	SAC (8-12)	National	40	84.0	82.7-85.3
EUROPE						
Albania	ND					
Andorra	ND					
Armenia	1998	Pre-SAC (0-5)	National	146	31.8	30.0-33.6
Austria	1994	SAC (6-15)	Local	111	49.4	46.3-54.3
Azerbaijan	2001[P]	SAC (8-14)	Regional	54	74.4	69.8-79.0
Belarus	1995-1998	SAC (6-18)	National	45	80.9	80.2-81.6
Belgium	1998	SAC (6-12)	National	80	66.9	65.1-68.7
Bosnia & Herzegovina	1999	SAC (7-14)	National	111	52.4	50.2-54.6
Bulgaria	1996	SAC (6-14)	National	111	42.9	39.9-45.9
Croatia	2002	SAC (6-12)	National	140	28.8	25.9-31.7
Cyprus	ND					
Czech Republic	2000[P]	SAC (6, 10, 13)	Regional	119	47.7	44.0-51.4
Denmark	1997-1998	Adults (18-65)	Regional	61	70.8	69.5-72.1
Estonia	1995	SAC (8-10)	National	65	67.0	64.9-69.2
Finland	1997	Adults (30-42)	Local	164	35.5	30.4-40.6

Country	Survey year	Population group & age SAC=School Age Children (years)	Geographic scope	Median Urinary Iodine (UI) ug/l	Proportion of population with UI<100ug/l %	95% CI %
France	1996	Adults (35-60)	National	85	60.4	59.5-61.3
Georgia	1998	NS	National	62	80.0	ND
Germany	1999	SAC (6-12)	National	148	27.0	25.4-28.6
Greece	ND					
Hungary	1994-1997	SAC (7-11)	National	80	65.2	63.4-67.0
Iceland	1998[P]	Elderly (66-70)	Local	150	37.7	27.6-47.8
Ireland	1999	Adults (22-61)	Local	82	60.8	52.5-69.1
Israel	ND					
Italy	1992-1994, 1993-1995, 1994[P], 1997[P], 1998[P], 1999[P]	SAC (6-15)	Region, local	94	55.7	54.8-56.6
Kazakhstan	1999	Women (15-49)	National	97	53.1	49.9-56.3
Kyrgyzstan	1994	SAC (7-11)	Region	30	88.1	83.8-92.4
Latvia	2000	SAC (8-10)	National	59	76.8	73.4-80.2
Lithuania	1995	SAC	National	75	62.0	59.9-64.1
Luxembourg	1994	SAC (6-15)	Local	90	57.4	48.7-66.1
Macedonia, The Former Yugoslav Republic of	2002	SAC (7-11)	National	199	11.8	10.0-13.6
Malta	ND					
Moldova, Republic of	1996	SAC (8-10)	National	78	62.0	57.8-66.2
Monaco	ND					
Netherlands	1995-1996	SAC (6-18)	Local	154	37.5	34.4-40.6
Norway	ND					
Poland	1999	SAC (6-15)	Local	84	64.0	60.8-67.2
Portugal	ND					
Romania	2000-2001	SAC (6-16)	National	68	64.2	63.1-65.3
Russian Federation	ND					

Country	Survey year	Population group & age SAC=School Age Children (years)	Geographic scope	Median Urinary Iodine (UI) ug/l	Proportion of population with UI<100ug/l %	95% CI %
San Marino	ND					
Serbia-Montenegro	1998-1999	SAC (7-15)	Region	158	20.8	18.8-22.8
Slovakia	2002	SAC	National	183	15.0	13.3-16.7
Slovenia	ND					
Spain	1995, 2000, 2000[P], 2001[P], 2002[P]	SAC	Regional, province	109	50.1	49.3-52.7
Sweden	ND					
Switzerland	1999	SAC (6-12)	National	115	39.5	35.6-43.4
Tajikistan	ND					
Turkey	1997-1999	SAC (9-11)	National	36	74.6	73.5-75.7
Turkmenistan	1999	SAC (8-10)	Local	64	65.6	54.1-77.2
Ukraine	1991-1996, 1996-1999	SAC (5-20)	Local	50	70.1	68.6-71.6
UK	ND					
Uzbekistan	1998	SAC (7-10)	National	36	97.4	96.3-98.5
Yugoslavia	ND					
REGION OF THE AMERICAS						
Antigua & Barbuda	ND					
Argentina	ND					
Bahamas	ND					
Barbados	ND					
Belize	1994-1995	SAC (7-14)	National	184	26.7	24.6-28.8
Bolivia	1996	Women 15-49 and children <5	National	250	19.0	15.6-22.4
Brazil	2000	SAC (6-12)	State	360	0.0	0.0-0.0
▪ Paraiba	ND					
▪ Pernambuco	ND					
▪ Piaui	ND					
▪ Sao Paulo	ND					
▪ Sergipe	ND					

Country	Survey year	Population group & age SAC=School Age Children (years)	Geographic scope	Median Urinary Iodine (UI) ug/l	Proportion of population with UI<100ug/l %	95% CI %
Canada	ND					
Chile	2001	SAC (6-18)	Local urban	984	0.2	0.0-0.7
Colombia	1994-1998	SAC (8-12)	National urban	249	6.4	5.8-7.0
Costa Rica	1996	SAC	National	233	8.9	6.5-11.3
Cuba	1995	SAC (6-12)	National	95	51.0	49.2-52.8
Dominica	ND					
Dominican Republic	1993	SAC (6-14)	National	39	86.0	83.7-88.4
Ecuador	1999	SAC	Local	420	0.0	0.0-0.0
El Salvador	1996-1997	SAC (6-14)	National	>150	4.6	3.8-5.4
Grenada	ND					
Guatemala	1995	SAC women	National	222	14.4	12.0-16.8
Guyana	1997[P]	SAC (5-14)	National	162	26.9	22.2-31.6
Haiti	ND					
Honduras	1999	SAC	Local	240	31.3	27.6-35.0
Jamaica	ND					
Mexico	1999	SAC (5-12)	National	235	8.5	6.2-10.8
Nicaragua	2000	SAC (6-9)	National	271	0.0	0.0-0.0
Panama	1999	SAC (6-12)	National	235	8.6	6.4-10.8
Paraguay	1999	SAC (6-12)	National	294	13.4	12.5-14.3
Peru	1999	SAC	National	230	11.8	10.9-12.7
Saint Kitts & Nevis	ND					
Saint Lucia	ND					
Saint Vincent & the Grenadines	ND					
Suriname	ND					
Trinidad & Tobago	ND					
USA	1988-1994	SAC (6-11)	National	237	9.5	8.5-10.5
Uruguay	ND					
Venezuela	2000-2001	SAC	State	286	0.0	0.0-0.0

Source: WHO (2004). Iodine Status Worldwide: WHO Global Database on Iodine Deficiency http://whqlibdoc.who.int/publications/2004/9241592001.pdf

[P] When survey date is not specified the year of publication is used.

Table A.1.11 Prevalence: Risk of Zinc Deficiency in the Population

Country	Prevalence of stunting %	Estimated zinc daily intake (mg/d)	Estimated zinc absorption %	Derived estimate of population at risk of inadequate intake, IZiNCG %
AFRICA				
Algeria	18.3	17.2	160.2	6.6
Angola	53.3	6.5	102.6	46.0
Benin	25.0	10.8	132.1	16.5
Botswana	28.9	10.2	131.1	17.1
Burkina Faso	36.8	13.4	138.6	13.3
Burundi	47.4	7.6	102.3	46.5
Cameroon	26.0	9.0	117.3	27.7
Cape Verde	16.2	10.8	132.0	16.6
Central African Republic	28.4	8.8	123.0	22.7
Chad	40.1	11.2	125.1	21.1
Comoros	33.8	6.0	100.1	49.9
Congo	27.5	6.2	104.7	42.9
Cote d'Ivoire	24.4	8.8	125.5	20.8
Democratic Republic of Congo	45.2	5.7	95.5	57.5
Equatorial Guinea	ND	ND	ND	ND
Eritrea	38.4	8.2	112.9	32.4
Ethiopia	64.2	9.9	124.3	21.7
Gabon	22.0	9.0	128.7	18.6
Gambia	30.1	8.1	109.7	36.1
Ghana	25.9	9.0	125.2	21.0
Guinea	26.1	7.3	111.5	33.9
Guinée Bissau	ND	8.9	116.1	29.0
Kenya	33.0	8.1	112.5	32.9
Lesotho	44.0	10.2	114.0	31.2
Liberia	32.8	5.4	94.5	59.2
Madagascar	48.3	7.4	112.5	32.9
Malawi	48.3	8.9	111.4	34.2
Mali	48.6	12.6	144.0	11.1
Mauritania	44.0	10.0	137.0	14.0
Mauritius	9.7	9.1	115.6	29.5

Country	Prevalence of stunting %	Estimated zinc daily intake (mg/d)	Estimated zinc absorption %	Derived estimate of population at risk of inadequate intake, IZiNCG %
Mozambique	35.9	6.2	93.7	60.5
Namibia	28.5	11.7	136.6	14.2
Niger	39.5	13.6	149.1	9.4
Nigeria	37.6	12.0	139.8	12.8
Rwanda	41.8	7.5	106.9	39.8
Sao Tome & Principe	25.9	7.0	109.3	36.7
Senegal	30.6	9.1	119.9	25.3
Seychelles	5.1	8.3	128.4	18.8
Sierra Leone	34.7	6.2	96.1	56.5
South Africa	22.8	11.2	127.0	19.7
Swaziland	30.3	10.3	125.9	20.5
Tanzania	43.4	7.9	108.7	37.5
Togo	34.0	9.8	122.8	22.9
Uganda	38.3	9.4	121.7	23.8
Zambia	42.4	8.3	108.3	38.0
Zimbabwe	21.4	8.3	104.3	43.4
EASTERN MEDITERRANEAN				
Afghanistan	51.6	12.0	132.4	16.4
Bahrain	ND	ND	ND	ND
Djibouti	25.7	6.2	108.8	37.3
Egypt	20.6	17.4	151.8	8.6
Iran	15.4	16.0	159.9	6.7
Iraq	27.5	11.1	128.8	18.5
Jordan	7.8	14.5	153.1	8.3
Kuwait	3.2	17.1	176.4	4.2
Lebanon	12.2	16.5	154.2	12.2
Libyan Arab Jamahiriya	15.1	17.2	168.2	5.2
Morocco	24.2	17.3	155.6	7.6
Oman	ND	ND	ND	ND
Pakistan	36.6	13.0	144.0	11.1
Qatar	ND	ND	ND	ND

Country	Prevalence of stunting %	Estimated zinc daily intake (mg/d)	Estimated zinc absorption %	Derived estimate of population at risk of inadequate intake, IZiNCG %
Saudi Arabia	41.0	13.8	149.0	9.4
Somalia	ND	7.9	131.2	17.1
Sudan	34.8	13.1	144.8	10.8
Syrian Arab Republic	20.8	15.3	161.1	6.5
Tunisia	8.3	18.6	159.5	6.8
United Arab Emirates	ND	16.7	156.4	7.5
Yemen	51.7	11.7	138.9	13.1
SOUTH/SOUTH EAST ASIA				
Bangladesh	54.8	7.4	99.7	50.4
Bhutan	ND	ND	ND	ND
Democratic Republic of Korea	59.5	9.8	107.6	38.8
India	42.6	10.9	119.3	25.9
▪ Rajasthan	ND	ND	ND	ND
▪ Madhya Pradesh	ND	ND	ND	ND
▪ Uttar Pradesh	ND	ND	ND	ND
▪ Bihar	ND	ND	ND	ND
▪ Orissa	ND	ND	ND	ND
▪ West Bengal	ND	ND	ND	ND
▪ Gujarat	ND	ND	ND	ND
▪ Maharashtra	ND	ND	ND	ND
▪ Andhra Pradesh	ND	ND	ND	ND
Indonesia	42.2	10.0	111.2	34.4
▪ Lampung	ND	ND	ND	ND
▪ Banten	ND	ND	ND	ND
▪ West Java	ND	ND	ND	ND
▪ Central Java	ND	ND	ND	ND
▪ East Java	ND	ND	ND	ND
▪ NTB/Lombok	ND	ND	ND	ND
▪ South Sulawesi	ND	ND	ND	ND
Maldives	26.9	11.0	137.6	13.7

Country	Prevalence of stunting %	Estimated zinc daily intake (mg/d)	Estimated zinc absorption %	Derived estimate of population at risk of inadequate intake, IZiNCG %
Myanmar	41.6	9.3	111.0	34.6
Nepal	53.1	11.1	124.9	21.3
Sri Lanka	20.4	8.6	103.4	44.7
Thailand	16.0	8.1	105.6	41.6
Timor-Leste	ND	ND	ND	ND
WESTERN PACIFIC				
Australia	0.0	13.3	169.1	5.1
Brunei Darussalam	ND	12.3	139.6	12.8
Cambodia	53.3	7.1	104.2	43.6
China	15.6	12.4	136.7	14.1
Cook Islands	ND	ND	ND	ND
Fiji	2.7	10.1	134.6	15.2
Japan	5.6	11.0	122.0	23.5
Kiribati	28.3	9.1	111.7	33.7
Korea, Republic of	18.3	11.9	127.6	19.4
Lao PDR	47.3	7.9	110.1	35.7
Malaysia	26.6	10.3	136.7	14.1
Marshall Islands	ND	ND	ND	ND
Micronesia, Federated States of	ND	ND	ND	ND
Mongolia	24.6	12.7	216.7	1.6
Nauru	ND	ND	ND	ND
New Zealand	2.9	14.1	172.9	4.6
Niue	ND	ND	ND	ND
Palau	ND	ND	ND	ND
Papua New Guinea	43.2	9.0	135.9	14.6
Philippines	32.7	7.8	113.3	31.9
Samoa	ND	ND	ND	ND
Singapore	ND	ND	ND	ND
Solomon Islands	27.3	7.9	123.0	22.8
Tonga	ND	ND	ND	ND

Country	Prevalence of stunting %	Estimated zinc daily intake (mg/d)	Estimated zinc absorption %	Derived estimate of population at risk of inadequate intake, IZiNCG %
Tuvalu	ND	ND	ND	ND
Vanuatu	19.1	11.2	129.7	18.0
Vietnam	38.7	9.2	117.3	27.8
EUROPE				
Albania	15.4	9.9	138.2	13.4
Andorra	ND	ND	ND	ND
Armenia	12.3	6.4	100.4	49.4
Austria	ND	13.0	152.6	8.4
Azerbaijan	22.2	6.9	101.6	47.5
Belarus	ND	15.1	164.9	5.8
Belgium[1]	ND	11.3	144.6	10.9
Bosnia & Herzegovina	ND	11.3	114.7	30.4
Bulgaria	ND	9.9	128.7	18.6
Croatia	0.8	7.9	109.0	37.0
Cyprus	ND	17.7	162.4	6.2
Czech Republic	1.9	10.6	140.8	12.3
Denmark	ND	13.3	149.8	9.2
Estonia	ND	13.8	152.7	8.4
Finland	ND	13.5	165.5	5.7
France	5.8	14.8	176.2	4.2
Georgia	11.7	8.1	101.7	47.3
Germany	ND	12.2	140.3	12.5
Greece	ND	12.7	144.8	10.8
Hungary	2.9	9.9	135.6	14.7
Iceland	ND	16.2	187.7	3.1
Ireland	ND	14.3	168.6	5.2
Israel	ND	12.2	141.0	12.2
Italy	2.7	12.5	150.0	9.1
Kazakhstan	15.8	11.6	148.3	9.6
Kyrgyzstan	24.8	9.5	137.4	13.8
Latvia	ND	12.1	145.1	10.7

Country	Prevalence of stunting %	Estimated zinc daily intake (mg/d)	Estimated zinc absorption %	Derived estimate of population at risk of inadequate intake, IZiNCG %
Lithuania	ND	13.0	150.9	8.9
Luxembourg[1]	ND	11.3	144.6	10.9
Macedonia, The Former Yugoslav Republic of	ND	9.5	113.7	31.5
Malta	ND	12.8	145.4	10.6
Moldova, Republic of	ND	10.2	114.4	30.8
Monaco	ND	ND	ND	ND
Netherlands	ND	13.6	157.0	7.3
Norway	ND	12.9	154.2	8.0
Poland	ND	12.5	148.7	9.5
Portugal	ND	13.0	147.4	9.9
Romania	7.8	11.1	129.2	18.3
Russian Federation	12.7	10.8	142.3	11.7
San Marino	ND	ND	ND	ND
Serbia-Montenegro	ND	ND	ND	ND
Slovakia	ND	10.6	132.4	16.4
Slovenia	ND	12.7	140.3	12.5
Spain	3.1	12.5	150.4	9.0
Sweden	ND	10.9	143.3	11.3
Switzerland	ND	12.6	155.8	7.6
Tajikistan	30.0	5.5	90.2	66.8
Turkey	16.0	9.9	123.7	22.2
Turkmenistan	ND	8.2	121.2	24.2
Ukraine	ND	10.3	133.4	15.8
UK	1.3	12.1	151.9	8.6
Uzbekistan	31.3	8.4	121.0	24.4
Yugoslavia	6.8	11.6	143.5	11.3
REGION OF AMERICAS				
Antigua & Barbuda	6.6	9.5	147.1	10.0
Argentina	12.4	14.0	186.2	3.2
Bahamas	ND	11.2	146.0	10.4

Country	Prevalence of stunting %	Estimated zinc daily intake (mg/d)	Estimated zinc absorption %	Derived estimate of population at risk of inadequate intake, IZiNCG %
Barbados	7.0	11.6	138.4	13.3
Belize	39.5	9.5	123.7	22.2
Bolivia	26.8	8.8	123.2	22.6
Brazil	10.5	10.5	126.2	20.3
▪ Paraiba	ND	ND	ND	ND
▪ Pernambuco	ND	ND	ND	ND
▪ Piaui	ND	ND	ND	ND
▪ Sao Paulo	ND	ND	ND	ND
▪ Sergipe	ND	ND	ND	ND
Canada	4.7	11.1	138.5	13.3
Chile	1.9	10.5	140.3	12.5
Colombia	15.0	9.0	117.6	27.4
Costa Rica	3.3	8.6	116.1	29.0
Cuba	ND	7.1	100.5	49.3
Dominica	6.1	11.8	156.7	7.4
Dominican Republic	10.7	6.7	103.4	44.7
Ecuador	34.0	8.0	115.5	29.6
El Salvador	23.3	8.9	105.5	41.7
Grenada	ND	9.9	134.5	15.2
Guatemala	46.4	8.0	101.1	48.3
Guyana	20.7	8.3	113.3	31.9
Haiti	31.9	6.8	96.6	55.6
Honduras	38.9	7.9	103.7	44.3
Jamaica	6.9	8.7	123.2	22.6
Mexico	17.7	12.2	126.4	20.2
Nicaragua	24.9	7.5	100.2	49.7
Panama	18.2	8.1	112.4	33.0
Paraguay	13.9	11.0	138.4	13.4
Peru	25.8	7.6	105.6	41.6
Saint Kitts & Nevis	ND	10.0	142.8	11.5
Saint Lucia	10.8	11.1	155.0	7.8

Country	Prevalence of stunting %	Estimated zinc daily intake (mg/d)	Estimated zinc absorption %	Derived estimate of population at risk of inadequate intake, IZiNCG %
Saint Vincent & the Grenadines	23.5	9.4	125.7	20.7
Suriname	ND	8.1	114.9	30.2
Trinidad & Tobago	4.8	7.5	109.2	36.9
USA	2.0	12.7	150.1	9.1
Uruguay	9.5	14.7	177.9	4.0
Venezuela	14.3	7.6	106.0	41.0

Source: IZincG, 2004.

[1] Reported as Belgium-Luxembourg

Tables A.2: Coverage

Table A.2.1 Coverage: Vitamin A Supplementation in Young Children and Women

Country	Children 6-59 months (unless otherwise noted) Bi-annual preventive dose of oral supplements				Women 15-49 years Postpartum oral dose	
	UNICEF[1, a] 2002 %	UNICEF [2, a] 2003 %	Other[b] (survey year) %	Source	Received a vitamin A dose in the first 2 months after delivery (survey year) %	Source
AFRICA						
Algeria	ND	ND	ND		ND	
Angola	88.0	68.0	ND		ND	
Benin	85.0	98.0[t]	18.3 (2001)	ORC MACRO, 2005. DHS STAT COMPILER	20.2 (2001)	ORC MACRO, 2005. DHS STAT COMPILER
Botswana	85.0	ND	ND		ND	
Burkina Faso	97.0[t]	95.0[t]	33.3 (2003)	ORC MACRO, 2005. DHS STAT COMPILER	16.4 (2003)	ORC MACRO, 2005. DHS STAT COMPILER
Burundi	89.0	95.0	ND		ND	
Cameroon	86.0	86.0	37.5 (2004)	ORC MACRO, 2005. DHS STAT COMPILER	28.2 (2004)	ORC MACRO, 2005. DHS STAT COMPILER
Cape Verde	ND	ND	ND		ND	
Central African Republic	90.0	84.0	ND		ND	
Chad	85.0	ND	ND		ND	
Comoros	ND	ND	ND		ND	
Congo	86.0	89.0	ND		ND	
Cote d'Ivoire	97.0	ND	ND		ND	
Democratic Republic of Congo	62.0	80.0[t]	ND		ND	
Equatorial Guinea	ND	ND	ND		ND	
Eritrea	51.0	52.0	38.0 (2002)	ORC MACRO, 2005. DHS STAT COMPILER	13.4 (2002)	ORC MACRO, 2005. DHS STAT COMPILER
Ethiopia	16.0	65.0	59.9 (2000)	ORC MACRO, 2005. DHS STAT COMPILER	11.8 (2000)	ORC MACRO, 2005. DHS STAT COMPILER

Country	Children 6-59 months (unless otherwise noted) Bi-annual preventive dose of oral supplements				Women 15-49 years Postpartum oral dose	
	UNICEF[1,a] 2002 %	UNICEF [2,a] 2003 %	Other[b] (survey year) %	Source	Received a vitamin A dose in the first 2 months after delivery (survey year) %	Source
Gabon	87.0	30.0	ND		ND	
Gambia	91.0	91.0	ND		ND	
Ghana	99.0[t]	78.0[t]	78.4 (2003)	ORC MACRO, 2005. DHS STAT COMPILER	43.0 (2003)	ORC MACRO, 2005. DHS STAT COMPILER
Guinea	95.0	98.0[t]	ND		ND	
Guinée Bissau	80.0	ND	ND		ND	
Kenya	91.0	33.0	33.3 (2003)	ORC MACRO, 2005. DHS STAT COMPILER	14.2 (2003)	ORC MACRO, 2005. DHS STAT COMPILER
Lesotho	ND	75.0[t]	ND		ND	
Liberia	40.0	ND	ND		ND	
Madagascar	95.0	91.0[t]	76.2 (2003/2004)	ORC MACRO, 2005. DHS STAT COMPILER	19.1 (2003/2004)	ORC MACRO, 2005. DHS STAT COMPILER
Malawi	86.0	92.0	70.6 (2000)	ORC MACRO, 2005. DHS STAT COMPILER	41.7 (2000)	ORC MACRO, 2005. DHS STAT COMPILER
Mali	68.0	61.0	40.9 (2001)	ORC MACRO, 2005. DHS STAT COMPILER	17.7 (2001)	ORC MACRO, 2005. DHS STAT COMPILER
Mauritania	89.0[t]	ND	ND		ND	
Mauritius	ND	ND	ND		ND	
Mozambique	71.0	50.0	49.8 (2003)	ORC MACRO, 2005. DHS STAT COMPILER	20.8 (2003)	ORC MACRO, 2005. DHS STAT COMPILER
Namibia	96.0	93.0	38.4 (2000)	ORC MACRO, 2005. DHS STAT COMPILER	33.4 (2000)	ORC MACRO, 2005. DHS STAT COMPILER
Niger	77.0[t]	95.0	ND		ND	
Nigeria	79.0	27.0	33.7 (2003)	ORC MACRO, 2005. DHS STAT COMPILER	19.6 (2003)	ORC MACRO, 2005. DHS STAT COMPILER
Rwanda	36.0	86.0	68.9 (2000)	ORC MACRO, 2005. DHS STAT COMPILER	13.9 (2000)	ORC MACRO, 2005. DHS STAT COMPILER

Country	Children 6-59 months (unless otherwise noted) Bi-annual preventive dose of oral supplements				Women 15-49 years Postpartum oral dose	
	UNICEF[1, a] 2002 %	UNICEF [2, a] 2003 %	Other[b] (survey year) %	Source	Received a vitamin A dose in the first 2 months after delivery (survey year) %	Source
Sao Tome & Principe	ND	ND	ND		ND	
Senegal	83.0	ND	ND		ND	
Seychelles	ND	ND	ND		ND	
Sierra Leone	87.0[t]	84.0[t]	68.2 (2004) 95.0 (2005)	Bendech et al, 2005 (MoH&S HKI/UNICEF rapid coverage surveys)	ND	
South Africa	ND	ND	ND		ND	
Swaziland	68.0	80.0	ND		ND	
Tanzania	94.0[t]	91.0[t]	93.4[c] (2004)	MOST, 2005	45.0 (1999)	HKI/MOST/ TFNC, 2004
Togo	95.0	84.0[t]	ND		ND	
Uganda	46.0	ND	37.6 (2000/2001)	ORC MACRO, 2005. DHS STAT COMPILER	11.3 (2000/2001)	ORC MACRO, 2005. DHS STAT COMPILER
Zambia	80.0	73.0[t]	67.4 (2001/2002)	ORC MACRO, 2005. DHS STAT COMPILER	ND	
Zimbabwe	78.0	46.0	ND		ND	
EASTERN MEDITERRANEAN						
Afghanistan	84.0[t]	86.0[t]	ND		ND	
Bahrain	ND	ND	ND		ND	
Djibouti	91.0	75.0	ND		ND	
Egypt	ND	ND	12.6 (2000)	ORC MACRO, 2005. DHS STAT COMPILER	11.9 (2000)	ORC MACRO, 2005. DHS STAT COMPILER
Iran	ND	ND	ND		ND	
Iraq	ND	ND	ND		ND	
Jordan	ND	ND	ND		ND	
Kuwait	ND	ND	ND		ND	
Lebanon	ND	ND	ND		ND	

Country	Children 6-59 months (unless otherwise noted) Bi-annual preventive dose of oral supplements				Women 15-49 years Postpartum oral dose	
	UNICEF[1, a] 2002 %	UNICEF [2, a] 2003 %	Other[b] (survey year) %	Source	Received a vitamin A dose in the first 2 months after delivery (survey year) %	Source
Libyan Arab Jamahiriya	ND	ND	ND		ND	
Morocco	ND	ND	25.5 (2003/2004)	ORC MACRO, 2005. DHS STAT COMPILER	23.5 (2003/2004)	ORC MACRO, 2005. DHS STAT COMPILER
Oman	97.0[t]	ND	ND		ND	
Pakistan	95.0[t]	95.0[t]	ND		ND	
Qatar	ND	ND	ND		ND	
Saudi Arabia	ND	ND	ND		ND	
Somalia	60.0	ND	ND		ND	
Sudan	93.0[t]	34.0	ND		ND	
Syrian Arab Republic	ND	ND	ND		ND	
Tunisia	ND	ND	ND		ND	
United Arab Emirates	ND	ND	ND		ND	
Yemen	49.0	36.0	ND		ND	
SOUTH/SOUTH EAST ASIA						
Bangladesh	84.0	87.0[t]	78.5 (2004)	ORC MACRO, 2005. DHS STAT COMPILER	14.5 (2004)	ORC MACRO, 2005. DHS STAT COMPILER
Bhutan	ND	ND	ND		ND	
Democratic Republic of Korea	99.0[t]	95.0[t]	98.2[d] (2004)	Central Bureau of Stats, 2005	33.5 (2004)	Central Bureau of Stats, 2005
India	27.0	45.0[w]	17.1	NFHS-2, 1998-99	ND	
▪ Rajasthan	ND	ND	12.5		ND	
▪ Madhya Pradesh	ND	ND	14.7		ND	
▪ Uttar Pradesh	ND	ND	9.5		ND	
▪ Bihar	ND	ND	6.8		ND	
▪ Orissa	ND	ND	26.4		ND	

Country	Children 6-59 months (unless otherwise noted) Bi-annual preventive dose of oral supplements				Women 15-49 years Postpartum oral dose	
	UNICEF[1, a] 2002 %	UNICEF [2, a] 2003 %	Other[b] (survey year) %	Source	Received a vitamin A dose in the first 2 months after delivery (survey year) %	Source
▪ West Bengal	ND	ND	23.5		ND	
▪ Gujarat	ND	ND	26.3		ND	
▪ Maharashtra	ND	ND	36.6		ND	
▪ Andhra Pradesh	ND	ND	14.0		ND	
Indonesia	82.0	62.0	75.1 (2002/2003)	ORC MACRO, 2005. DHS STAT COMPILER	42.5 (2002/2003)	ORC MACRO, 2005. DHS STAT COMPILER
▪ Lampung	ND	ND	ND		ND	
▪ Banten	ND	ND	ND		ND	
▪ West Java	ND	ND	ND		ND	
▪ Central Java	ND	ND	ND		ND	
▪ East Java	ND	ND	ND		ND	
▪ NTB/Lombok	ND	ND	ND		ND	
▪ South Sulawesi	ND	ND	ND		ND	
Maldives	51.0	ND	ND		ND	
Myanmar	92.0[t]	87.0[t]	ND		ND	
Nepal	83.0	96.0[t]	81.0 (2001)	MOH et al., 2002	10.3 (2001)	ORC MACRO, 2005. DHS STAT COMPILER
Sri Lanka	ND	ND	ND		ND	
Thailand	ND	ND	ND		ND	
Timor-Leste	35.0	95.0	ND		ND	
WESTERN PACIFIC						
Australia	ND	ND	ND		ND	
Brunei Darussalam	ND	ND	ND		ND	
Cambodia	34.0	47.0	30.8 (2000)	ORC MACRO, 2005. DHS STAT COMPILER	10.7 (2000)	ORC MACRO, 2005. DHS STAT COMPILER
China	ND	ND	ND		ND	

Country	Children 6-59 months (unless otherwise noted) Bi-annual preventive dose of oral supplements				Women 15-49 years Postpartum oral dose	
	UNICEF[1,a] 2002 %	UNICEF [2,a] 2003 %	Other[b] (survey year) %	Source	Received a vitamin A dose in the first 2 months after delivery (survey year) %	Source
Cook Islands	ND	ND	ND		ND	
Fiji	ND	ND	ND		ND	
Japan	ND	ND	ND		ND	
Kiribati	ND	45.0	ND		ND	
Korea, Republic of	ND	ND	ND		ND	
Lao PDR	58.0	64.0	28.8 (2000)	MOH (LPDR), 2001	4.4 (2000)	MOH (LPDR), 2001
Malaysia	ND	ND	ND		ND	
Marshall Islands	51.0	23.0	ND		ND	
Micronesia, Federated States of	71.0	95.0[t]	ND		ND	
Mongolia	84.0[t]	87.0[t]	ND		ND	
Nauru	ND	ND	ND		ND	
New Zealand	ND	ND	ND		ND	
Niue	ND	ND	ND		ND	
Palau	ND	ND	ND		ND	
Papua New Guinea	ND	1.0	ND		ND	
Philippines	86.0[t]	76.0[t]	76.0 (2003)	ORC MACRO, 2005. DHS STAT COMPILER	44.6 (2003)	ORC MACRO, 2005. DHS STAT COMPILER
Samoa	ND	ND	ND		ND	
Singapore	ND	ND	ND		ND	
Solomon Islands	ND	ND	ND		ND	
Tonga	ND	ND	ND		ND	
Tuvalu	ND	ND	ND		ND	
Vanuatu	ND	ND	ND		ND	
Vietnam	55.0	99.0[t,w]	77.0[e] (2000)	Ninh et al., 2004	52.0	Ninh et al., 2004

Country	Children 6-59 months (unless otherwise noted) Bi-annual preventive dose of oral supplements				Women 15-49 years Postpartum oral dose	
	UNICEF[1, a] 2002 %	UNICEF [2, a] 2003 %	Other[b] (survey year) %	Source	Received a vitamin A dose in the first 2 months after delivery (survey year) %	Source
EUROPE						
Albania	ND	ND	ND		ND	
Andorra	ND	ND	ND		ND	
Armenia	ND	ND	ND		ND	
Austria	ND	ND	ND		ND	
Azerbaijan	ND	ND	ND		ND	
Belarus	ND	ND	ND		ND	
Belgium	ND	ND	ND		ND	
Bosnia & Herzegovina	ND	ND	ND		ND	
Bulgaria	ND	ND	ND		ND	
Croatia	ND	ND	ND		ND	
Cyprus	ND	ND	ND		ND	
Czech Republic	ND	ND	ND		ND	
Denmark	ND	ND	ND		ND	
Estonia	ND	ND	ND		ND	
Finland	ND	ND	ND		ND	
France	ND	ND	ND		ND	
Georgia	ND	ND	ND		ND	
Germany	ND	ND	ND		ND	
Greece	ND	ND	ND		ND	
Hungary	ND	ND	ND		ND	
Iceland	ND	ND	ND		ND	
Ireland	ND	ND	ND		ND	
Israel	ND	ND	ND		ND	
Italy	ND	ND	ND		ND	
Kazakhstan	ND	ND	ND		ND	
Kyrgyzstan	ND	ND	ND		ND	
Latvia	ND	ND	ND		ND	

Country	Children 6-59 months (unless otherwise noted) Bi-annual preventive dose of oral supplements				Women 15-49 years Postpartum oral dose	
	UNICEF[1, a] 2002 %	UNICEF [2, a] 2003 %	Other[b] (survey year) %	Source	Received a vitamin A dose in the first 2 months after delivery (survey year) %	Source
Lithuania	ND	ND	ND		ND	
Luxembourg	ND	ND	ND		ND	
Macedonia, The Former Yugoslav Republic of	ND	ND	ND		ND	
Malta	ND	ND	ND		ND	
Moldova, Republic of	ND	ND	ND		ND	
Monaco	ND	ND	ND		ND	
Netherlands	ND	ND	ND		ND	
Norway	ND	ND	ND		ND	
Poland	ND	ND	ND		ND	
Portugal	ND	ND	ND		ND	
Romania	ND	ND	ND		ND	
Russian Federation	ND	ND	ND		ND	
San Marino	ND	ND	ND		ND	
Serbia-Montenegro	ND	ND	ND		ND	
Slovakia	ND	ND	ND		ND	
Slovenia	ND	ND	ND		ND	
Spain	ND	ND	ND		ND	
Sweden	ND	ND	ND		ND	
Switzerland	ND	ND	ND		ND	
Tajikistan	ND	ND	ND		ND	
Turkey	ND	ND	ND		ND	
Turkmenistan	ND	ND	15.8 (2000)	ORC MACRO, 2005. DHS STAT COMPILER	ND	
Ukraine	ND	ND	ND		ND	
UK	ND	ND	ND		ND	
Uzbekistan	79.0	93.0[t]	ND		ND	
Yugoslavia	ND	ND	ND		ND	

Country	Children 6-59 months (unless otherwise noted) Bi-annual preventive dose of oral supplements				Women 15-49 years Postpartum oral dose	
	UNICEF[1, a] 2002 %	UNICEF [2, a] 2003 %	Other[b] (survey year) %	Source	Received a vitamin A dose in the first 2 months after delivery (survey year) %	Source
REGIONS OF THE AMERICAS						
Antigua & Barbuda	ND	ND	ND		ND	
Argentina	ND	ND	ND		ND	
Bahamas	ND	ND	ND		ND	
Barbados	ND	ND	ND		ND	
Belize	ND	ND	ND		ND	
Bolivia	50.0	38.0	60.0 (2003)	ORC MACRO, 2005. DHS STAT COMPILER	30.7 (2003)	ORC MACRO, 2005. DHS STAT COMPILER
Brazil	ND	ND	ND		ND	
▪ Paraiba	ND	ND	ND		ND	
▪ Pernambuco	ND	ND	ND		ND	
▪ Piaui	ND	ND	ND		ND	
▪ Sao Paulo	ND	ND	ND		ND	
▪ Sergipe	ND	ND	ND		ND	
Canada	ND	ND	ND		ND	
Chile	ND	ND	ND		ND	
Colombia	ND	ND	ND		ND	
Costa Rica	ND	ND	ND		ND	
Cuba	ND	ND	ND		ND	
Dominica	ND	ND	ND		ND	
Dominican Republic	31.0	40.0	30.7 (2002)	ORC MACRO, 2005. DHS STAT COMPILER	24.1 (2002)	ORC MACRO, 2005. DHS STAT COMPILER
Ecuador	59.0	ND	ND		ND	
El Salvador	ND	ND	ND		ND	
Grenada	ND	ND	ND		ND	
Guatemala	33.0	ND	ND		ND	
Guyana	ND	ND	ND		ND	

Country	Children 6-59 months (unless otherwise noted) Bi-annual preventive dose of oral supplements				Women 15-49 years Postpartum oral dose	
	UNICEF[1, a] 2002 %	UNICEF [2, a] 2003 %	Other[b] (survey year) %	Source	Received a vitamin A dose in the first 2 months after delivery (survey year) %	Source
Haiti	ND	25.0	31.4 (2000)	ORC MACRO, 2005. DHS STAT COMPILER	24.5 (2000)	ORC MACRO, 2005. DHS STAT COMPILER
Honduras	61.0	35.0	ND		ND	
Jamaica	ND	ND	ND		ND	
Mexico	ND	ND	ND		ND	
Nicaragua	ND	91.0	65.3 (2001)	ORC MACRO, 2005. DHS STAT COMPILER	ND	
Panama	ND	ND	ND		ND	
Paraguay	ND	ND	ND		ND	
Peru	6.0	ND	ND		11.6 (2000)	ORC MACRO, 2005. DHS STAT COMPILER
Saint Kitts & Nevis	ND	ND	ND		ND	
Saint Lucia	ND	ND	ND		ND	
Saint Vincent & the Grenadines	ND	ND	ND		ND	
Suriname	ND	ND	ND		ND	
Trinidad & Tobago	ND	ND	ND		ND	
USA	ND	ND	ND		ND	
Uruguay	ND	ND	ND		ND	
Venezuela	ND	ND	ND		ND	

[a] Percentage of children 6-59 months who received at least one high dose of vitamin A in (Year)
[b] Percentage of children 6-59 months who received vitamin A supplements in the 6 months preceding the survey
[c] Figure provided is an average of the values presented in the report for coverage during World Aids Day & Day of the African Child
[d] For children age 6-23 months; unweighted
[e] For children 6-36 months;
[t] Countries that have achieved a second round of vitamin A coverage greater than or equal to 70 per cent
[w] Countries with vitamin A supplementation programs that do not target children all the way up to 59 months of age

[1] UNICEF, State of the World's Children 2005
[2] UNICEF, State of the World's Children 2006

Table A.2.2 Coverage: Iron Supplementation in Pregnant Women

Country	Survey year	Percent of women who took iron tablets/syrup for 90+ days during last pregnancy	Source
AFRICA			
Algeria	ND		
Angola	ND		
Benin	2001	40.1	ORC MACRO, 2005. DHS STAT COMPILER
Botswana	ND		
Burkina Faso	2003	10.3	ORC MACRO, 2005. DHS STAT COMPILER
Burundi	ND		
Cameroon	2004	46.5	ORC MACRO, 2005. DHS STAT COMPILER
Cape Verde	ND		
Central African Republic	ND		
Chad	ND		
Comoros	ND		
Congo	ND		
Cote d'Ivoire	ND		
Democratic Republic of Congo	ND		
Equatorial Guinea	ND		
Eritrea	2002	0.7	ORC MACRO, 2005. DHS STAT COMPILER
Ethiopia	2000	100.0	ORC MACRO, 2005. DHS STAT COMPILER
Gabon	ND		
Gambia	ND		
Ghana	2003	39.7	ORC MACRO, 2005. DHS STAT COMPILER
Guinea	ND		
Guinée Bissau	ND		
Kenya	2003	2.5	ORC MACRO, 2005. DHS STAT COMPILER
Lesotho	ND		
Liberia	ND		

Country	Survey year	Percent of women who took iron tablets/syrup for 90+ days during last pregnancy	Source
Madagascar	2003/2004	2.5	ORC MACRO, 2005. DHS STAT COMPILER
Malawi	2000	11.4	ORC MACRO, 2005. DHS STAT COMPILER
Mali	2001	3.0	ORC MACRO, 2005. DHS STAT COMPILER
Mauritania	ND		
Mauritius	ND		
Mozambique	2003	14.3	ORC MACRO, 2005. DHS STAT COMPILER
Namibia	2000	100.0	ORC MACRO, 2005. DHS STAT COMPILER
Niger	ND		
Nigeria	2003	21.2	ORC MACRO, 2005. DHS STAT COMPILER
Rwanda	2000	0.3	ORC MACRO, 2005. DHS STAT COMPILER
Sao Tome & Principe	ND		
Senegal	ND		
Seychelles	ND		
Sierra Leone	ND		
South Africa	ND		
Swaziland	ND		
Tanzania	ND		
Togo	ND		
Uganda	2000/2001	1.7	ORC MACRO, 2005. DHS STAT COMPILER
Zambia	ND		
Zimbabwe	1999	59.9	ORC MACRO, 2005. DHS STAT COMPILER
EASTERN MEDITERRANEAN			
Afghanistan	ND		
Bahrain	ND		
Djibouti	ND		

Country	Survey year	Percent of women who took iron tablets/syrup for 90+ days during last pregnancy	Source
Egypt	2000	8.3	ORC MACRO, 2005. DHS STAT COMPILER
Iran	ND		
Iraq	ND		
Jordan	2002	46.4	ORC MACRO, 2005. DHS STAT COMPILER
Kuwait	ND		
Lebanon	ND		
Libyan Arab Jamahiriya	ND		
Morocco	2003/2004	5.2	ORC MACRO, 2005. DHS STAT COMPILER
Oman	ND		
Pakistan	ND		
Qatar	ND		
Saudi Arabia	ND		
Somalia	ND		
Sudan	ND		
Syrian Arab Republic	ND		
Tunisia	ND		
United Arab Emirates	ND		
Yemen	ND		
South/South East Asia			
Bangladesh	2004	50.0	ORC MACRO, 2005. DHS STAT COMPILER
Bhutan	ND		
Democratic Republic of Korea	ND		
India	1998-99	47.5	NFHS-2, 1998-99
▪ Rajasthan		30.6	
▪ Madhya Pradesh		38.4	
▪ Uttar Pradesh		20.6	
▪ Bihar		19.8	
▪ Orissa		62.2	
▪ West Bengal		56.4	

Country	Survey year	Percent of women who took iron tablets/syrup for 90+ days during last pregnancy	Source
▪ Gujarat		66.6	
▪ Maharashtra		71.6	
▪ Andhra Pradesh		70.7	
Indonesia	2002/2003	29.1	ORC MACRO, 2005. DHS STAT COMPILER
▪ Lampung	2003	37.6	HKI (NSS), 2003
▪ Banten	2003	45.4	HKI (NSS), 2003
▪ West Java	2003	44.2	HKI (NSS), 2003
▪ Central Java	2003	66.6	HKI (NSS), 2003
▪ East Java	2003	46.6	HKI (NSS), 2003
▪ NTB/Lombok	2003	73.6	HKI (NSS), 2003
▪ South Sulawesi	2003	15.9	HKI (NSS), 2003
Maldives	ND		
Myanmar	ND		
Nepal	2001	5.7	ORC MACRO, 2005. DHS STAT COMPILER
Sri Lanka	ND		
Thailand	ND		
Timor-Leste	ND		
WESTERN PACIFIC			
Australia	ND		
Brunei Darussalam	ND		
Cambodia	2000	1.2	ORC MACRO, 2005. DHS STAT COMPILER
China	ND		
Cook Islands	ND		
Fiji	ND		
Japan	ND		
Kiribati	ND		
Korea, Republic of	ND		
Lao PDR	2000	13.6[1]	MOH, 2001
Malaysia	ND		

Country	Survey year	Percent of women who took iron tablets/syrup for 90+ days during last pregnancy	Source
Marshall Islands	ND		
Micronesia, Federated States of	ND		
Mongolia	ND		
Nauru	ND		
New Zealand	ND		
Niue	ND		
Palau	ND		
Papua New Guinea	ND		
Philippines	2003	29.1	ORC MACRO, 2005. DHS STAT COMPILER
Samoa	ND		
Singapore	ND		
Solomon Islands	ND		
Tonga	ND		
Tuvalu	ND		
Vanuatu	ND		
Vietnam	ND		
EUROPE			
Albania	ND		
Andorra	ND		
Armenia	2000	0.5	ORC MACRO, 2005. DHS STAT COMPILER
Austria	ND		
Azerbaijan	ND		
Belarus	ND		
Belgium	ND		
Bosnia & Herzegovina	ND		
Bulgaria	ND		
Croatia	ND		
Cyprus	ND		
Czech Republic	ND		
Denmark	ND		

Country	Survey year	Percent of women who took iron tablets/syrup for 90+ days during last pregnancy	Source
Estonia	ND		
Finland	ND		
France	ND		
Georgia	ND		
Germany	ND		
Greece	ND		
Hungary	ND		
Iceland	ND		
Ireland	ND		
Israel	ND		
Italy	ND		
Kazakhstan	ND		
Kyrgyzstan	ND		
Latvia	ND		
Lithuania	ND		
Luxembourg	ND		
Macedonia, The Former Yugoslav Republic of	ND		
Malta	ND		
Moldova, Republic of	ND		
Monaco	ND		
Netherlands	ND		
Norway	ND		
Poland	ND		
Portugal	ND		
Romania	ND		
Russian Federation	ND		
San Marino	ND		
Serbia-Montenegro	ND		
Slovakia	ND		
Slovenia	ND		
Spain	ND		

Country	Survey year	Percent of women who took iron tablets/syrup for 90+ days during last pregnancy	Source
Sweden	ND		
Switzerland	ND		
Tajikistan	ND		
Turkey	ND		
Turkmenistan	2000	0.1	ORC MACRO, 2005. DHS STAT COMPILER
Ukraine	ND		
UK	ND		
Uzbekistan	ND		
Yugoslavia	ND		
Region of the Americas			
Antigua & Barbuda	ND		
Argentina	ND		
Bahamas	ND		
Barbados	ND		
Belize	ND		
Bolivia	2003	21.8	ORC MACRO, 2005. DHS STAT COMPILER
Brazil	ND		
▪ Paraiba	ND		
▪ Pernambuco	ND		
▪ Piaui	ND		
▪ Sao Paulo	ND		
▪ Sergipe	ND		
Canada	ND		
Chile	ND		
Colombia	2000	34.4	ORC MACRO, 2005. DHS STAT COMPILER
Costa Rica	ND		
Cuba	ND		
Dominica	ND		
Dominican Republic	2002	57.1	ORC MACRO, 2005. DHS STAT COMPILER

Country	Survey year	Percent of women who took iron tablets/syrup for 90+ days during last pregnancy	Source
Ecuador	ND		
El Salvador	ND		
Grenada	ND		
Guatemala	ND		
Guyana	ND		
Haiti	2000	10.8	ORC MACRO, 2005. DHS STAT COMPILER
Honduras	ND		
Jamaica	ND		
Mexico	ND		
Nicaragua	2001	78.9	ORC MACRO, 2005. DHS STAT COMPILER
Panama	ND		
Paraguay	ND		
Peru	2000	15.6	ORC MACRO, 2005. DHS STAT COMPILER
Saint Kitts & Nevis	ND		
Saint Lucia	ND		
Saint Vincent & the Grenadines	ND		
Suriname	ND		
Trinidad & Tobago	ND		
USA	ND		
Uruguay	ND		
Venezuela	ND		

[1] Duration (i.e., 90+ days) is not specified.

Table A.2.3 Coverage: Iodization of household salt

Country	Iodization of household salt	
	Survey year	Percent of households consuming iodized salt (15+ ppm)
AFRICA		
Algeria	2000	69.0
Angola	2001	35.0
Benin	2001	72.0
Botswana	2000	66.0
Burkina Faso	2003	47.8[1]
Burundi	2000	96.0
Cameroon	2004	88.3[1]
Cape Verde	ND	
Central African Republic	2000	86.0
Chad	2000	58.0
Comoros	2000	82.0
Congo	ND	
Cote d'Ivoire	2000	31.0
Democratic Republic of Congo	2001	72.0
Equatorial Guinea	1995	20.0 (no cut-off indicated)
Eritrea	2002	68.0
Ethiopia	2000	28.0 (25+ ppm)
Gabon	2000	15.0 (no cut-off indicated)
Gambia	2000	8.0
Ghana	2003	28.3[1]
Guinea	2003	68.0 (no cut-off indicated)
Guinée Bissau	2000	2.0
Kenya	2000	91.0
Lesotho	2000	69.0
Liberia	ND	
Madagascar	2003/2004	75.4[1]
Malawi	2000	49.0/53.0[1]
Mali	2001	74 (no cut-off indicated)/37.1[1]
Mauritania	2000/2001	2.0 (no cut-off indicated)
Mauritius	ND	

Country	Iodization of household salt	
	Survey year	Percent of households consuming iodized salt (15+ ppm)
Mozambique	1995	62.0 (no cut-off indicated)
Namibia	2000	62.9[1]
Niger	2000	15.0
Nigeria	2003	97.0
Rwanda	2000	90.0/91.3[1]
Sao Tome & Principe	2000	41.0
Senegal	2000	16.0
Seychelles	ND	
Sierra Leone	2000	23.0
South Africa	1998	62.0
Swaziland	2000	59.0
Tanzania	1999	67.0 (25+ ppm)
Togo	2000	67.0 (25+ ppm)
Uganda	2000/2001	95.0
Zambia	2002	77.0
Zimbabwe	1999	93.0 (30+ ppm)
EASTERN MEDITERRANEAN		
Afghanistan	2003	1.0
Bahrain	ND	
Djibouti	ND	
Egypt	2003	56.0 (25+ ppm)
Iran	1997-98	94.0 (no cut-off indicated)
Iraq	2000	40.0
Jordan	2000	88.0 (no cut-off indicated)
Kuwait	ND	
Lebanon	2000	87.0
Libyan Arab Jamahiriya	1993	90.0 (no cut-off indicated)
Morocco	2000	41.0 (no cut-off indicated)
Oman	1998	61.0 (no cut-off indicated)
Pakistan	2002	17.0 (no cut-off indicated)

Country	Iodization of household salt	
	Survey year	Percent of households consuming iodized salt (15+ ppm)
Qatar	ND	
Saudi Arabia	ND	
Somalia	ND	
Sudan	2000	1.0
Syrian Arab Republic	1997	40.0 (no cut-off indicated)
Tunisia	2000	97.0
United Arab Emirates	ND	
Yemen	1997	39.0 (no cut-off indicated)
SOUTH/SOUTH EAST ASIA		
Bangladesh	2003	70.0
Bhutan	2001	95.0
Democratic Republic of Korea	2004	40.2[3]
India	1998-99	32.8[1]
▪ Rajasthan	1998-99	21.9[2]
▪ Madhya Pradesh	1998-99	14.4[2]
▪ Uttar Pradesh	1998-99	19.6[2]
▪ Bihar	1998-99	26.6[2]
▪ Orissa	1998-99	18.2[2]
▪ West Bengal	1998-99	25.8[2]
▪ Gujarat	1998-99	14.9[2]
▪ Maharashtra	1998-99	11.0[2]
▪ Andhra Pradesh	1998-99	10.2[2]
Indonesia	2003	73.0 (30+ ppm)
▪ Lampung	ND	
▪ Banten	ND	
▪ West Java	ND	
▪ Central Java	ND	
▪ East Java	ND	
▪ NTB/Lombok	ND	
▪ South Sulawesi	ND	

Country	Iodization of household salt	
	Survey year	Percent of households consuming iodized salt (15+ ppm)
Maldives	2001	44.0
Myanmar	2000	48.0
Nepal	2000	63.0
Sri Lanka	2000	88.0 (no cut-off indicated)
Thailand	2002	67.0 (30+ ppm)
Timor-Leste	2000	72.0
WESTERN PACIFIC		
Australia	ND	
Brunei Darussalam	ND	
Cambodia	2000	12.2[4]
China	2002	93.0
Cook Islands	ND	
Fiji	1994	31.0 (no cut-off indicated)
Japan	ND	
Kiribati	ND	
Korea, Republic of	ND	
Lao PDR	2000	75.2[5]
Malaysia	ND	
Marshall Islands	ND	
Micronesia, Federated States of	ND	
Mongolia	2000	45.0/54.0[6] (no cut-off indicated)
Nauru	ND	
New Zealand	1996-99	83.0 (no cut-off indicated)
Niue	ND	
Palau	ND	
Papua New Guinea	ND	
Philippines	2003	56.4[7] (no cut-off indicated)
Samoa	ND	
Singapore	ND	
Solomon Islands	ND	
Tonga	ND	

Country	Iodization of household salt	
	Survey year	Percent of households consuming iodized salt (15+ ppm)
Tuvalu	ND	
Vanuatu	ND	
Vietnam	2003	83.0 (20+ ppm)
EUROPE		
Albania	2000	62.0
Andorra	ND	
Armenia	2000	84.0
Austria	ND	
Azerbaijan	2000	26.0
Belarus	NS	37.0 (no cut-off indicated)
Belgium	ND	
Bosnia & Herzegovina	1999	77.0 (10+ppm)
Bulgaria	ND	
Croatia	1999	90 (no cut-off indicated)
Cyprus	ND	
Czech Republic	ND	
Denmark	ND	
Estonia	ND	
Finland	ND	
France	ND	
Georgia	2003	68.0
Germany	ND	
Greece	ND	
Hungary	ND	
Iceland	ND	
Ireland	ND	
Israel	ND	
Italy	ND	
Kazakhstan	2000	20.0
Kyrgyzstan	1997	27.0 (ppm not tested)
Latvia	ND	

Country	Iodization of household salt	
	Survey year	Percent of households consuming iodized salt (15+ ppm)
Lithuania	ND	
Luxembourg	ND	
Macedonia, The Former Yugoslav Republic of	2003	80.0 (20+ ppm)
Malta	ND	
Moldova, Republic of	2000	33.0
Monaco	ND	
Netherlands	ND	
Norway	ND	
Poland	ND	
Portugal	ND	
Romania	2002	53.0 (25+ ppm)
Russian Federation	2002/2003	35.0 (no cut-off indicated)
San Marino	ND	
Serbia-Montenegro	2000	73.0
Slovakia	ND	
Slovenia	ND	
Spain	ND	
Sweden	ND	
Switzerland	ND	
Tajikistan	2003	28.0
Turkey	2002	64.0 (no cut-off indicated)
Turkmenistan	2000	75.0/76.8[1]
Ukraine	2003	32.0 (no cut-off indicated)
UK	ND	
Uzbekistan	2000	19.0
Yugoslavia	ND	
REGION OF THE AMERICAS		
Antigua & Barbuda	ND	
Argentina	1996	90.0 (no cut-off indicated)

Country	Iodization of household salt	
	Survey year	Percent of households consuming iodized salt (15+ ppm)
Bahamas	ND	
Barbados	ND	
Belize	1994	90.0 (no cut-off indicated)
Bolivia	2003	90.0 (no cut-off indicated)
Brazil	2000	88.0
▪ Paraiba	ND	
▪ Pernambuco	ND	
▪ Piaui	ND	
▪ Sao Paulo	ND	
▪ Sergipe	ND	
Canada	ND	
Chile	1999	100.0 (no cut-off indicated)
Colombia	1997	92.0 (no cut-off indicated)
Costa Rica	1996	97.0 (no cut-off indicated)
Cuba	2003	83.0 (25+ppm)
Dominica	ND	
Dominican Republic	2000	18.0
Ecuador	1999	99.0 (no cut-off indicated)
El Salvador	1995	91.0 (25+ppm)
Grenada	ND	
Guatemala	2002	67.0
Guyana	ND	
Haiti	2000	11.0
Honduras	1998	80.0 (25+ ppm)
Jamaica	1999	100.0 (no cut-off indicated)
Mexico	1999	90.0
Nicaragua	2003	97.0
Panama	1998	95.0 (no cut-off indicated)
Paraguay	1998	83.0 (no cut-off indicated)
Peru	1997	93.0 (no cut-off indicated)
Saint Kitts & Nevis	2000	100.0 (no cut-off indicated)
Saint Lucia	ND	

Country	Iodization of household salt	
	Survey year	Percent of households consuming iodized salt (15+ ppm)
Saint Vincent & the Grenadines	ND	
Suriname	ND	
Trinidad & Tobago	2000	1.0
USA	ND	
Uruguay	ND	
Venezuela	1998	90.0

Sources: Unless otherwise noted - UNICEF Global Database on Iodized Salt Consumption (last updated August 2004) http://www.childinfo.org/eddb/idd/database.htm.

1 ORC Macro 2005. MEASURE DHS STAT Compiler. http://www.measuredhs.com. DHS coverage figure was reported if it was more recent than the coverage figure available through the UNICEF database or in cases where the source or figure reported in the UNICEF database was different from the DHS figure for the same year. In such cases, the DHS figure follows the UNICEF figure.

2 India National Family Health Survey (NFHS-2) 1989-1999 http://www.measuredhs.com/pubs/pdf/FRIND2/00FrontMatter.pdf.

3 Central Bureau of Statistics (DPRK), 2005 [2004 Nutrition Assessment]

4 NIS & ORC MACRO, 2001

5 MOH (LPDR), 2001 [National Health Survey]

6 The first figure comes from MICS 2000 and the second from MOH, 2002 [Second National Nutrition Survey, 2000]

7 FNRI, 2003 [6th National Nutrition Survey, 2003]

Tables A.3: Health Conditions & Services

Table A.3.1 Mortality Rates and Infectious Disease Prevalence

Country	Infant Mortality Rate[1/a] (under one)	Under 5 Mortality Rate[2/a]	Under 5 Mortality Rank[a]	% Diarrhea in the last two weeks[3/b] (under 5)	% ARI in the last two weeks[4/c] (under 5)	% Fever in the last two weeks[5/d] (under 5)	% of children vulnerable to measles[6/e] (< 1 year)	Estimated number of people living with HIV[7/f] (thousands)	Estimate TB prevalence rate including HIV+[8/g] (per 100,000)	Estimate TB prevalence rate excluding HIV+[9/g] (per 100,000)
AFRICA										
Algeria	35	40	79	ND	9	ND	19	9.1	53	53
Angola	154	260	2	ND	8	25.0	36	240	272	256
Benin	90	152	23	13.4	12	41.0	15	68	144	141
Botswana	84	116	41	9.8	40	NRD	10	350	515	342
Burkina Faso	97	192	16	20.7	9	36.7	22	300	315	303
Burundi	114	190	17	17.2	13	16.5	25	250	558	519
Cameroon	87	149	25	16.1	11	24.8	36	560	241	221
Cape Verde	27	36	86	ND	ND	ND	31	ND	329	328
Central African Republic	115	193	15	ND	10	31.8	65	260	548	493
Chad	117	200	12	21.5	12	29.2	44	200	456	439
Comoros	52	70	61	ND	10	31	27	ND	103	103
Congo	81	108	44	ND	ND	ND	35	90	521	489
Côte d'Ivoire	117	194	14	21.4	4	30.7	51	570	659	618
Democratic Republic of Congo	129	205	8	ND	11	41.1	36	1100	564	537
Equatorial Guinea	122	204	9	ND	ND	25.1	49	ND	374	351
Eritrea	52	82	54	13.2	19	29.8	16	60	444	431
Ethiopia	110	166	20	23.6	24	28.4	29	1500	533	507
Gabon	60	91	49	15.7	13	29.1	45	48	268	242
Gambia	89	122	36	ND	8	14.8	10	6.8	341	337
Ghana	68	112	42	15.2	10	21.3	17	350	380	369
Guinea	101	155	22	21.2	15	41.9	27	140	407	394
Guinée Bissau	126	203	10	ND	10	42.2	20	ND	312	300
Kenya	79	120	37	16.0	18	41.6	27	1200	884	821
Lesotho	61	82	54	ND	7	ND	30	320	588	390

Country	Infant Mortality Rate[1/a] (under one)	Under 5 Mortality Rate[2/a]	Under 5 Mortality Rank[a]	% Diarrhea in the last two weeks[3/b] (under 5)	% ARI in the last two weeks[4/c] (under 5)	% Fever in the last two weeks[5/d] (under 5)	% of children vulnerable to measles[6/e] (< 1 year)	Estimated number of people living with HIV[7/f] (thousands)	Estimate TB prevalence rate including HIV+[8/g] (per 100,000)	Estimate TB prevalence rate excluding HIV+[9/g] (per 100,000)
Liberia	157	235	5	ND	39	NRD	58	100	507	484
Madagascar	76	123	35	9.8	9	15.9	41	140	331	325
Malawi	110	175	19	17.6	27	39	20	900	551	469
Mali	121	219	7	18.6	10	26.8	25	140	593	582
Mauritania	78	125	33	18.3	10	37.5	36	9.5	668	664
Mauritius	14	15	131	ND	ND	ND	2	ND	136	136
Mozambique	104	152	23	14.1	10	ND	23	1300	636	557
Namibia	47	63	68	12.0	18	19.4	30	210	635	477
Niger	152	259	3	27.7	12	41.6	26	70	276	272
Nigeria	101	197	13	18.8	10	31.6	65	3600	546	518
Rwanda	118	203	10	16.9	12	32.7	16	250	664	628
Sao Tome & Principe	75	118	38	ND	5	29.0	9	ND	256	256
Senegal	78	137	29	15.1	7	20.5	43	44	432	429
Seychelles	12	14	135	ND	ND	ND	1	ND	65	65
Sierra Leone	165	283	1	ND	9	45.9	36	ND	809	794
South Africa	54	67	65	13.2	19	ND	19	5300	458	341
Swaziland	108	156	21	ND	10	4	70	220	992	683
Tanzania	78	126	31	12.4	14	35.1	6	1600	524	476
Togo	78	140	27	29.3	9	36.2	30	100	696	673
Uganda	80	138	28	19.6	22	43.9	9	530	652	621
Zambia	102	182	18	21.2	15	43.3	16	920	638	508
Zimbabwe	79	129	30	13.9	16	25.8	20	1800	660	500
EASTERN MEDITERRANEAN										
Afghanistan	165	257	4	ND	19	ND	39	ND	671	671
Bahrain	9	11	148	ND	ND	ND	1	<0.6	52	52
Djibouti	101	126	31	ND	ND	ND	40	9.1	1020	988

Country	Infant Mortality Rate[1/a] (under one)	Under 5 Mortality Rate[2/a]	Under 5 Mortality Rank[a]	% Diarrhea in the last two weeks[3/b] (under 5)	% ARI in the last two weeks[4/c] (under 5)	% Fever in the last two weeks[5/d] (under 5)	% of children vulnerable to measles[6/e] (< 1 year)	Estimated number of people living with HIV[7/f] (thousands)	Estimate TB prevalence rate including HIV+[8/g] (per 100,000)	Estimate TB prevalence rate excluding HIV+[9/g] (per 100,000)
Egypt	26	36	86	7.1	10	17.7	3	12	36	36
Iran	32	38	83	ND	24	ND	4	31	37	36
Iraq	102	125	33	ND	7	ND	10	<0.5	236	236
Jordan	23	27	101	14.7	6	8.8	1	0.6	5	5
Kuwait	10	12	143	ND	ND	ND	3	ND	31	31
Lebanon	27	31	93	ND	4	ND	4	2.8	13	13
Libyan Arab Jamahiriya	18	20	120	ND	ND	ND	1	10	21	21
Morocco	38	43	77	12.0	12	27	5	15	105	105
Oman	10	13	140	ND	ND	ND	2	1.3	12	12
Pakistan	80	101	47	14.5	16x	29.9	33	74	359	358
Qatar	18	21	113	ND	ND	ND	1	ND	72	72
Saudi Arabia	21	27	101	ND	ND	ND	3	ND	57	57
Somalia	133	225	6	ND	ND	ND	60	ND	755	748
Sudan	63	91	49	ND	5	ND	41	400	364	355
Syrian Arab Republic	15	16	130	ND	18	ND	2	<0.5	52	52
Tunisia	21	25	105	20.6	9	ND	5	1.0	24	24
United Arab Emirates	7	8	152	ND	ND	ND	6	ND	26	26
Yemen	82	111	43	27.5	24	39.7	24	12	151	151
SOUTH/SOUTH EAST ASIA										
Bangladesh	56	77	58	7.5	21	40.1	23	ND	490	490
Bhutan	67	80	56	ND	ND	ND	13	ND	194	194
Democratic Republic of Korea	42	55	71	ND	12	ND	5	ND	187	187
India	62	85	52	ND	19	ND	44	ND	290	287
Indonesia	30	38	83	11.0	8	25.9	28	110	675	674

Country	Infant Mortality Rate[1/a] (under one)	Under 5 Mortality Rate[2/a]	Under 5 Mortality Rank[a]	% Diarrhea in the last two weeks[3/b] (under 5)	% ARI in the last two weeks[4/c] (under 5)	% Fever in the last two weeks[5/d] (under 5)	% of children vulnerable to measles[6/e] (< 1 year)	Estimated number of people living with HIV[7/f] (thousands)	Estimate TB prevalence rate including HIV+[8/g] (per 100,000)	Estimate TB prevalence rate excluding HIV+[9/g] (per 100,000)
Maldives	35	46	74	ND	22	ND	3	ND	39	39
Myanmar	76	106	45	ND	2	ND	22	330	187	183
Nepal	59	76	59	20.4	23	32	27	61	318	316
Sri Lanka	12	14	135	6.0	ND	ND	4	3.5	89	89
Thailand	18	21	113	15.6	ND	ND	4	570	208	203
Timor-Leste	64	80	56	ND	14	ND	45	ND	754	753
WESTERN PACIFIC										
Australia	5	6	162	ND	ND	ND	7	14	6	6
Brunei Darussalam	8	9	150	ND	ND	ND	1	<0.2	61	61
Cambodia	97	141	26	18.9	20	35.4	20	170	762	742
China	26	31	93	ND	ND	ND	6	840	246	245
Cook Islands	18	21	113	ND	ND	ND	1	ND	59	59
Fiji	16	20	120	ND	ND	ND	38	0.6	38	38
Japan	3	4	185	ND	ND	ND	1	12	42	42
Kiribati	49	65	66	ND	ND	ND	44	ND	60	60
Korea, Republic of	5	6	162	ND	ND	ND	1	8.3	118	118
Lao PDR	65	83	53	ND	1	ND	64	1.7	327	327
Malaysia	10	12	143	ND	ND	ND	5	52	136	135
Marshall Islands	52	59	69	ND	ND	ND	30	ND	60	60
Micronesia, Federated States of	19	23	110	ND	ND	ND	15	ND	62	62
Mongolia	41	52	72	ND	2	ND	4	<0.5	237	237
Nauru	25	30	95	ND	ND	ND	60	ND	36	36
New Zealand	5	6	162	ND	ND	ND	15	1.4	11	11
Niue	ND	ND	ND	ND	ND	ND	1	ND	59	59

Country	Infant Mortality Rate[1/a] (under one)	Under 5 Mortality Rate[2/a]	Under 5 Mortality Rank[a]	% Diarrhea in the last two weeks[3/b] (under 5)	% ARI in the last two weeks[4/c] (under 5)	% Fever in the last two weeks[5/d] (under 5)	% of children vulnerable to measles[6/e] (< 1 year)	Estimated number of people living with HIV[7/f] (thousands)	Estimate TB prevalence rate including HIV+[8/g] (per 100,000)	Estimate TB prevalence rate excluding HIV+[9/g] (per 100,000)
Palau	22	27	101	ND	ND	ND	1	ND	ND	ND
Papua New Guinea	68	93	48	ND	13x	ND	11	16	529	527
Philippines	26	34	88	10.6	10	23.8	20	9.0	458	458
Samoa	25	30	95	ND	ND	ND	75	ND	44	44
Singapore	3	3	192	ND	ND	ND	6	4.1	42	42
Solomon Islands	34	56	70	ND	ND	ND	28	ND	60	60
Tonga	20	25	105	ND	ND	ND	1	ND	44	44
Tuvalu	36	51	73	ND	ND	ND	2	ND	59	59
Vanuatu	32	40	79	ND	ND	ND	52	ND	71	71
Vietnam	17	23	110	ND	20	ND	3	220	240	238
EUROPE										
Albania	17	19	125	ND	1	ND	4	ND	33	33
Andorra	6	7	159	ND	ND	ND	2	ND	17	17
Armenia	29	32	90	7.8	11	16.5	8	2.6	90	89
Austria	5	5	172	ND	ND	ND	26	10	12	12
Azerbaijan	75	90	51	ND	3	ND	2	1.4	109	109
Belarus	9	11	148	ND	ND	ND	1	ND	60	59
Belgium	4	5	172	ND	ND	ND	18	10	12	12
Bosnia & Herzegovina	13	15	131	ND	2	ND	12	0.9	63	63
Bulgaria	12	15	131	ND	ND	ND	5	<0.5	47	47
Croatia	6	7	159	ND	ND	ND	4	<0.2	68	68
Cyprus	5	5	172	ND	ND	ND	14	ND	4	4
Czech Republic	4	4	185	ND	ND	ND	3	2.5	12	12
Denmark	4	5	172	ND	ND	ND	4	5.0	6	6
Estonia	6	8	152	ND	ND	ND	4	7.8	54	53

Country	Infant Mortality Rate[1/a] (under one)	Under 5 Mortality Rate[2/a]	Under 5 Mortality Rank[a]	% Diarrhea in the last two weeks[3/b] (under 5)	% ARI in the last two weeks[4/c] (under 5)	% Fever in the last two weeks[5/d] (under 5)	% of children vulnerable to measles[6/e] (< 1 year)	Estimated number of people living with HIV[7/f] (thousands)	Estimate TB prevalence rate including HIV+[8/g] (per 100,000)	Estimate TB prevalence rate excluding HIV+[9/g] (per 100,000)
Finland	3	4	185	ND	ND	ND	3	1.5	10	10
France	4	5	172	ND	ND	ND	14	120	12	12
Georgia	41	45	75	ND	8	ND	14	3	95	95
Germany	4	5	172	ND	ND	ND	8	43	7	7
Greece	4	5	172	ND	ND	ND	12	9.1	22	22
Hungary	7	8	152	ND	ND	ND	1	2.8	33	33
Iceland	2	3	192	ND	ND	ND	7	<0.5	3	3
Ireland	5	6	162	ND	ND	ND	19	2.8	12	12
Israel	5	6	162	ND	ND	ND	4	3	8	8
Italy	4	5	172	ND	ND	ND	16	140	6	6
Kazakhstan	63	73	60	13.4	3	12.3	1	17	153	152
Kyrgyzstan	58	68	64	ND	4x	ND	1	3.9	140	140
Latvia	10	12	143	ND	ND	ND	1	7.6	80	78
Lithuania	8	8	152	ND	ND	ND	2	1.3	73	73
Luxembourg	5	6	162	ND	ND	ND	9	<0.5	10	10
Macedonia, The Former Yugoslav Republic of	13	14	135	ND	ND	ND	96	<0.2	37	37
Malta	5	6	162	ND	ND	ND	13	<1.0	6	6
Moldova, Republic of	23	28	98	ND	1	ND	4	5.5	178	177
Monaco	4	5	172	ND	ND	ND	1	ND	2	2
Netherlands	5	6	162	ND	ND	ND	2	19	6	6
Norway	4	4	185	ND	ND	ND	12	2.1	5	5
Poland	7	8	152	ND	ND	ND	3	14	34	34
Portugal	4	5	172	ND	ND	ND	5	22	38	37
Romania	17	20	120	ND	ND	ND	3	6.5	194	194
Russian Federation	17	21	113	ND	ND	ND	3	860	160	157

Country	Infant Mortality Rate[1/a] (under one)	Under 5 Mortality Rate[2/a]	Under 5 Mortality Rank[a]	% Diarrhea in the last two weeks[3/b] (under 5)	% ARI in the last two weeks[4/c] (under 5)	% Fever in the last two weeks[5/d] (under 5)	% of children vulnerable to measles[6/e] (< 1 year)	Estimated number of people living with HIV[7/f] (thousands)	Estimate TB prevalence rate including HIV+[8/g] (per 100,000)	Estimate TB prevalence rate excluding HIV+[9/g] (per 100,000)
San Marino	3	4	185	ND	ND	ND	2	ND	5	5
Serbia -Montenegro	13	15	131	ND	3	ND	4	10	44	44
Slovakia	6	9	150	ND	ND	ND	2	<0.2	29	29
Slovenia	4	4	185	ND	ND	ND	6	<0.5	22	27
Spain	3	5	172	ND	ND	ND	3	140	28	27
Sweden	3	4	185	ND	ND	ND	6	3.6	4	4
Switzerland	5	5	172	ND	ND	ND	18	13	7	7
Tajikistan	91	118	38	ND	ND	ND	11	<0.2	267	267
Turkey	28	32	90	29.7	29	29.9	9	ND	40	40
Turkmenistan	80	103	46	3.2	1	4	3	<0.2	83	83
Ukraine	14	18	127	ND	ND	ND	1	360	135	133
UK	5	6	162	ND	ND	ND	19	32	12	12
Uzbekistan	57	69	62	ND	0	ND	2	11	156	156
Yugoslavia	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
REGION OF THE AMERICAS										
Antigua & Barbuda	11	12	143	ND	ND	ND	3	ND	10	10
Argentina	16	18	127	ND	ND	ND	5	130	56	55
Bahamas	10	13	140	ND	ND	ND	11	5.6	54	52
Barbados	10	12	143	ND	ND	ND	2	2.5	14	14
Belize	32	39	81	ND	ND	ND	5	3.6	58	56
Bolivia	54	69	62	22.4	22	29.3	36	4.9	301	301
Brazil	32	34	88	13.1	24x	25.6	1	660	92	91
Canada	5	6	162	ND	ND	ND	5	56	5	4
Chile	8	8	152	ND	ND	ND	5	26	17	17
Colombia	18	21	113	13.9	13.0	25.5	8	190	80	80
Costa Rica	11	13	140	ND	ND	ND	12	12	18	18

Country	Infant Mortality Rate[1/a] (under one)	Under 5 Mortality Rate[2/a]	Under 5 Mortality Rank[a]	% Diarrhea in the last two weeks[3/b] (under 5)	% ARI in the last two weeks[4/c] (under 5)	% Fever in the last two weeks[5/d] (under 5)	% of children vulnerable to measles[6/e] (< 1 year)	Estimated number of people living with HIV[7/f] (thousands)	Estimate TB prevalence rate including HIV+[8/g] (per 100,000)	Estimate TB prevalence rate excluding HIV+[9/g] (per 100,000)
Cuba	6	7	159	ND	ND	ND	1	3.3	13	13
Dominica	13	14	135	ND	ND	ND	1	ND	23	23
Dominican Republic	27	32	90	14.0	20	26.4	21	88	126	123
Ecuador	23	26	104	ND	ND	ND	1	21	210	209
El Salvador	24	28	98	36.1	42	ND	7	29	79	78
Grenada	18	21	113	ND	ND	ND	26	ND	8	8
Guatemala	33	45	75	13.3	18	26.8	25	78	106	104
Guyana	48	64	67	ND	5	ND	12	11	184	178
Haiti	74	117	40	25.7	39	40.6	46	280	415	386
Honduras	31	41	78	ND	ND	ND	8	63	105	102
Jamaica	17	20	120	ND	3	ND	20	22	9	9
Mexico	23	28	98	22.7	ND	ND	4	160	45	45
Nicaragua	31	38	83	13.1	31	24.9	16	6.4	78	78
Panama	19	24	107	ND	ND	ND	1	16	52	52
Paraguay	21	24	107	8.1	17x	31.2	11	15	106	105
Peru	24	29	97	15.4	20	25.9	11	82	233	231
Puerto Rico	ND	ND	ND	ND	ND	ND	ND	ND	8	8
Saint Kitts & Nevis	18	21	113	ND	ND	ND	2	ND	16	16
Saint Lucia	13	14	135	ND	ND	ND	5	ND	22	22
Saint Vincent & the Grenadines	18	22	112	ND	ND	ND	1	ND	40	40
Suriname	30	39	81	ND	4	ND	14	5.2	104	102
Trinidad & Tobago	18	20	120	6.0	3	ND	5	29	13	13
USA	7	8	152	ND	ND	ND	7	950	3	3
Uruguay	15	17	129	ND	ND	ND	5	6	33	33
Venezuela	16	19	125	ND	9	ND	20	110	52	52

[1] Probability of dying between birth and exactly one year of age expressed per 1,000 live births.
[2] Probability of dying between birth and exactly five years of age expressed per 1,000 live births.
[3] Percent of children under five years who had diarrhea in the two weeks preceding the survey.
[4] Percent of children (0-4 years) with acute respiratory infection (ARI) in the least two weeks.
[5] Percent of children under 5 years of age with reported fever in the 2 weeks prior to the survey.
[6] Data calculated by subtracting the % of 1 year old children immunized for measles from 100, to obtain the percent of children not immunized and therefore vulnerable.
[7] Estimated adults and children (0 to 49 years) living with HIV/AIDS as of the end of 2003.
[8] All cases of tuberculosis, per 100,000 total population, including HIV+ TB cases.
[9] All cases of Tuberculosis, per 100,000 total population, NOT including HIV+ TB cases.

Sources
[a] Taken from UNICEF SOWC 2006 (2005), Table 1: Basic Indicators. Original data provided by UNICEF, WHO, United Nations Population Division and United Nations Statistics Division. Data from 2004.
[b] Taken from MEASURE DHS STATCompiler at www.measuredhs.com, accessed 16 December 2005. Search criteria included all surveys, "diarrhea prevalence last 2 weeks" for "births in five years preceding the survey". Data from most recent survey for each country, between 1988-2004.
[c] Taken from UNICEF SOWC 2006 (2005), Table 3: Health. Original data provided by DHS, MICS and other national household surveys. Data from the most recent year available between 1998-2004; x in column denotes data refers to either years other than 1996-2004, differ from the standard deviation or refer to only part of a country.
[d] For AFRICA Region: Taken from Roll Back Malaria, WHO & UNICEF World Malaria Report (2005), Table A.13. Original data provided by the most recent DHS, MICS and MoH national surveys between 1999-2004. NRD indicates "no recent data", with the last national survey reported in the 1980s. Where DHS and MICS performed surveys in the same year, data from the DHS survey was taken, to respect consistency with data from this and other tables in this report. For ALL OTHER Regions: Taken from DHS STATCompiler at www.measuredhs.com, accessed 21 December 2005. Search criteria included all surveys for this region, under "prevalence and treatment of ARI and fever", chose "Fever" for "births in five years preceding the survey". Data from most recent survey for each country, between 1996-2004.
[e] Vulnerability data derived from percent of children vaccinated for measles, taken from UNICEF SOWC 2006 (2005), Table 3: Health. Original measles immunization data provided by DHS and MICS. Data from 2004.
[f] Taken from UNICEF SOWC 2006 (2005), Table 4: HIV/AIDS. Originally provided by UNAIDS, Report on the Global HIV/AIDS Epidemic 2004 Data from 2003.
[g] Taken from WHO Global Tuberculosis Report (2005). Data from 2003.

Table A.3.2 Health Services Coverage and Use

Country	% Women reported antenatal care (2 or more visits)[1/a]	% Children immunized (DPT[3])[2/b] (1 year)	% ARI[3]: Cases taken to a health care provider[c] (under 5)	%ORT[4] Use for Diarrhea[d] (under 5)	% Children with fever receiving antimalarial drugs[5/e] (under 5)	Use of Insecticide Treated Nets: % Children[6/f] (under 5)	Use of Insecticide Treated Nets: % Pregnant Women[6/f]
AFRICA							
Algeria	ND	86	52	ND	ND	ND	ND
Angola	ND	59	58	32	63	2.3	ND
Benin	83.3	83	35	42	60	7.4	28.7*
Botswana	ND	97	14	7	ND	ND	ND
Burkina Faso	62.5	88	36	ND	50	1.6	2.6
Burundi	ND	74	40	16	31	1.3	ND
Cameroon	79.8	73	40	33	ND	1.3	ND
Cape Verde	ND	75	ND	ND	ND	ND	ND
Central African Republic	69.7	40	32	47	69	1.5	ND
Chad	33.5	50	22	50	32	0.6	7.2*
Comoros	77.6	76	49	31	63	9.3	ND
Congo	ND	67	ND	ND	ND	ND	ND
Côte d'Ivoire	72.6	50	38	34	ND	1.1	ND
Democratic Republic of Congo	ND	64	36	17	45	0.7	ND
Equatorial Guinea	ND	33	ND	36	49	0.7	ND
Eritrea	66.5	83	44	54	4	4.2	2.9
Ethiopia[g]	20.5	80	16	38	3	6*	6*
Gabon	90.9	38	48	44	ND	ND	ND
Gambia	ND	92	75	38	55	14.7	ND
Ghana	86	80	44	40	63	3.5	2.7
Guinea	69.4	69	33	44	56	.5*	2.7*
Guinée Bissau	ND	80	64	23	58	7.4	ND
Kenya	83.4	73	49	33	27	4.6	4.4
Lesotho	ND	78	49	29	ND	ND	ND
Liberia	ND	31	70	ND	ND	ND	ND
Madagascar	73.9	61	48	47	34	0.2	ND
Malawi	90.3	89	27	51	27	35.5	31.4

Country	% Women reported antenatal care (2 or more visits)[1/a]	% Children immunized (DPT[2])[2/b] (1 year)	% ARI[3]: Cases taken to a health care provider[c] (under 5)	%ORT[4] Use for Diarrhea[d] (under 5)	% Children with fever receiving antimalarial drugs[5/e] (under 5)	Use of Insecticide Treated Nets	
						% Children[6/f] (under 5)	% Pregnant Women[6/f]
Mali	46.8	76	36	45	38	17.7*	19.6*
Mauritania	55.8	70	41	28	ND	2.1	ND
Mauritius	ND	98	ND	ND	ND	ND	ND
Mozambique	81.1	72	55	33	15	3.5*	5.6*
Namibia	82.9	81	53	39	14	ND	ND
Niger	34.7	62	27	43	48	1.0	ND
Nigeria	58.4	25	33	28	34	1.2	1.3
Rwanda	79.1	89	20	16	13	4.3	ND
Sao Tome & Principe	ND	99	47	44	ND	22.8	ND
Senegal[h]	77.3	87	27	33	36	1.7	31*
Seychelles	ND	99	ND	ND	ND	ND	ND
Sierra Leone	ND	61	50	39	61	1.5	ND
South Africa	86.5	93	75	37	ND	ND	ND
Swaziland	ND	83	60	24	26	0.1	ND
Tanzania	93	95	68	38	58	2.1	ND
Togo	77.1	71	30	25	60	2.0	ND
Uganda	84.1	87	67	29	ND	0.2	0.5
Zambia	ND	80	69	48	52	6.5	7.9
Zimbabwe	80.4	85	50	80	ND	ND	ND
EASTERN MEDITERRANEAN							
Afghanistan	ND	66	28	48	ND	ND	ND
Bahrain	ND	98	ND	ND	ND	ND	ND
Djibouti	ND	64	ND	ND	ND	ND	ND
Egypt	50.6	97	70	29	ND	ND	ND
Iran	ND	99	93	ND	ND	ND	ND
Iraq	ND	81	76	ND	ND	0	ND
Jordan	97	95	78	44	ND	ND	ND

Country	% Women reported antenatal care (2 or more visits)[1/a]	% Children immunized (DPT[3])[2/b] (1 year)	% ARI[3]: Cases taken to a health care provider[c] (under 5)	%ORT[4] Use for Diarrhea[d] (under 5)	% Children with fever receiving antimalarial drugs[5/e] (under 5)	Use of Insecticide Treated Nets	
						% Children[6/f] (under 5)	% Pregnant Women[6/f]
Kuwait	ND	98	ND	ND	ND	ND	ND
Lebanon	ND	92	74	ND	ND	ND	ND
Libyan Arab Jamahiriya	ND	97	ND	ND	ND	ND	ND
Morocco	59.1	97	38	50	ND	ND	ND
Oman	ND	99	ND	ND	ND	ND	ND
Pakistan	ND	65	66x	33x	ND	ND	ND
Qatar	ND	96	ND	ND	ND	ND	ND
Saudi Arabia	ND	96	ND	ND	ND	ND	ND
Somalia	ND	30	ND	ND	19	0.3	ND
Sudan	ND	55	57	38	50	0.4	ND
Syrian Arab Republic	ND	99	66	ND	ND	ND	ND
Tunisia	ND	97	43	ND	ND	ND	ND
United Arab Emirates	ND	94	ND	ND	ND	ND	ND
Yemen	24.3	78	47	23x	ND	ND	ND
SOUTH/SOUTH EAST ASIA							
Bangladesh[7]	41.3	85	20	35	ND	ND	ND
Bhutan	ND	89	ND	ND	ND	ND	ND
Dem Rep of Korea	ND	72	93	ND	ND	ND	ND
India	57.1	64	67	22	ND	ND	ND
Indonesia	92.1	70	61	61	1.0	0.1	ND
Maldives	ND	89	27	51	27.0	ND	ND
Myanmar	ND	82	66	48	ND	ND	ND
Nepal	41.6	80	26	43	ND	ND	ND
Sri Lanka	ND	97	ND	ND	ND	ND	ND
Thailand	ND	98	ND	ND	ND	ND	ND
Timor-Leste	ND	57	24	ND	47	ND	ND

Country	% Women reported antenatal care (2 or more visits)[1/a]	% Children immunized (DPT[3])[2/b] (1 year)	% ARI[3]: Cases taken to a health care provider[c] (under 5)	%ORT[4] Use for Diarrhea[d] (under 5)	% Children with fever receiving antimalarial drugs[5/e] (under 5)	Use of Insecticide Treated Nets	
						% Children[6/f] (under 5)	% Pregnant Women[6/f]
WESTERN PACIFIC							
Australia	ND	92	ND	ND	ND	ND	ND
Brunei Darussalam	ND	92	ND	ND	ND	ND	ND
Cambodia	30.8	85	37	59	ND	ND	ND
China	ND	91	ND	ND	ND	ND	ND
Cook Islands	ND	99	ND	ND	ND	ND	ND
Fiji	ND	71	ND	ND	ND	ND	ND
Japan	ND	99	ND	ND	ND	ND	ND
Kiribati	ND	62	ND	ND	ND	ND	ND
Korea, Republic of	ND	88	ND	ND	ND	ND	ND
Lao PDR	ND	45	36	37	9	14.6	ND
Malaysia	ND	99	ND	ND	ND	ND	ND
Marshall Islands	ND	64	ND	ND	ND	ND	ND
Micronesia, Federated States of	ND	78	ND	ND	ND	ND	ND
Mongolia	ND	99	78	66	ND	ND	ND
Nauru	ND	80	ND	ND	ND	ND	ND
New Zealand	ND	90	ND	ND	ND	ND	ND
Niue	ND	99	ND	ND	ND	ND	ND
Palau	ND	ND	ND	ND	ND	ND	ND
Papua New Guinea	ND	46	75x	ND	ND	ND	ND
Philippines	87.8	79	55	76	ND	ND	ND
Samoa	ND	68	ND	ND	ND	ND	ND
Singapore	ND	94	ND	ND	ND	ND	ND
Solomon Islands	ND	80	ND	ND	ND	ND	ND
Tonga	ND	99	ND	ND	ND	ND	ND
Tuvalu	ND	98	ND	ND	ND	ND	ND
Vanuatu	ND	49	ND	ND	ND	ND	ND
Vietnam	76.7	96	71	39	7	15.8	ND

Country	% Women reported antenatal care (2 or more visits)[1/a]	% Children immunized (DPT3)[2/b] (1 year)	% ARI[3]: Cases taken to a health care provider[c] (under 5)	%ORT[4] Use for Diarrhea[d] (under 5)	% Children with fever receiving antimalarial drugs[5/e] (under 5)	Use of Insecticide Treated Nets: % Children[6/f] (under 5)	Use of Insecticide Treated Nets: % Pregnant Women[6/f]
EUROPE							
Albania	ND	97	83	51	ND	ND	ND
Andorra	ND	99	ND	ND	ND	ND	ND
Armenia	81.2	91	26	48	ND	ND	ND
Austria	ND	83	ND	ND	ND	ND	ND
Azerbaijan	ND	96	36	40	1	1.4	ND
Belarus	ND	99	ND	ND	ND	ND	ND
Belgium	ND	95	ND	ND	ND	ND	ND
Bosnia & Herzegovina	ND	84	80	23	ND	ND	ND
Bulgaria	ND	95	ND	ND	ND	ND	ND
Croatia	ND	96	ND	ND	ND	ND	ND
Cyprus	ND	98	ND	ND	ND	ND	ND
Czech Republic	ND	98	ND	ND	ND	ND	ND
Denmark	ND	95	ND	ND	ND	ND	ND
Estonia	ND	94	ND	ND	ND	ND	ND
Finland	ND	98	ND	ND	ND	ND	ND
France	ND	97	ND	ND	ND	ND	ND
Georgia	ND	78	99	ND	ND	ND	ND
Germany	ND	97	ND	ND	ND	ND	ND
Greece	ND	88	ND	ND	ND	ND	ND
Hungary	ND	99	ND	ND	ND	ND	ND
Iceland	ND	99	ND	ND	ND	ND	ND
Ireland	ND	89	ND	ND	ND	ND	ND
Israel	ND	96	ND	ND	ND	ND	ND
Italy	ND	96	ND	ND	ND	ND	ND
Kazakhstan	79.2	82	48	22	ND	ND	ND
Kyrgyzstan	86.9	99	48x	16	ND	ND	ND
Latvia	ND	98	ND	ND	ND	ND	ND
Lithuania	ND	94	ND	ND	ND	ND	ND

Country	% Women reported antenatal care (2 or more visits)[1/a]	% Children immunized (DPT3)[2/b] (1 year)	% ARI[3]: Cases taken to a health care provider[c] (under 5)	%ORT[4] Use for Diarrhea[d] (under 5)	% Children with fever receiving antimalarial drugs[5/e] (under 5)	Use of Insecticide Treated Nets	
						% Children[6/f] (under 5)	% Pregnant Women[6/f]
Luxembourg	ND	98	ND	ND	ND	ND	ND
Macedonia, The Former Yugoslav Republic of	ND	94	ND	ND	ND	ND	ND
Malta	ND	55	ND	ND	ND	ND	ND
Moldova, Republic of	ND	98	78	52	ND	ND	ND
Monaco	ND	99	ND	ND	ND	ND	ND
Netherlands	ND	98	ND	ND	ND	ND	ND
Norway	ND	91	ND	ND	ND	ND	ND
Poland	ND	99	ND	ND	ND	ND	ND
Portugal	ND	95	ND	ND	ND	ND	ND
Romania	ND	97	ND	ND	ND	ND	ND
Russian Federation	ND	97	ND	ND	ND	ND	ND
San Marino	ND	98	ND	ND	ND	ND	ND
Serbia-Montenegro	ND	97	97	ND	ND	ND	ND
Slovakia	ND	99	ND	ND	ND	ND	ND
Slovenia	ND	92	ND	ND	ND	ND	ND
Spain	ND	96	ND	ND	ND	ND	ND
Sweden	ND	99	ND	ND	ND	ND	ND
Switzerland	ND	95	ND	ND	ND	ND	ND
Tajikistan	ND	82	51	29	69	ND	ND
Turkey	62.2	85	41	19	ND	ND	ND
Turkmenistan	86.3	97	51	ND	ND	ND	ND
Ukraine	ND	99	ND	ND	ND	ND	ND
UK	ND	90	ND	ND	ND	ND	ND
Uzbekistan	86.5	99	57	33	ND	ND	ND
Yugoslavia	ND	ND	ND	ND	ND	ND	ND

Country	% Women reported antenatal care (2 or more visits)[1/a]	% Children immunized (DPT[3])[2/b] (1 year)	% ARI[3]: Cases taken to a health care provider[c] (under 5)	%ORT[4] Use for Diarrhea[d] (under 5)	% Children with fever receiving antimalarial drugs[5/e] (under 5)	Use of Insecticide Treated Nets	
						% Children[6/f] (under 5)	% Pregnant Women[6/f]
REGION OF THE AMERICAS							
Antigua & Barbuda	ND	97	ND	ND	ND	ND	ND
Argentina	ND	90	ND	ND	ND	ND	ND
Bahamas	ND	93	ND	ND	ND	ND	ND
Barbados	ND	93	ND	ND	ND	ND	ND
Belize	ND	95	66	ND	ND	ND	ND
Bolivia	73.5	81	52	54	ND	15.3*	17.8*
Brazil	84.5	96	24x	46x	ND	ND	ND
Canada	ND	91	ND	ND	ND	ND	ND
Chile	ND	94	ND	ND	ND	ND	ND
Colombia	87.6	89	51	44	ND	2.8	ND
Costa Rica	ND	90	ND	ND	ND	ND	ND
Cuba	ND	88	ND	ND	ND	ND	ND
Dominica	ND	99	ND	ND	ND	ND	ND
Dominican Republic	96.7	71	63	53	ND	ND	ND
Ecuador	ND	90	ND	ND	ND	ND	ND
El Salvador	ND	90	62	ND	ND	ND	ND
Grenada	ND	83	ND	ND	ND	ND	ND
Guatemala	82.7	84	64	22	ND	1.2	ND
Guyana	ND	91	78	40	3	ND	ND
Haiti	71.1	43	26	41	12	ND	ND
Honduras	ND	89	ND	ND	ND	ND	ND
Jamaica	ND	77	39	21	ND	ND	ND
Mexico	ND	98	ND	ND	ND	ND	ND
Nicaragua	82.1	79	57	49	2	ND	ND
Panama	ND	99	ND	ND	ND	ND	ND
Paraguay	86	76	51x	ND	ND	ND	ND
Peru	81.9	87	58	46	ND	ND	ND
Puerto Rico	ND	ND	ND	ND	ND	ND	ND

Country	% Women reported antenatal care (2 or more visits)[1/a]	% Children immunized (DPT[3])[2/b] (1 year)	% ARI[3]: Cases taken to a health care provider[c] (under 5)	%ORT[4] Use for Diarrhea[d] (under 5)	% Children with fever receiving antimalarial drugs[5/e] (under 5)	Use of Insecticide Treated Nets	
						% Children[6/f] (under 5)	% Pregnant Women[6/f]
Saint Kitts & Nevis	ND	96	ND	ND	ND	ND	ND
Saint Lucia	ND	91	ND	ND	ND	ND	ND
Saint Vincent & the Grenadines	ND	99	ND	ND	ND	ND	ND
Suriname	ND	85	58	43	ND	2.7	ND
Trinidad & Tobago	ND	94	74	31	ND	ND	ND
USA	ND	96	ND	ND	ND	ND	ND
Uruguay	ND	95	ND	ND	ND	ND	ND
Venezuela	ND	86	72	51	ND	ND	ND

1 Percentage of women reporting 2 or more antenatal visits during pregnancy for births in the three years preceding the survey. Data was calculated by adding women reporting 2-3 visits and women reporting 4+ visits in the latest available DHS survey.
2 Infants that received three doses of diphtheria, pertussis (whooping cough) and tetanus vaccine by the age of 1.
3 Percentage of children (0-4 years) with an Acute Respiratory Infection in the last two weeks and taken to a health provider.
4 Percentage of children (0-4 years) with diarrhea in the two weeks preceding the survey who received either oral rehydration therapy (Oral Rehydration Solutions or Recommended Homemade Fluids) or increased fluids and continued feeding.
5 Percentage of children (0-4 years) who were ill with fever in the last two weeks and received any appropriate (locally defined) antimalarial drugs.
6 Percentage of children under 5 (first column) and pregnant women (second column) who slept under an insecticide treated net the night preceding the survey.

Sources:
a Taken from MEASURE DHS STATCompiler at www.measuredhs.com, accessed 16 December 2005. Search criteria included all surveys, selected by most recent for each country and "number of antenatal care visits and timing of first visit" for "births in the past three years" reporting "2-3" and "4+" visits. Data from most recent survey for each country, between 1990-2004.
b Taken from UNICEF SOWC 2006 (2005), Table 3: Health. Original sources include UNICEF and WHO. Data from 2004.
c Taken from UNICEF SOWC 2006 (2005), Table 3: Health. Original sources include the most recent national survey between 1998-2004. Provided by DHS, MICS and other national household surveys. x in column denotes data refers to either years other than 1998-2004, differ from the standard deviation or refer to only part of a country.
d Taken from UNICEF SOWC 2006 (2005), Table 3: Health. Original sources include the most recent national survey between 1996-2004. Provided by DHS, and MICS.
e Taken from UNICEF SOWC 2006 (2005), Table 3: Health. Original sources include the most recent national survey between 1999-2004. Provided by DHS, and MICS.
f Taken from Roll Back Malaria, WHO & UNICEF World Malaria Report (2005), Tables A.10 and A. 12. Original data provided by the most recent DHS, MICS, RBM and NetMark national surveys between 1999-2004. Where DHS and MICS performed surveys in the same year (Rwanda), data from the DHS survey was taken, to respect consistency with data from this and other tables in this report. (*) indicates data taken from most recent sub-national survey, as no national survey is available.
g Data for ITN use in Ethiopia was taken from the most recent NetMark Survey at the sub-national level, conducted in 2004, as no data is available for Ethiopia in the 2005 World Malaria Report.
h Data for ITN use in Senegal was taken from the most recent NetMark Survey at the sub-national level, conducted in 2004, replacing 2000 data provided by NetMark to the 2005 World Malaria Report.

Tables A.4: Anthropometry & Child Feeding Health Conditions & Services

Table A.4 Anthropometry and Young Child Feeding

Country	% Children Underweight < -2 SD[1] (under 5)[a]	% Children Stunted < -2 SD[1] (under 5)[a]	Infant and Young Child Feeding						
			% Children Exclusively Breastfed[2] (< 6 months)[b]	% Children Breastfed with Complementary Food(s) (6-9 months)[b]	Types of Complementary Foods Consumed[3/c]				
					Fruits/ Vegetables[4]	Food made from legumes[5]	Meat/fish/shell-fish/ poultry/ eggs[6]	Food made from grains[7]	Food made with oil/fat/butter[8]
AFRICA									
Algeria	10	19	13	38	ND	ND	ND	ND	ND
Angola	31	45	11	77	ND	ND	ND	ND	ND
Benin	23	31	38	66	46.9	15.6	44.8	68.4	52.7
Botswana	13	23	34	57	ND	ND	ND	ND	ND
Burkina Faso	38	39	19	38	26.6	9.6	18.1	66.4	22.0
Burundi	45	57	62	46	ND	ND	ND	ND	ND
Cameroon	18	32	21	80	55.0	30.5	49.6	72.5	56.5
Cape Verde	14x	16x	57k	64	ND	ND	ND	ND	ND
Central African Republic	24	39	17	77	ND	ND	61.7	55.6	ND
Chad	28	29	2	77	43.6	ND	43.4	82.3	ND
Comoros	25	42	21	34	ND	ND	64.1	72.8	ND
Congo	14	19	4k	94	ND	ND	ND	ND	ND
Côte d’Ivoire	17	21	5	73	ND	ND	ND	ND	ND
Democratic Republic of Congo	31	38	24	79	ND	ND	ND	ND	ND
Equatorial Guinea	19	39	24	ND	ND	ND	ND	ND	ND
Eritrea	40	38	52	43	29	17.7	26.6	33.3	19.9
Ethiopia	47	52	55	43	16.6	39.2	10.8	69.7	18.1
Gabon	12	21	6	62	55.3	ND	59.5	71.8	ND
Gambia	17	19	26	37	ND	ND	ND	ND	ND
Ghana	22	30	53	62	51.9	17.9	46.9	72.6	17.9
Guinea	21	33	23	43	ND	ND	ND	ND	ND
Guinée Bissau	25	30	37	36	ND	ND	ND	ND	ND
Kenya	20	30	13	84	77.1	28.2	24.1	74.1	ND
Lesotho	18	46	15	51	ND	ND	ND	ND	ND
Liberia	26	39	35	70	ND	ND	ND	ND	ND

Country	% Children Underweight < -2 SD[1] (under 5)[a]	% Children Stunted < -2 SD[1] (under 5)[a]	Infant and Young Child Feeding						
			% Children Exclusively Breastfed[2] (< 6 months)[b]	% Children Breastfed with Complementary Food(s) (6-9 months)[b]	Types of Complementary Foods Consumed[3/c]				
					Fruits/ Vegetables[4]	Food made from legumes[5]	Meat/fish/shell-fish/ poultry/ eggs[6]	Food made from grains[7]	Food made with oil/fat/butter[8]
Madagascar	42	48	67	78	74.5	13.4	27	86.6	30
Malawi	22	45	44	93	65.2	27.4	36.4	95	ND
Mali	33	38	25	32	23.2	8.2	23.6	52.3	18.4
Mauritania	32	35	20	78	22.4	ND	40.0	62.6	ND
Mauritius	15x	10x	21k	ND	ND	ND	ND	ND	ND
Mozambique	24	41	30	80	59.0	15.1	26.5	86.1	44.1
Namibia	24	24	19	57	ND	ND	ND	ND	ND
Niger	40	40	1	56	ND	ND	35.2	84.9	ND
Nigeria	29	38	17	64	44.6	24.1	43.7	72.9	35.1
Rwanda	27	41	84	79	51.2	57.6	11.5	63.6	32.4
Sao Tome & Principe	13	29	56	53	ND	ND	ND	ND	ND
Senegal	23	25	24k	64	ND	ND	ND	ND	ND
Seychelles	6x	5x	ND	ND	ND	ND	ND	ND	ND
Sierra Leone	27	34	4	51	ND	ND	ND	ND	ND
South Africa	12	25	7	67	ND	ND	53.1	ND	ND
Swaziland	10	30	24	60	ND	ND	ND	ND	ND
Tanzania	22	38	41	91	ND	ND	42.1	92.6	ND
Togo	25	22	18	65	ND	ND	50.4	85.2	ND
Uganda	23	39	63	75	65.7	58.7	29.6	69.7	34.1
Zambia	23	49	40	87	72.6	26.5	42.6	79.2	40.3
Zimbabwe	13	27	33	90	ND	ND	38.4	94.7	ND
EASTERN MEDITERRANEAN									
Afghanistan	39	54	ND	29	ND	ND	ND	ND	ND
Bahrain	9x	10x	94x,k	65x	ND	ND	ND	ND	ND
Djibouti	18	26	ND	ND	ND	ND	ND	ND	ND
Egypt	9	16	30	72	45.6	ND	39.7	68.7	ND
Iran	11	15	44	ND	ND	ND	ND	ND	ND
Iraq	16	22	12	51	ND	ND	ND	ND	ND

Country	% Children Underweight < -2 SD[1] (under 5)[a]	% Children Stunted < -2 SD[1] (under 5)[a]	Infant and Young Child Feeding						
			% Children Exclusively Breastfed[2] (< 6 months)[b]	% Children Breastfed with Complementary Food(s) (6-9 months)[b]	Types of Complementary Foods Consumed[3/c]				
					Fruits/ Vegetables[4]	Food made from legumes[5]	Meat/fish/shell-fish/ poultry/ eggs[6]	Food made from grains[7]	Food made with oil/fat/butter[8]
Jordan	4	9	27	70	76.8	31.0	49.6	85.3	64.0
Kuwait	12k	26	10	24	ND	ND	ND	ND	ND
Lebanon	3	12	27k	35	ND	ND	ND	ND	ND
Libyan Arab Jamahiriya	5x	15x	ND	ND	ND	ND	ND	ND	ND
Morocco	9	24	31	66	69.8	19.6	48.5	72.6	ND
Oman	24x	23x	ND	92	ND	ND	ND	ND	ND
Pakistan	38	37	16x,k	31x	ND	ND	ND	ND	ND
Qatar	6x	8x	12k	48	ND	ND	ND	ND	ND
Saudi Arabia	14	20	31k	60	ND	ND	ND	ND	ND
Somalia	26	23	9	13	ND	ND	ND	ND	ND
Sudan	17x	ND	16	47	ND	ND	ND	ND	ND
Syrian Arab Republic	7	18	81k	50	ND	ND	ND	ND	ND
Tunisia	4	12	47	ND	ND	ND	ND	ND	ND
United Arab Emirates	14x	17x	34x,k	52x	ND	ND	ND	ND	ND
Yemen	46	53	12	76	ND	ND	32.1	45.2	ND
SOUTH/SOUTH EAST ASIA									
Bangladesh	48	43	36	69	42.1	17.6	36.4	78.1	ND
Bhutan	19	40	ND	ND	ND	ND	ND	ND	ND
Democratic Republic of Korea	23	37	65	31	ND	ND	ND	ND	ND
India	47	46	37k	44	59.6	ND	ND	ND	ND
Indonesia	28	ND	40	75	80.7	43.4	58.7	92.0	26.8
Maldives	30	25	10	85	ND	ND	ND	ND	ND
Myanmar	32	32	15k	66	ND	ND	ND	ND	ND
Nepal	48	51	68	66	41.2	41.6	15.6	89.5	47.1
Sri Lanka	29	14	84	ND	ND	ND	ND	ND	ND
Thailand	19x	16x	4x,k	71x	ND	ND	ND	ND	ND
Timor-Leste	46	49	31	82	ND	ND	ND	ND	ND

Country	% Children Underweight < -2 SD[1] (under 5)[a]	% Children Stunted < -2 SD[1] (under 5)[a]	Infant and Young Child Feeding						
			% Children Exclusively Breastfed[2] (< 6 months)[b]	% Children Breastfed with Complementary Food(s) (6-9 months)[b]	Types of Complementary Foods Consumed[3/c]				
					Fruits/ Vegetables[4]	Food made from legumes[5]	Meat/fish/shell-fish/ poultry/ eggs[6]	Food made from grains[7]	Food made with oil/fat/butter[8]
WESTERN PACIFIC									
Australia	ND	ND	ND	ND	ND	ND	ND	ND	ND
Brunei Darussalam	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cambodia	45	45.0	12.0	72	63.9	14.3	66.9	87.7	33.3
China	8	14.0	51.0	32	ND	ND	ND	ND	ND
Cook Islands	ND	ND	19k	ND	ND	ND	ND	ND	ND
Fiji	8x	3x	47x,k	ND	ND	ND	ND	ND	ND
Japan	ND	ND	ND	ND	ND	ND	ND	ND	ND
Kiribati	13x	28x	80x,k	ND	ND	ND	ND	ND	ND
Korea, Republic of	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lao PDR	40	42.0	23.0	10	ND	ND	ND	ND	ND
Malaysia	11	ND	29k	ND	ND	ND	ND	ND	ND
Marshall Islands	ND	ND	63x,k	ND	ND	ND	ND	ND	ND
Micronesia, Federated States of	ND	ND	60k	ND	ND	ND	ND	ND	ND
Mongolia	13	25.0	51.0	55	ND	ND	ND	ND	ND
Nauru	ND	ND	ND	ND	ND	ND	ND	ND	ND
New Zealand	ND	ND	ND	ND	ND	ND	ND	ND	ND
Niue	ND	ND	ND	ND	ND	ND	ND	ND	ND
Palau	ND	ND	59x,k	ND	ND	ND	ND	ND	ND
Papua New Guinea	35x	ND	59	74	ND	ND	ND	ND	ND
Philippines	28	30	34	58	69.5	7.8	59.8	88.0	10.7
Samoa	ND	ND	ND	ND	ND	ND	ND	ND	ND
Singapore	14x	11x	ND	ND	ND	ND	ND	ND	ND
Solomon Islands	21x	27x	65k	ND	ND	ND	ND	ND	ND
Tonga	ND	ND	62k	ND	ND	ND	ND	ND	ND
Tuvalu	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanuatu	20x	19x	50k	ND	ND	ND	ND	ND	ND
Vietnam	28	32	15	ND	ND	ND	ND	ND	ND

Country	% Children Underweight < -2 SD[1] (under 5)[a]	% Children Stunted < -2 SD[1] (under 5)[a]	Infant and Young Child Feeding						
			% Children Exclusively Breastfed[2] (< 6 months)[b]	% Children Breastfed with Complementary Food(s) (6-9 months)[b]	Types of Complementary Foods Consumed[3/c]				
					Fruits/ Vegetables[4]	Food made from legumes[5]	Meat/fish/shell-fish/ poultry/ eggs[6]	Food made from grains[7]	Food made with oil/fat/butter[8]
EUROPE									
Albania	14	34	6	24	ND	ND	ND	ND	ND
Andorra	ND	ND	ND	ND	ND	ND	ND	ND	ND
Armenia[9]	3	13	30	51	72.1	1.9	19.0	68.6	ND
Austria	ND	ND	ND	ND	ND	ND	ND	ND	ND
Azerbaijan	7	13	7	39	ND	ND	ND	ND	ND
Belarus	ND	ND	ND	ND	ND	ND	ND	ND	ND
Belgium	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bosnia & Herzegovina	4	10	6	ND	ND	ND	ND	ND	ND
Bulgaria	ND	ND	ND	ND	ND	ND	ND	ND	ND
Croatia	1	1	23	ND	ND	ND	ND	ND	ND
Cyprus	ND	ND	ND	ND	ND	ND	ND	ND	ND
Czech Republic	ND	ND	1x	2x	ND	ND	ND	ND	ND
Denmark	ND	ND	ND	ND	ND	ND	ND	ND	ND
Estonia	ND	ND	ND	ND	ND	ND	ND	ND	ND
Finland	ND	ND	ND	ND	ND	ND	ND	ND	ND
France	ND	ND	ND	ND	ND	ND	ND	ND	ND
Georgia	3	12	18k	12	ND	ND	ND	ND	ND
Germany	ND	ND	ND	ND	ND	ND	ND	ND	ND
Greece	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hungary	2x	3x	ND	ND	ND	ND	ND	ND	ND
Iceland	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ireland	ND	ND	ND	ND	ND	ND	ND	ND	ND
Israel	ND	ND	ND	ND	ND	ND	ND	ND	ND
Italy	ND	ND	ND	ND	ND	ND	ND	ND	ND
Kazakhstan[10]	4	10	36	73	75.8	ND	50.2	42.3	ND
Kyrgyzstan[10]	11	25	24	77	79.7	ND	58.8	89.5	ND
Latvia	ND	ND	ND	ND	ND	ND	ND	ND	ND

Country	% Children Underweight < -2 SD[1] (under 5)[a]	% Children Stunted < -2 SD[1] (under 5)[a]	Infant and Young Child Feeding						
			% Children Exclusively Breastfed[2] (< 6 months)[b]	% Children Breastfed with Complementary Food(s) (6-9 months)[b]	Types of Complementary Foods Consumed[3/c]				
					Fruits/ Vegetables[4]	Food made from legumes[5]	Meat/fish/shell-fish/ poultry/ eggs[6]	Food made from grains[7]	Food made with oil/fat/butter[8]
Lithuania	ND	ND	ND	ND	ND	ND	ND	ND	ND
Luxembourg	ND	ND	ND	ND	ND	ND	ND	ND	ND
Macedonia, The Former Yugoslav Republic of	6	7	37	8	ND	ND	ND	ND	ND
Malta	ND	ND	ND	ND	ND	ND	ND	ND	ND
Moldova, Republic of	3	10	ND	ND	ND	ND	ND	ND	ND
Monaco	ND	ND	ND	ND	ND	ND	ND	ND	ND
Netherlands	ND	ND	ND	ND	ND	ND	ND	ND	ND
Norway	ND	ND	ND	ND	ND	ND	ND	ND	ND
Poland	ND	ND	ND	ND	ND	ND	ND	ND	ND
Portugal	ND	ND	ND	ND	ND	ND	ND	ND	ND
Romania	6x	8x	ND	ND	ND	ND	ND	ND	ND
Russian Federation	3x	13x	ND	ND	ND	ND	ND	ND	ND
San Marino	ND	ND	ND	ND	ND	ND	ND	ND	ND
Serbia-Montenegro	2	5	11k	33	ND	ND	ND	ND	ND
Slovakia	ND	ND	ND	ND	ND	ND	ND	ND	ND
Slovenia	ND	ND	ND	ND	ND	ND	ND	ND	ND
Spain	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sweden	ND	ND	ND	ND	ND	ND	ND	ND	ND
Switzerland	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tajikistan	ND	36	50	ND	ND	ND	ND	ND	ND
Turkey	4	12	21	38	ND	ND	ND	ND	ND
Turkmenistan	12	22	13	71	88.9	16.5	64.7	87.3	ND
Ukraine	1	3	22	ND	ND	ND	ND	ND	ND
UK	ND	ND	ND	ND	ND	ND	ND	ND	ND
Uzbekistan[10]	8	21	19	49	81.3	ND	49.6	86.4	ND
Yugoslavia	6	7	37	8	ND	ND	ND	ND	ND

Country	% Children Underweight < -2 SD[1] (under 5)[a]	% Children Stunted < -2 SD[1] (under 5)[a]	Infant and Young Child Feeding						
			% Children Exclusively Breastfed[2] (< 6 months)[b]	% Children Breastfed with Complementary Food(s) (6-9 months)[b]	Types of Complementary Foods Consumed[3/c]				
					Fruits/ Vegetables[4]	Food made from legumes[5]	Meat/fish/shell-fish/ poultry/ eggs[6]	Food made from grains[7]	Food made with oil/fat/butter[8]
REGION OF THE AMERICAS									
Antigua & Barbuda	10x	7x	ND	ND	ND	ND	ND	ND	ND
Argentina	5	12	ND	ND	ND	ND	ND	ND	ND
Bahamas	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barbados	6x	7x	ND	ND	ND	ND	ND	ND	ND
Belize	6x	ND	24k	54	ND	ND	ND	ND	ND
Bolivia	8	27	54	74	79.9	7.9	71.4	86.5	70.0
Brazil	6	11	ND	30	ND	ND	71.6	22.5	ND
Canada	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chile	1	2	63	47	ND	ND	ND	ND	ND
Colombia	7	14	26	58	62.6	33.2	76.2	84.3	36.6
Costa Rica	5	6	35x,k	47x	ND	ND	ND	ND	ND
Cuba	4	5	41	42	ND	ND	ND	ND	ND
Dominica	5x	6x	ND	ND	ND	ND	ND	ND	ND
Dominican Republic	5	9	10	41	57.2	63.0	55.7	67.4	49.9
Ecuador	12	26	35	70	ND	ND	ND	ND	ND
El Salvador	10	19	24	76	ND	ND	ND	ND	ND
Grenada	ND	ND	39k	ND	ND	ND	ND	ND	ND
Guatemala	23	49	51	67	ND	ND	58.3	46.5	ND
Guyana	14	11	11	42	ND	ND	ND	ND	ND
Haiti	17	23	24	73	54.7	22.0	28.3	76.2	82.3
Honduras	17	29	35	61	ND	ND	ND	ND	ND
Jamaica	4	5	ND	ND	ND	ND	ND	ND	ND
Mexico	8	18	98x,k	36x	ND	ND	ND	ND	ND
Nicaragua	10	20	31	68	65	74.8	47.7	80.8	71.6
Panama	7	14	25x	38x	ND	ND	ND	ND	ND
Paraguay	5	14	22	60	ND	ND	ND	ND	ND
Peru	7	25	67	76	79.1	33	65.3	84.5	66.3

Country	% Children Underweight < -2 SD[1] (under 5)[a]	% Children Stunted < -2 SD[1] (under 5)[a]	Infant and Young Child Feeding							
			% Children Exclusively Breastfed[2] (< 6 months)[b]	% Children Breastfed with Complementary Food(s) (6-9 months)[b]	Types of Complementary Foods Consumed[3/c]				
					Fruits/ Vegetables[4]	Food made from legumes[5]	Meat/fish/shell-fish/ poultry/ eggs[6]	Food made from grains[7]	Food made with oil/fat/butter[8]
Puerto Rico	ND	ND	ND	ND	ND	ND	ND	ND	ND
Saint Kitts & Nevis	ND	ND	56k	ND	ND	ND	ND	ND	ND
Saint Lucia	14x	11x	ND	ND	ND	ND	ND	ND	ND
Saint Vincent & the Grenadines	ND	ND	ND	ND	ND	ND	ND	ND	ND
Suriname	13	10	9	25	ND	ND	ND	ND	ND
Trinidad & Tobago	7x	5x	2	19	ND	ND	ND	ND	ND
USA	1x	2x	ND	ND	ND	ND	ND	ND	ND
Uruguay	5x	8x	ND	ND	ND	ND	ND	ND	ND
Venezuela	4	13	7k	50	ND	ND	ND	ND	ND

1 No more than 3% of all children in a healthy population will fall below - 2 Standard Deviations.
2 "k" denotes exclusive breastfeeding for four months only.
3 Percentage of breastfeeding children between 6-23 months who received various types of food in the 24 hours (day and night) preceding the interview. Percentage for this age group calculated by, for each type of food in the following steps: 1) multiplying the percentage of children who received the food type by the number of respondent children in the same age group, 2) adding the subtotals of each age group, 3) adding the total number of respondent children between the ages of 6-23 months, and 4) dividing the sum of the subtotals of each age group (from step 2) by the total number of children (from step 3).
4 For Egypt, this category includes fruit only; For Bangladesh and India, this survey for this category was simply for "green leafy vegetables".
5 For Rwanda, this category is listed as "peas"; For Bangladesh, this category is listed as Dal in the survey; For Peru and the Dominican Republic, this category includes beans, legumes, lentils and soy; For Haiti it is listed as "peas".
6 For Egypt, this category includes fish, eggs and poultry only. "Meat" is a separate category; For Ethiopia, this food type includes cheese and yogurt products.
7 For Chad , Mauritania and Rwanda, this category is listed as "cereals" only. For Comoros, CAR, Gabon, Niger and Togo, it is listed as "wheat, cereals". For Tanzania, it is listed as "grain, flour, cereal"
8 For Cambodia, this category includes oil, fat and coconut milk.
9 For Armenia, respondents reported types of complementary foods for children 6-9 months only.
10 For Kazakhstan, Kyrgyzstan and Uzbekistan, surveys grouped child ages from 4-7 months, 8-11 months and 12-23 months. The data for types of complementary food represents children 8-23 months of age for these three countries.

Sources:
a Taken from UNICEF SOWC 2006 (2005), Table 2: Nutrition. Provided by DHS, MICS, UNICEF and WHO. Data from most recent year available between 1996-2004.
b Taken from UNICEF SOWC 2006 (2005), Table 2: Nutrition. Provided by DHS, MICS and UNICEF. Date from most recent year available between 1996-2004. "x" denotes that the data refers to either years other than 1996-2004, differ from the standard deviation or refer to only part of a country.
c Taken from calculation derived from data represented in the most recent DHS survey with a table on Types of Food Received in either 24 hours or the day/night preceding the interview for each country. Survey years range from 1995-2004.

Tables A.5: Demographic Indicator

Table A.5 Demographic Indicators

Country	Total Population (thousands)[a]	% Urban Population[1/b]	No. Children < 5 (thousands)[b]	No. School Age Children and Adolescents (thousands)[2/c]	Annual No. Births (thousands)[a]	Annual No. Deaths < 5 years (thousands)[a]
AFRICA						
Algeria	32358	59	3099	9004	671	27
Angola	15490	36	2887	5390	749	195
Benin	8177	45	1406	2786	341	52
Botswana	1769	52	221	585	46	5
Burkina Faso	12822	18	2393	4589	601	115
Burundi	7282	10	1270	2605	330	63
Cameroon	16038	52	2434	5367	562	84
Cape Verde	495	57	70	166	15	1
Central African Republic	3986	43	636	1361	149	29
Chad	9448	25	1804	3283	456	91
Comoros	777	36	125	255	28	2
Congo	3883	54	727	1358	172	19
Côte d'Ivoire	17872	45	2751	6078	661	128
Democratic Republic of Congo	55853	32	10829	19298	2788	572
Equatorial Guinea	492	49	86	164	21	4
Eritrea	4232	20	733	1450	166	14
Ethiopia	75600	16	12861	26144	509	509
Gabon	1362	85	193	453	42	4
Gambia	1478	26	228	461	52	6
Ghana	21664	46	3069	6988	679	76
Guinea	9202	36	1562	3063	383	59
Guinée Bissau	1540	35	300	528	77	16
Kenya	33467	41	5557	11341	159	159
Lesotho	1798	18	232	616	50	4
Liberia	3241	47	621	1123	164	39
Madagascar	18113	27	3064	6129	704	87

Country	Total Population (thousands)[a]	% Urban Population[1/b]	No. Children < 5 (thousands)[b]	No. School Age Children and Adolescents (thousands)[2/c]	Annual No. Births (thousands)[a]	Annual No. Deaths < 5 years (thousands)[a]
Malawi	12608	17	2319	4456	550	96
Mali	13124	33	2540	4691	647	142
Mauritania	2980	63	513	958	123	15
Mauritius	1233	44	98	266	20	0
Mozambique	19424	37	3254	6615	769	117
Namibia	2009	33	273	717	56	4
Niger	13499	23	2775	4736	734	190
Nigeria	128709	48	21943	44268	5323	1049
Rwanda	8882	20	1477	3163	365	74
Sao Tome & Principe	153	38	23	49	5	1
Senegal	11386	50	1820	3898	419	57
Seychelles	80	50	14	27	3	0
Sierra Leone	5336	40	925	1702	245	69
South Africa	47208	57	5248	13169	1093	73
Swaziland	1034	24	138	381	30	5
Tanzania	37627	36	5998	12835	1403	177
Togo	5988	36	996	2034	233	33
Uganda	27821	12	5744	10220	1412	195
Zambia	11479	36	1987	4140	468	85
Zimbabwe	1296	35	1756	4533	384	50
EASTERN MEDITERRANEAN						
Afghanistan	28574	24	5329	9854	1395	359
Bahrain	716	90	65	166	13	0
Djibouti	779	84	120	258	27	3
Egypt	72642	42	8795	20696	1890	68
Iran	68803	67	5890	20025	1308	50
Iraq	28057	67	4274	9225	972	122
Jordan	5561	79	734	1708	150	4

Country	Total Population (thousands)[a]	% Urban Population[1/b]	No. Children < 5 (thousands)[b]	No. School Age Children and Adolescents (thousands)[2/c]	Annual No. Births (thousands)[a]	Annual No. Deaths < 5 years (thousands)[a]
Kuwait	2606	96	235	513	50	1
Lebanon	3540	88	327	903	66	2
Libyan Arab Jamahiriya	5740	87	623	1496	133	3
Morocco	31020	58	3343	8391	713	31
Oman	2534	78	302	748	64	1
Pakistan	154794	34	20922	50375	4729	478
Qatar	777	92	65	134	14	0
Saudi Arabia	23950	88	3178	7339	665	18
Somalia	7964	35	1446	2570	359	81
Sudan	35523	40	5180	11148	1163	106
Syrian Arab Republic	6430	50	2488	5821	526	22
Tunisia	9995	64	806	2506	166	4
United Arab Emirates	4284	85	325	825	67	1
Yemen	20329	26	3581	7405	826	92
SOUTH/SOUTH EAST ASIA						
Bangladesh	139215	25	17284	41686	3738	288
Bhutan	2116	9	289	684	64	5
Democratic Republic of Korea	22384	61	1763	5047	349	3
India	1087124	28	120155	299287	26000	2210
Indonesia	68803	47	21477	54205	4513	50
Maldives	321	29	46	110	10	0
Myanmar	50004	30	4716	13395	992	105
Nepal	26591	15	3638	8622	786	60
Sri Lanka	20570	21	1631	4477	330	5
Thailand	63694	32	5020	13597	1015	21
Timor-Leste	887	8	160	282	45	4

Country	Total Population (thousands)[a]	% Urban Population[1/b]	No. Children < 5 (thousands)[b]	No. School Age Children and Adolescents (thousands)[2/c]	Annual No. Births (thousands)[a]	Annual No. Deaths < 5 years (thousands)[a]
WESTERN PACIFIC						
Australia	19942	92	1257	3559	249	1
Brunei Darussalam	7780	77	40	88	8	1
Cambodia	13798	19	1801	4449	422	60
China	1307989	40	86055	272832	17372	539
Cook Islands	18	72	2	5	0	0
Fiji	841	52	93	224	19	0
Japan	127923	66	5912	16037	1169	5
Kiribati	97	49	12	26	2	0
Korea, Republic of	47645	81	2521	8510	467	1
Lao PDR	5792	21	884	1904	204	17
Malaysia	24894	64	2738	6791	549	7
Marshall Islands	60	67	7	17	0	0
Micronesia, Federated States of	110	30	16	35	3	0
Mongolia	2614	57	268	741	58	3
Nauru	13	100	2	9	0	0
New Zealand	3989	86	276	774	55	0
Niue	1	36	0	1	0	ND
Palau	ND	ND	ND	ND	ND	ND
Papua New Guinea	5772	13	820	1897	176	16
Philippines	81617	62	9873	24575	2026	69
Samoa	184	22	26	61	5	1860
Singapore	4273	100	226	807	40	0
Solomon Islands	466	17	71	152	15	1
Tonga	102	34	12	32	2	0
Tuvalu	10	56	1	3	0	0
Vanuatu	207	23	30	68	6	0
Vietnam	83123	26	7900	22841	1644	38

Country	Total Population (thousands)[a]	% Urban Population[1/b]	No. Children < 5 (thousands)[b]	No. School Age Children and Adolescents (thousands)[2/c]	Annual No. Births (thousands)[a]	Annual No. Deaths < 5 years (thousands)[a]
EUROPE						
Albania	3112	44	256	792	53	1
Andorra	67	91	3	9	1	0
Armenia	3026	64	164	688	34	1
Austria	8171	66	387	1184	75	0
Azerbaijan	8335	50	607	2195	132	12
Belarus	9811	71	444	1604	91	1
Belgium	10400	97	565	1566	111	1
Bosnia & Herzegovina	3909	45	194	633	37	1
Bulgaria	7780	70	332	1074	67	1
Croatia	4540	59	210	676	41	0
Cyprus	826	69	49	158	10	0
Czech Republic	10229	74	449	1468	91	0
Denmark	5414	85	329	874	63	0
Estonia	1335	70	63	210	13	0
Finland	5235	61	281	827	55	0
France	60257	76	3722	9568	744	4
Georgia	4518	52	245	870	50	2
Germany	82645	88	3615	11318	687	3
Greece	11098	61	517	1451	102	1
Hungary	10124	66	481	1512	95	1
Iceland	292	93	21	57	4	0
Ireland	4080	60	296	708	63	0
Israel	6601	92	660	1509	134	1
Italy	58033	67	2661	7200	531	3
Kazakhstan	14839	56	1079	3436	237	17
Kyrgyzstan	5204	34	539	1488	116	8
Latvia	2318	66	99	366	21	0
Lithuania	3443	67	154	615	31	0

Country	Total Population (thousands)[a]	% Urban Population[1/b]	No. Children < 5 (thousands)[b]	No. School Age Children and Adolescents (thousands)[2/c]	Annual No. Births (thousands)[a]	Annual No. Deaths < 5 years (thousands)[a]
Luxembourg	459	92	29	74	6	0
Macedonia, The Former Yugoslav Republic of	2030	60	119	385	23	0
Malta	400	92	20	69	4	0
Moldova, Republic of	4218	46	211	841	43	1
Monaco	35	100	2	5	0	0
Netherlands	16226	66	979	2577	190	1
Norway	4598	80	286	796	55	0
Poland	38559	62	1830	6413	365	3
Portugal	10441	55	562	1448	112	1
Romania	21790	55	1063	3427	213	4
Russian Federation	143899	73	7052	22757	1511	32
San Marino	28	89	1	4	0	0
Serbia-Montenegro	10510	52	611	2416	122	2
Slovakia	5401	58	259	915	51	0
Slovenia	1967	51	87	265	17	0
Spain	42646	77	2160	5247	447	2
Sweden	9008	83	479	1470	95	0
Switzerland	7240	68	361	1112	68	0
Tajikistan	6430	24	839	2223	186	22
Turkey	72220	67	7236	18047	1505	48
Turkmenistan	4766	46	484	1412	107	11
Ukraine	46989	67	1930	7537	391	7
UK	59479	89	3398	9810	663	4
Uzbekistan	26209	36	2815	7982	611	42
Yugoslavia	ND	ND	ND	ND	ND	ND

Country	Total Population (thousands)[a]	% Urban Population[1/b]	No. Children < 5 (thousands)[b]	No. School Age Children and Adolescents (thousands)[2/c]	Annual No. Births (thousands)[a]	Annual No. Deaths < 5 years (thousands)[a]
REGION OF THE AMERICAS						
Antigua & Barbuda	81	38	8	19	2	0
Argentina	38372	90	3350	8927	685	12
Bahamas	319	90	30	78	6	0
Barbados	269	52	16	48	3	0
Belize	264	34	48	68	7	0
Bolivia	9009	64	1231	2812	265	18
Brazil	183913	84	17946	44248	3728	127
Canada	31958	81	1705	5302	328	2
Chile	16124	87	1246	3743	249	2
Colombia	44915	77	4734	11951	970	20
Costa Rica	4253	61	393	1107	79	1
Cuba	11245	76	689	2017	136	1
Dominica	79	72	7	20	2	0
Dominican Republic	8768	60	997	2479	211	7
Ecuador	13040	62	1449	3641	296	8
El Salvador	6762	60	804	1923	166	5
Grenada	102	41	10	25	2	0
Guatemala	12295	47	1988	4187	433	19
Guyana	750	30	76	188	16	1
Haiti	8407	30	1137	2705	253	30
Honduras	7048	46	975	2309	206	8
Jamaica	269	52	262	736	52	1
Mexico	105699	76	10962	28825	2201	62
Nicaragua	5376	58	730	1782	153	6
Panama	3175	57	341	812	70	2
Paraguay	6017	58	814	1874	175	4
Peru	27562	74	3007	7694	627	18
Puerto Rico	ND	ND	ND	ND	ND	ND

Country	Total Population (thousands)[a]	% Urban Population[1/b]	No. Children < 5 (thousands)[b]	No. School Age Children and Adolescents (thousands)[2/c]	Annual No. Births (thousands)[a]	Annual No. Deaths < 5 years (thousands)[a]
Saint Kitts & Nevis	42	32	4	10	1	0
Saint Lucia	159	31	14	43	3	0
Saint Vincent & the Grenadines	118	59	12	31	2	2
Suriname	446	77	46	117	9	0
Trinidad & Tobago	1301	76	89	276	19	0
USA	295410	80	20243	54451	4134	33
Uruguay	3439	93	283	714	57	57
Venezuela	26282	88	2842	7105	590	11

[1] Indicates the percentage of the population living in urban areas as defined according to the national definition used in the most recent population census.

[2] Number of school-age and adolescent children (5-18 years) was calculated by subtracting the under 5 population from the under 18 population in UNICEF SOWC 2006 (2005).

Sources:

[a] Taken from UNICEF SOWC 2006 (2005), Table 1: Basic Indicators. Provided by the United Nations Population Division and UNICEF. Data from 2004

[b] Taken from UNICEF SOWC 2006 (2005), Table 6: Demographic Indicators. Originally provided by the United Nations Population Division. Data from 2004.

[c] Number of school-age and adolescent children derived from number of children under 5 and under 18, taken from UNICEF SOWC 2006 (2005), Table 1: Basic Indicators. Data from 2004.

Annex A: Explanatory Notes

The tables in this annex present data on country-wise prevalence (Annex Tables A..1.1-A.11), and coverage (Annex Tables A.2.1-A.2.3) by micronutrient and country indicators related to demographics, nutrition and health (A.3, A.4, and A.5). These notes provide a brief overview of methods and data sources used to collect the information that is presented in the tables.

I. Country Indicators on Prevalence and Coverage By Micronutrient

The data presented in Tables A.1 and A.2 of Annex A are described here and the data sources identified.

The list of countries in each table is organized by the six WHO regions namely Africa, Eastern Mediterranean, South/South East Asia, Western Pacific, Europe, and Region of the Americas. The countries and regions chosen were identified as member states of the six World Health Organization Regional Offices. The listing of countries in the statistical tables reflect WHO classification for regional grouping and spelling. One exception has been made, in regard to the way the WHO lists countries alphabetically: the tables in this Annex alphabetize "Macedonia, The Former Yugoslav Republic" under M so that this country may be easily located in the tables. The location in the table and alphabetical order of all other countries has been copied directly from WHO classifications. A list of member states is available on the website of each particular regional office and is subject to change based on WHO classification standards.

The only countries not included in the Annex A tables are American Samoa, French Polynesia, Guam, Hong Kong, Macao, New Caledonia, Northern Mariana Islands (Commonwealth of the), Palestine, Pitcairn Islands, Tokelau, Wallis and Futuna.

I. A. Methods, Definitions and Data Sources

VITAMIN A

Prevalence of Vitamin A Deficiency, Xerophthalmia and Night Blindness (Tables A.1.1-A.1.4)

"Last Measured Prevalence" Estimates

Except for night blindness in pregnant women, DHS does not report on prevalence of vitamin A deficiency (VAD) in women and children nor does it report xerophthalmia in children. The last published WHO Micronutrient Deficiency Information System (MDIS) source was 1995. Starting in the mid-1990s, there was a massive global expansion of vitamin A supplementation associated with immunization programs, especially National Immunization Days (NIDs); this makes older VAD estimates less relevant for describing the current situation. However, derived estimates are available from two sources, Tulane/MI/UNICEF (Mason et al, 2005) and Johns Hopkins (West et al, 2002). The ACC/SCN 5th Nutrition Report cites the Johns Hopkins estimates in their report.

Data have been presented in Annex A.1 so that the reader can distinguish between the **actual** last measured prevalence and the **derived estimates** for each country. For night blindness in women, DHS surveys that report on percentage of women who suffered from night blindness during pregnancy (reported and adjusted) were reviewed and reported.

Limitations:

Since doing a search for the last measured prevalence for each country is not within the scope of this stock-taking exercise (and given the updated WHO MDIS database is soon forthcoming), the data for the last measured prevalence column was taken for the most part from the most recent surveys reported by West/Hopkins, unless more recent data were available from the surveys reported by Mason/Tulane, or more recent data was available at the national level that we had come across through our searches. Since the original references were unavailable when taken from the 2 main source documents, the tables only specify age ranges for preschool children for select countries. Please note that the references provided in the "Source" column sometimes refer to databases such as the Tulane/MI Global Micronutrient Survey 2002 as well as the WHO MDIS, 1995 or WHO MDIS 2001 and those have been left in for now since tracking down the original references were not within the scope of this exercise. In some cases, the complete references were not provided in the source documents (the bibliography of this annex, therefore, has a few incomplete references). The "Last Measured Prevalence" columns can be updated when the WHO MDIS vitamin A deficiency database is released in early 2006 and referenced as "WHO MDIS, 2006"as needed.

Derived Prevalence Estimates

Data were obtained from two sources, Tulane/MI/UNICEF (Mason et al, 2005) and Johns Hopkins (West et al, 2002). For a full description of methods and indicators, including adjustments made to measured prevalences, please refer to the source documents.

Data Sources:

1. Mason, J, Rivers, J, and Helwig C. Recent trends in malnutrition in developing regions: Vitamin A deficiency, anemia, iodine deficiency, and child development. Food and Nutrition Bulletin. Vol 26, No.1, 2005; pages 160-162.

2. West KP Jr, Rice A, Sugimoto J. Tables on the Global Burden of Vitamin A Deficiency and Xerophthalmia among Preschool Aged Children and Low Vitamin A Status, Vitamin A Deficiency and Maternal Night Blindness among Pregnant Women by WHO Region. http://www.jhsph.edu/CHN/GlobalVAD.pdf (updated August 2002).

3. West KP Jr. Extent of Vitamin A Deficiency Among Preschool Children and Women of Reproductive Age. J Nutr 2002; 132; 2857S-2866S. http://www.nutrition.org/cgi/reprint/132/9/2857S?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=&author1=west&searchid=1133644780258_4095&stored_search=&FIRSTINDEX=0&sortspec=relevance&volume=132&journalcode=nutrition

The estimates have been derived from available prevalence survey reports and population-based research studies, both published and unpublished, and analyses carried out previously by the WHO (1995 and 2001) and the MI (1998), coupled with, at times, revisions of previous population weights to derive national prevalence estimates, based on new findings. The West/Hopkins estimates have also been adjusted for the start-up of large-scale vitamin A supplementation programs (achieving a reported program coverage of over 75%) if the available prevalence data preceded the start-up of these programs. The Mason/Tulane estimates have been adjusted for age in a few cases (aggregated to 0 less than 72 months). Other adjustments have been made by the authors (e.g., if the available data were only at the sub-national level) to obtain the best national prevalence estimates (best guesses) for vitamin A deficiency, xerophthalmia, and night blindness. For countries where survey data was unavailable, the authors have used their best estimate for a measured prevalence, either from a similar neighboring country or an average of the countries in the region.

Indicators Reported and Definitions:

Data have been provided for the following 2 groups:

a) Young (Preschool age) Children: The Mason/Tulane estimates are an aggregation of age groupings into 0-72 months while the West/Hopkins estimates generally refer to children under 5 years of age, but for which estimates may have included, at times, older ages.

b) Pregnant Women: Due to paucity of data on vitamin A status during pregnancy, although pregnant women represent the target group, the West/JHU estimates of burden of deficiency have been based on the status of women during lactation, especially the first 6 months following child birth.

- Prevalence of vitamin A deficiency: Reported in terms of serum retinol concentrations (having serum or plasma retinol concentration below 0.70umol/L (occasionally abnormal conjunctival impression cytology or the distribution of vitamin A concentration in breastmilk for women, both considered for the purpose of this analysis to be roughly comparable with serum retinol for estimating population prevalence were used for the West/Hopkins estimates).
- Prevalence of xerophthalmia in preschool children: For West/Hopkins, prevalence of ocular manifestations of VAD were based on reports of reliably diagnosed stages of xerophthalmia, as defined by WHO; that is XN, Bitot's spots (X1B), and active corneal disease (X2 and X3). Instead of compiling estimates of the burden of separate clinical manifestations of xerophthalmia, a single prevalence of "active xerophthalmia" was derived to estimate the total ocular burden, as done previously (by MI and MDIS). The Mason/Tulane estimates define xerophthalmia as night blindness plus Bitot's spots (XN+X1B) in children 0-72 months.
- Prevalence of night blindness in pregnant women. DHS reports on percentage of women who suffered night blindness during pregnancy (reported prevalence) and percentage of women who reported night blindness but did not report difficulty with vision during the day (adjusted for blindness not attributed to vitamin A deficiency during pregnancy (adjusted prevalence). Maternal night blindness has been assumed to only occur during pregnancy for the purpose of the West/Hopkins derived prevalence calculations.

Vitamin A Supplementation Coverage (Table A.2.1)

Data have been provided for the following 2 groups: Young Children (6-59 months) and Women 15-49 years of age

a) Young Children (Children 6-59 months unless otherwise noted)

Indicators Reported and Definitions:

- Percentage of children aged 6-59 months who have received at least one high dose of vitamin A capsules in Year (2002, 2003).

Countries that have achieved a second round of vitamin A coverage greater than or equal to 70 per cent are marked with a symbol (t).

Data Sources:

UNICEF 2002 column: Available data for coverage in 2002: UNICEF State of the World's Children 2005. Table 2 Nutrition; pgs 110-113.
http://www.unicef.org/sowc05/english/statistics.html

UNICEF 2003 column: Available data for coverage in 2003: UNICEF State of the World's Children 2006. Table 2 Nutrition: pgs 106-109
http://www.unicef.org/sowc06/pdfs/sowc06_table2.pdf

(Main original data sources indicated as UNICEF and WHO)

- Percentage of children 6-59 months who received vitamin A supplements in the 6 months preceding the survey.

Data Sources:

Other column: Available data from recent DHS surveys or National Nutrition Surveys

b) Women 15-49 years

Indicators Reported and Definitions:

- Percentage of women with a birth in the five years preceding the survey who received a vitamin A dose in the first 2 months after delivery

Primary Data Source:

Most recent DHS surveys: Available for 26 countries. Extracted using
DHS STAT Compiler. http://www.measuredhs.com/statcompiler/start.cfm?action=new_table&userid=169835&usertabid=185859&CFID=643325&CFTOKEN=47070402

Supplemental Data Source:

Available data from recent National Nutrition Surveys or technical reports.

IRON

Prevalence of Anemia (Tables A.1.5-A.1.9)

Indicators Reported and Definitions:

Data have been provided for the following 5 groups: Young Children 6-59 months (Table A1.5), Older Children (Table A1.6), Pregnant Women (PW) 15-49 years of age (Table A1.7), Women 15-49 years of age (Table A1.8), and Men [age group varies] (Table A1.9).

Percentage of (population group) with:

- Any anemia: Proportion of population with Hb below 11.0 g/dl (for children 6-59 months and pregnant women); below 12 g/dl (for Older Children, Total Women and Non-pregnant women); and below 13g/dl for men. When data were obtained from the WHO MDIS for total women, the figure reported in the line notes was taken (Hb below 11g/dl PW, Hb<120 g/L NPW).
- Mild anemia: Hb 10.0-10.9 g/dl (for children under 5 and pregnant women); otherwise 10.0-11.9 g/dl. Not reported for older children and men.
- Moderate anemia: Hb 7.0-9.9 g/dl . Both mild and moderate anemia were usually only obtained from DHS. Not reported for older children and men.
- Severe anemia: Hb below 7.0 g/dl (DHS and several surveys reported by WHO MDIS provide this level of anemia). Not reported for older children and men.

All efforts were made to footnote any deviations from the above cut-offs when that data were available in the source documents.

Primary Data Sources:

Most recent DHS surveys for countries where this data are available (n=19). DHS Stat Compiler was used to extract these data for young children (individual level reported versus household level), women, and pregnant women.

http://www.measuredhs.com/statcompiler/start.cfm?action=new_table&userid=164494&usertabid=180125&CFID=423510&CFTOKEN=92452650

WHO MDIS 2005

Priority was given to data at the national level (followed by regional/state level), even if more recent local surveys were available. When not indicated, it can be assumed that the data is at the national level (sample sizes have not been included for national figures, but can be obtained from the WHO MDIS, 2005 database). If no national or regional data were available, then the most recent local survey was reported.

Footnotes have been provided when age ranges differed from the default and also when Hb cut-offs are not consistent with standard cut-offs used by DHS and WHO. If sub-national data have been used, the type of survey, location, and sample size has been indicated, if available, in the footnotes. For original references and additional notes on the surveys, please refer to the WHO MDIS anemia database recently released in December 2005 and available at

http://www3.who.int/whosis/menu.cfm?path=whosis,mn,mn_anaemia,mn_anaemia_data&language=english

Supplemental Data Sources: Technical reports from HKI and/or MOST or national micronutrient surveys were used to fill in the gaps and/or to report most recent data not covered by the above sources.

Limitations on indicators

Other than the DHS reports, very few reports break-out the data by severity of anemia (usually any anemia and severe anemia only). The age groups reported for all population groups, especially older children, women, and men are extremely different in the surveys and often the age ranges are not reported in the source documents. WHO MDIS does a good job with extracting the method used to collect the data and makes note of instances where hemoglobin cut-offs are either not specified or not standard. The Hb cut-offs are the most inconsistent for the older children and men population groups.

Reporting of "Any anemia" can get confusing. Sometimes data reported through DHS stat compiler and those figures reported in WHO MDIS are different for "any anemia" e.g., For Madagascar, Children 6-59 months

DHS stat compiler reports 70.2 for any anemia at the individual level and 68.3 for the household level while WHO MDIS reports 68.3 (under proportion of population with Hb below 11 g/dl), making it unclear how any anemia is being defined.

Additional Information on Methods/Process:

For countries where DHS data are not available:

Before the recent release of the WHO MDIS database in late December 2005), the most recent WHO MDIS compilation had been published in 1992. Since we were not sure the MDIS data would be available before our deadline, we had looked into obtaining unpublished data from WHO MDIS as well as data through the IDASTAT website (On MI website but maintained by Tulane). The IDASTAT link no longer works (does not appear to have been updated for a while, and Mark Fryars at MI believed it was due to Katrina). We found that the most recent compilation had been done by Mason et al, 2002 Global Micronutrient Project http://www.tulane.edu/~internut/ for the Tulane/MI/UNICEF Micronutrient Report and subsequently for the Country Damage Assessment Reports. These were data that had been updated primarily through surveys sent to UNICEF country representatives. The country pages online do not cite the original source/reference for the prevalence figures which made it difficult for us to include in our tables. The other limitation is that most of the other sources we obtained (IDPAS had compiled a matrix for MI as of 2003 and a compilation from Dr. Maberly at Emory available at http://www.sph.emory.edu/wheatflour/training/data_evaluation/other/anemia.xls) cited Tulane/MI as the source. However, again we did not have the original references. The IDPAS matrix was a repeat in most cases of the figures reported in Tulane country pages with a few additions of data reported in the FAO Country Nutrition Profiles (for the most case sub-national data). The WHO database includes original reference information for every source cited.

Iron Supplementation in Pregnant Women Coverage (Table A2.2)

Indicator Reported and Definitions:

- Percentage of women who took iron tablets or syrup for 90+ days during pregnancy.

Primary Data Source:

Most recent DHS Surveys for countries where this data are available (n=32 countries between 1999-2004). DHS Stat Compiler was used to extract these data.

Supplemental Data Source:

Technical reports from HKI and/or MOST or national micronutrient surveys where DHS data are unavailable.

IODINE

Prevalence of Iodine Deficiency in the Population (Table A1.10)

Data for this table were extracted from the WHO 2004 publication listed below. This source provides iodine deficiency data primarily for school-age children (age ranges differ) since WHO recommends that iodine deficiency surveys examine this population (6-12 years). In some cases, where data for this population group are not available, data for the next closest age group are reported in the following order of priority: data from children closest to school age, adults, general population or other population groups such as general pregnant women. Survey data for urinary iodine (UI) are available for school-age children for 126 countries collected between 1993 and 2003 (national=75; sub-national=51). Sixty-six countries have no data on UI.

Indicators Reported and Definitions:

Please refer to the source document for details on the indicators, selection of survey data, the methods used to derive median UI when national median UI was for available for severity classification, and the epidemiological criteria for assessing iodine nutrition based on median UI concentrations in school-age children.

- Median urinary iodine (ug/l): The median is reported since UI values from populations are not usually normally distributed.

- Proportion of population with urinary iodine levels below 100ug/l: Median UI below 100ug/l define a population which has iodine deficiency.

Data Source:

WHO (2004). Iodine Status Worldwide: WHO Global Database on Iodine Deficiency.

http://whqlidoc.who.int/publications/2004/9241592001.pdf

Data in this report are based on data available in the WHO Global Database on Iodine Deficiency, which compiles country data on urinary iodine and total goiter prevalence (TGP) in a standardized and easily accessible format at: http://www3.who.int/whosis/menu.cfm?path=whosis,mn,mn_iodine&language=english

Iodization of Household Salt Coverage (Table A2.3)

Indicator Reported and Definitions:

- Percent of households consuming iodized salt (15+ppm)

Primary Data Source:

UNICEF global database on iodized salt consumption (updated as of August 2004)
http://www.childinfo.org/eddb/idd/database.htm

Most recent DHS surveys.

DHS coverage figure was reported if it was more recent than the coverage figure available through the UNICEF database or in cases where the source or figure reported in the UNICEF database was different from the DHS figure for the same year. In such cases, the DHS figure follows the UNICEF figure.

Supplemental Data Sources:

Technical reports of National Nutrition/Health Survey data were reported if the surveys were more recent that the coverage figures available through the UNICEF database (in the absence of a DHS survey)

ZINC

Prevalence: Risk of Zinc Deficiency in the Population (Table A1.11)

Indicators Reported and Definitions:

- Prevalence of stunting of children under 5 years of age: Low height-or-length-for age <-2SD. The WHO considers national stunting rates of > 20% to be a level of public health concern. National level data on stunting prevalence are compiled routinely by the WHO Global Database on Child Growth the Malnutrition (Http://www.who.int/nutgrowthdb/).

For a full description of methods for the following indicators, including details on the derivation of the data, the definition of risk categories, and limitations in their interpretation, please refer to the source document.

- Estimated zinc daily intake (mg/dl)
- Estimated zinc absorption
- Derived estimate of population at risk of inadequate intake

Data Source:

International Zinc Nutrition Consultative Group (IZiNCG) (2004). Assessment of the risk of zinc deficiency in populations and options for its control. Hotz C and Brown KH, ed. Food and Nutrition Bulletin 25.

There are no coverage data for zinc.

II. Country Indicators Related to Demographics, Nutrition and Health

This section summarizes the data sources and methods used to extract information for Tables A.3-A.5 in Annex A. The indicators have been defined as footnotes in the relevant tables. Indicators were selected based on their influence on or relationship to micronutrient deficiencies and program strategies as well as availability of recent and meaningful data. Data was collected from pre-selected reliable data sources, including the NetMark Project, ORC Macro, UNICEF and WHO. Nationally representative data were given priority. Some of the indicators are from calculations applied to data from these sources to create a data set meaningful to this report. The data sources for each table are as follows.

Data Sources:

- Data on Demographic Indicators was collected from Table 1 (Basic Indicators) and Table 6 (Demographic Indicators) of the Statistical Tables section of UNICEF State of the World's Children 2006.
- Mortality Rates and Infectious Disease Prevalence data was extracted from Table 1 (Basic Indicators), Table 3 (Health), and Table 4 (HIV/AIDS) of the Statistical Tables section of UNICEF State of the World's Children 2006, DHS STATCompiler and the WHO 2005 Global Tuberculosis Report. The percent of children vulnerable to measles was calculated by subtracting the percent of children immunized (from SOWC 2006) by 100, thus arriving at a number that represents children not immunized and therefore vulnerable.
- Health Services Coverage and Use data were taken from three main sources, including Table 3 (Health) of the Statistical Tables Section of UNICEF State of the World's Children 2006, DHS STATCompiler, and the 2005 World Malaria Report. Calculations were applied to DHS survey data to obtain the number of women who had attended 2 or more antenatal visits in the last pregnancy. DHS surveys report women who make 2-3 and 4+ antenatal as separate. These two percentages were added. In addition, Insecticide Treated Net data was supplemented by 2004 subnational NetMark surveys for Ethiopia and Senegal because there was no data reported in the global 2005 Malaria Report for Ethiopia. Senegal's subnational data for pregnant women has since been updated, with a significant increase in the number of women using nets. Other recent NetMark surveys were not used because the 2005 World Malaria Report included national-level data for these countries and national-level data was preferred.
- Data on Anthropometric Status and Infant/Young Child Feeding was collected from two main sources: Table 2 (Nutrition of the Statistical Tables section) of UNICEF State of the World's Children 2006 and recent DHS surveys that included a table on foods received by breastfed children under 3 in the 24 hours period (day/night) before the interview. Underweight, stunting and breastfeeding status were taken directly from SOWC 2006. The DHS data is given for disaggregated age groups, and a weighted average of the ages was calculated.

Annex A: References

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ANNEX B

Health and Productivity Impacts of Vitamin and Mineral Deficiencies

Table B.1 Functional Consequences of Micronutrient Malnutrition: Vitamin A and Iodine

Country	Vitamin A		Iodine	
	Child deaths (0-59m)/ year due to Vitamin A deficiency	Maternal deaths/year due to Vitamin A deficiency	NPV of lost future productivity/year ($million)	Babies born with intellectual impairment
Afghanistan	40596	1754	55.4	372946
Angola	22597	812	133.8	188963
Azerbaijan	205	8	20.4	28764
Bangladesh	20071	1158	296.7	894642
Belarus	30	2	38.7	25024
Benin	5095	152	41.1	94794
Bhutan	324	50	11.7	15708
Botswana	456	3	34.7	12804
Brazil	4071	916	278.9	107213
Burkina Faso	19318	1114	46.6	169645
Burundi	7940	233	7.2	116525
Cambodia	4947	87	9.0	37296
Cameroon	4615	102	77.2	130946
Central African Republic	5189	98	8.0	35183
Chad	10780	329	29.2	118364
China	16876	272	940.3	930998
Comoros	159	8	4.4	8260
Congo	1190	57	38.8	44270
Congo, D R	55565	1805	60.7	720902
Côte d'Ivoire	12136	272	103.3	173530
Djibouti	209	12	5.8	7965
East Timor	1074	26	1.6	4704
Equatorial Guinea	320	12	26.7	5359
Ethiopia	90907	8513	74.5	944295
Gabon	333	10	38.0	9553
Gambia	961	17	3.2	13468
Ghana	5709	191	56.2	178192
Guatemala	846	55	85.8	38889

Country	Vitamin A		Iodine	
	Child deaths (0-59m)/ year due to Vitamin A deficiency	Maternal deaths/year due to Vitamin A deficiency	NPV of lost future productivity/year ($million)	Babies born with intellectual impairment
Guinea	5191	173	39.2	102564
Guinea-Bissau	1778	55	2.9	22015
Haiti	2171	44	3.4	12593
India	168702	35624	2888.8	6129214
Indonesia	22653	114	319.6	369516
Iraq	7584	145	348.6	201348
Kenya	24073	853	154.2	426865
Korea, Dem. People's Rep.	658	13	279.1	17278
Lao People's Dem. Rep.	1083	333	5.9	17472
Lesotho	725	16	6.1	14259
Liberia	6345	78	30.4	45325
Madagascar	10278	700	63.0	215940
Malawi	6573	1067	20.5	167265
Mali	24283	1187	54.2	180782
Mauritania	1640	77	10.4	33929
Mozambique	11152	299	40.8	230395
Myanmar	4988	464	100.8	78792
Nepal	5339	1032	40.3	188734
Niger	20244	748	36.4	205387
Nigeria	118823	2584	460.9	1419579
Pakistan	26175	1441	579.2	1163820
Papua New Guinea	1110	46	3.9	7568
Rwanda	1909	903	16.7	115935
Senegal	7516	176	61.1	111888
Sierra Leone	8233	316	6.9	69412
Somalia	7974	248	49.6	112690
Sri Lanka	210	28	70.3	77112
Sudan	8581	406	136.0	295251
Swaziland	707	6	9.1	8439
Tajikistan	401	11	9.7	44268
Tanzania	23135	1250	89.5	417130

Country	Vitamin A		Iodine	
	Child deaths (0-59m)/ year due to Vitamin A deficiency	Maternal deaths/year due to Vitamin A deficiency	NPV of lost future productivity/year ($million)	Babies born with intel-lectual impairment
Togo	3475	81	18.9	62678
Turkmenistan	199	2	26.2	25942
Uganda	24043	2363	107.8	476720
Yemen	9646	301	98.7	182580
Zambia	16185	897	43.5	142190
Zimbabwe	5897	470	141.6	113280
TOTAL	922201	72618	8902.0	18935357
PAR (%) or % of GNP	0.090	0.133	0.23	0.194

Table B.2 Functional Consequences of Micronutrient Malnutrition: Iron

Country	Iron									
	Maternal deaths/y due to iron deficiency anemia	Maternal deaths from all causes	Perinatal deaths/y due to iron deficiency anemia	Perinatal deaths from all causes	Value of lost current productivity ($million/y) (Female adults)	Value of lost current productivity/y ($million) (Total)	NPV of lost future productivity/y ($million) (Children)	NPV of lost future productivity/y ($million) (Children)	Total value of lost productivity/y ($million)	Total value of lost productivity/y (as % of GDP)
Afghanistan	7976	29773	39332	106847	10.3	10.3	10.3	7.4	17.6	0.30
Angola	2074	13787	9898	46388	66.0	66.0	66.0	14.8	80.8	0.52
Azerbaijan	17	133	1106	6164	22.0	22.0	22.0	3.8	25.7	0.35
Bangladesh	2212	14284	33744	153787	143.0	143.0	143.0	59.0	202.0	0.38
Belarus		0		0	0.0	0.0	0.0	0.0	0.0	0.00
Benin	850	3111	5520	14732	27.6	27.6	27.6	11.1	38.7	0.89
Bhutan	56	277	804	2850	7.4	7.4	7.4	3.8	11.2	0.65
Botswana	3	44	209	1864	11.5	11.5	11.5	5.7	17.2	0.22
Brazil	1522	9612	13583	60616	410.0	410.0	410.0	437.8	847.8	0.16
Burkina Faso	1678	6550	8824	24977	22.5	22.5	22.5	13.9	36.4	0.80
Burundi	710	3950	4340	17154	4.3	4.3	4.3	1.5	5.8	0.93
Cambodia	490	1998	7019	20701	27.7	27.7	27.7	6.5	34.2	0.77
Cameroon	691	4103	5661	23812	47.9	47.9	47.9	23.4	71.3	0.56
Central African Republic	303	1661	1968	7677	7.3	7.3	7.3	2.9	10.2	0.81
Chad	908	5588	5562	24214	15.3	15.3	15.3	9.7	25.0	0.84
China	783	9837	49419	429980	2129.9	2129.9	2129.9	302.0	2431.9	0.17
Comoros		0		0	0.0	0.0	0.0	0.0	0.0	0.00
Congo	145	969	1368	6440	11.7	11.7	11.7	7.3	19.0	0.50
Congo, D R	8717	30631	59951	154032	35.6	35.6	35.6	13.7	49.3	0.80
Côte d'Ivoire		0		0	38.5	38.5	38.5	19.9	58.3	0.39
Djibouti		0		0	0.0	0.0	0.0	0.0	0.0	0.00
East Timor	72	448	594	2611	1.0	1.0	1.0	0.3	1.3	0.35
Equatorial Guinea		0		0	0.0	0.0	0.0	0.0	0.0	0.00
Ethiopia	1948	27209	17911	172922	12.4	12.4	12.4	19.8	32.2	0.43
Gabon	46	172	494	1346	9.7	9.7	9.7	7.4	17.1	0.27
Gambia	80	281	982	2534	2.0	2.0	2.0	0.9	2.9	0.68
Ghana	864	3715	6348	19676	37.4	37.4	37.4	16.3	53.7	0.66
Guatemala	70	1073	875	9283	26.3	26.3	26.3	34.9	61.2	0.24
Guinea	700	2930	6666	20134	18.7	18.7	18.7	10.5	29.2	0.68

Country	Iron									
	Maternal deaths/y due to iron deficiency anemia	Maternal deaths from all causes	Perinatal deaths/y due to iron deficiency anemia	Perinatal deaths from all causes	Value of lost current productivity ($million/y) (Female adults)	Value of lost current productivity/y ($million) (Total)	NPV of lost future productivity/y ($million) (Children)	NPV of lost future productivity/y ($million) (Children)	Total value of lost productivity/y ($million)	Total value of lost productivity/y (as % of GDP)
Guinea-Bissau	144	935	942	4322	1.5	1.5	1.5	0.7	2.2	0.86
Haiti	419	1748	3170	9551	13.4	13.4	13.4	4.6	18.0	0.61
India	22834	139066	292040	1258462	2108.1	2108.1	2108.1	950.8	3058.9	0.49
Indonesia	1581	10118	20424	92296	604.2	604.2	604.2	151.4	755.5	0.35
Iraq	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Kenya	2653	14470	11461	44449	57.9	57.9	57.9	36.3	94.2	0.61
Korea, Dem. People's Rep.	25	218	1355	8360	0.0	0.0	0.0	212.1	212.1	0.05
Lao People's Dem. Rep.	206	1352	1834	8486	11.6	11.6	11.6	3.4	15.0	0.68
Lesotho	41	270	313	1453	3.5	3.5	3.5	1.2	4.7	0.41
Liberia	313	1330	3996	12234	19.8	19.8	19.8	8.3	28.1	0.95
Madagascar	667	4026	5986	25587	24.0	24.0	24.0	13.5	37.5	0.62
Malawi	2479	10206	8074	24024	9.3	9.3	9.3	4.4	13.7	0.68
Mali	2312	8376	15386	40664	30.2	30.2	30.2	14.6	44.7	0.89
Mauritania	199	1310	2095	9713	6.2	6.2	6.2	2.6	8.8	0.74
Mozambique	1545	7810	11005	39709	21.1	21.1	21.1	9.8	30.9	0.68
Myanmar	907	3377	16143	43734	415.9	415.9	415.9	71.7	487.6	0.57
Nepal	1649	5868	13871	36048	39.5	39.5	39.5	13.5	53.0	0.82
Niger	3215	12688	12628	36119	10.3	10.3	10.3	10.0	20.3	0.63
Nigeria	10989	43848	106478	307702	133.3	133.3	133.3	125.7	259.1	0.46
Pakistan	3132	24450	57884	316758	316.6	316.6	316.6	119.5	436.1	0.50
Papua New Guinea	101	516	1762	6416	27.1	27.1	27.1	5.9	33.0	0.97
Rwanda	434	5502	2135	18733	8.3	8.3	8.3	1.8	10.1	0.57
Senegal	601	2981	4003	14185	32.2	32.2	32.2	15.7	47.9	0.65
Sierra Leone	803	5360	3377	15897	4.9	4.9	4.9	2.3	7.2	0.88
Somalia		0		0	0.0	0.0	0.0	8.6	8.6	0.17
Sri Lanka	25	298	496	4050	0.0	0.0	0.0	9.5	9.5	0.05
Sudan		0		0	58.2	58.2	58.2	37.1	95.2	0.50
Swaziland	13	107	209	1167	2.9	2.9	2.9	1.8	4.7	0.27
Tajikistan	30	186	1838	8032	5.7	5.7	5.7	2.0	7.6	0.48

Country	Iron									
	Maternal deaths/y due to iron deficiency anemia	Maternal deaths from all causes	Perinatal deaths/y due to iron deficiency anemia	Perinatal deaths from all causes	Value of lost current productivity ($million/y) (Female adults)	Value of lost current productivity/y ($million) (Total)	NPV of lost future productivity/y ($million) (Children)	NPV of lost future productivity/y ($million) (Children)	Total value of lost productivity/y ($million)	Total value of lost productivity/y (as % of GDP)
Tanzania	3468	21210	14885	64404	51.8	51.8	51.8	19.5	71.3	0.65
Togo	226	1379	2370	10253	8.1	8.1	8.1	5.8	13.9	0.62
Turkmenistan	5	34	843	4335	21.5	21.5	21.5	4.4	25.9	0.42
Uganda	1922	14221	10544	54775	20.7	20.7	20.7	17.7	38.4	0.54
Yemen	799	5102	8917	40211	26.3	26.3	26.3	24.7	51.0	0.43
Zambia	559	3615	4471	20422	11.0	11.0	11.0	7.6	18.7	0.38
Zimbabwe	233	4224	1075	13423	58.7	58.7	58.7	10.5	69.2	0.28
Total or % GDP	97441	528335	924191	3926717	7309	7309	7309	2963	10272	0.29

Table B.3 Functional Consequences of Micronutrient Malnutrition: Zinc

Country	Zinc	
	Child deaths (0-59m)/year due to zinc deficiency	NPV of lost future productivity/ year ($million) (Children)
Afghanistan	14094	10.0
Angola	25388	24.2
Azerbaijan	712	1.2
Bangladesh	19187	51.5
Belarus	4	2.9
Benin	2295	4.4
Bhutan	179	1.9
Botswana	193	2.2
Brazil	3690	73.2
Burkina Faso	5391	6.2
Burundi	7049	1.1
Cambodia	5105	4.5
Cameroon	6947	9.8
Central African Republic	1378	1.0
Chad	6199	3.2
China	11677	216.2
Comoros	218	0.5
Congo	1804	3.0
Congo, D R	86779	8.7
Côte d'Ivoire	7042	9.9
Djibouti	182	0.4
East Timor	343	0.7
Equatorial Guinea	153	2.1
Ethiopia	25457	12.4
Gabon	170	2.5
Gambia	523	0.2
Ghana	3628	6.4
Guatemala	1153	39.5
Guinea	6035	3.7
Guinée Bissau	1173	0.3
Haiti	1884	1.6

Country	Zinc	
	Child deaths (0-59m)/year due to zinc deficiency	NPV of lost future productivity/ year ($million) (Children)
India	95691	552.4
Indonesia	8719	125.0
Iraq	4768	32.2
Kenya	10325	14.1
Korea, Dem. People's Rep.	976	217.8
Lao People's Dem. Rep.	655	2.8
Lesotho	276	1.0
Liberia	5024	4.2
Madagascar	8371	9.8
Malawi	8975	3.3
Mali	5007	7.2
Mauritania	842	1.3
Mozambique	17977	4.9
Myanmar	7844	42.5
Nepal	2448	8.5
Niger	5620	5.1
Nigeria	41213	65.4
Pakistan	10235	85.7
Papua New Guinea	246	3.9
Rwanda	6136	2.2
Senegal	3551	5.8
Sierra Leone	11605	0.8
Somalia	3340	3.7
Sri Lanka	182	3.6
Sudan	5139	22.7
Swaziland	205	0.9
Tajikistan	1595	1.5
Tanzania	21420	13.2
Togo	1860	1.5
Turkmenistan	345	2.1
Uganda	13666	11.9
Yemen	3022	22.9

Country	Zinc	
	Child deaths (0-59m)/year due to zinc deficiency	NPV of lost future productivity/ year ($million) (Children)
Zambia	7315	6.7
Zimbabwe	4295	13.0
Total	564921	1804.9
PAR (%) or % of GDP	0.055	0.05

Table B.4 Economic Productivity Consequences of Iron, Iodine and Zinc

Note: Anemia prevalences for older children and men are missing so these groups are not included in the iron results presented here. Also missing are estimates of lost productivity due to childhood blindness and nightblindness associated with vitamin A deficiency.

Country	Iodine	Iron						Zinc			
	NPV of lost future productivity/year due to iodine deficiency ($million)	Value of lost current productivity ($million/y) (Female adults)	Value of lost current productivity ($million/y) (Male adults)	Value of lost current productivity/year ($million) (Total)	NPV of lost future productivity/year ($million) (Children)	Total value of lost productivity/year ($million)	Total value of lost productivity/year (as % of GDP)	NPV of lost future productivity/year ($million) (Children)	Total value of lost productivity/year (iodine + iron + zinc) ($millions)	Total value of lost productivity/year (iodine + iron + zinc) (as % of GDP)	Equivalent work days lost per worker per year
Afghanistan	55.4	10.3	0.0	10.3	7.4	17.6	0.30	10.0	83.0	1.4	83.8
Angola	133.8	66.0	0.0	66.0	14.8	80.8	0.52	24.2	238.8	1.5	65.3
Azerbaijan	20.4	22.0	0.0	22.0	3.8	25.7	0.35	1.2	47.4	0.7	15.2
Bangladesh	296.7	143.0	0.0	143.0	59.0	202.0	0.38	51.5	550.2	1.0	447.6
Belarus	38.7	0.0	0.0	0.0	0.0	0.0	0.00	2.9	41.6	0.2	7.0
Benin	41.1	27.6	0.0	27.6	11.1	38.7	0.89	4.4	84.2	1.9	43.4
Bhutan	11.7	7.4	0.0	7.4	3.8	11.2	0.65	1.9	24.9	1.4	8.4
Botswana	34.7	11.5	0.0	11.5	5.7	17.2	0.22	2.2	54.1	0.7	3.4
Brazil	278.9	410.0	0.0	410.0	437.8	847.8	0.16	73.2	1200.0	0.2	117.3
Burkina Faso	46.6	22.5	0.0	22.5	13.9	36.4	0.80	6.2	89.2	2.0	68.3
Burundi	7.2	4.3	0.0	4.3	1.5	5.8	0.93	1.1	14.1	2.3	50.0
Cambodia	9.0	27.7	0.0	27.7	6.5	34.2	0.77	4.5	47.7	1.1	47.6
Cameroon	77.2	47.9	0.0	47.9	23.4	71.3	0.56	9.8	158.3	1.2	48.8
Central African Republic	8.0	7.3	0.0	7.3	2.9	10.2	0.81	1.0	19.1	1.5	16.3
Chad	29.2	15.3	0.0	15.3	9.7	25.0	0.84	3.2	57.4	1.9	47.2
China	940.3	2129.9	0.0	2129.9	302.0	2431.9	0.17	216.2	3588.4	0.2	1181.1
Comoros	4.4	0.0	0.0	0.0	0.0	0.0	0.00	0.5	4.9	1.1	2.4
Congo	38.8	11.7	0.0	11.7	7.3	19.0	0.50	3.0	60.7	1.6	14.6
Congo, D R	60.7	35.6	0.0	35.6	13.7	49.3	0.80	8.7	118.7	1.9	259.5
Côte d'Ivoire	103.3	38.5	0.0	38.5	19.9	58.3	0.39	9.9	171.5	1.2	49.3
Djibouti	5.8	0.0	0.0	0.0	0.0	0.0	0.00	0.4	6.3	0.9	1.5
East Timor	1.6	1.0	0.0	1.0	0.3	1.3	0.35	0.7	3.5	1.0	2.6
Equatorial Guinea	26.7	0.0	0.0	0.0	0.0	0.0	0.00	2.1	28.8	1.0	1.1
Ethiopia	74.5	12.4	0.0	12.4	19.8	32.2	0.43	12.4	119.1	1.6	298.4
Gabon	38.0	9.7	0.0	9.7	7.4	17.1	0.27	2.5	57.6	0.9	3.4

Country	Iodine	Iron						Zinc	Total value of lost productivity/year (iodine + iron + zinc) ($millions)	Total value of lost productivity/year (iodine + iron + zinc) (as % of GDP)	Equivalent work days lost per worker per year
	NPV of lost future productivity/year due to iodine deficiency ($million)	Value of lost current productivity ($million/y) (Female adults)	Value of lost current productivity ($million/y) (Male adults)	Value of lost current productivity/year ($million) (Total)	NPV of lost future productivity/year ($million) (Children)	Total value of lost productivity/year ($million)	Total value of lost productivity/year (as % of GDP)	NPV of lost future productivity/year ($million) (Children)			
Gambia	3.2	2.0	0.0	2.0	0.9	2.9	0.68	0.2	6.3	1.5	6.6
Ghana	56.2	37.4	0.0	37.4	16.3	53.7	0.66	6.4	116.3	1.4	94.7
Guatemala	85.8	26.3	0.0	26.3	34.9	61.2	0.24	39.5	186.5	0.7	19.1
Guinea	39.2	18.7	0.0	18.7	10.5	29.2	0.68	3.7	72.1	1.7	44.1
Guinée Bissau	2.9	1.5	0.0	1.5	0.7	2.2	0.86	0.3	5.4	2.1	8.0
Haiti	3.4	13.4	0.0	13.4	4.6	18.0	0.61	1.6	22.9	0.8	16.9
India	2888.8	2108.1	0.0	2108.1	950.8	3058.9	0.49	552.4	6500.1	1.0	3024.2
Indonesia	319.6	604.2	0.0	604.2	151.4	755.5	0.35	125.0	1200.1	0.6	367.0
Iraq	348.6	0.0	0.0	0.0	0.0	0.0	0.00	32.2	380.7	0.6	28.8
Kenya	154.2	57.9	0.0	57.9	36.3	94.2	0.61	14.1	262.4	1.7	167.6
Korea, DPR	279.1	0.0	0.0	0.0	212.1	212.1	0.05	217.8	708.9	0.2	10.2
Lao PDR.	5.9	11.6	0.0	11.6	3.4	15.0	0.68	2.8	23.7	1.1	18.5
Lesotho	6.1	3.5	0.0	3.5	1.2	4.7	0.41	1.0	11.8	1.0	4.4
Liberia	30.4	19.8	0.0	19.8	8.3	28.1	0.95	4.2	62.6	2.1	16.1
Madagascar	63.0	24.0	0.0	24.0	13.5	37.5	0.62	9.8	110.3	1.8	91.9
Malawi	20.5	9.3	0.0	9.3	4.4	13.7	0.68	3.3	37.5	1.9	63.4
Mali	54.2	30.2	0.0	30.2	14.6	44.7	0.89	7.2	106.1	2.1	71.8
Mauritania	10.4	6.2	0.0	6.2	2.6	8.8	0.74	1.3	20.5	1.7	13.8
Mozambique	40.8	21.1	0.0	21.1	9.8	30.9	0.68	4.9	76.6	1.7	98.1
Myanmar	100.8	415.9	0.0	415.9	71.7	487.6	0.57	42.5	630.9	0.7	121.3
Nepal	40.3	39.5	0.0	39.5	13.5	53.0	0.82	8.5	101.8	1.6	112.9
Niger	36.4	10.3	0.0	10.3	10.0	20.3	0.63	5.1	61.8	1.9	68.9
Nigeria	460.9	133.3	0.0	133.3	125.7	259.1	0.46	65.4	785.4	1.4	419.4
Pakistan	579.2	316.6	0.0	316.6	119.5	436.1	0.50	85.7	1101.0	1.3	454.0
Papua New Guinea	3.9	27.1	0.0	27.1	5.9	33.0	0.97	3.9	40.8	1.2	20.2
Rwanda	16.7	8.3	0.0	8.3	1.8	10.1	0.57	2.2	29.0	1.6	45.8
Senegal	61.1	32.2	0.0	32.2	15.7	47.9	0.65	5.8	114.7	1.6	46.9

Country	Iodine	Iron						Zinc	Total value of lost productivity/year (iodine + iron + zinc) ($millions)	Total value of lost productivity/year (iodine + iron + zinc) (as % of GDP)	Equivalent work days lost per worker per year
	NPV of lost future productivity/year due to iodine deficiency ($million)	Value of lost current productivity ($million/y) (Female adults)	Value of lost current productivity ($million/y) (Male adults)	Value of lost current productivity/year ($million) (Total)	NPV of lost future productivity/year ($million) (Children)	Total value of lost productivity/year ($million)	Total value of lost productivity/year (as % of GDP)	NPV of lost future productivity/year ($million) (Children)			
Sierra Leone	6.9	4.9	0.0	4.9	2.3	7.2	0.88	0.8	15.0	1.8	22.3
Somalia	49.6	0.0	0.0	0.0	8.6	8.6	0.17	3.7	61.9	1.3	23.4
Sri Lanka	70.3	0.0	0.0	0.0	9.5	9.5	0.05	3.6	83.4	0.4	24.0
Sudan	136.0	58.2	0.0	58.2	37.1	95.2	0.50	22.7	254.0	1.3	107.6
Swaziland	9.1	2.9	0.0	2.9	1.8	4.7	0.27	0.9	14.7	0.9	1.9
Tajikistan	9.7	5.7	0.0	5.7	2.0	7.6	0.48	1.5	18.8	1.2	18.6
Tanzania	89.5	51.8	0.0	51.8	19.5	71.3	0.65	13.2	174.0	1.6	180.3
Togo	18.9	8.1	0.0	8.1	5.8	13.9	0.62	1.5	34.2	1.5	22.9
Turkmenistan	26.2	21.5	0.0	21.5	4.4	25.9	0.42	2.1	54.1	0.9	12.2
Uganda	107.8	20.7	0.0	20.7	17.7	38.4	0.54	11.9	158.2	2.2	164.2
Yemen	98.7	26.3	0.0	26.3	24.7	51.0	0.43	22.9	172.5	1.5	58.6
Zambia	43.5	11.0	0.0	11.0	7.6	18.7	0.38	6.7	68.9	1.4	41.3
Zimbabwe	141.6	58.7	0.0	58.7	10.5	69.2	0.28	13.0	223.7	0.9	31.9
TOTAL	8902.0	7309	0	7309	2963	10272		1804.9	20979.3		9047.0
% of GDP	0.23					0.29		0.05	0.57		

Table B.5 Health Consequences of Vitamin A, Iron, Iodine and Zinc Deficiencies

Country	Child deaths (0-59m)/y due to vitamin A deficiency	Maternal deaths/y due to vitamin A deficiency	Babies born with intellectual impairment due to iodine deficiency disorders	Maternal deaths/y due to iron deficiency anemia	Perinatal deaths/y due to iron deficiency anemia	Child deaths (0-59m)/y due to zinc deficiency
Afghanistan	40596	1754	372946	7976	39332	14094
Angola	22597	812	188963	2074	9898	25388
Azerbaijan	205	8	28764	17	1106	712
Bangladesh	20071	1158	894642	2212	33744	19187
Belarus	30	2	25024			4
Benin	5095	152	94794	850	5520	2295
Bhutan	324	50	15708	56	804	179
Botswana	456	3	12804	3	209	193
Brazil	4071	916	107213	1522	13583	3690
Burkina Faso	19318	1114	169645	1678	8824	5391
Burundi	7940	233	116525	710	4340	7049
Cambodia	4947	87	37296	490	7019	5105
Cameroon	4615	102	130946	691	5661	6947
Central African Republic	5189	98	35183	303	1968	1378
Chad	10780	329	118364	908	5562	6199
China	16876	272	930998	783	49419	11677
Comoros	159	8	8260			218
Congo	1190	57	44270	145	1368	1804
Congo, D R	55565	1805	720902	8717	59951	86779
Côte d'Ivoire	12136	272	173530			7042
Djibouti	209	12	7965			182
East Timor	1074	26	4704	72	594	343
Equatorial Guinea	320	12	5359			153
Ethiopia	90907	8513	944295	1948	17911	25457
Gabon	333	10	9553	46	494	170
Gambia	961	17	13468	80	982	523
Ghana	5709	191	178192	864	6348	3628

Country	Child deaths (0-59m)/y due to vitamin A deficiency	Maternal deaths/y due to vitamin A deficiency	Babies born with intel-lectual impairment due to iodine deficiency disorders	Maternal deaths/y due to iron deficiency anemia	Perinatal deaths/y due to iron deficiency anemia	Child deaths (0-59m)/y due to zinc deficiency
Guatemala	846	55	38889	70	875	1153
Guinea	5191	173	102564	700	6666	6035
Guinée Bissau	1778	55	22015	144	942	1173
Haiti	2171	44	12593	419	3170	1884
India	168702	35624	6129214	22834	292040	95691
Indonesia	22653	114	369516	1581	20424	8719
Iraq	7584	145	201348			4768
Kenya	24073	853	426865	2653	11461	10325
Korea, DPR	658	13	17278	25	1355	976
Lao PDR.	1083	333	17472	206	1834	655
Lesotho	725	16	14259	41	313	276
Liberia	6345	78	45325	313	3996	5024
Madagascar	10278	700	215940	667	5986	8371
Malawi	6573	1067	167265	2479	8074	8975
Mali	24283	1187	180782	2312	15386	5007
Mauritania	1640	77	33929	199	2095	842
Mozambique	11152	299	230395	1545	11005	17977
Myanmar	4988	464	78792	907	16143	7844
Nepal	5339	1032	188734	1649	13871	2448
Niger	20244	748	205387	3215	12628	5620
Nigeria	118823	2584	1419579	10989	106478	41213
Pakistan	26175	1441	1163820	3132	57884	10235
Papua New Guinea	1110	46	7568	101	1762	246
Rwanda	1909	903	115935	434	2135	6136
Senegal	7516	176	111888	601	4003	3551
Sierra Leone	8233	316	69412	803	3377	11605
Somalia	7974	248	112690			3340
Sri Lanka	210	28	77112	25	496	182
Sudan	8581	406	295251			5139

Country	Child deaths (0-59m)/y due to vitamin A deficiency	Maternal deaths/y due to vitamin A deficiency	Babies born with intel-lectual impairment due to iodine deficiency disorders	Maternal deaths/y due to iron deficiency anemia	Perinatal deaths/y due to iron deficiency anemia	Child deaths (0-59m)/y due to zinc deficiency
Swaziland	707	6	8439	13	209	205
Tajikistan	401	11	44268	30	1838	1595
Tanzania	23135	1250	417130	3468	14885	21420
Togo	3475	81	62678	226	2370	1860
Turkmenistan	199	2	25942	5	843	345
Uganda	24043	2363	476720	1922	10544	13666
Yemen	9646	301	182580	799	8917	3022
Zambia	16185	897	142190	559	4471	7315
Zimbabwe	5897	470	113280	233	1075	4295
TOTAL	922201	72618	18935357	97441	924191	564921
(%)	9.0	13.3	19.4	18.4	23.5	5.5

ANNEX C

Technical Notes

Evidence on Infectious Diseases and VMDs

The threat of global pandemics and new infections has received more attention recently than before. This merits a more detailed exploration of the literature on VMDs and immune function and infections. There is good evidence that the lack of adequate micronutrients, especially zinc, selenium, iron, and the antioxidant vitamins (e.g. vitamin A, C and E), can lead to clinically significant immune deficiency and more frequent as well as more severe infections in children and adults (Cunningham-Rundles et al 2005). Nutrients act as antioxidants and as cofactors at the sub-cellular level. Some of these impacts may be mediated through the endocrine system.

The impact of vitamin A on specific components of the immune system that translate to protection from infectious disease severity, duration and adverse outcomes is well established (Villamor and Fawzie, 2005)[1]. There is evidence that sufficient iron is essential for immune function (Beard 2001), and also that excess iron may exacerbate some diseases

(i) Immune Function

- **Vitamin A:** Vitamin A's effects on morbidity from measles are related to enhanced antibody production and lymphocyte proliferation (Villamor and Fawzie, 2005). Its effects on morbidity from severe diarrhea are related to sustaining the integrity of mucosal epithelia in the gut, and among HIV-infected children to increased T-cell lymphopoiesis. There is no conclusive evidence for a direct effect of vitamin A supplementation on cytokine production or lymphocyte activation. Under certain circumstances, vitamin A supplementation in infants has the potential to improve the antibody response to some vaccines, including tetanus and diphtheria toxoids and measles. There is limited research on the effects of vitamin A supplementation in adults and the elderly on their immune function; currently available data provide no consistent evidence for beneficial effects.
- **Iron:** There is evidence that sufficient iron is essential for immune function (Beard 2001), and also that excess iron may exacerbate some diseases. The evidence from experimental trials does not suggest that iron supplementation reduces morbidity; in some cases it has been associated with increased morbidity, most notably malaria and respiratory infections in malarious areas (Oppenheimer 2001). We do know that immune function is compromised in iron deficient subjects (Chandra et al 1975). Iron is required during the development of neutrophils in the bone marrow (Walter et al 1986). In children with iron deficiency anemia, bactericidal capacity of polymorphonuclear leukocytes (PMN) was shown to decline and was restored after iron therapy (Yetgin et al 1979). In one study, abnormalities of the immune system could be detected in subclinical iron deficiency before the development of clinical anemia, suggesting that altered immunologic function was an early manifestation of iron deficiency and normal results were obtained two to three months after iron therapy was begun (Macdougall et al, 1975). Dallman (1987) concluded that in iron- deficient patients abnormalities in cell- mediated immunity and ability of neutrophils to kill several types of bacteria have been well established under experimental conditions. However, the risk of increased morbidity and its adverse outcomes remains

1 *Villamor E, Fawzi WW* 2005. Effects of vitamin a supplementation on immune responses and correlation with clinical outcomes. Clin Microbiol Rev. 2005 Jul;18(3):446-64. Review

and was recently documented in a study of iron supplementation in young children in a high malaria prevalence region in Pemba, Tanzania.

- **Zinc:** Zinc deficiency decreases the ability of the body to respond to infection, affecting both cell-mediated immune responses and humoral responses (Shankar and Prasad 1998). Zinc is known to be essential for all highly proliferating cells in the human body, especially the immune system. A variety of in vivo and in vitro effects of zinc on immune cells mainly depend on the zinc concentration (Ibs and Rink 2003). All kinds of immune cells show decreased function after zinc depletion. In monocytes, all functions are impaired, whereas in natural killer cells, cytotoxicity is decreased, and in neutrophil granulocytes, phagocytosis is reduced. The normal functions of T cells are impaired. Impaired immune functions due to zinc deficiency are shown to be reversed by adequate zinc supplementation. Zinc deficiency has also been hypothesized to exacerbate malaria, HIV infection and tuberculosis, that rely on macrophage killing of infected cells (Shankar and Prasad 1998).

Table: A

The estimated relative risks associated with vitamin A deficiency in children are:

- 1.86 (95% CI 1.32–2.59) for measles mortality,
- 2.15 (95% CI 1.83–2.58) for diarrhoea mortality,
- 1.13 (95% CI 1.01–1.32) for other infectious disease mortality including malaria

Source: Caulfield et al 2005.

Note: Randomized controlled trial data of vitamin A interventions and survival provide the basis for estimating the risk of mortality associated with vitamin A deficiency. Relative risks were calculated from meta-analyses (for measles, diarrhoea, and other infectious disease causes of child mortality). Single studies (malaria mortality among children and all-cause maternal mortality) indicate large effects for additional conditions

Table: B

The estimated relative risks associated with zinc deficiency in children are:

- 1.52 (95% CI 1.20–1.89) for pneumonia morbidity,
- 1.28 (95% CI 1.10–1.49) for diarrhoea morbidity,
- 1.56 (95% CI 1.29–1.89) for malaria morbidity.

Source: Caulfield and Black 2005.

Note: Randomized controlled trials of zinc supplementation and health outcomes provide the basis for estimating the risk of morbidity and mortality associated with vitamin zinc deficiency. Nine studies were on diarrhea outcomes, five contributed to the findings on pneumonia outcomes, and three contributed on the risk of malaria outcomes. Therapeutic use of zinc supplements are not included here.

(ii) VMDs and HIV AIDS

- **Vitamin A Supplementation in HIV Infected Children:** Wiysonge et al (2005) conducted a Cochrane review to assess the effects of antenatal and intrapartum vitamin A supplementation on the risk of MTCT of HIV infection and infant and maternal mortality and morbidity and concluded that currently available evidence does not support the use of vitamin A supplementation of HIV-infected pregnant women to reduce MTCT of HIV, though there is an indication that vitamin A supplementation improves birth weight. Semba et al (2005) conducted a randomized, double-blind, placebo-controlled clinical trial of vitamin A supplementation on 6-month old HIV-infected children in Uganda. There are other studies also demonstrating the benefits of VAS in HIV+ children – in South Africa and most recently in Zimbabwe (in press) where single dose neonatal VAS reduced mortality among in-utero infected infants by 28% (Piwoz, personal communication). Mortality rates among 87 children in the vitamin A group and 94 children in the control group were 20.6% and 32.9%, respectively, yielding a relative risk of 0.54 (95% confidence interval, 0.30 to 0.98; P = 0.044) after adjusting for baseline weight-for-height Z score.
- **HIV AIDS Disease Progression:** Irlam et al (2005) assessed whether micronutrient supplements are effective in reducing morbidity and mortality in adults and children already infected with HIV. Fifteen trials were included. Six trials comparing vitamin A/beta-carotene with placebo in adults failed to show any effects on mortality, morbidity, CD4 and CD8 counts, or on viral load. Four trials of other micronutrients in adults did not affect overall mortality, although there was a reduction in mortality in a low CD4 subgroup. In a large Tanzanian trial in pregnant and lactating women, daily multivitamin supplementation was associated with a number of benefits to both mothers and children: a reduction in maternal mortality from AIDS-related causes; a reduced risk of progression to stage four disease; fewer adverse pregnancy outcomes; less diarrhoeal morbidity; and a reduction in early-child mortality among immunologically- and nutritionally-compromised women. Wasting is a strong independent predictor of mortality in HIV-infected persons and Villamor et al (2005) found that vitamins C and E and the vitamin B complex have a protective effect on wasting in HIV-infected women. There is evidence of benefit of vitamin A supplementation in children. The current WHO recommendation is to promote and support adequate dietary intake of micronutrients at one RDA levels for all populations whether at risk of HIV or not. Zinc supplementation can decrease the incidence of diarrhoea and pneumonia in children in resource-poor countries. To test the safety of zinc supplementation in children with HIV-1 infection, Bobat et al (2005)2 randomly assigned children with HIV-1 infection to receive 10 mg of elemental zinc as sulphate or placebo daily for 6 months. No increase in HIV-1 viral load was detected and children given zinc supplementation were less likely to get watery diarrhoea than those given placebo..
- **Quality of Life Among HIV AIDS Survivors:** There are a lot of data suggesting that Hb levels are independently and inversely associated with mortality in HIV+ adults. It is also associated with risk of MTCT. The impact of iron supplements and/or strategies for treating anemia in the presence of HIV needs to be elucidated since low HB may have nutritional or disease

2 *Bobat R, Coovadia H, Stephen C, Naidoo KL, McKerrow N, Black RE, Moss WJ.* 2005. Safety and efficacy of zinc supplementation for children with HIV-1 infection in South Africa: a randomised double-blind placebo-controlled trial. Lancet. 2005 Nov 26;366(9500):1862-7.

related origins (Piwoz, personal communication 2005). This question is also important because AZT and possibly other drugs affect red blood cell production and their use is contraindicated in patients with low HB. AZT is a front line ARV medication.With the expanded use of effective drugs, assuring quality of life in HIV AIDS survivors is a major objective of AIDS control programs globally. In a multicenter, prospective, cohort study involving 19 clinics in the United States, Semba et al (2005) studied 1406 individuals, 13 years and older at baseline and at 3- to 6-months. Energy and physical functioning scores were the main outcomes. At baseline, a higher hemoglobin level was associated with a higher energy score and a higher physical functioning score ($P < .001$ for both), after adjusting for CD4 lymphocyte count, sex, age, education, and HIV risk factor. In longitudinal analyses, increases in hemoglobin were associated with increases in energy and physical functioning scores ($P < .001$ for both), after adjusting for CD4 lymphocyte count, sex, age, education, and HIV risk factor. Changes in the energy scales were, on average, 1.5 and 2.3 scale points per 1-g/dL change in hemoglobin level in the normal and anemic ranges, respectively. For the physical functioning scale, average changes were 2.7 and 2.6 scale points per 1-g/dL change in hemoglobin level in the normal and anemic ranges, respectively. Higher levels of hemoglobin are associated with better quality of life among individuals with AIDS. Changes in hemoglobin level within the conventional normal range of hemoglobin were also significantly associated with reported changes in quality of life.

(iii) VMDs and Malaria

Shankar and others[51] conducted a meta-analysis of 12 published and unpublished placebo-controlled iron supplementation trials[7,46,52–61] to examine the effect of iron supplementation on malaria morbidity. Overall, there was a significantly heightened risk of infection as measured at the end of the study associated with malaria and iron supplementation (1.17, 95% CI = 1.08–1.25). Iron supplementation appeared to increase risk of a malaria attack (1.09, 95% CI= 0.92–1.30; 8 studies) and spleen enlargement (1.12, 95% CI = 0.99–1.26; 6 studies), although the increases were not significant. The hematologic improvements in the iron supplementation groups summarized over the studies were significant and included an average increase in hemoglobin levels of 1.2 g/dL (95% CI = 1.2–1.3) and a 50% decrease in the risk of severe anemia (95% CI = 45–54%). A recent field trial of iron supplementation in a high malaria setting in Pemba, Tanzania resulted in an increased number of hospitalized children. [45] Consensus has not yet been reached on the risks and benefits associated with iron supplementation and malaria morbidity and mortality.[50]

Numerous animal studies have demonstrated the role of zinc in the immune response to infectious disease.[65] Based on the prevalences of inadequate zinc intake and the relative risk calculated from the pooled analyses of zinc supplementation trails, zinc deficiency in children 0–4 years old may be responsible for approximately 20% of malaria clinic attacks and 193,000 malaria deaths each year.

(iv) VMD and TB

Tuberculosis (TB)[4] is on the increase throughout the world and is one of the most important causes of death among adults in developing countries. In 1993, the WHO declared TB to be a "global health emergency" (Reichman 1996✤). TB is also commonly found in association with

HIV AIDS. Micronutrient deficiencies are important as predisposing factors and as adjunct therapy for recovery from TB. Karyadi et al (2000) showed that the nutritional status of patients with active pulmonary TB was poor compared with healthy controls in Indonesia. The prevalence of anemia and low concentrations of plasma retinol and zinc was significantly higher in patients than in controls (see Figure below).

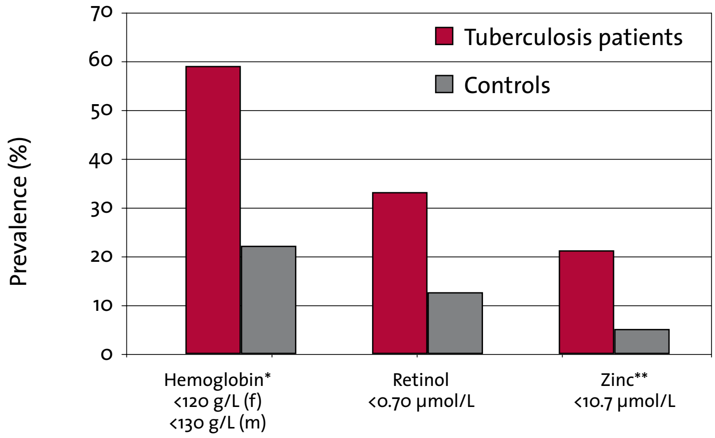

Figure A. The prevalence of low hemoglobin, retinol and zinc in active tuberculosis patients (n = 41, 30 and 38, respectively) and healthy controls (n = 41, 30 and 39, respectively) in Jakarta, Indonesia; f = female; m = male. Asterisks indicate significant difference between patients and controls, *P < 0.05; **P < 0.01 (χ^2 test).

Wiid et al (2004) found that total antioxidant levels including vitamin A and zinc were low during active TB and rose with anti-tuberculosis therapy; they suggested that total antioxidant status of TB patients should be considered for more effective disease control and that diets low in antioxidants may render individuals susceptible to tuberculosis. In a cross-sectional study involving 579 HIV-positive and 222 HIV-negative adults with pulmonary tuberculosis in Malawi, wasting and higher HIV load in pulmonary tuberculosis were associated with micronutrient malnutrition (van Lettow et al 2004). In a randomized, double-blind placebo-controlled 2 x 2 trial of zinc and multi-micronutrient (MMN) supplementation in pulmonary TB patients in Tanzania, neither zinc nor MMN supplementation had significant effects on culture conversion, but MMN supplementation increased weight gain in TB patients (Range et al 2005).

ANNEX D

Institutions

Excerpts from World Bank, 2006. Repositioning Nutrition, Technical Annexes

Annex D.1 Institutions Involved in Micronutrient and other Nutrition Programs

Types	Organizations	General Malnutrition	Micronutrients	HIV and nutrition	Food policy/ Agriculture/ rural development	Nutrition in Maternal & Child Health/Child feeding
UN Agencies	UNICEF	X	X			X
	SCN				X	
	WFP		X		X	X
	IFAD					
	WHO	X	X		X	X
	FAO		X	X	X	
Multilateral Agencies	World Bank	X	X		X	X
	ADB	X			X	X
Bilateral Agencies	DFID				X	
	SIDA				X	
	CIDA		X			X
	USAID	X		X	X	X
	BMZ				X	
	GTZ				X	
	DANIDA					X
	NORAD					
	JICA				X	
	Dutch					
	Ireland AID					
Public/Pvt Partnerships	GAIN		X			
	WABA					X
Private Sector	Manoff group		X			X
NGOs	AED			X	X	X
	HKI		X		X	
	MI		X			
	MOST		X			
	CARE	X		*	X	X
	La Leche League					X

Types	Organizations	General Malnutrition	Micronutrients	HIV and nutrition	Food policy/ Agriculture/ rural development	Nutrition in Maternal & Child Health/Child feeding
	AKF					X
Government Agencies	CDC		X			X
Academic/Research Institutions	Harvest Plus				X	
	IFPRI/CGIAR			X**	X	
	Institute for Development Studies				X	

Annex D.1 Institutions Involved in Micronutrient and Other Nutrition Programs

	Organizations	Commitment Building			Capacity Development			Mainstreaming nutrition into PRSCs, PRSPs and SWAps			Monitoring and evaluation			Research		
		G	N	SN	G	N	SN	G	N	SN	G	N	SN	T	A	O
UN Agencies	UNICEF					X					X					X
	SCN	X									X					
	WFP															X
	IFAD															
	WHO	X			X						X					X
	FAO	X				X					X					
Multilateral Agencies	World Bank	X	X		X	X			X		X	X				
	ADB					X									X	X
Bilateral Agencies	DFID	X	X		X?			X	X						X	
	SIDA															
	CIDA															
	USAID											X				
	BMZ											X				
	GTZ														X	
	DANIDA		X												X	
	NORAD***					X										
	JICA															
	Ireland AID															
Public/Private Partnerships	GAIN	X				X									X	
	WABA		X			X										
Private Sector	Manoff group											X			X	
NGOs	AED		X			X										X
	HKI					X						X			X	X
	MI					X						X		X	X	
	MOST	X	X			X						X				
	CARE					X										
	La Leche League						X****									
	AKF					X										
Government Agencies	CDC											X		X	X	

	Organizations	Commitment Building			Capacity Development			Mainstreaming nutrition into PRSCs, PRSPs and SWAps			Monitoring and evaluation			Research		
		G	N	SN	G	N	SN	G	N	SN	G	N	SN	T	A	O
Academic/ Research Inst.	Harvest Plus														X	
	IFPRI/CGIAR	X				X									X	X
	Institute for Development Studies														X	

Note:
G Global
N National
SN sub-national
T Technological research
A Applied research
O Operational research
* as it relates to food security
*** as it relates to food security
** Provides monetary support
*** Provide education to mothers on breastfeeding practices within the US

Annex D.2 Mandate and focus of development partners in nutrition (including micronutrient programs)

Org/Institutions	Mission Statement/Mandate	Nutrition strategy
UN Agencies **WHO/Dept of Nutrition for Health and Development (NHD)**	The importance of WHO's role in promoting nutrition is well elucidated. "Because of the fundamental role nutritional well-being plays in health and human development, and the worldwide magnitude of malnutrition-related mortality and morbidity, WHO has always included nutrition promotion, and the prevention and reduction of malnutrition, among its key health-promotion instruments"	▪ WHO shares responsibility with UNICEF in reporting on child mortality, maternal health, nutritional status etc ▪ WHO along with FAO convened International Conference on Nutrition, 1992. **Key documents include:** *Turning the Tide of Malnutrition: Responding to the challenge of the 21st century*; Nutrition for Health and Development: A global agenda for combating malnutrition, 2000 ▪ Consistent with 9 goals and 9 strategies of the World declaration and Plan of Action for Nutrition, NHD works through 7 priority areas of action --multisectoral framework ▪ The main Objectives: 1 Capacity building for assessing and addressing nutrition related problems, development of nutrition policies and programs 2 Help develop scientific knowledge, methodologies, standards, strategies etc. for detecting and preventing all forms of malnutrition-deficiencies and excesses including improvements in horticulture and farming systems. 3 Promote sustainable health and nutrition benefits of targeted food and development projects. Works with WFP to ensure effectiveness of food aid interventions 4 Maintains global data base for M&E and reporting on world's major forms of malnutrition, effectiveness of programs and towards achieving targets at national, regional and global levels.
WHO/NHD		▪ The seven priority areas are: PEM: Management of severe malnutrition; Spearheading a study to recalculate and overhaul existing growth curves 1 Micronutrients: With partners NHD provides technical tools, scientific standards, guidelines and methodologies to build up national programs such as salt iodization programs; evaluate IDD programs in collaboration with UNICEF; maintain the Global databank on IDD; promoting breast feeding, supplementation; food fortification and home gardens for eradicating vitamin A deficiencies; increasing iron intake, and infection control. Conduct research on vitamin A supplementation. 2 Obesity: Awareness raising; developing strategies that will make healthy choices easier to make; Collaborating to calculate economic impact of obesity and to analyze the impact of globalization and rapid economic transition on nutrition 3 Infant feeding: ‣ Promoting baby friendly hospital initiative with UNICEF ‣ Intensifying technical support to improve complementary feeding practices 4 Emergencies: Provision of manuals and guidelines on managing nutrition in emergencies; rapid nutrition assessments; promoting safe feeding practices and caring for the nutritionally vulnerable 5 Guiding food aid for development: ‣ WHO's Food Aid for Development (FAD) office assists elaboration of WFP's policies, guidelines and country programs. ‣ It assists WFP in identification, formulation and evaluation of supplementary feeding programs. 6 Developing effective food and nutrition polices and programs: ‣ WHO sees household food security as a basic human right? Undertaking a multi country, multi disciplinary study since 1995 examining causal factors of malnutrition ▪ Other priority areas include developing Global Nutrition Data Banks and global network of collaborating centers in nutrition ▪ Advisory group on Nutrition and HIV/AIDS.

<table>
<tr><th>Org/Institutions</th><th>Mission Statement/Mandate</th><th>Nutrition strategy</th></tr>
<tr><td>UNICEF</td><td>Mandated to advocate for the protection of children’s rights, to help meet their basic needs and to expand their opportunities to reach their full potential.
Nutrition is one of the eight key program areas</td><td>Nutrition strategy is their conceptual framework developed in 1990
Focus areas include:
1 Micronutrients:
Works with governments in both donor and developing countries to develop innovative programs to deliver micronutrients in foods or through health care services. Salt iodization, folate capsules and Vit. A supplementation (DFID is a partner supplying capsules). Assists countries to formulate and use national recommendations on multi-micronutrients
▪ Not much focus on food based strategies
2 Infant and child feeding:
▪ promotion of EBF, timely introduction of complementary foods
▪ Also on the forefront of developing policy guidelines for infant feeding in HIV; capacity building of national institutions to develop their own guidelines, training including training in counseling of mothers in infant feeding choices
▪ Immunization Plus as part of Child Health Weeks including malaria components in some countries
3 Maternal nutrition/LBW: Low Birth Weight Prevention Initiative is being piloted in 11 countries. The initiative includes the use of multiple micronutrient supplements for pregnant women.
▪ will complement UNICEF’s Care for Women and Children Initiative, which focuses on women’s education, workload, physical health and nutrition status, emotional well-being, reproductive health, and care during pregnancy and lactation.
4 Growth Monitoring and Promotion (GMP):
▪ Working with WHO to develop a new international growth reference standard. Support for growth monitoring in more than 40 countries
▪ Expansion of therapeutic centers for severely malnourished children, esp. in emergencies
5 Community based programs:
▪ Strengthens local capacities to run such programs
▪ Triple A approach for community mobilization
6 Nutrition information and surveillance systems:
▪ Supports generation of data on many key indicators of children and women’s well-being including their nutrition status
▪ Supports updated data on selected nutrition indicators is the “childinfo” site
▪ Active involvement in FIVIMS
7 Emergencies: Most of the above in emergencies
▪ Research and Development: Development of complementary food supplements and social marketing of these supplements
▪ Conducts national and regional nutrition surveillance to analyze the possible links between malnutrition and HIV/AIDS in Southern Africa</td></tr>
</table>

Org/Institutions	Mission Statement/Mandate	Nutrition strategy

WFP
 	
(new nutrition cell?)
	As the food aid arm of the UN, WFP uses its food to:
	▪ meet emergency needs
	▪ support economic & social development
	"Works to put hunger at the center of the international agenda, promoting policies, strategies and operations that directly benefit the poor and hungry".
		Strategic and Financial Plan 2002-2005: The goal for 2002–2005 is, "Excellence in providing food assistance that enables all planned beneficiaries of WFP relief activities to survive and maintain healthy nutritional status, and enabling the social and economic development of at least 30 million hungry people every year."
		▪ Aligning future polices and operations with "Enabling Development". Policies and guidelines currently exist for procurement and for donors
		▪ Development activities are envisioned to enable hungry poor to work towards sustainable food security, adequate nutrition and economic development
		▪ Combating micronutrient deficiencies
		  ▫ production and low cost blended foods including building national capacities (Pilot in Ethiopia, India, Madagascar, North Korea, Malawi)
		  ▫ piloting standardization of pre-mixed blended foods
		  ▫ provision of fortified commodities-oil and blended food esp. in emergencies, high energy biscuits, iodized slat, wheat and maize flour fortified with vitamins and minerals
		  ▫ Training staff and NGOs in nutrition issues
		▪ Research on dietary diversity as an indicator of food security, and on ration composition quality in relation to nutrition outcomes. Project review committee screens all food interventions and examines quality and appropriateness. Supports research on the micronutrient impact of fortified biscuits derived from wheat. Supports research into effectiveness of blanket complementary food distribution for malnutrition prevention (Haiti)
		▪ Monitors the cost effectiveness of local purchases within country redistribution of foods
		Enabling Development (1999); Reaching mothers and children at
		▪ critical times of their lives (1997)
		▪ Supplementary feeding using blended foods
		▪ School feeding (esp. girls) as women's education could potentially reduce child malnutrition
		▪ Improving livelihoods route to improving nutrition
		▪ Acting early: Improving VAM
		Emerging issues: *Urban food insecurity and HIV.*
		Urban food insecurity: process of understanding the complex socio-economic issues, informal safety nets and how they respond to crisis
		HIV: policy statement (Oct , 2002 draft)

Org/Institutions	Mission Statement/Mandate	Nutrition strategy

Standing Committee on Nutrition (SCN)	The mandate of SCN is to:
	▪ raise awareness of nutrition problems and mobilize commitment to solve them -- at global, regional and national levels
	▪ refine the direction, increase the scale and strengthen the coherence and impact of actions against malnutrition world wide
	▪ promote co-operation amongst UN agencies and partner organizations in support of national efforts to end malnutrition in this generation.
		Three main areas for action:
		1 Promote harmonized approaches among the UN agencies, and between the UN agencies and governmental and non-governmental partners, for greater overall impact on malnutrition.
		2 Review the UN system response to malnutrition overall, monitor resource allocation and collate information on trends and achievements reported to specific UN bodies.
		3 Advocate and mobilize to raise awareness of nutrition issues at global, regional and country levels and mobilize accelerated action against malnutrition.
		Ending Malnutrition by 2020: An Agenda for Change in the Millennium. Final Report to the ACC/SCN by the Commission on the Nutrition Challenges of the 21st Century, February 2000.
		▪ Proposes a new paradigm of nutrition, which incorporates the double burden of udernutrition and diet-related adult diseases.
		▪ Focus on preventable disorders in the middle and old age
		▪ Why have global plans of action such as ICN and WFS not achieved more?
		  ▫ Lack of motivated actors do drive the nutrition agenda
		  ▫ Failure of health and ag.sectors to combine forces for a coherent action. Lack of intersectoral approach highlighted
		New agenda identifies four major tasks:
		1 Assessment of national policies and plans developed in response to SCN
		2 Coordination of UN efforts
		3 New mechanism for developing national polices for diet and physical activity. The commission proposes National Nutrition Councils based on Norwegian and Thai experiences
		4 Acceptance of National Nutrition Councils to be the major focus for international support

IFAD/not clear	IFAD mobilizes resources on concessional terms for programs that alleviate poverty and improve nutrition
	
	Nutrition per se not mentioned
		Enabling the Rural poor to overcome their poverty: Strategic Framework for IFAD 2002-2006:
		"IFAD will continue to work towards enabling the rural poor towards enabling the rural poor to overcome their poverty-as perceived by the poor themselves-by fostering social development, gender equity, income generation, improving nutritional status, environmental sustainability and good governance"
		▪ Strategic objectives:
		  ▫ Capacity strengthening of rural poor and their organizations such as self-help groups, water user associations, farmer cooperatives etc.
		  ▫ Increasing equitable access to productive natural resources and technology
		  ▫ Increasing access to financial markets
		▪ key areas for M&E include:
		  ▫ Poor men and women improve aspects of their lives that they themselves consider most important
		  ▫ Rural poor improve livelihood strategies, gain access to assets etc.

Org/Institutions	Mission Statement/Mandate	Nutrition strategy
FAO/Economic and Social Department / Food and Nutrition Division (ESN)	Food and Nutrition Division aims to: ▪ Raise awareness of the benefits of combating hunger and reducing malnutrition ▪ Assist countries in identifying people who are food insecure and vulnerable to nutritional problems; ▪ Promote food safety and prevent food borne diseases ▪ Focus on consumer protection and fair practices in food trade ▪ It has primary responsibility for coordinating FAO nutrition-related activities in follow-up to international meetings and agreements	**ESN is responsible for:** ▪ maintaining food and nutrition country profiles ▪ stimulating and maintaining analysis of food composition data (INFOODS) ▪ nutrition assessments and monitoring including FIVIMS, State of Food Insecurity in the World Reports; and FAO statistical databases on foods available for consumption ▪ organizing consultations on nutrient requirements with other key partners ▪ building the necessary programme activities and support at the government and institutional levels to respond to identified needs, and thus reverse the situation; working on understanding urban nutrition, incorporating nutritional needs in NARS agenda ▪ Identify best practices, Monitor impact on behavior, consumption, biochemistry and function ▪ Initiatives to develop appropriate locally-based complementary foods ▪ Provide fortification recommendations and technical assistance on food legislation, standards and food control, quality assurance. In collaboration with WHO, provide standards and guidelines for labeling, nutrition and health claims, nutritional quality.

FAO/Economic and Social Department / Food and Nutrition Division (ESN)		▪ Household Food Security and Community Nutrition Group, together with the Nutrition Information, Communication and Education Group, directs their activities towards developing and implementing effective community centered programs:
		  ▫ Focus areas include food-based, community centered approaches including home gardens, food fortification , preparing and planning for food emergencies
		  ▫ Nutrition in HIV/AIDS. Developed Guide, "Living well with HIV/AIDS"
		▪ Nutrition IEC Division's activities include:
		  ▫ Feeding Minds Fighting Hunger: a global education initiative to introduce young people to the issues of hunger, malnutrition, and food security including nutrition education in schools
		  ▫ Strengthening the capacities of national and local institutions to provide effective nutrition education and communication within schools, to the public, to highly vulnerable groups
		  ▫ Assisting in developing and disseminating food based dietary guidelines
		▪ Anti-hunger programme: Reducing hunger through sustainable agriculture and rural development and wider access to food FAO, Rome, 2002 (http://www.fao.org/DOCREP/004/Y7151E/Y7151e00.HTM)
		  ▫ Identifies key priority areas for action. : Improve agricultural productivity and enhance livelihoods and food security in poor rural communities; develop and conserve natural resources; expand rural infrastructure; strengthen capacity for knowledge generation and dissemination; safety nets and other direct assistance to the most vulnerable
		  ▫ Proposes formation of International Alliance Against Hunger whose mission would be "to mobilize political will, technical expertise and financial resources so that every country can achieve success in reducing the number of undernourished by at least half by 2015."

Multilateral Agencies		

Org/Institutions	Mission Statement/Mandate	Nutrition strategy

World Bank/Health, Nutrition and Population (HNP)	Mission statement of HNP:
	
	“Assist clients to improve health, nutrition, and population outcomes of poor people and protect people from the impoverishing effects of illness, malnutrition, and high fertility”
		▪ Supports a multisectoral approach (including PRSP, SWAPs) to nutrition that targets the poor, especially young children and their mothers.
		▪ Focus on community-and school-based nutrition programs, food fortification programs, and food policy reforms
		▪ §Increasing focus on micronutrient deficiencies, the impact of nutrition on education and learning ability, and early child development projects
		▪ The Bank’s nutrition strategy is explicitly being framed in terms of accelerating progress towards achieving nutrition relevant MDGs.
		  ▪ Investing in capacity development within the World Bank and also at the national levels to enable nutrition partners to be at the negotiating table when the reforms, SWAPs and PRSPs are discussed.
		  ▪ Continued advocacy on how nutrition actions can best be positioned within the new programming environment
		▪ Health Systems Development (HSD) group under HNP in the next 2-3 years will reorient its activities to focus on building the global knowledgebase and institutional support needed to help countries accelerate progress towards achieving their MDG targets
		
		Sector Strategy: Health, Nutrition, & Population, 1997: Key objectives stated include:
		  ▪ improve the health, nutrition, and population outcomes of the poor, and to protect the population from the impoverishing effects of illness, malnutrition, and high fertility
		  ▪ enhance the performance of health care systems by promoting equitable access to preventive and curative health, nutrition, and population services that are affordable, effective, well managed, of good quality, and responsive to clients
		  ▪ secure sustainable health care financing by mobilizing adequate levels of resources, establishing broad-based risk pooling mechanisms, and maintaining effective control over public and private expenditure
		▪ Bank-supported programs in agriculture and rural development, water and sanitation, social protection, early child development, maternal and child health, can have significant impact on nutrition

ADB		
Bilaterals		

Norway-Ministry of Foreign Affairs		**Action Plan for Combating Poverty in the south towards 2015, March 2002:**
		  ▪ Increase in development assistance to 1% of GNI by 2005.
		  ▪ Mentions education and health but not nutrition.

NORAD
 	
Institutional set up for nutrition not clear
 	
http://www.norad.no/
	▪ NOARD aims to achieve lasting improvements in political, economic and social conditions for the entire population within the limits imposed by the natural environment and the natural resource base.
	▪ Has links to health/education and HIV but not nutrition. Nutrition not mentioned even under these overtly.
		“Nutritional considerations in Norwegian development cooperation” argues that NORAD should explicitly incorporate nutritional considerations in its plan for 2000-2005.
		  ▪ Recommends supporting partner countries’ national plan of action for food and nutrition in formulation and implementation
		  ▪ Building or strengthening institutions
		  ▪ Supporting nutrition surveillance systems
		  ▪ Not sure if these recommendations have been incorporated
		
		Other key documents include:
		▪ Focus on NOARD: Statement to the Starting on development cooperation policy 2002: Report on NORAD in 2002. (expands on the Action Plan)
		▪ Annual Report 2001.NORAD
		  ▪ Emphasizes that health and education are the most important areas of focus

Org/Institutions	Mission Statement/Mandate	Nutrition strategy
Denmark/DANIDA	▪ Danish assistance will in the future concentrate on its original main objective: promoting sustainable development through poverty-oriented economic growth ▪ A critical review conducted in 2002. Results will appear in appropriation bill of 2003	▪ No clear nutrition strategy mentioned. ▪ But "to help poor by investing in education and health" is the primary goal. ▪ More focus on women

Japan/JICA
 	
No institutional set up for nutrition apparent
	"Technical assistance aimed to transfer technology and knowledge that can serve the socioeconomic development of the developing countries."
	
	http://www.jica.go.jp/english
		▪ Nutrition per se not prominent.
		▪ Their priority areas are dependent on regional and country level issues. Therefore, JICA's priorities in South America are very different from Africa.
		  ▪ Food security, agriculture development and health care are priority issues in Africa. In South America, issues include strengthening international competitiveness, environment friendly agriculture etc.
		▪ Global issues of concern include:
		  ▪ Poverty; gender; environment, education
		  ▪ Population and AIDS
		  ▪ Trade; peace building
		  ▪ Disability

Canada/CIDA/Health and Nutrition	▪ "CIDA supports sustainable development activities in order to reduce poverty and to contribute to a more secure, equitable and prosperous world". ▪ H&N: " Canada is active in promoting health and nutrition in developing countries and countries in transition, focusing on the poorest and most marginalized people—who are most often women and children."	▪ "Canada will commit 25% of its ODA to basic human needs as a means of enhancing its focus on addressing the security of the individual." ▪ Under the priority area of "Basic human needs" CIDA supports health and nutrition ▪ Created Micronutrient Initiative (MI) **CIDA's Action Plan on Health and Nutrition, 2001: guidelines through 2005** ▪ Contribute to reduction in poverty by investing in health, nutrition and water ▪ Rights based approach, gender analysis ▪ Integrated and targeted nutrition programs: protecting women's nutrition, improving child feeding practices ▪ Vitamin A. supplementation and salt iodization ▪ Food Security: Food based strategies, emphasizes the need develop new ways of examining impacts ▪ Has research and capacity development program for tropical diseases and reproductive health but not nutrition

<table>
<tr><th>Org/Institutions</th><th>Mission Statement/Mandate</th><th>Nutrition strategy</th></tr>
<tr><td>Sweden/SIDA

Health and education are under the Department for Democracy and Social Development (DESO).

There seems to be no house for nutrition</td><td>The overall goal of Swedish development cooperation is to raise the standard of living of poor people in the world. The Swedish Parliament has adopted the following six specific objectives to achieve this overall goal:
Economic growth
Economic and political independence
Economic and social equality
Democratic development in society
The long-term sustainable use of natural resources and protection of the environment
Equality between men and women</td><td>Health Sector policy states that SIDA supports research, including malnutrition.
Emphasizes health sector development through bilateral and multi lateral cooperation.
Malnutrition is mentioned as “other sectors” that could affect health
SIDA’s Poverty Programme 1996: Food security is one of the priority areas under the dept. of Natural Resources and Environment. No elaboration provided
Key documents include:
SIDA Looks Forward – SIDA’s Programme for Global Development (not available on line)
Policy for development cooperation: Health sector, 1997
Perspectives on poverty, 2002(fleeting mention of nutrition)</td></tr>
<tr><td>Germany/GTZ</td><td></td><td>GTZ: Agriculture and agriculture research are priority areas
The only publication on nutrition listed on the web is on certification of organic foods</td></tr>
<tr><td>Ireland Aid</td><td>The Government is committed, through its Action Programme for the Millennium to reaching the target for development aid of 0.45% of GNP by the year 2002.

http://www.irlgov.ie/iveagh/irishaid/overview/default.htm</td><td>Programs and projects to meet the basic needs include: food security, health care, education and clean water supplies.
Report of the Ireland Aid review committee, February 2002
http://www.irlgov.ie/iveagh/irishaid/irlaidreview.pdf
It endorses its food security program
No nutrition specific strategy.
Reaching the UN target-A millennium decision for Ireland, Ireland Aid, 2000
http://www.irlgov.ie/iveagh/irishaid/2000report/IrelandAid.pdf
Seems to use nutrition as an indicator of food security. Some projects:
Natural resource management; infrastructure
Experimentation with seed bank; microcredit
Institutional support and strengthening of research and extension;
Area based programming and sector wide approaches preferred</td></tr>
</table>

Org/Institutions	Mission Statement/Mandate	Nutrition strategy

USAID	USAID Places the highest priority on alleviating undernutrition and is focused on improving nutrition through sectoral programs in agriculture, health, food aid, population, education as well as direct nutrition programs.	**USAID'S strategy of incorporating nutrition through USAID's development assistance program through**
		▪ Identifying projects based on nutrition and food consumption problems
		▪ Include nutrition as a factor in project design in:
		  ▸ Agriculture projects
		  ▸ In health through primary health care
		  ▸ In food aid through targeting appropriate rations to at risk groups
		  ▸ In population by complementing FP services
		  ▸ In education through promotion of nutrition education in schools, training community health workers, providing advanced training for professionals
		▪ Targeting sectoral projects at individuals/households who are at risk to developing nutrition programs
		▪ Monitoring and evaluating nutrition impacts of projects
		▪ Complementing sectoral projects with nutrition projects
		▪ Utilizing the private sector in food programs where feasible
		▪ Encouraging the development of national policies
		▪ Coordinating with LDC governments/donors to reach nutrition goals
		▪ USAID has also developed a strategy to provide food and nutrition assistance in HIV/AIDS programs. Country programs include:
		  ▸ Rwanda-USAID provides assistance to NGOs to provide food to approximately 29,000 children affected by HIV/AIDS as part of a comprehensive package of services.
		  ▸ Uganda-USAID has a five-year, $30 million program which is the largest of its kind in the world. The program targets approximately 60,000 individuals who have HIV/AIDS or live in households where providing HIV/AIDS care is undermining the ability to meet food and nutrition needs. The target population receives intensive nutrition education in addition to food aid. The program involves communities in food distribution in order to raise awareness, reduce stigma, and mobilize community involvement in HIV/AIDS activities.
		DHS/MACRO
		BASICS

DFID		**DFID's strategy for achieving the MDG1 target of reducing hunger by 2015:** ▪ Promote a shared analysis of the causes of hunger and malnutrition and of progress towards the hunger MDG ▪ Better integration of food security into poverty reduction efforts ▪ Promote the development of human capital ▪ Promote trade reforms that strengthen the food security of poor ▪ Better response to drought, conflict and emergencies ▪ Better systems to identify who is hungry, where and why **Proposed global nutrition priorities for DFID based on existing gaps (IFPRI study, 2003)** ▪ Embed nutrition components within development actions ▪ Manage and generate practical knowledge at the intersection of livelihoods, the lifecourse and lifestyles ▪ Develop capacity to integrate nutrition within sector initiatives ▪ Use and develop nutrition indicators to measure progress of non nutrition activities ▪ Highlight the key role of nutrition as both a driver of development and a non-exclusive investment opportunity
Government Agencies		

Org/Institutions	Mission Statement/Mandate	Nutrition strategy
Centers for Disease Control (CDC)		▪ Promote breastfeeding through the 'Baby friendly Hospital Initiative' ▪ Monitor and evaluate best buy interventions ▪ Conduct in-country surveys and monitoring ▪ Conduct research on lab tech methods and indicators and research on iron supplementation in pregnant women ▪ Part of the network for sustainable elimination of iodine deficiency ▪ Take part in technical meetings and consultations to review flour fortification science and iron standard indicators in collaboration with WHO as well as collaborate with the grain and wheat industry. Provide recommendations on prevention and control of ID cut of points for anemia ▪ Monitor and evaluate oil, sugar, fat, and vitamin A fortification within countries e.g. Zambia and Nicaragua ▪ Conduct assessments on centrally produced fortification of complementary foods in Latin America ▪ Conduct national assessments and monitoring of micronutrient fortification ▪ Include iron supplementation as an adjunct to malaria control
NGOs		
AED (Funding mainly from USAID and other partners)	AED helps communities secure stable food sources and improve their overall health and well-being. With programs addressing issues such as breastfeeding, malnutrition and food security, AED helps foster healthy communities around the world. AED is a leader in applying behavior change and social marketing methodologies to public health nutrition problems, particularly in breastfeeding, infant feeding, feeding of infants born to HIV positive mothers, and micronutrient deficiencies. Over the last five years, AED has built up one of the largest concentrations of public health nutrition experts outside academia. Areas of focus include policy analysis and advocacy, evaluation and monitoring, comprehensive planning for food security	**AED is involved in several large projects, mostly funded by USAID which lays out it's the strategy for addressing the different aspects of nutrition** ▪ CHANGE PROJECT-develops tools and strategies to facilitate individual and social behavior change relevant to child health, maternal health, infectious disease and HIV/AIDS. A major focus is improving individual and household behaviors ▪ Ethiopia Child Survival and Systems Strengthening Project (ESHE)-Focus of the project is to increase the survival rates of young children in Ethiopia through improved vaccination and nutritional supplementation. The program provides Vitamin A, iron and folate supplementation coverage for women and children and promotes exclusive breastfeeding for infants and continues breastfeeding to at least 24 months of age. ▪ Food and Nutrition Technical Assistance Project (FANTA)-supports integrated food security and nutrition programming. Helps integrate nutrition into the strategic planning process; provides analyses for food security and nutrition policy development and shares information and knowledge with partners. ▪ LINKAGES-this is a program that focuses on increasing breastfeeding and related practices to improve maternal and reproductive health through technical assistance and training. ▪ Preventing Type 11 Diabetes (STOPP-T2D) (funded by GWU)-this is an initiative to design a social marketing strategy and communications program for middle schools in the US to promote physical activity and health food choices. ▪ PROFILES (multiple funders)-engages national leaders in policy dialogue and public health nutrition. Has been credited with raising awareness about nutrition, building consensus, building capacity, and developing leadership skills of nutrition advocates. ▪ Support for Analysis and Research in Africa (SARA)-provides assistance to African institutions to develop and promote policies to increase sustainability, quality, efficiency and equity of a variety of health services including nutrition. ▪ Useful tools and publications: ▸ Breastfeeding and maternal nutrition: frequently asked questions ▸ Child health counseling cards, Dominican republic ▸ Community heath worker incentives and disincentives: how they effect motivation, retention and sustainability ▸ Food and nutrition implications of ART in resource limited settings ▸ HIV/AIDS Mitigation: using what we already know ▸ Quantifying the benefits of breastfeeding: a summary of the evidence

Org/Institutions	Mission Statement/Mandate	Nutrition strategy
HKI	Provide technical assistance, training and M&E for homestead food production (gardening, fisheries, poultry and animal husbandry)	▪ Research and Development: Development of dietary assessment methods; testing plant varieties and gardening methods, developing and testing post flood gardening rehabilitation practices. Compliance with international code of breastfeeding. ▪ Provide advice to agriculture ministries within countries to think about production of non-grain foods and appreciate the importance of food for better health ▪ Provide technical assistance and training to support ongoing programs with local partners in 6 countries in Africa and Asia ▪ Conduct surveillance and program monitoring to monitor anemia and iron deficiency, evaluate program coverage and the impact of homestead food production on nutrition status, household income, food consumption and women's empowerment. ▪ Conduct food surveys including FRATs to determine food patterns for fortification; impact of iron-fortified candy ▪ Provide assistance to countries to develop guidelines, training and materials to implement new policies on vitamin A supplementation for children postpartum and sick children. Conduct operational research on anemia programs for school-age children and early infants and help develop national surveys to identify iron deficiency and impact of interventions on anemia ▪ Integrate malaria and vitamin A in program interventions ▪ Monitor breastfeeding practices and evaluate program impact
MI	The Micronutrient Initiative (MI) is a not-for-profit organization specializing in addressing micronutrient malnutrition. MI is governed by an international Board of Directors. MI supports and promotes food fortification and supplementation programs in Asia, Africa and Latin America and provides technical and operational support in those countries where micronutrient malnutrition is most prevalent. MI carries out its work in partnership with other international agencies, governments and industry.	▪ Support for FFI, planning and implementation of national food fortification programs for iron, folic acid and other nutrients, technical guidelines. ▪ Research and development: efficacy and effectiveness studies. Promote use of red palm oil by households and school feeding programs in West Africa; promote cultivation and use of orange-fleshed sweet potatoes in Southern Africa; efficacy of carotene rich sweet potatoes in improving Vitamin A staples; efficacy of double fortified salt; impact of iron supplements on school performance ▪ Procure premix and equipment ▪ Conduct national and sub-national impact evaluations ▪ Conduct vitamin A stability studies ▪ Provide program planning/implementation and technical assistance to governments and oil refining in core countries ▪ Pilot and scale up programs for production and distribution of complementary foods as well as conduct research on the efficacy/effectiveness of complementary foods ▪ Procure vitamin A capsules and support program implementation; design oral dropper technology and develop field methods for biochemical assessment ▪ Promote and conduct impact studies on the effect of multiple micronutrient supplements for special feeding programs ▪ Provide expert training workshops, capacity building for understanding how to develop effective fortification programs ▪ Provide technical guidelines for flour fortification
Private Sector		

Org/Institutions	Mission Statement/Mandate	Nutrition strategy
Manoff Group	The Manoff Group provides assistance in communications and behavior-centered planning, management and evaluations for health, nutrition, and population projects.	The Manoff Group addresses nutrition through a variety of programmatic approaches. ▪ Strategic program design ▪ Consultative Research-Trials on Improved Practice (TIPS) is the core method for the consultative research process. TIPS offers: ▸ In-depth understanding of child feeding practices ▸ Adaptation of feeding recommendations to specific situations ▸ Understanding the motivations and constraints to change behaviour ▸ Flexibility ▸ Quick and inexpensive field research ▸ A bridge between the nutrition program, and the family and community ▸ Training in nutrition counseling ▪ Community Mobilization-The Manoff Group has a variety of approaches including, community based growth promotion model, community surveillance and behaviour change approach. ▪ Product marketing-this is driven by a behavior change strategy based on formative, consultative research. Examples of products that Manoff Group projects have promoted are: ▸ Iron tablets in Indonesia, Pakistan, India , Bolivia among other countries ▸ Vitamin A Capsules in Thailand, Indonesia, El Salvador among other countries ▸ Vitamin A fortified sugar in Zambia, Bolivia and El Salvador ▸ Iron-fortified wheat products in Nicaragua ▪ Country program experience includes: ▸ Communicating importance of breastfeeding to families in Pakistan and Indonesia ▸ Identification/education on nutritious weaning foods in El Salvador, India and Zambia ▸ Community counseling on importance of nutrition for growth in Honduras, The Dominican Republic among other countries ▸ Micronutrient supplementation and nutrition education programs for school children in Egypt and Indonesia ▸ Young child feeding in El, Salvador, India, Guatemala ▪ Manoff group have produced useful resources for general health and nutrition communication, micronutrient malnutrition, maternal health and environmental health
Public/Private Partnerships		

Org/Institutions	Mission Statement/Mandate	Nutrition strategy
GAIN	GAIN's mandate is to forge an alliance of public, private and civil society partners committed to eliminating vitamin and mineral deficiencies globally. GAIN has adopted the goals for country level operations from the United Nations General Assembly Special Session on Children in May 2002 to ▪ Achieve sustainable elimination of vitamin A deficiency by 2010 ▪ Reduce anemia prevalence including iron deficiency by one third by 2010 ▪ Eliminate iodine deficiency disorders by 2005 ▪ Accelerate progress towards reduction of other vitamin and mineral deficiencies through dietary diversification, food fortification, biofortification and supplementation.	**GAIN will combine the strengths of public and private sector organizations to:** ▪ Mobilize private industry, international donors and foundations in support of food fortification initiatives in low income countries ▪ Tap the expertise and resources of the corporate sector in technology transfer, business development, trade and marketing ▪ Work with the UN and other multilateral agencies to set international standards and establish systems for quality assurance and control ▪ Utilize public sector capabilities to address legislative and regulatory barriers to food fortification ▪ Develop a broader role for NGOs and civic organizations in food fortification ▪ Link food fortification efforts with other essential interventions, such as micronutrient supplementation and dietary diversification **N/B Fortification of staple foods and condiments is determined by country situation and not by GAIN** Research and development: ▪ GAIN will prioritize research needs (global and regional) as well as capacity development ▪ GAIN follows a code of fortification and is developing a global advisory group on fortification within the context of the already existing WHO IMAGE. ▪ Elevate nutrition on national agendas; further the MDGs. ▪ Provide support to NFA building partnerships
Academic/research institutions		
Harvestplus	Biofortification is a strategy of getting plants to fortify their seeds/roots through plant breeding. An interdisciplinary, global alliance of research institutions and implementing agencies has been assembled to develop biofortified varieties and to disseminate them to farmers in developing countries. Harvestplus is the name of this global program	▪ Research and development is the main focus of Harvestplus ▪ Conduct research on food and agricultural policies which impact the dietary quality of the poor. Conduct cost benefit analyses of alternative interventions and conduct efficacy trials ▪ Develop social marketing messages such as encouraging consumers to switch from white to consumption of yellow/orange varieties in breeding vitamin A carotenoids; develop messages to promote food and agricultural policies that enhance dietary quality ▪ Collaborate with government extension agencies, NGOs, and private sector to disseminate biofortified varieties by working through established seed markets and developing new seed markets as necessary.

ANNEX E

Methodological Notes

A multi-disciplinary team collected the information through literature reviews, web-based searches and interviews during October-December 2005.

The framework shown in the introduction to Annex A. represents the main elements of the micronutrient sector that were surveyed. Starting at the right hand end of the figure, information on the magnitude of impacts and evidence of efficacy were reviewed, and moving from right to left, the current state of prevalence data for each VMD was identified and the evidence of program effectiveness at scale were reviewed. Further to the left, the adequacy of coverage data were assessed and reports on constraints and barriers to expanding coverage were reviewed. On the left hand side of the figure, costs related to different delivery channels/program structures, and the financing of those costs were addressed. Finally, information available on the geographic scope and program content of institutions and stakeholders available on their websites and reports was reviewed.

I. Data on Country-Wise Prevalence and Coverage By Micronutrient

Detailed notes on indicators and sources is provided with the tables in Annex A. The following is commentary on the data sources.

Vitamin A

Prevalence

The tables are based on several data sources, depending heavily on the Mason and West summaries, complemented by the 1995 WHO MDIS, which will be updated in 2006. DHS data are limited to nightblindness, as biologic measures have not been examined for these surveys. Three primary indicators are used: xerophthalmia (various stages), serum retinol, and maternal nightblindness. and to a lesser degree CIC.

- Data on under-5 mortality is included under Annex A.3. It is important to note that under-5 mortality is an indicator suggesting high risk of vitamin A deficiency in a population. U5 mortality greater than 70 has been accepted by UNICEF as a surrogate for likely vitamin A deficiency in countries where other data do not exist or are incomplete.
- Serum retinol is an established indicator for assessing deficiency in a population. However, interpretation is limited in the absence of some corrective factor for acute and chronic infection, using CRP or AGP. While most assessments in the past may not have included these measures, surveys since 2002 should have, and findings adjusted accordingly. Serum retinol levels in children in countries with high infection rates may be depressed.
- Adjustments were made by Mason and Wets et al, correcting for either sub-national data, or for absent data. Caution should be used in ascribing an estimated retinol level based on neighboring countries unless it is clear that infection rates and dietary factors are similar. Extrapolating from sub-national surveys may be problematic if those surveys targeted either high or low risk populations, as is common. Hence, such adjustments should be interpreted with caution, and such countries should be seen as having inadequate data.
- The methods for adjusting for coverage are described in detail in the source documents. In

countries with serum retinol estimates preceding the initiation of vitamin A supplement programs, it is important to note that improvement is likely when high coverage is achieved. However, in many countries high coverage is achieved for only one round (during NIDs), and thus any adjustment needs to take this into consideration. The authors have made some of these adjustments.

- In some countries the national coverage estimate may not accurately reflect geographic differences, which may coincide with populations at higher risk.

Coverage

The indicators mentioned are consistent with current recommendations, given the evolution of reporting on vitamin A coverage, and the complications from NIDs. However, this is an area for further improvement.

- Coverage estimation can be done by aggregation of district level tally reports, or through independent surveys, the latter more likely to provide a stronger estimate. Alternatives include child health cards, marking each vitamin A dose, but most countries experience difficulty with retention of cards by mothers. For countries with NIDs, coverage estimates are usually good, and parallel polio (or measles) immunization coverage.
- The primary limitation in coverage estimation is data collection. While the ideal indicator would be the % of U5 children fully protected for the year, this is difficult to collect in surveys because of difficulty with recall for 2 doses over the course of a year. In the past, countries commonly presented national coverage as the figure for the NIDs round, without attention to the second round. DHS, as noted in the document, reports receipt of capsule in the past 6 months—a reasonably reliable indicator for surveys. The tables in Annex A.2 address these issues by reporting national coverage for NIDs, and noting whether coverage >70% was achieved for the second round. In addition, recent DHS coverage estimates are reported.
- Many countries have relied on NIDs for achieving high vitamin A coverage. As countries complete NIDs, or shift to sub-national NIDs, vitamin A coverage may suffer. It would be useful to gain consensus on a standard coverage indicator that is amenable to simple population-based assessment, allowing countries to follow trends in coverage over time.

Iron Deficiency

Prevalence

- Several issues emerge that require greater consensus among different stakeholders: a) reporting of degree of anemia; b) age group for reporting for women
- Malaria prevalence is given in Annex A.3; it is an important predictor of anemia and among all factors influencing anemia rates, malaria is perhaps the most important.
- There would be value in trying to get a consensus on whether to report all levels of anemia (mild, moderate, severe) or only a prevalence of anemia and the % severe, since the distinction between mild and moderate is not functionally important – all degrees of anemia need to be addressed.
- DHS surveys constitute a vital source of data on national levels of anemia. It is important to discuss the importance of including anemia for all DHS surveys in the future.

Coverage

- The key issue is dependence upon recall during the last pregnancy when using survey data such as DHS. Routine tracking of prenatal IFA distributed is an important process indicator but does not provide insights regarding compliance.

Iodine Deficiency

Prevalence

The data are drawn from the WHO Global Database on Iodine deficiency, which follows the original MDIS completed in 1993. This database reports on total goiter rates and urinary iodine, and includes data back to before 1995 to 'present'.

- As reported, many countries lack UI data, or have UI data only for sub-national geographic areas. In addition, as noted, UI is reported for school children and/or for total populations.
- There has been recent concern about whether iodine intake is adequate to meet the needs of pregnant women, even when household iodized salt coverage is adequate. However, there are little data on UI for this target group. School children are relatively easier to sample for UI than total populations, but it is not clear which provides the best overall population estimate. Since there is no evidence to suggest dramatic differences in household salt consumption, either is likely to provide a reasonable population estimate.
- UI is often reported for research populations or sub-national populations. As with retinol, sub-national sampling may be purposive, or represent an unusual population that is either more or less likely to have deficiency. Since the degree of iodine deficiency may differ substantially for different geographic areas, interpretation of sub-national sampling should be interpreted with caution, as it may not represent the situation for the majority of the population.
- The tables do not contain TGR as an indicator. Since TGR is likely to be less reliable as salt iodization programs are established, this is reasonable. During country-level planning and advocacy it may be useful to consider TGR as a 'baseline' estimate of the magnitude of the problem, reporting TGR before 1995 or so. Changes in TGR over time differ for different age groups, with children likely to mostly resolve goiters, leaving a small sub-set with some residual enlargement, while adults may have residual nodules that do not respond to iodine sufficiency. Regardless, UI should be the standard, as noted, for monitoring progress in iodine deficiency elimination.
- The WHO database has limitations and additional data are available for some countries, but not yet included in the WHO database. UNICEF regional data made available from the E. Europe/Central Asia database provides updated information on 6 countries, representing more recent surveys that included UI determination.

Coverage

- The indicator is "Proportion of households consuming adequately iodized salt, [Percent distribution of households with salt tested for iodine content, by level of iodine in salt (15+ parts per million)]". However, it is well known that the salt test kit used provides a subjective qualitative assessment that is most reliable for determining presence or absence of iodine.

However, most surveys continue to report the qualitative assessment of amount of iodine. For country level planning, it would be useful to consider the % of HH samples with no iodine (as is reported by DHS), and encourage more precise estimates of samples drawn from HH level using laboratory techniques periodically, as part of strengthening monitoring and surveillance systems overall for micronutrients.

- There has been recent concern about the accuracy of salt test kit reporting for national surveys, and in recent surveys, a sub-set of samples has been collected and tested by the more reliable titration. There is also a relatively field friendly 'Chinese checker' which provides a quantitative assessment. However, there are few data available for these recent surveys.
- There appear to be several recent DHS surveys which did not report salt testing, and no HH coverage figure was reported. If this is true, then it would seem important to discuss the importance of including HH coverage for all DHS surveys in the future, since the variability and dramatic range of coverage currently reported suggests that many countries have not achieved a sustained high coverage.
- There have been some recent observations that in some countries there is not as strong a correlation between HH coverage as measured by salt samples and UI values as might be expected (e.g. Indonesia) and this may reflect the presence of iodine in more processed foods, and the wider use of such foods. This may become more relevant should UI values appear to be higher than expected for the given level of HH coverage and production level of iodine added.
- There has been recent interest in reviewing production tonnage figures as a means to provide an alternative to survey based household coverage, using national or district production figures to estimate HH use based on estimated HH salt consumption. Production level use rates for potassium iodate are also being explored. However, currently there are few data on iodized salt production, or on potassium iodate use.

II. Demographic and Health Indicators Related to VMDs

This section summarizes the data sources and methods used to extract information for Tables A.3 and A.4 in Annex A. Indicators were selected based on their influence on or relationship to micronutrient deficiencies and program strategies as well as availability of recent and meaningful data. Data was collected from pre-selected reliable data sources, including NetMark, ORC Macro, UNICEF and WHO. Nationally representative data were given priority. Some of the indicators are from calculations applied to data from these sources to create a data set meaningful to this report. The methods for each table are as follows.

- Data on Demographic Indicators was collected from Table 1 (Basic Indicators) and Table 6 (Demographic Indicators) of the Statistical Tables section of UNICEF State of the World's Children 2006.
- Mortality Rates and Infectious Disease Prevalence data was extracted from Table 1 (Basic Indicators), Table 3 (Health), and Table 4 (HIV/AIDS) of the Statistical Tables section of UNICEF State of the World's Children 2006, DHS STATCompiler and the WHO 2005 Global Tuberculosis Report. The percent of children vulnerable to measles was calculated by subtracting the percent of children immunized (from SOWC 2006) by 100, thus arriving at a number that represents children not immunized and therefore vulnerable.

- Health Services Coverage and Use data were taken from three main sources, including Table 3 (Health) of the Statistical Tables Section of UNICEF State of the World's Children 2006, DHS STATCompiler, and the 2005 World Malaria Report. Calculations were applied to DHS survey data to obtain the number of women who had attended 2 or more antenatal visits in the last pregnancy. DHS surveys report women who make 2-3 and 4+ antenatal as separate. These two percentages were added. In addition, Insecticide Treated Net data was supplemented by 2004 subnational NetMark surveys for Ethiopia and Senegal because there was no data reported in the global 2005 Malaria Report for Ethiopia. Senegal's subnational data for pregnant women has since been updated, with a significant increase in the number of women using nets. Other recent NetMark surveys were not used because the 2005 World Malaria Report included national-level data for these countries and national-level data was preferred.
- Data on Anthropometric Status and Infant/Young Child Feeding was collected from two main sources: Table 2 (Nutrition of the Statistical Tables section) of UNICEF State of the World's Children 2006 and recent DHS surveys that included a table on foods received by breastfed children under 3 in the 24 hours period (day/night) before the interview. Underweight, stunting and breastfeeding status were taken directly from SOWC 2006. The DHS data is given for disaggregated age groups, and a weighted average of the ages was calculated.

III. Costs of Programs

The information in the cost section is drawn from a review of literature conducted by the A2Z Project (Fiedler, 2006). Ninety-four studies were identified and reviewed in the A2Z review. Only 13 of the cost studies (14 percent) appeared in peer-reviewed journals. The remainder come from what is referred to as "grey-cover literature" or simply "grey literature." Grey literature is subject to varying levels of review, and is generally regarded as of being of lesser quality.[1] Roughly two-thirds of the 81 studies that are grey literature are either Asian Development Bank, World Bank or USAID-sponsored project documents, which go through some type of review process, but one that is substantively less rigorous than the typical peer-reviewed journal process.

The review is based on studies mainly from Asia. The four most studied countries are Pakistan, Bangladesh, Viet Nam and Indonesia. Asia accounts for 34 percent of the studies. This Asian concentration reflects three factors:

- the already noted high prevalence of micronutrient deficiencies, and the even higher proportion of all deficient persons in the world who live in Asia,
- the disproportionate number of specifically fortification studies that have been done in Asia, which, in turn, in large part reflects both (a) the relatively greater feasibility and promise of fortification in Asia, owing to its more urban-concentrated population and (b) the relatively greater market penetration of commercially produced foods in rural areas (particularly relative to Africa), and
- the laudable and persistent efforts of the ADB (spearheaded until 2004 by Joseph Hunt) to promote fortification in Asia through the RETA 1 and RETA 2 projects.

1 A recent assessment of the immunization literature, for instance, concluded that "the quality of data on the effectiveness and cost-effectiveness of strategies to increase immunization coverage is shown to be similar across literatures, but the quality of information on costing is much lower in the grey literature" (Batt, et al., 2004). In this study the authors defined grey literature as "a range of published and unpublished material materials which is not normally identifiable through conventional methods of bibliographic control."

Most of the studies (79 percent) are "national" in scope in the sense that they analyze interventions that are uniformly implemented throughout the country; for instance, throughout the entire system of the ministry of health (MOH) as is commonly the case of vitamin A supplementation programs, or, in the case of iron fortification, throughout the entire wheat flour industry. It is important to note, that while a program intervention may be structured (from the supply side) as a national program, its may not cover the entire population, owing, for instance (continuing with the same examples), to a lack of access to MOH vitamin A supplementation services, or the possibility that a segment of the population does not consume the commercially produced wheat products containing fortified flour. For purposes of this report, the definition of a program's scope is independent of its level of coverage, and is based exclusively on supply-side, structural considerations.

Fifty-two (55%) of the studies are "prospective" studies; i.e., they modeled the costs of hypothetical programs. This reflects one of the most common motivations for cost analyses of micronutrient interventions; viz., they have been used to conduct feasibility assessments and cost-benefit analyses (CBA).[2] The remaining 45 percent of the studies were "retrospective"; i.e., they estimated the costs of existing programs.

The studies fall into two different categories of micronutrient cost studies. One category consists of the policy discussions that frequently also discuss the burden of micronutrient deficiencies and provide a cost-benefit analysis discussion-based justification for financing micronutrient programs. These studies also discuss the cost of micronutrient intervention programs, but do not contain original estimates. The second category of micronutrient cost studies are those that present original estimates. The former are the more common and probably the most visible and influential of these two bodies of related works. Both are discussed in this section.

IV. International Agencies Engaged in Micronutrient Programs

A web-based search was conducted and reports of the organizations' activities were reviewed for information. The resulting information was analysed for regional and content focus. This revealed a substantial bias in the information available through the sources that were used. It was decided to use the recent collection of institutional information contained in the technical annexes of the recent World Bank publication, Repositioning Nutrition (2006).

V. Donor Financing

A. Methods

Data for this section were gathered by identifying the key organisations involved and exploring their websites. These websites presented some relevant descriptive information but, in general, did not provide financial data of sufficient specificity to be helpful in this exercise. We then approached the organisations directly, through personal contacts where possible, with a request for as much financial information about their micronutrient interventions as they could reasonably provide in the limited time. See the attached table 'List of Key Agencies and Organizations

2 The results of the CBA will be discussed below.

Contacted for MN Financing Information'. In some cases, when direct contact did not generate adequate information, we returned to secondary sources and websites.[3]

The requests for information were match to what organisations were most likely to be able to provide, including the following key pieces of data:

- A list of countries and regional or international agencies or programs whose micronutrient programs were supported in 2004.
- The total amount of expenditure on all micronutrient activities in 2004 and the source of those funds.
- An indication of the relative importance (in financial terms if possible) of different micronutrients (vitamin A, iron, iodine, zinc) different kinds of programs (supplementation, fortification, agriculture-based) and different types of support (inputs or activities that were focussed on) in the profile of support for 2004.
- The number of staff working on micronutrient activities at global or regional headquarters.

We avoided being too prescriptive about the data we required. Donors vary so much in both the nature of their programs and the way they collect data that whatever particular format we had decided on would have posed major problems for some donors. Instead, we encouraged donors to provide what data they could in the time available. Leaving it open in this way improved the response rate but also created more challenges in analysing the data which has significant gaps and incompatibilities. Key assumptions we have had to make to overcome these are noted in the text or recorded as comments in the tables and annexes.

We chose to ask for data that would give us a snap-shot of what was happening in a specific, recent year (2004)[4] since this would allow us to more easily to summarise the data and make comparisons. This does mean that some important activities that have already concluded and others that are just starting in 2005 will not be included in the financial tables. It also means that we are unable to comment on trends over time.

B. Notes on Sources

Micronutrient Initiative

Source: M. Fryar (personal communication, December 2005)

Total Contribution to MN Activities in 2004 (US$): MI fiscal year 2004/5 total program expenditure. MI Investment plan summaries.xls, worksheet one *2004-5 Expenditure*.

Breakdown by Type of Micronutrient (% / Yes): Provided by M. Fryar

3 In the case of the World Bank, for example, we identified 42 projects with a micronutrient component which were active in 2004 using a bank document (Heaver, 2005) which comprehensively reviews lending projects active in 2004, identifies those that had some proportion of support to nutrition and codes them for specific nutrition components (including micronutrients. We accessed the Project Appraisal Documents of these 42 projects from the website http://web.worldbank.org/external/projects/ from which we obtained information on the budget for total project (but not the micronutrient component) and on the kind of micronutrient activity implemented (which micronutrient, whether supplementation or fortification, targeted at whom, on what scale, and involving what inputs).

4 Organisations provided data according to their 'financial year' which for some coincides with the calendar year and for others begins in October or April

Breakdown by Type of Technology (% / Yes): Based on data from MI Investment plan summaries.xls, worksheet one *2004-5 Expenditure*, MI FY 2004-5 total program expenditure by line item. **Methods:** The 12% of total FY 04/05 costs that support both fortification and supplementation programs (MI line items: Innovation, Advocacy and Training + Program Design and Monitoring) were allocated in proportion to the direct costs reported for the MI Supplementation and Fortification line items.

Breakdown by Region (% / Yes): MI FY 2004-5 total program expenditure by region. MI Investment plan summaries.xls, worksheet one *2004-5 Expenditure*. Regional categories as defined by MI. The category "Other" includes Latin America and the Caribbean, Middle East and North Africa, and East Asia.

Breakdown by Broad Activity (% / Yes): N/A

Staff at HQ: As footnoted in table "MI staff include 28 in Ottowa and 19 in regions or countries."

USAID

Source: M. Boggs (personal communication, December 2005)

Total Contribution to MN Activities in 2004 (US$): Fiscal Year 2004 runs from October 1, 2003 through September 30, 2004. Actual expenditure including BASICS but not including agreements managed by USAID's regional bureaus or field support expenditure.

Breakdown by Type of Micronutrient (% / Yes): As reported by USAID. Although USAID reports 0% to iodine, breakdown of FY04 obligations indicate that USAID supports UNICEF's iodized salt program to the tune of 3.5 million.

Breakdown by Type of Technology (% / Yes): N/A

Breakdown by Region (% / Yes): Based on the distribution of reported FY04 obligation between AFR, ANE and LAC bureaus which together comprise 42% of total obligations (excluding BASICS).

Breakdown by Broad Activity (% / Yes): N/A

Staff at HQ: As reported by USAID.

UNICEF

Source: I. Darnton-Hill and N. Dalmiya (personal communications, December 2005)

Total Contribution to MN Activities in 2004 (US$): UNICEF fiscal year 2004 runs January 1 through December 31 , 2004. Based on file UNICEF-1(GANESH matrix).xls, *Sheet 1*, FY2004 OR and RR [CHECK ??}funds [expenditures?] Line Items N129 & N130. This is a lower limit and the true figure probably lies between this and $22,674,341 (total from Ganesh matrix).

Note: 'Regular resources' (RR) are unrestricted funds used for UNICEF's country programmes, programme support and management and administration of the organization, as approved by the UNICEF Executive Board. 'Other resources' (OR) are restricted in their use and are designated by the donor for specific programme purposes. They are subdivided into regular and emergency contributions.

Breakdown by Type of Micronutrient (% / Yes): Percentage information not provided, but yes/no for each micronutrient was confirmed with program activity descriptions described elsewhere.

Breakdown by Type of Technology (% / Yes): Percentage information not provided, but yes/no for each micronutrient was confirmed with program activity descriptions described elsewhere.

Breakdown by Region (% / Yes): Based on data provided by UNICEF on VAS country programs in file UNICEF-2 (vit A support).xls, *Sheet 1*. Percentages based on the number of countries with a UNICEF VAS program in a particular region, and then divided by the total number of UNICEF VAS programs worldwide. Note that regions were as defined by WHO, and then collapsed into three regions as follows:

Africa = WHO Africa region
Asia = WHO S/SE Asia + W. Pacific regions
Other = E Mediterranean, Europe, Regions of the Americas

Breakdown by Broad Activity (% / Yes): N/A

Staff at HQ: N/A

World Bank

No primary data from the World Bank (WB) was available. We instead began with a background paper (Heaver, 2005)[5] which summarized a recent, comprehensive review of lending in nutrition. That paper identified all World Bank projects with a nutrition component that were active in FY2004, and estimates the overall level of funding to nutrition projects worldwide, as well as which projects had a micronutrient component. From this we identified a subset of 42 projects with an activity coding for micronutrients, and reviewed the Project Appraisal Documents for each project to extract additional relevant information.[6]

Sources:

- Heaver, Richard. 2005. "The World Bank's experience in nutrition:an informal review." Nutrition Policy Note Background Paper, Health Nutrition and Population Department, Human Development Network, Washington DC: World Bank.
- Review of relevant World Bank Project Appraisal Documents for each project cited in Heaver, 2005.

Total Contribution to MN Activities in 2004 (US$): Estimate of $10.2 - $20.3M is derived from a subset all World Bank projects with a nutrition component that were active in FY2004, as identified in a comprehensive review of lending in nutrition (Heaver, 2005). Our subset is comprised of 42 projects that Heaver indicated as having an MN activity code.

We used the US$ figure for the total WB commitment estimated by Heaver for each of the 42 projects that included micronutrient activities and then divided it by the average planned project life of 4.8 years. [*Note 1*: The planned project life in years was extracted from a further review of

5 World Bank: Heaver, Richard, 2005 "The World Bank's experience in nutrition: an informal review" (Nutrition Policy Note Background Paper, Health Nutrition and Population Department, Human Development Network).

6 Before implementation of a World Bank project a project appraisal document (PAD) is prepared which provides a substantial amount of detail on the activities being funded. These PADs can be accessed from the World Bank website (http://web.worldbank.org/external/projects/).

World Bank Project Appraisal Documents (PADs). The average planned project life is based on only 35 projects, as this information was missing from 7 of the 42 project documents. *Note 2*: Heaver details sources of potential error in his estimates. (See Heaver, 2005, Annex 1)]

Breakdown by Type of Micronutrient (% / Yes): Percentage represents the % of all World Bank project countries (29) that include each specific micronutrient.

Breakdown by Type of Technology (% / Yes): Percentage represents the % of all World Bank project countries (29) that include this specific type of intervention

Breakdown by Region (% / Yes): Percentage is based on WB financing commitment for all relevant projects within a designated region divided by the WB commitment to nutrition overall as identified by Heaver, 2005. This assumes that the subcomponent that is micronutrients roughly follows the same patterns as that for the larger nutrition component.

Breakdown by Broad Activity (% / Yes): N/A

Staff at HQ: N/A

List of Key Agencies and Organizations Contacted for MN Financing Information

Full Name of Organization (Acronym)	Contact Name	Contact E-mail
Multilateral Organizations		
Asian Development Bank (ADB)	Barbara Lochmann	blochmann@adb.org
	Lisa Studert	lstuddert@adb.org
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	Joseph Hunt(ex-ADB)	josephhunt4@hotmail.com
Pan American Health Organization (PAHO)	Ms. Sunny Kim	Kimsunny@paho.org
United Nations Childrens Fund (UNICEF)	Ian Darnton-Hill	idarntonhill@unicef.org
The World Bank	Meera Shekar	mshekar@worldbank.org
The World Food Programme (WFP)	Tina van den Briel	Tina.vandenbriel@wfp.org
World Health Organization (WHO)	Bruno de Benoist	debenoistb@who.int
African Development Bank (AfDB)	Dr Jay Naidoo	AFDB@afdb.org
International NGOs		
Global Alliance for Improved Nutrition (GAIN)	Barbara MacDonald	bmacdonald@gaingeneva.org
Hellen Keller International (HKI)	Erin Dusch	edusch@hki.org
International Center for Research on Women (ICRW)	Dr. Kavita Sethuraman	ksethuraman@icrw.org
Internatonal Life Sciences Institute (ILSI)	–	–
International Potato Center (CIP)	Pamela Anderson	p.anderson@cgiar.org
R Kapinga	r.kapinga@cgiar.org	
The Micronutrient Initiative (MI)	Mark Fryars	mfryars@micronutrient.org
The Network for Sustained Elimination of Iodine Deficiency	–	–
(Iodine Network)	Juliawati Untoro	juntoro@micornutrient.org
Initiatives and Consultative Groups		
Flour Fortification Initiative (FFI)	Glenn Maberley	gmaberly@sph.emory.edu
HarvestPlus	Bonnie McClafferty	b.mcclafferty@CGIAR.org
International Zinc Nutrition Consultative Group (IZINCG)	Kevin Brown	khbrown@ucdavis.edu
Iron Deficiency Project Advisory Service Network (IDPAS)	Gary Gleason	gary.gleason@tufts.edu

Full Name of Organization (Acronym)	Contact Name	Contact E-mail
Government Agencies		
Canadian International Development Agency (CIDA)	ErnestLoevinsohn	Ernest_Loevinsohn@acdi-cida.gc.ca
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German Society for Technical Cooperation (GTZ)	No funding	No Funding
Swedish Agency for International Development (SIDA)	Gunilla Essner	gunilla.essner@side.se
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US Agency for International Development (USAID)	Malia Boggs	mboggs@usaid.gov
	Frances Davidson	fdavidson@usaid.gov
(JICA)	–	–
US Center for Disease Control & Prevention (CDC)	Ibrahim Parvanta	iparvanta@cdc.gov
Academy for Educational Development Projects		
A2Z Project	Jean Baker	jbaker@aed.org
Food and Nutrition Technical Assistance Project (FANTA)	Leslie Elder	lelder@aed.org
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Support for Analysis and Research in Africa (SARA)	Suzanne Prysor-Jones	sprysor@aed.org
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